



ON MATTERS THAT MATTER

The Rise of Environmental Infrastructure Markets

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An Occasional Essay on Matters that Matter

The Rise of Environmental Infrastructure Markets

As private equity investors in selected environmental markets in North America, NewWorld Capital Group publishes occasional essays on matters that matter in our investment strategy. We seek to present an analysis of the forces at work shaping investment opportunities and risks in our target markets and in the broader environmental opportunities sector.

Environmental infrastructure is emerging as a specialized, growing, and generally underexploited sector within the broader U.S. infrastructure market, offering compelling opportunities in the near-term for the smart, specialist investor to earn attractive economic returns with relatively modest investment risk. This sector sits at the crossroads of infrastructure markets and the environmental opportunities sector. The melding of favorable environmental market trends, in combination with general attributes of both infrastructure investments and specific environmental infrastructure value-drivers, suggests that this is the time for potential investors to look closely at this rising asset class and developing market.

An infrastructure asset refers to any capital-intensive physical asset, or group of such assets, that provides goods or services to an end market. Investments in infrastructure assets are typically structured as project finance transactions, which are based on underwriting internally generated cash flows.¹ Typically characterized by a captive customer base and a long physical life span, infrastructure as an asset class is distinguished by both predictable, stable cash flows and the ability to structure highly risk-mitigated transactions.² Accordingly, infrastructure investments generally produce lower economic returns than typically sought for growth company investments. However, infrastructure projects' more predictable cash flows allow sponsors to place non-recourse debt on the assets, which has the effect of enhancing investment returns without materially increasing investment risk. There is also typically a surprising amount of market liquidity available despite the long-term nature of infrastructure projects.

¹ David Gardner and James Wright, "Project Finance," HSBC, <http://www.hsbcnet.com/gbm/attachments/products-services/financing/project-finance.pdf>.

² Mark Weisdorf and Serkan Bahçeci, "The Infrastructure Moment: Favorable trends in infrastructure investing," *Insights*, JP Morgan Asset Management, July 2011; and David Russ, "Can Infrastructure Investing Enhance Portfolio Efficiency?" *White Paper*, Credit Suisse, May 2010.

Environmental infrastructure can be defined as encompassing: (i) projects using free, clean and abundant resources (such as sunshine, wind, or water) to generate power, otherwise known as renewable energy or “clean energy”; (ii) projects focused on energy efficiency (such as projects involving combined cooling heat and power or repowering of existing facilities); (iii) projects seeking to clean and amplify water supply (such as water management or wastewater treatment); and (iv) projects seeking to optimize waste management through recycling of waste into valuable products (such as waste-to-energy or waste-to-materials recovery).

Environmental infrastructure enjoys not only the attractive attributes of traditional infrastructure investments, but also several key value-drivers specific to alternative energy and other clean infrastructure. In addition, environmental infrastructure markets are currently benefiting from favorable trends driving environmental business markets more broadly.

The following sections examine environmental infrastructure markets against the larger backdrop of infrastructure markets and environmental markets, identifying trends and reinforcing specific value-drivers of environmental opportunities, navigating risks and exploring potential investment opportunities within this emerging sector.

I. The Rising Opportunity of Environmental Infrastructure

Neither renewable energy generation nor clean energy asset project finance are new practices, but the recent coalescing of favorable market trends and long-developing dynamics make the environmental infrastructure market an emergent investment space for private equity investors. The emergence of the North American environmental infrastructure segment as an attractive investment class largely results from dynamic U.S. government policy that facilitated initial demonstration of success in the market, which provided the basis for investor confidence in applying project finance to renewable energy and other environmental infrastructure investments.

Renewable energy and other environmental infrastructure technologies have been well understood technically for quite some time, thanks in large measure to longstanding research and development (R&D) efforts in the United States. Even as recently as the mid-1990s, however, renewable energy projects still seemed too unproven—too risky from an investment standpoint. Though the use of project financing for large combined cycle generation plants or in other infrastructure applications was widespread, few private investors were eager to finance the “first” solar PV or wind energy project, partially due to a limited understanding of the resource risk, as well as the relatively high capital costs associated with these projects.

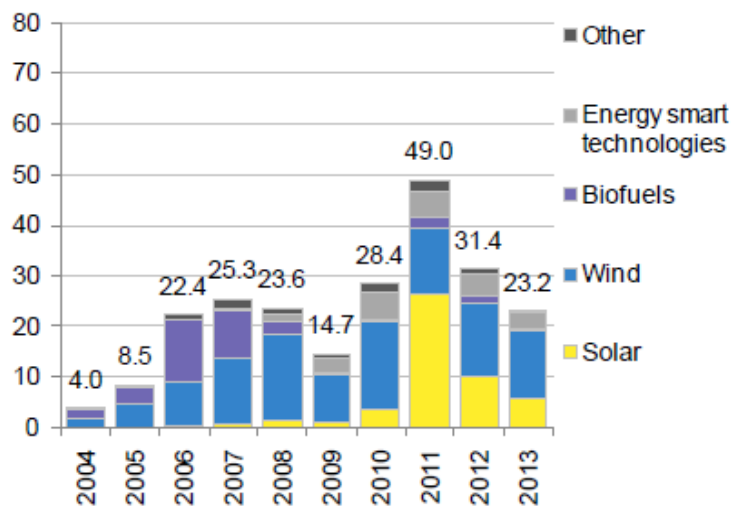
Energy policy at the federal level, such as the Production Tax Credit (PTC), helped change that, spurring broader sector development by improving the economics and thus encouraging the development of mid-sized wind projects into the early-2000s. However, traditional investors and developers remained reluctant to engage in the space. With increases in the number of installed projects came better assessments of wind as a renewable energy resource.

With the introduction of the federal Investment Tax Credit (ITC) in 2006, private investment in renewable energy projects, particularly in solar projects, began to increase as well. The supportive policy environment at the federal level, along with state-level developments, drove the development of financing mechanisms to take advantage of favorable tax credits, and the renewable energy tax equity market emerged, effectively further encouraging broader private

sector interest and participation. The project finance market in clean energy developed still further in light of demonstrated success of these initial projects, falling technology costs, better wind and solar resource predictability, and volatile hydrocarbon resource prices, and as investors began to better recognize the potential of project finance in the environmental markets context, particularly for power generation.

New federal measures introduced in the aftermath of the 2008 global financial crisis to address the capital limitations of the market also helped spur investments in very large-scale renewable energy projects. Thus despite the dip during the financial crisis, larger-scale wind and solar investments saw incremental, but steady, growth through 2011 (see Figure 1), due to increased cost competitiveness and as developers closed project financing before key incentives related to the federal stimulus program expired. Wind gained prominence early-on because it was the cheapest generation method at a large scale for utilities to comply with renewable energy mandates.³ Large-scale solar PV projects also saw strong growth later, as the solar ITC allowed tax equity partners to benefit from the tax credits up front (in contrast to the PTC for wind projects, which generates credits over a longer time span).

Figure 1: U.S. Large-scale Project Finance Investment in Clean Energy by Sector, 2004-2013 (in billion \$)



Reproduced from Bloomberg New Energy Finance. *Sustainable Energy in America: 2014 Factbook*, February 2014.

As the market saw the success of these projects, particularly in wind and solar, investment in the sector expanded, despite lapses in important government incentives after 2011 and other policy uncertainty, which resulted in decreased investment and deal flow in the sector in subsequent years, to \$48.4 billion in 2013.⁴ Even so, project financing of large-scale wind projects remained relatively strong and steady through 2013 (see Figure 1). Furthermore, the decrease in large-scale solar project finance investment after 2011, as can be seen in Figure 1, is a reflection of the market’s evolution: expanded private investor interest in utility-scale⁵ solar PV, the commercial and industrial (C&I) solar space, and small residential solar sector. Indeed, thanks to market

³ Bloomberg New Energy Finance. *Sustainable Energy in America: 2014 Factbook*, February 2014.

⁴ Bloomberg New Energy Finance. *Sustainable Energy in America: 2014 Factbook*, February 2014.

⁵ In this essay, “utility-scale projects” is a term that refers to projects that have a utility offtaker rather than referring to a specific project size.

scaling and expanded demand and production, as well as very rapid expansion in Europe and extensive government subsidies in China, many clean energy technologies, particularly wind and solar, witnessed dramatic reductions in their cost structure. As costs declined, private investors started seeing the market potential for smaller-scale projects.

Innovation in financing arrangements also continued to play an important role in the sector's development by expanding profitable investment into the residential solar sector, such as third-party lease agreements, consumer credit-based financing, and securitization. In addition, other financing innovations, like "YieldCos," have also contributed to the expansion of the universe of investors in the space. YieldCos are publicly traded companies formed to own operating assets that produce predictable cash flows that may be distributed as dividends to shareholders. In the past, renewable energy portfolios have been hindered by laws and regulations expressly benefitting traditional fossil fuel energy. However, the YieldCo model has allowed renewable energy portfolios the liquidity benefits previously restricted to Master Limited Partnerships (MLP) (which are limited partnerships available only oil, natural gas, or coal-related entities or activities) or Real Estate Investment Trusts (REIT), further expanding attractive economics and private investor interest in renewable energy assets.

Beneficial tax and investment policies and related financing structures, along with growing comfort and track records of success in the environmental infrastructure sector, are helping to build a robust public secondary market for environmental infrastructure assets, attracting investors who are seeking substantial liquidity. Thus, environmental infrastructure assets can be surprisingly liquid and, while having the potential to yield stable cash flows over the long term, most do not require the investor to engage in a long-term hold of the assets before a liquidity event. Certain smaller-scale projects with low construction and operating risks (such as solar PV projects) can be brought to market as soon as they are gathered into asset portfolios that are sufficiently large to interest a larger "next owner" (typically, in investment clusters of \$20 million or more). Other environmental infrastructure assets can be brought to market once they have been operating for one or two years.

Building on all of these developments, and shaped by a number of additional value drivers, the environmental infrastructure opportunity continues to grow. Today, environmental infrastructure markets in the United States are benefitting from positive macro-forces increasingly driving the broader rise of the environmental opportunities market sector, including inefficient existing resource management practices; proven and established technologies with high rates of business innovation, expanding market size and declining production costs; volatile hydrocarbon fuel and other commodity costs; and favorable economic and tax incentives at many levels of government.⁶

The steady yield of environmental projects, combined with attractive liquidity, makes environmental infrastructure particularly attractive to at least four types of investors: first, those made skittish by the 2008 financial crisis and the burst of the cleantech bubble but who are still interested in environmental opportunities or the energy sector; second, those looking for long-term, stable cash flows; third, those frustrated by low-interest rates; and fourth, those investors interested in investing for environmental impact but not ready to take, or wanting to balance their portfolios against, the increased risk of venture capital or growth equity investments.

⁶ See NewWorld's essay titled, "The Rise of Environmental Business Markets," in the series *On Matters That Matter*.

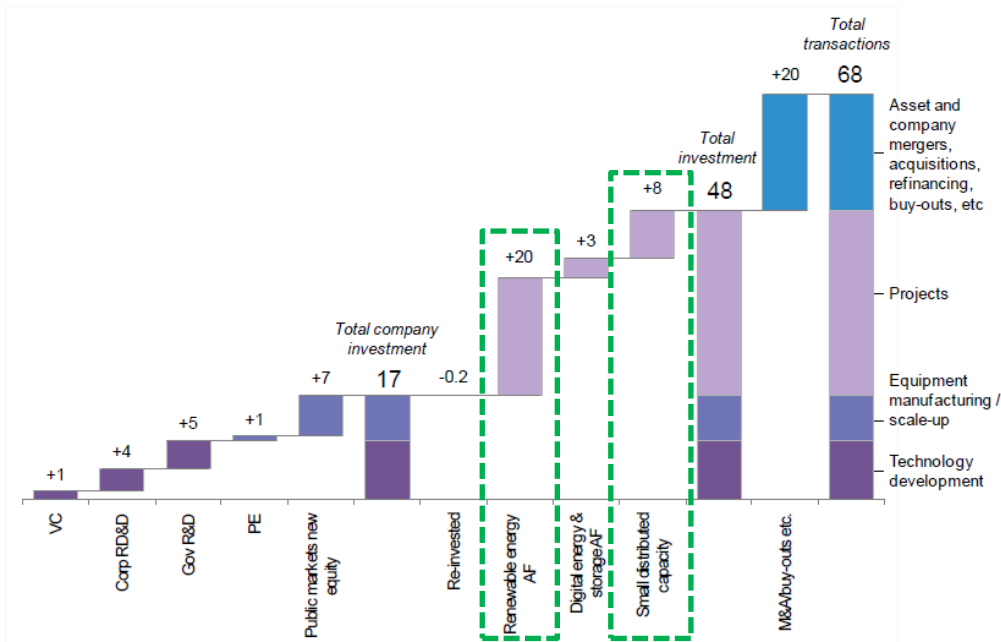
Indeed, developing renewable energy projects has become attractive to a range of consumers, large institutions, land and real estate owners, and others who recognize the economic, environmental, and reliability or security potential of renewable energy.⁷ Larger buyers or strategic investors have also begun to act on the sector's prospects, reflecting dynamics promoting more efficient resource use, creating a cleaner, less-polluting economy, improving national energy security, and reducing greenhouse-gas emissions, in addition to the financial attractiveness of the sector.

Renewable energy, followed by other areas of the environmental infrastructure market, is thus rapidly becoming even more understood, though much complexity—thus much investment opportunity—remains. Market growth and opportunity is particularly evident in the commercial and industrial (C&I) and similarly sized smaller utility-scale segments of the environmental infrastructure sector. For example, market penetration in the U.S. renewable energy C&I sector, including hydro but excluding biomass projects, is estimated at roughly 2% as of 2014, a very modest level relative to the market opportunity.⁸ Experience has demonstrated that the middle and lower middle markets are an attractive place to invest with less competition for assets and more arbitrage opportunities, since large investors typically pass over projects below a certain size or at an earlier stage of development. In addition, debt is usually not available for such projects on a standalone basis. In the context of these favorable trends and others, investors are beginning to take notice. As can be seen in Figure 2, renewable energy projects made up a large proportion of investment types and flows in 2013.

⁷ Robert Springer, *A Framework for Project Development in the Renewable Energy Sector*, NREL/TP-7A40-57963, National Renewable Energy Laboratory, February 2013.

⁸ U.S. Energy Information Administration; NewWorld analysis.

Figure 2: Clean Energy Investment Types and Flows in the United States in 2013 (\$ billions)

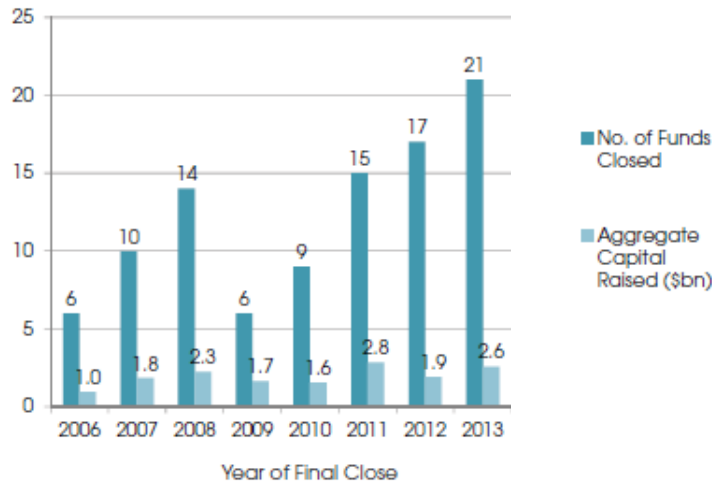


Note: This chart uses Bloomberg New Energy Finance’s definition of “Clean Energy,” which is defined as renewable energy, energy smart technologies, and other low-carbon technologies and activities; “AF” denotes “Asset Finance”, which consists of the funding of specific projects and plants, according to Bloomberg New Energy Finance.

Reproduced from Bloomberg New Energy Finance. *Sustainable Energy in America: 2014 Factbook*, February 2014.

In particular, although private equity has played only a modest role to date in renewable energy infrastructure investments, recent years have seen a shift in this behavior. As an example, the number of infrastructure investment funds focused on renewable energy has increased steadily since 2009, demonstrating increased investor appetite for environmental infrastructure investments, as well as a growing pool of project financing opportunities (see Figure 3).

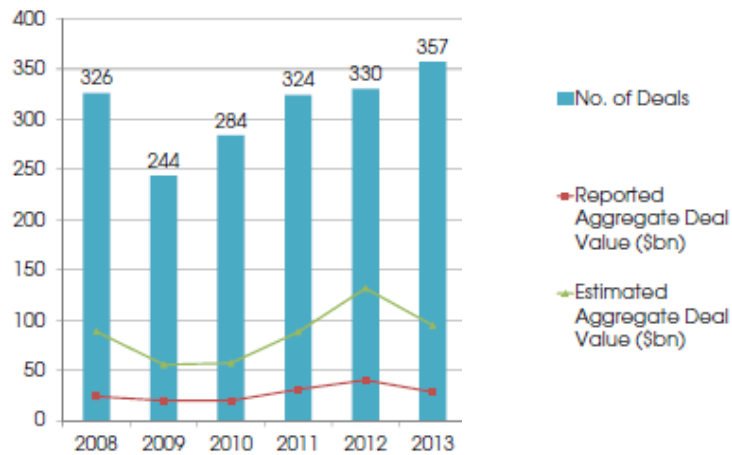
Figure 3: Annual Fundraising by Renewable Energy-Focused Unlisted Infrastructure Funds, 2006-2013



Reproduced from Preqin, *Special Report: Renewable Energy Infrastructure*, October 2014.

Fundraising in the renewable energy infrastructure sector has also increased steadily over recent years: the number of renewable energy infrastructure transactions completed has increased each year since 2009, indicating growing investment in the industry (see Figure 4).

Figure 4: Number and Aggregate Value of Renewable Energy Infrastructure Deals, 2008-2013



Reproduced from Preqin, *Special Report: Renewable Energy Infrastructure*, October 2014.

Increased private investment activity in this space reflects the extent to which investors and lenders have tended to become comfortable with risks associated with renewable energy like wind and solar. In fact, in Q2 2014 renewable energy projects made up 37% of all infrastructure deals—with the next largest portion coming from transportation at 21%.⁹ Improved understanding of renewable energy and environmental technologies, along with efforts to lower

⁹ Preqin Infrastructure Online.

the cost of capital by accessing public markets (through YieldCos and other publicly traded clean energy investment vehicles), have set a promising stage for future growth in environmental infrastructure.

II. Capitalizing on Attractive Attributes of Infrastructure and Project Finance

A. The Advantages of Infrastructure

The environmental infrastructure sector derives attractiveness from characteristics of the infrastructure asset class more broadly, including low-risk, long-term, inflation-protected, steady returns that are more resistant to business cycles.

Critical infrastructure across the United States is not only aging, but also deteriorating. Investment in its renewal has not kept pace. Though infrastructure has traditionally fallen within the purview of government ownership and of public finance, the current—and growing—need for investment in infrastructure has created an opportunity for private capital.¹⁰ As a Council on Foreign Relations report observes, while cost estimates for modernizing U.S. transportation, energy, and water infrastructure alone run over \$2 trillion by 2022, public infrastructure investment in 2012 (which amounted to just over 2% of GDP) was half of what it was fifty years earlier.¹¹

The relative low-risk of infrastructure investing in general is driven primarily by three features: (i) a captive customer base, as infrastructure assets typically provide fundamental services with relatively stable demand usually more resistant to business cycles; (ii) relatively long physical and economic life spans (typically 20 years or more); and (iii) high barriers to entry, as traditional infrastructure projects (such as toll roads, bridges, ports) typically require large initial investments.¹² The way infrastructure investments are structured also adds to their low-risk profile.

In particular, the combination of a captive customer base and long physical and economic life means that infrastructure assets generate relatively consistent and usually growing cash flows, leading to predictable asset valuations, particularly compared to the volatility experienced in many other asset classes.¹³ Infrastructure has also traditionally exhibited relatively low correlation with other asset classes, according to Credit Suisse analysis.¹⁴ Low correlation to other asset classes helps to insulate infrastructure investments from business cycles and volatility in other sectors. Reflecting in part these favorable attributes, infrastructure assets have a strong track record.

Private investment in infrastructure assets is expected to increase as more investors realize the potential of this asset class more broadly. Bain & Company concluded in 2014 that private investment in infrastructure would play a larger role globally, up from its 15% current investment level: “Weakened public finances are triggering a worldwide influx of private capital,

¹⁰ David Russ, “Can Infrastructure Investing Enhance Portfolio Efficiency?” *White Paper*, Credit Suisse, May 2010.

¹¹ Scott Thomasson, “Encouraging U.S. Infrastructure Investment,” *Policy Innovation Memorandum* No. 17, Council on Foreign Relations, <http://www.cfr.org/infrastructure/encouraging-us-infrastructure-investment/p27771>.

¹² David Russ, “Can Infrastructure Investing Enhance Portfolio Efficiency?” *White Paper*, Credit Suisse, May 2010.

¹³ Mark Weisdorf and Serkan Bahçeci, “The Infrastructure Moment: Favorable trends in Infrastructure Investing,” *Insights*, JP Morgan Asset Management, July 2011

¹⁴ David Russ, “Can Infrastructure Investing Enhance Portfolio Efficiency?” *White Paper*, Credit Suisse, May 2010.

at a time when private investment capital has been steadily accumulating, and is now eager for long-term, low-risk, inflation-protected returns that are better insulated against economic cycles.”¹⁵ With over \$50 trillion to invest globally, long-term investors such as insurers and pension funds are eager to invest in infrastructure, as are endowments and sovereign-wealth funds, but only 0.8% of their assets are currently invested in infrastructure projects.¹⁶ Given these types of investors and their willingness to look over a longer time horizon, it appears that ‘patient investment capital’ is on the rise.¹⁷ Moreover, as noted above, there is liquidity available for those investors who do not want to hold for the full life of an asset.

Despite the funding gap, the attractive aspects of infrastructure assets, and the strong track record of infrastructure investments, there is currently a substantial mismatch between funding requirements and capital made available by private investors. A World Economic Forum report stated in 2014: “Many investors, particularly long-term ones such as pension funds, insurance companies and sovereign wealth funds, want to allocate more capital in infrastructure but struggle to find bankable projects.”¹⁸ Specialist private equity investors are well-suited to navigate both sides of the challenge.

B. The Advantages of Project Finance

Financing infrastructure is generally a complex undertaking, and financing new facilities and projects in environmental infrastructure is no different. Environmental infrastructure projects, such as renewable power generation, are typically financed using an asset-based financing structure commonly referred to as project finance.

Project finance is the long-term investment in and financing of infrastructure projects as standalone investments in single purpose projects, where sponsors invest equity and lenders lend money for the construction of a project based solely on the specific project’s risks and future cash flows. They are therefore standalone, single-purpose investments in selected assets that are financed and controlled at the project level, rather than the company level, and which also have the benefit of no recourse to the project developer or sponsor.¹⁹

For equity investors, the appeal of project finance is that it can allow transactions to be specifically structured to minimize risks by allocating specific risks to parties responsible for those risks (move significant liabilities off balance sheet), maximize equity returns, protect key assets, and monetize tax financing opportunities.

Project financing emerged in the 1970s and 1980s as a leading way for private investors to finance large infrastructure projects that might otherwise be too expensive or speculative for any one individual investor to carry on a corporate balance sheet. Project financing has been particularly important for more risky project developments, with participants often relying on

¹⁵ Bain & Company, “Global infrastructure investment to reach four trillion dollars by 2017, finds new Bain & Company study,” February 4, 2014, <http://www.bain.com/about/press/press-releases/global-infrastructure-investment-to-reach-four-trillion-dollars-by-2017.aspx>.

¹⁶ *The Economist*, “Infrastructure Financing: A long and Winding Road,” May 22, 2014.

¹⁷ Bain & Company, “Global infrastructure investment to reach four trillion dollars by 2017, finds new Bain & Company study,” February 4, 2014, <http://www.bain.com/about/press/press-releases/global-infrastructure-investment-to-reach-four-trillion-dollars-by-2017.aspx>.

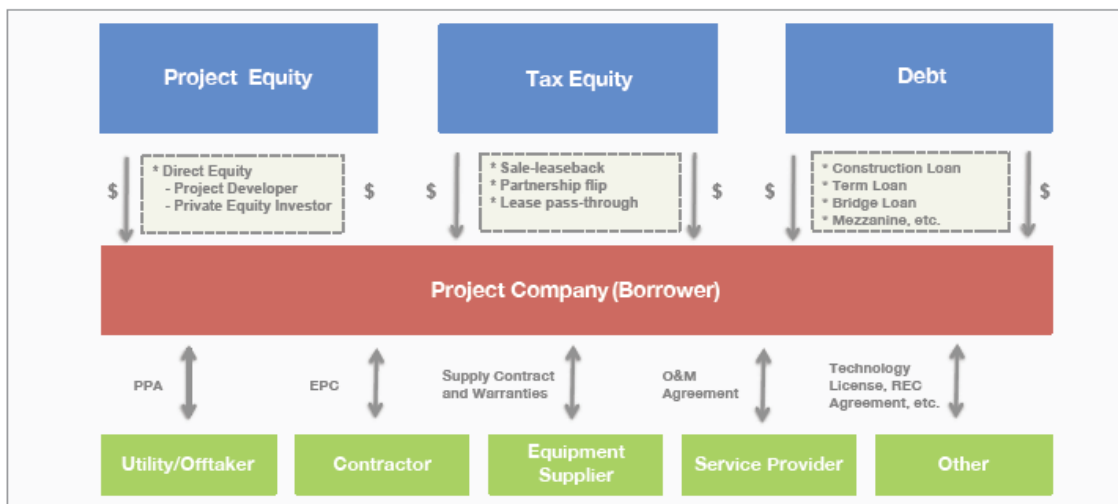
¹⁸ World Economic Forum, *Infrastructure Investment Blueprint*, February 2014.

¹⁹ Chris Groobey, John Pierce, Michael Faber, and Greg Broome, *Project Finance Primer for Renewable Energy and Clean Tech Projects*, Wilson Sonsini Goodrich & Rosati, August 2010.

long-term offtake or purchase agreements, guarantees, and other contractual relationships to ensure the long-term viability of individual projects.²⁰ Project finance in the United States has largely been dominated by power and transportation projects, as these sectors typically are capital-intensive, have predictable revenue streams and long asset lives.²¹

Environmental infrastructure projects generally have all of these features, making them ideal for project financing.²² Project finance is also attractive for environmental infrastructure because the underwritten cash flows allow project sponsors to enter into partnership agreements with various players (e.g., tax equity investors) and to place additional non-recourse debt on the assets, which helps improve returns for investors without materially increasing investment risk.

Figure 5: Typical Project Finance Structure for Renewable Energy Projects in the United States



Reproduced from Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., *Renewable Energy Project Finance in the U.S.: 2010-2013 Overview and Future Outlook*, Greenpaper, January 2012.

Renewable project financing generally involves (i) debt financing, where lenders have rights to a priority distribution of cash flows according to a set payment schedule; (ii) tax equity, where tax investors receive a disproportionate amount of tax benefits and cash distributions until achieving a target return; and (iii) cash equity, where equity investors receive the balance of cash flows and all residual and upside potential. Several sophisticated long-term contracts (such as for Engineering, Procurement, and Construction (EPC), Operations and Management (O&M), interconnection, feedstock supply, offtake agreements, insurance, and site leases), along with a variety of joint ownership and financing structures, are used to allocate the risks of the project to the party most capable of managing each risk, while ensuring commensurate profits to each party involved. Specialized expertise is necessary to properly assess and structure such projects in

²⁰ Chris Groobey, John Pierce, Michael Faber, and Greg Broome, *Project Finance Primer for Renewable Energy and Clean Tech Projects*, Wilson Sonsini Goodrich & Rosati, August 2010.

²¹ David Gardner and James Wright, “Project Finance,” HSBC, <http://www.hsbcnet.com/gbm/attachments/products-services/financing/project-finance.pdf>.

²² David Gardner and James Wright, “Project Finance,” HSBC, <http://www.hsbcnet.com/gbm/attachments/products-services/financing/project-finance.pdf>.

order to identify and ensure the appropriate allocation of risks. While in appearance more complicated than other forms of investment, once properly assessed and structured, project finance investments are typically significantly less risky than most other equity investments, and often used to generate safer, stable, and inflation-adjusted returns.²³

III. Value Drivers of Environmental Infrastructure Markets

Capitalizing on favorable macro-forces driving environmental business opportunities and the advantages of infrastructure project finance, the environmental infrastructure market is further propelled by a number of key value drivers: (i) abundant, free or undervalued fuel or feedstock; (ii) proven, de-risked technologies; (iii) investor appetite for risk-mitigated, inflation-protected assets; (iv) investor appetite for current yield; (v) growing demand for lower-cost, stable-priced energy; and (vi) advantageous investment and tax incentives.

These drivers are showing the way for private investors, particularly as they coalesce in the larger environmental market context of increased consumer interest in sustainability and climate change concerns, favorable market and economic forces, and industry development and evolution. These favorable drivers have successfully attracted significant amounts of private capital to the burgeoning environmental infrastructure industry already: in the U.S. renewable energy sector alone, over \$300 billion was invested from 2004-2013, with \$36 billion invested in 2013.²⁴

A. Abundant, Free or Undervalued Feedstock

For many environmental markets, abundant, free—or, at a minimum, undervalued—fuel or feedstock confers great economic advantage to an investment. In the clean power sector, for example, the cost savings derived from feedstock advantages are a large part of the opportunity of environmental infrastructure. Solar and wind energy production feature free feedstock, as do wastewater treatment and reuse and small-scale hydro projects. Even further from high feedstock prices, some waste-to-value plays, such as those that convert municipal solid waste (MSW) into energy, feature feedstock as a revenue source in the form of tipping fees (though consequently involving certain pricing risks).

These positive feedstock attributes are in contrast to traditional power or energy infrastructure, which is largely dependent on rising and volatile commodities costs. For gas-fired power plants, for example, fuel costs can represent up to 70% of the levelized cost of electricity (LCOE) of the project.²⁵ In addition, volatility in gas and coal prices can trigger a corresponding volatility in power prices, as well as impact the dispatch of certain plants to the detriment of others, thus significantly impacting the profitability of generators.

While some of these feedstocks may not be undervalued indefinitely (*e.g.*, MSW), this particular feature yields gains to the current environmental infrastructure sector. Additionally, feedstock cost advantages help drive market scaling for environmental infrastructure. Where non-renewable LCOE prices are based on technology and fuel supply, the costs of renewable energy

²³ Chris Groobey, John Pierce, Michael Faber, and Greg Broome, *Project Finance Primer for Renewable Energy and Clean Tech Projects*, Wilson Sonsini Goodrich & Rosati, August 2010.

²⁴ U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

²⁵ U.S. Energy Information Administration, *Annual Energy Outlook 2014*, May 7, 2014.

are generally based on technology. As the capital costs of renewable technologies—particularly solar and wind—decline through technological improvements and innovation, renewable generation will only become more cost-competitive with non-renewable technologies.

B. Proven, De-Risked Technologies

Many of the core technologies underlying the U.S. environmental infrastructure market are proven and de-risked with demonstrated success. Wind turbines and solar PV have been in commercial operation since the 1950s and 1980s, respectively. Scaled production of mature technologies like solar PV have facilitated increased market penetration and reduced the installed cost of energy to a point where solar is now at grid parity in many areas of the United States. Some waste-to-value technologies, such as anaerobic digesters, have been used in Europe since the late 1890s. Treating water with reverse osmosis has been practiced since at least the 1980s, and cost reductions have made desalination one of the least costly and most energy-efficient water treatment technologies for many applications.²⁶

Many environmental technologies have their roots in post-World War II U.S. government R&D efforts, which pursued energy-related R&D to support economic growth. Government investment in energy technologies and other R&D efforts starting in the 1970s is critical for today's environmental markets, forming many of the base technologies employed by the successful and growing companies of today. Other government investment into basic or technical research (often for military and defense applications) contributed to the broader proliferation of what are now critical technologies, such as the Internet, semiconductors, microprocessors, and memory processors.²⁷ Many of these technologies also come into play when considering how to capitalize on resource management challenges in environmental infrastructure.

Because the Federal government, via agencies like the Department of Energy (DOE) and others, was willing to take the initial technology risk for many of these opportunities, there are now middle- and lower-middle market environmental companies with de-risked technologies and track records of customers and revenues sufficient to support private market investments. These environmental technologies, and many others, have progressed down the development curve. Improvements in efficiencies have dominated recent innovation, but the core technology is established and reliable. In particular, many technologies have matured enough to gain the trust of some more risk-averse investors like corporations and banks, which may lead to lower cost of capital for projects as well as greater interest in renewable energy stocks, bonds and mutual funds.²⁸ Many technologies also benefit from some level of manufacturer warranties, further mitigating performance risks. Proven technologies thus offer a risk-mitigated investment opportunity in the environmental infrastructure context.

Technological risk mitigation is also reflected in the falling technology costs of many environmental infrastructure project components. Thanks to supportive policies (both domestic

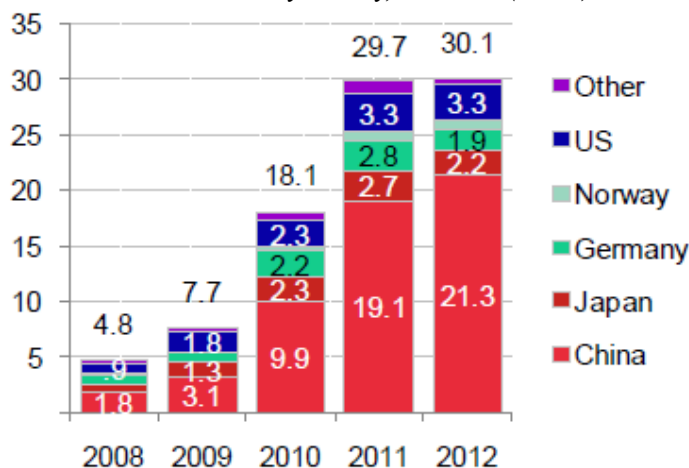
²⁶ See for example Anand K. Plappally and John H. Lienhard, "Costs for water supply, treatment, end-use and reclamation," *Desalination and Water Treatment* 51 (2013), 200-232.

²⁷ Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (New York: Anthem Press, June 2013).

²⁸ Jennifer Runyon, "Renewable Energy Finance Outlook for 2014: Where Will the Cash Flow?" *RenewableEnergyWorld.com*, January 30, 2014, <http://www.renewableenergyworld.com/rea/news/article/2014/01/renewable-energy-finance-outlook-for-2014-where-will-the-cash-flow?page=2>.

and international) that drove investment and therefore, industry growth, equipment costs for both wind and solar PV have decreased from 2010 to 2014 by roughly 43% and 80%, respectively.²⁹ Deployment and innovation in the wind industry, largely due to the PTC, has allowed for a 90% reduction in the cost of wind power since 1980.³⁰ The residential and commercial solar ITC has helped solar installations grow by over 3,000% since the policy was implemented in 2006, and contributed to great reductions in both average solar system prices—falling 60% since 2006—and in the cost of solar panels³¹ as well as other critical components of the solar supply chain.³² Expanded production globally (notably, in China for solar PV) also helped scale these markets (see Figure 6).

Figure 6: Global Solar PV Module Production By Country, 2008-2012 (in GW)



Reproduced from Bloomberg New Energy Finance. *Sustainable Energy in America: 2014 Factbook*, February 2014.

These technology advances and cost decreases associated with successful investment and market scaling have facilitated the growth of not only environmental business markets more broadly, but also environmental infrastructure markets specifically.

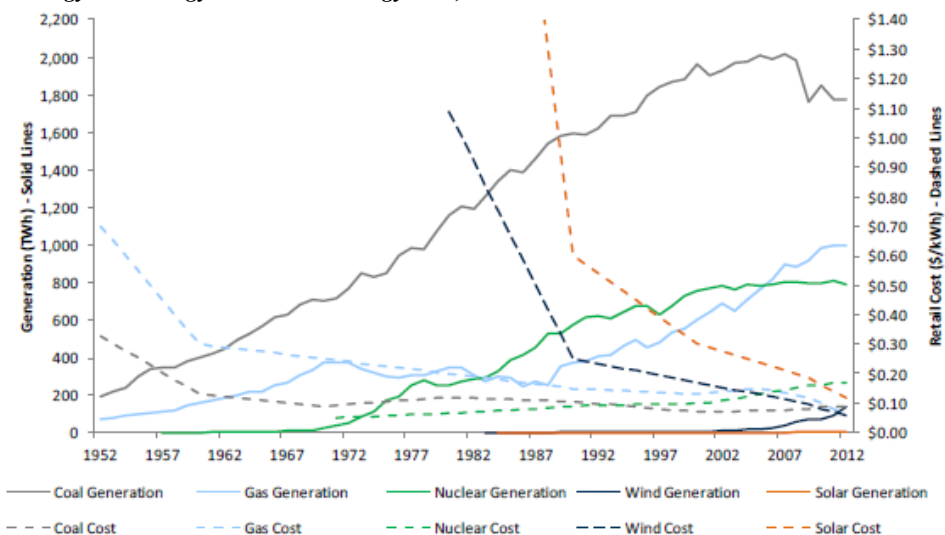
²⁹ U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

³⁰ AWEA, *Federal Production Tax Credit for Wind Energy*. As cited in U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

³¹ Wholesale module prices from top tier manufacturers have declined from an average of \$4/W in 2007 to \$0.70/W in 2014.

³² American Council On Renewable Energy, *The Outlook for Renewable Energy in America: 2014*, March 2014. As cited in U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

Figure 7: Energy Technology Versus Technology Cost, 1952-2012



Source: Hudson Clean Energy Partners Analysis. As cited in U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

C. Investor Appetite for Risk-Mitigated, Inflation-Protected Assets

Long-term asset holders, such as public and private pension plans and insurance companies, are constantly seeking risk-mitigated and stable returns, which makes environmental infrastructure assets attractive.

Environmental infrastructure projects are generally characterized by risk-mitigated capital exposure from contracted, abundant or free feedstock, contracted revenue streams, experienced contractors and equipment providers, and creditworthy counterparties. These risk mitigants are discussed in more detail below. To take renewable energy projects as an example: clean energy projects tend to have relatively higher capital costs than conventional energy projects but lower annual variable costs, which, once they are in operation, tend to result in long-term steady cash flows with attractive returns (in part from free or undervalued feedstock) for investors.³³

Environmental infrastructure projects are also generally protected against inflation to the extent that offtake and operating agreements are usually escalated by actual or expected inflation rates. In addition, the value of the assets tends to track associated replacement costs, which, for tangible assets like infrastructure projects, generally follow inflation-adjustments in material prices and labor.³⁴

D. Investor Appetite for Current Yield

Environmental infrastructure projects typically generate stable yields over the life of the project and can be underwritten based on those projected stable and predictable cash flows. As with most projects, renewable energy and environmental infrastructure investments face higher risks

³³ Marley Urdanick, “A Deeper Look into Yieldco Structuring,” *Renewable Energy Project Finance*, National Renewable Energy Laboratory, September 3, 2014, <https://financere.nrel.gov/finance/content/deeper-look-yieldco-structuring>.

³⁴ Dave Esrig, “Infrastructure: Inflation Protection for the Long and the Short Term,” *Insights*, JP Morgan Asset Management.

during development stages, but once projects are built, their cash flows are generally stable and low-risk. At a time of low interest rates, these yields are particularly attractive to investors.

While financing structures (including tax equity) sometimes alter the current yield to the cash investor in the early years to the benefit of lenders and tax investors, current yields generally increase over time as the tax equity earns its target return and debt is retired. Cash-flowing, inflation-insulated environmental infrastructure assets are thus highly attractive opportunities for yield-seeking investors.

E. Growing Demand for Lower-Cost, Stable-Priced Energy

A confluence of factors, including state-level Renewable Portfolio Standards (RPS), falling costs of distributed generation, incremental advances in renewable energy technologies, rising interest in demand-side management, and high retail electricity prices in many areas, is driving clean distributed electricity generation.³⁵

In contrast to high oil prices (relative to pre-early 2000 levels), natural gas prices in the United States have declined in recent years and remained relatively low, reflecting significantly expanded production in the largely contained North American market.³⁶

But lower prices from abundant gas supply have not translated into material gains for consumers. Take electricity for example, which has been increasingly generated in the U.S. from low-cost natural gas. Electricity retail prices are relatively high, and held steady—or even increased for many areas in the United States, largely due to transmission and distribution costs, which make up roughly 40% of the retail price on average, across residential, industrial, and commercial consumers.³⁷ Indeed, less than half the delivered cost of natural gas is associated with the actual supply when taxes are added to the cost of transmission and distribution.

These costs have largely offset recent declines in electricity generation costs (for example, natural gas generation³⁸), particularly as investment by utilities into transmission and distribution infrastructure has risen.³⁹ New U.S. electricity transmission investment increased five-fold from 1997 to 2012, and further upgrade and investment requirements remain.⁴⁰ Moreover, as natural gas producers move into areas where resources are more difficult and expensive to extract, natural gas prices are forecast to increase by an average of 3.7% annually through 2040.⁴¹

³⁵ 13D research (2013).

³⁶ The recent decline in global crude oil prices in 2014 is not expected to have an impact on the \$250 billion clean power industry. According to the International Energy Agency, clean energy will receive almost 60% of the \$5 trillion expected to be invested in new power plants over the next decade. As reported in Reed Landberg, “OPEC Oil Price Squeeze To Leave Renewable Energy Unscathed,” *Bloomberg*, December 3, 2014.

³⁷ For 2011, 41% and for 2012, 42% (in 2012 dollars). U.S. Energy Information Administration, “Electricity Supply, Disposition, Prices, and Emissions,” *Annual Energy Outlook 2014*, May 7, 2014.

³⁸ Hawaii is an exception, since the state relies on expensive, imported oil for power generation. With the recently announced takeover of Hawaiian Electric Industries Inc. by NextEra Energy Inc., the increase in renewable power generation may ultimately reduce electricity costs for customers. See Mark Chediak and Ehren Goossens, “NextEra Buys Hawaii’s Biggest Utility To Study Renewable Energy in the Island State,” *Bloomberg*, December 4, 2014.

³⁹ U.S. Energy Information Administration, “Investment in electricity transmission infrastructure shows steady increase” August 26, 2014, <http://www.eia.gov/todayinenergy/detail.cfm?id=17711>.

⁴⁰ U.S. Energy Information Administration, “Investment in electricity transmission infrastructure shows steady increase” August 26, 2014, <http://www.eia.gov/todayinenergy/detail.cfm?id=17711>.

⁴¹ U.S. Energy Information Administration, “Market Trends: Natural gas,” *Annual Energy Outlook 2014*, May 7, 2014, http://www.eia.gov/forecasts/aeo/MT_naturalgas.cfm#natgas_prices.

In the context of these trends, growing consumer concern for stable-priced, affordable energy is understandable. Corporate sustainability, green building goals, image and competitiveness concerns, longer-term hedging against increasing utility rates, and marketing differentiation are other drivers along with high energy costs for non-residential consumers, particularly in the C&I environmental infrastructure sectors.

The rise of residential solar also illustrates consumers' concerns for reliable energy with lower-cost and more stable electricity pricing, as with distributed generation of renewable energy more broadly. The residential solar market segment has experienced healthy and sustained growth in recent years, largely because of falling costs of PV and the development of financing models inspired by the typical project finance structure characteristic of large utility-scale projects that reduce or eliminate the up-front capital expense for consumers. New residential PV installations increased by more than a third (year-over-year) in 2013, to roughly 770MW, which amazingly accounted for 20% of total U.S. PV capacity installed that year.⁴² Customer-sited PV capacity growth is expected to exceed utility-scale solar growth between 2013 and 2015, which is projected to double over that period.⁴³ Furthermore, there is significant room for further development of the solar residential market, particularly given rising electricity prices, low costs of solar PV, available loan financing in addition to lease options, and increasing consumer interest.

F. Advantageous Investment and Tax Incentives

Many recent changes in the renewable energy market have been facilitated by U.S. government policy, particularly in the wake of the global recession, at the federal and state levels. These measures include tax incentives, loans, and grants, along with a variety of other policy incentives. Generally, these policy mechanisms have proven to be effective market drivers, and they have helped influence investments in renewable energy, shaping a strong and growing market.

However, it is worth noting that economics rather than policy will increasingly drive the proliferation of renewable generation.⁴⁴ According to the EIA's 2014 projections, as natural gas prices rise and the capital costs of renewable technologies—particularly solar and wind—decline, renewable generation will become even more competitive, making up roughly 16% of total electricity generation by 2040.⁴⁵ This positive trend has been shaped by the supportive (albeit at times uncertain) history of the regulatory environment, which has also contributed to the market development of important finance innovations, including YieldCos, Green Bonds, and securitization financing structures.⁴⁶

⁴² Bloomberg New Energy Finance, *Sustainable Energy in America: 2014 Factbook*, February 2014.

⁴³ U.S. Energy Information Administration, "Renewables and CO2 Emissions," *Short-Term Energy and Winter Fuels Outlook*, Release Date: October 7, 2014, http://www.eia.gov/forecasts/steo/report/renew_co2.cfm.

⁴⁴ Bloomberg New Energy Finance, *2030 Market Outlook*, July 2014, [bnef.folioshack.com/document/v71ve0nkr8e0/who42hnkr8fo](http://www.bnef.com/document/v71ve0nkr8e0/who42hnkr8fo). Accessed November 2014.

⁴⁵ U.S. Energy Information Administration, "Executive Summary," *Annual Energy Outlook 2014*, May 7, 2014, http://www.eia.gov/forecasts/aeo/executive_summary.cfm.

⁴⁶ U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

1. Federal Incentives

At the federal level, several key tax credits have contributed greatly to the development of environmental markets, including those for the production or investment of certain renewable energy technologies.

The ITC includes a 30% tax credit on capital expenditures for new solar thermal and PV plants, if they are placed in service before the end of 2016. Solar projects are eligible to receive a 10% ITC on capital expenditures beyond 2016 under current law.⁴⁷ If under construction before the end of 2013, new wind, geothermal, biomass, hydroelectric, and landfill gas projects were eligible to receive either: a \$21.5/MWh (\$10.7/MWh for technologies other than wind, geothermal and closed-loop biomass) inflation-adjusted production tax credit (PTC) over the plant's first ten years of service; or a 30% ITC.⁴⁸ In December 2014, Congress passed legislation that would extend the PTC for wind by one year.⁴⁹ With the measure signed into law, wind projects under construction prior to January 1, 2015 would be eligible to receive the PTC.⁵⁰ After 2016, geothermal projects are eligible to receive a 10% ITC, under current law.⁵¹ These incentives have played a major role in driving environmental infrastructure investing in recent years.

Aside from these main federal tax credit incentives, accelerated depreciation has been another essential driver of private investment into renewables.⁵² The 2008 economic stimulus included a 50% first-year "bonus depreciation" provision for eligible renewable-energy systems, which has since been extended and modified several times.⁵³ Most recently in December 2014, legislation extending bonus depreciation was passed by the Congress and signed into law, extending the 50% first-year bonus depreciation for renewable projects by one year through the end of 2014.⁵⁴

⁴⁷ U.S. Energy Information Administration, "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014," *Annual Energy Outlook 2014*, April 17, 2014, http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. Accessed November 2014.

⁴⁸ U.S. Energy Information Administration, "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014," *Annual Energy Outlook 2014*, April 17, 2014, http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. Accessed November 2014.

⁴⁹ The measure was signed into law on December 19, 2014. Office of the Press Secretary, "Statement by the Press Secretary on Statement by the Press Secretary on H.R. 1068, H.R. 2754, H.R. 2901, H.R. 3608, H.R. 3979, H.R. 4030, H.R. 4681, H.R. 5462, H.R. 5771, and S. 2673," The White House, December 19, 2014. See also Akin Gump Strauss Hauer & Feld LLP, "House Passes PTC Extension Through End of 2014," Renewable Energy Alert, December 4, 2014, <http://www.akingump.com/en/news-publications/house-passes-ptc-extension-through-end-of-2014-2.html>.

⁵⁰ Office of the Press Secretary, "Statement by the Press Secretary on Statement by the Press Secretary on H.R. 1068, H.R. 2754, H.R. 2901, H.R. 3608, H.R. 3979, H.R. 4030, H.R. 4681, H.R. 5462, H.R. 5771, and S. 2673," The White House, December 19, 2014. See also Akin Gump Strauss Hauer & Feld LLP, "House Passes PTC Extension Through End of 2014," Renewable Energy Alert, December 4, 2014, <http://www.akingump.com/en/news-publications/house-passes-ptc-extension-through-end-of-2014-2.html>.

⁵¹ U.S. Energy Information Administration, "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014," *Annual Energy Outlook 2014*, April 17, 2014, http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. Accessed November 2014.

⁵² Database of State Incentives for Renewables and Efficiency, "Modified Accelerated Cost-Recovery System (MACRS)," January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F; U.S. Partnership for Renewable Energy Finance, *Tax Credits, Tax Equity and Alternatives To Spur Clean Energy Financing*, White Paper, September 2011.

⁵³ Database of State Incentives for Renewables and Efficiency, "Modified Accelerated Cost-Recovery System (MACRS)," January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

⁵⁴ Office of the Press Secretary, "Statement by the Press Secretary on Statement by the Press Secretary on H.R. 1068, H.R. 2754, H.R. 2901, H.R. 3608, H.R. 3979, H.R. 4030, H.R. 4681, H.R. 5462, H.R. 5771, and S. 2673," The White House, December 19, 2014. See also Akin Gump Strauss Hauer & Feld LLP, "House Passes PTC Extension Through End of 2014," Renewable Energy Alert, December 4, 2014, <http://www.akingump.com/en/news-publications/house-passes-ptc-extension-through-end-of-2014-2.html>.

The current depreciation system (Modified Accelerated Cost-Recovery System, or MACRS) is still favorable for renewable energy projects. Since 1986, MACRS has assigned a five-year useful life to most renewable energy property, including solar, wind, geothermal, fuel cells, and micro-turbines, as well as combined cycle projects.⁵⁵ For certain other types of renewable energy property, such as biomass or marine and hydrokinetic property⁵⁶, the useful life is seven years.⁵⁷

2014-2.html; and Database of State Incentives for Renewables and Efficiency, “Modified Accelerated Cost-Recovery System (MACRS),” January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

⁵⁵ Database of State Incentives for Renewables and Efficiency, “Modified Accelerated Cost-Recovery System (MACRS),” January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F; U.S. Partnership for Renewable Energy Finance, *MACRS Depreciation and Renewable Energy Finance*, White Paper, December 2013.

⁵⁶ “Eligible biomass property generally includes assets used in the conversion of biomass to heat or to a solid, liquid or gaseous fuel, and to equipment and structures used to receive, handle, collect and process biomass in a waterwall, combustion system, or refuse-derived fuel system to create hot water, gas, steam and electricity. Marine and hydrokinetic property includes facilities that utilize waves, tides, currents, free-flowing water, or differentials in ocean temperature to generate energy. It does not include traditional hydropower that uses dams, diversionary structures, or impoundments.” As described in Database of State Incentives for Renewables and Efficiency, “Modified Accelerated Cost-Recovery System (MACRS),” January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

⁵⁷ Database of State Incentives for Renewables and Efficiency, “Modified Accelerated Cost-Recovery System (MACRS),” January 3, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F.

Figure 8 : Federal Tax and Investment Incentives for U.S. Renewable Energy

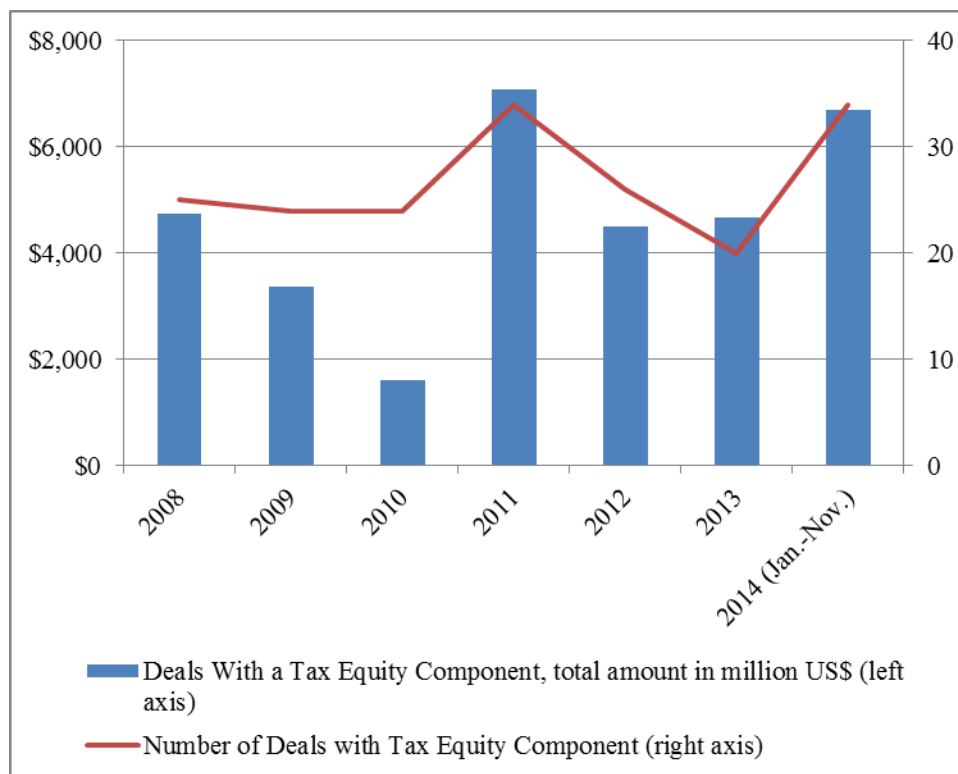
Tax Incentive	Incentive	Sector	Expiration
Investment Tax Credit	Credit equal to 30% of eligible capital expenditure	Solar, fuel cells, small wind	Must commission by end-2016 for 30% incentive. For solar, qualifying properties are then eligible to receive 10% incentive thereafter. ITC for other technologies not available after 2016.
		Wind, biomass, geothermal, hydropower, marine, tidal	Must begin construction by end-2013
	Credit equal to 10% of eligible capital expenditure	Geothermal	No expiration
		CHP, microturbines	Must commission by end-2016
Production Tax Credit	10-year production-based credit equal to \$22/MWh (inflation adjusted)	Wind, closed-loop biomass, geothermal	Must begin construction by end-2014
	10-year production-based credit equal to \$11/MWh (inflation adjusted)	Open-loop biomass, landfill gas, waste-to-energy, marine, qualified hydropower and hydrokinetic	Must begin construction by end-2014
Modified Accelerated Cost Recovery System (MACRS) and other depreciation incentives	MACRS allows depreciation of tangible property on an accelerated basis (five years for wind, solar, and geothermal; seven years for biomass and marine)	All sectors	MACRS does not expire
	Bonus depreciation allows for an accelerated schedule (50% in year one)	All sectors	Bonus depreciation expired at end-2014
	Superbonus depreciation allows for an even more accelerated schedule (100% in year one)	All sectors	Superbonus depreciation (100% in year one) expired at end-2011

Note: In December 2014, Congress passed legislation that extended both the PTC for wind and the bonus depreciation by one year. The measure was signed into law on December 19, 2014. Office of the Press Secretary, "Statement by the Press Secretary on Statement by the Press Secretary on H.R. 1068, H.R. 2754, H.R. 2901, H.R. 3608, H.R. 3979, H.R. 4030, H.R. 4681, H.R. 5462, H.R. 5771, and S. 2673," The White House, December 19, 2014. See also Akin Gump Strauss Hauer & Feld LLP, "House Passes PTC Extension Through End of 2014," Renewable Energy Alert, December 4, 2014, <http://www.akingump.com/en/news-publications/house-passes-ptc-extension-through-end-of-2014-2.html>.

Adapted from Bloomberg New Energy Finance, *Sustainable Energy in America: 2014 Factbook*, February 2014.

The particular configuration of these main federal incentives has made tax equity a key component in private-sector financing of clean energy projects (though it is not necessarily required). As these tax credits and benefits are only attractive to companies and entities that are large enough to have substantial tax liability and pay income tax, and many project sponsors or investors are unable to utilize tax benefits, tax equity partners can play a valuable role in facilitating environmental infrastructure project finance.

Figure 9: Renewable Energy Project Finance Deals With Tax Equity, 2008-2014 (January-November)



Notes: For some deals, investment amounts also include construction and pre-construction debt, as well as equity finance; investment amounts include all disclosed amounts (but not all amounts were disclosed); deals are counted by the year in which the transaction was announced; “renewable energy” includes biomass, hydro, solar, wind, geothermal, and other renewables.

CleanEnergy Pipeline, “Transactions: Project / Asset Finance,” December 2014; NewWorld calculations.

Because of the potential for substantially lessening tax burdens for entities with high tax liability, tax equity investment has become an attractive financing mechanism for renewable energy projects in the United States.⁵⁸ Companies like Bank of America, GE, U.S. Bancorp and Google, among others, have used the tax equity structure to invest in wind, solar and other renewable energy projects.⁵⁹ Additionally, previously under the Section 1603 program, project sponsors

⁵⁸ U.S. Partnership for Renewable Energy Finance, *Tax Credits, Tax Equity and Alternatives To Spur Clean Energy Financing*, White Paper, September 2011.

⁵⁹ Ryan Tracy, “Renewable Firms Seek Tax-Equity Partners,” *Wall Street Journal*, February 11, 2012, <http://online.wsj.com/articles/SB10001424052970203646004577215163265069078>.

could elect to receive a cash grant in lieu of tax credits, thereby alleviating the constraints associated with tax equity financing.⁶⁰

It is also important to note that other federal level tax arrangements in the form of corporate structures such as YieldCos, which are not specific to renewable energy projects, have also facilitated the proliferation of alternative financing mechanisms for renewable energy projects.

The U.S. federal government has long had in place other measures to encourage deployment of renewable energy projects. The U.S. DOE Loan Programs Office has a Section 1703 program to provide guarantees to innovative clean energy technologies that may have difficulty in attracting traditional financing due to perceived higher technology risks.⁶¹ Qualifying technologies include those related to electricity delivery and energy reliability, alternative fuel vehicles, industrial energy efficiency projects, biomass, hydrogen, solar, wind/hydropower, nuclear, advanced fossil energy coal, carbon sequestration practices/technologies, or pollution control technologies.⁶² These efforts were ramped up in the wake of the global recession. For example, as part of the financial stimulus, the U.S. DOE Loan Programs Office's Section 1705 program provided loan guarantees to U.S.-based renewable energy projects in construction before Q3 2011.⁶³ The Section 1705 program played a major role in the large utility-scale solar market build-out by encouraging lenders to support renewable energy development through reducing risk.⁶⁴ Despite a few well-publicized failures, DOE's loan guarantee programs have demonstrated great success: as of 2014, with 87%⁶⁵ of projects in good standing, a reported surplus return, and \$5 billion expected in profits.⁶⁶ Reopened in April 2014⁶⁷, these programs continue the U.S. government's (DOE, DOD, among others) long legacy of taking initial technology risk by supporting R&D efforts in not only renewable energy, but also other energy arenas.

Finally, U.S. Green Bonds (or the Brownfields Demonstration Program for Qualified Green Building and Sustainable Design Projects) represent another federal incentive. The program was designed to provide funding (by way of \$2 billion worth of AAA-rated bonds issued by the U.S. Treasury) to finance environmentally friendly development, specifically contaminated industrial and commercial land (known as brown fields) reclamation, production of energy from renewable sources, and energy conservation.

⁶⁰ U.S. Partnership for Renewable Energy Finance, *Tax Credits, Tax Equity and Alternatives To Spur Clean Energy Financing*, White Paper, September 2011.

⁶¹ Loan Programs Office, "Section 1703 Loan Program," Department of Energy, <http://energy.gov/lpo/services/section-1703-loan-program>. Accessed December 2014.

⁶² Loan Programs Office, "Section 1703 Loan Program," Department of Energy, <http://energy.gov/lpo/services/section-1703-loan-program>. Accessed December 2014.

⁶³ Loan Programs Office, "Section 1705 Loan Program," Department of Energy, <http://energy.gov/lpo/services/section-1705-loan-program>. Accessed December 2014.

⁶⁴ "Through our existing renewable energy loan guarantees, the Department's Loan Programs Office helped launch the U.S. utility-scale solar industry and other clean energy technologies that are now contributing to our clean energy portfolio." Secretary of Energy Ernest Moniz, as quoted in Roy L. Hales, "The DOE Loan Program Office, A Government Success Story," April 27, 2014, *CleanTechnica*, <http://cleantechnica.com/2014/04/27/doe-loan-program-office-government-success-story/>.

⁶⁵ As described in Roy L. Hales, "The DOE Loan Program Office, A Government Success Story," April 27, 2014, *CleanTechnica*, <http://cleantechnica.com/2014/04/27/doe-loan-program-office-government-success-story/>.

⁶⁶ Jonathan Silver, "Former DOE Official: Critics of the Clean Energy Loan Program Were Proved Wrong," *Greentech Media*, November 24, 2014.

⁶⁷ Kenneth W. Hansen, "DOE Reopens for Renewable Energy Loan Guarantees," Chadbourne Project Finance Newswire, April 2014, http://www.chadbourne.com/DOE_Reopens_Renewable_Energy_Loan_projectfinance/.

2. State-Level Incentives

State-level policy has also contributed to the recent expansion of environmental infrastructure markets in the United States, particularly in the clean energy and power sector. Perhaps the most prominent of these state-level policies are Renewable Portfolio Standards, which are regulations requiring increased production of energy from renewable energy sources, such as solar, wind, biomass and geothermal, at the state level.

In the absence of a federal standard, thirty-six states have instituted a RPS. As of April 2014, RPSs have driven the creation of one-third of U.S. non-hydro renewable electricity.⁶⁸ To the extent they are enforced, these standards will help further drive the adoption of renewable energy. RPSs tend to vary by state along several dimensions, including by targets, by target year, whether they assess penalties for non-compliance, and more.

For example, California's RPS requires the state's electric utilities to have 33% of their retail sales come from eligible renewable energy resources by 2020 and all years following.⁶⁹ The state is on track to meet this goal, reporting "On April 1, 2014, the large [investor-owned utilities, or IOUs] reported in their 33% RPS Procurement Progress Reports that they collectively served 20.9% of their retail electric load with RPS-eligible generation during the first compliance period (CP 1) from 2011-13."⁷⁰ The IOUs collectively provide over two-thirds of California's electricity, which gives a good sense of the state's overall progress on its RPS.⁷¹

Many states have also carved-out goals for specific renewable energy sources, such as solar or wind. Minnesota has a solar and wind set-aside: there is a 1.5% solar mandate for investor owned utilities by 2020, and a statewide goal of 10% of retail electric sales from solar by 2030.⁷² In another example, New Mexico has carved out goals for solar and wind—in addition to "other" renewables and an overall distributed generation goal.⁷³ Other states have specific RPS goals that call for a certain percentage of energy to come from distributed generation, which also tend to have additional customer-siting requirements. For example, Arizona requires 4.5% of energy from distributed generation by 2025, half of which must be residential, while the remaining half must be from non-residential, non-utility applications.⁷⁴

There are several other dimensions along which states' RPS can vary. Some states have different targets and regulations for investor-owned utilities and a separate schedule for electric cooperatives (e.g., Colorado) while one state (Oregon) has RPS regulations covering three classes of utilities as of 2013.⁷⁵ Some states have certain geographic requirements, typically

⁶⁸ U.S. Partnership for Renewable Energy Finance, *Renewable Energy Finance, Market & Policy Overview*, April 2014.

⁶⁹ Database of State Incentives for Renewables and Efficiency, "California: Incentives/Policies for Renewables & Efficiency," Last updated June 25, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA25R.

⁷⁰ California Public Utilities Commission, *Renewable Portfolio Standard Status Report Q2 2014*, August 2014.

⁷¹ California Public Utilities Commission, *Renewable Portfolio Standard Status Report Q2 2014*, August 2014.

⁷² Database of State Incentives for Renewables and Efficiency, "Minnesota: Incentives/Policies for Renewables & Efficiency," Last updated October 31, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MN14R.

⁷³ New Mexico's set-asides are in terms of the percentage of the overall target for any given year. The solar set aside is 20%, the wind set-aside is 30%, and the "other" renewables set-aside is 5%. This means the balance of the RPS (45%) may be met with any qualifying renewable resource. The distributed generation set-aside is set at 1.5% in 2011 and increases to 3% in 2015. The distributed generation set-aside is applied to the target as a whole in any given year. Database of State Incentives for Renewables and Efficiency, "New Mexico: Incentives/Policies for Renewables & Efficiency," Last Updated October 29, 2014, http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NM05R&re=1&ee=1.

⁷⁴ Database of State Incentives for Renewables and Efficiency, "Arizona: Incentives/Policies for Renewables & Efficiency," Last Updated September 5, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R.

⁷⁵ Justin Barnes, "Renewable Portfolio Standards Data," Database of State Incentives for Renewables and Efficiency, March 2013, <http://www.dsireusa.org/rpsdata/>.

mandating that at least 50% of the renewable energy requirement be met by in-state facilities. Other state-level measures vary by net metering policies, under which utilities pay renewable energy systems owners for the electricity they generate and contribute to the grid. Finally, some states without binding RPS have adopted voluntary measures to increase the proportion of their energy from renewable sources, such as Indiana or Vermont.

Certain states with an RPS have associated Renewable Energy Credit (REC) provisions, which may be bought and sold to comply with RPS regulations (grid-tied renewable electricity generation projects produce RECs along with physical electricity, typically one REC for 1000 kWh).⁷⁶ Since state RPSs require electricity suppliers to produce a specified fraction of electricity from renewable sources, either by producing it themselves or by purchasing RECs equal to their obligations under a RPS program, there are now several well-developed state-level markets for RECs. In some cases, RECs may be banked (to be used in future years) or borrowed (to meet current obligations). Some states' REC programs have geographic restrictions (utilities may only purchase RECs from in-state facilities, for example), while others do not. Generally, however, at the state-level, RECs are a useful way to track the amount of renewable power that is produced and sold, and also to compensate eligible power producers. Solar RECs (SRECs) are a special variant of RECs, related to solar set-asides in RPS programs.

There are other state incentives that have also contributed to the proliferation of clean energy projects. For example, North Carolina offers a 35% personal tax credit for renewable energy projects⁷⁷ and has additional property tax incentives for solar PV systems.⁷⁸ For customers of Minnesota's investor-owned utilities, there is a "Made in Minnesota" solar energy production incentive for eligible residential, commercial, non-profit, and multi-residential customers.⁷⁹

IV. Navigating Environmental Infrastructure Risks

The environmental infrastructure sector is complex, and is not without risk, but the risks are navigable by investors with deep sector expertise, and can generally be mitigated, either contractually or analytically. In the context of this essay, use of the term "risk" generally refers to risk that target returns are not met, rather than risk that the investment might be lost. A successful project finance strategy is one that attempts to avoid taking "binary" risk, or the risk of total investment loss.

In general, robust, long-term, and predictable forecasted cash flows are essential to successful project finance investments.⁸⁰ Sustainable project economics that also incorporate clearly identified demand for the project's goods or services are critical, in addition to detailed financial due diligence and rigorous modeling to stress-test the impact of financing, offtake, operations,

⁷⁶ U.S. Environmental Protection Agency, "Renewable Energy Certificates (RECs)," Last Updated April 15, 2014, <http://www.epa.gov/greenpower/gpmarket/rec.htm>.

⁷⁷ Database of State Incentives for Renewables and Efficiency, "North Carolina: Incentives/Policies for Renewables and Efficiency: Renewable Energy Tax Credit (Personal)," Last Updated September 11, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC20F.

⁷⁸ Database of State Incentives for Renewables and Efficiency, "North Carolina: Incentives/Policies for Renewables and Efficiency: Property Tax Abatement for Solar Electric Systems," Last Updated September 11, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC51F&re=1&ee=1.

⁷⁹ Database of State Incentives for Renewables and Efficiency, "Minnesota: Incentives/Policies for Renewables & Efficiency," Last updated October 31, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MN14R.

⁸⁰ David Gardner and James Wright, "Project Finance," HSBC, <http://www.hsbcnet.com/gbm/attachments/products-services/financing/project-finance.pdf>.

and operating agreement assumptions on projected cash flows. Hurdle rates (the required rate of return on an investment) for direct equity participants in renewable energy projects depend on factors like project size, deployed technology⁸¹, location, and project phase. The complexity of these variables makes generalizations across projects, let alone market segments, difficult to make.

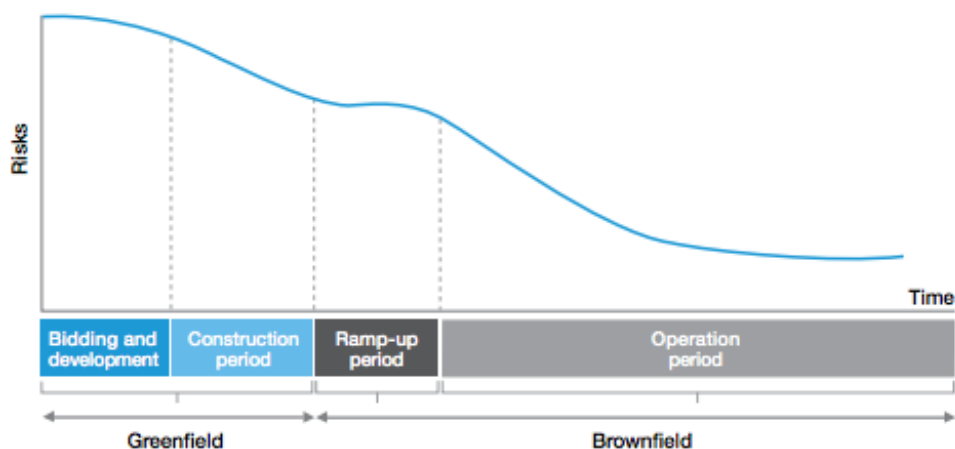
As a function of process complexity, time-to-construct, variability of operating expense, and performance expectations and guarantees, solar PV is currently the lowest risk renewable energy project, followed by hydro, wind, CHP, and waste-to-value toward the higher end of the risk spectrum.

One of the most effective risk mitigants is portfolio diversification: an investment strategy that blends projects of varying degrees of risk and target returns in the overall portfolio.

A. Project Phase Risks

Risks may be associated with a particular project phase (development, construction, or operational). For projects of a given technology, investments at the development phase are generally the most risky, with commensurately lower investment amounts and higher returns. Operational projects are generally much lower risk, with associated lower returns.

Figure 10: Development Stage Risks for Project Finance



Reproduced from World Economic Forum, *Infrastructure Investment Blueprint*, February 2014.

During the development phase, there are certain project milestones involving permitting, leasing, or other approvals and agreements that can help investors evaluate risks associated with various stages of development. For example, project agreements that are often crucial for project financing are an EPC agreement; a site lease agreement (if the project land is not owned by the project company itself); a REC agreement (where applicable); an interconnection agreement (for projects connected to the electricity grid); offtake agreements; feedstock agreements (where applicable); and environmental and/or building permits. Depending on the size of the project,

⁸¹ Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., *Renewable Energy Project Finance in the U.S.: 2010-2013 Overview and Future Outlook*, Greenpaper, January 2012.

the location, the market, the technology employed, and the risk appetite of the investor, some or all of these agreements may need to be in place prior to an investment. As an example, obtaining a permit for a large, utility-scale wind power project in a populated area is a longer endeavor and significantly riskier than obtaining a permit for a rooftop solar project in a commercial zone.

Construction phase risks are typically associated with potential completion delays or cost overruns. In this case, technology is a primary driver of construction stage risk. Building a wind powered project, for example, has more potential for delays than a solar PV facility. A project with a strong turnkey EPC contractor exposes investors to lower risk than a project with several contractors (*e.g.*, separate contractors for civil works, equipment, electrical). Other drivers of potential construction delays could involve factors outside the control of investors, such as utility non-compliance with interconnection timing requirements for commercial solar projects. Overall, utilities across the U.S. have complied with the rules on pricing and access but often with some significant delays and minor costs. Delays in commercial interconnects beyond statutory deadlines can thus be challenging in certain circumstances, but these risks may be addressed by project planning with proper contingencies.

Risks associated with the operational phase of a project are also technology specific (with waste-to-value projects significantly riskier than solar projects, for example), and may be mitigated through various contractual measures or investment approaches, including proper sensitivity analysis. For example, risks associated with project operations and maintenance may be tempered by long-term maintenance agreements with the original equipment manufacturers, by using experienced operators with strong track records, or by assessing feedstock quality for continuity and equipment for feedstock intake flexibility.

B. Feedstock or Offtake Risks

Risks associated with other project elements, such as supply, feedstock, and offtake, vary and influence project underwriting. For example, from a feedstock perspective, sunshine is the lowest risk, followed by wind, water, various fuels, and finally biomass. Meteorological wind data for wind power projects and long-term insolation data for solar projects would be needed to support project viability.

Offtake agreements are intended to ensure a steady revenue stream for projects and thus matter greatly, particularly whether the offtaker is rated or not. Contracted power purchase agreements (PPAs) with utilities offer the lowest offtake risk, followed by agreements with municipal buyers, rated commercial entities, unrated commercial entities and, depending on regions, merchant (spot price) as higher relative risk. For non-utility offtakers, there also may be some net-metering risk depending on the regulatory environment of the state.

Feedstock supply and price risks (when applicable) and offtake risks may be mitigated with robust, specific agreements, usually with rated, creditworthy counterparties, that ensure downside protection and account for fluctuations in commodity prices, logistics or tipping fees, where applicable.

A common development milestone that renewable energy project developers must reach in order to secure project financing is a long-term PPA for power or a similar offtake agreement. Projects without PPAs or other offtake contracts might be project financeable in certain cases, but likely at lower leverage ratios, higher debt costs, and only in selected regions and if future operators are

experienced and have a proven track record of managing market risk. The length of the PPA or offtake agreement should also be sufficient to fully amortize the contemplated project debt and provide comfortable levels of equity returns.

C. Exit Risk

Finally, identifying and planning for an exit before making an investment is essential to reducing exit risk. By structuring and aggregating a portfolio of projects at a sufficient scale to attract lenders and a larger universe of buyers, investors could potentially profit from both debt leverage and arbitrage opportunities at exit.

Broadly speaking, with abundant, free or undervalued feedstock and long-term PPAs, low or manageable construction and operational risk, and an expanding consumer base, the market for renewable energy asset buyers has been expanding rapidly, particularly as environmental infrastructure markets have grown in the context of sensitivity to global environmental concerns.

Growing interest for this sector provides ample opportunity for environmental infrastructure investors to exit portfolios of projects to actors such as institutional investors, YieldCos, or utilities. To take utilities as an example: utilities often receive premium rates from their customers for renewable energy, and they also are able to make money from smaller projects to meet peak power demand, which provide utilities an opportunity to sell the energy at a premium. Thus, many utilities are buying renewable energy projects, big and small, for their portfolios. Further, given that more than half of the states have legislated RPSs, utilities are under even greater pressure to include renewable energy in their portfolios. As a result, utility companies are gradually incorporating solar arrays into their power generation activities; average utility solar sector installations grew from 11.7GW to 12.5GW within Q4 2013. Companies like Duke Energy, Edison International, and NextEra have also invested in renewable energy through purchasing existing projects.

But exit risks largely depend on the coherence and simplicity of the assets being marketed (how easily they are grouped and explained), so as to be attractive as rollups by larger players. For example, solar PV projects in geographic proximity to each other would likely be easy to sell, whereas a mixed portfolio of waste-to-value assets across the U.S. may entail multiple buyers or a longer holding period. In addition, from a timing perspective, solar PV projects can currently be brought to market as soon as they are gathered into asset portfolios of around \$20 million or more, a scale sufficient to attract a large buyer. Other environmental infrastructure assets, such as waste-to-value projects, can be brought to market once they have been operating for one or two years, demonstrating that they are de-risked.

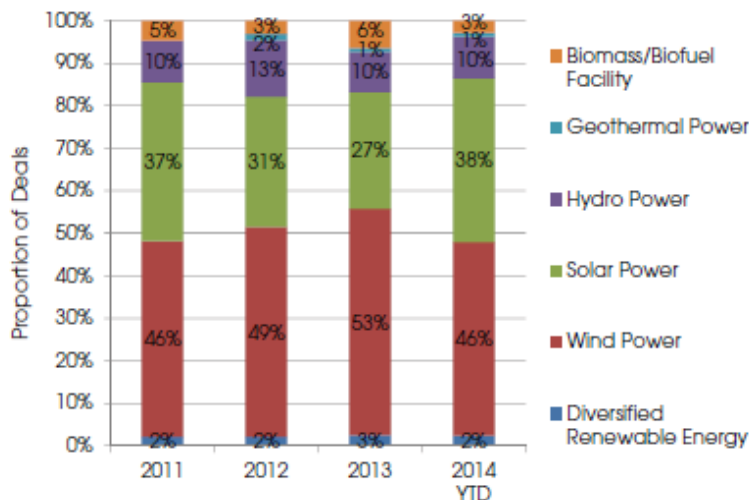
V. Environmental Infrastructure Segments of Interest

The complexity of environmental infrastructure markets provides an advantage to specialist investors who understand the intricacies of different policy environments and can underwrite investments in selected sub-segments with full understanding of related risks.

It is important to note, however, that in the project finance context, not all environmental infrastructure segments are attractive, let alone every sub-segment within an environmental market space. Within many market segments, there are a range of project finance opportunities: some sub-segments that are higher-risk and higher-return, and other sub-segments that are lower-

risk and lower-return. There are many undercapitalized opportunities in some markets—spaces where larger financial players have no interest and other, more generalist investors, largely unaware of attractive prospects. In a larger portfolio context, therefore, specialist private equity investors may be in a position to exploit some of these spaces in a risk-mitigated manner to provide portfolio upside, for an overall competitive return in aggregate. The specialist investor is advantaged by deep sector-specific knowledge and sufficient expertise to weed through the larger landscape of opportunities to create an attractive portfolio.

Figure 11: Breakdown of Renewable Energy Infrastructure Deals by Industry, 2011-2014 YTD (October 6, 2014)



Reproduced from Preqin, *Special Report: Renewable Energy Infrastructure*, October 2014.

For example, despite significant efforts to encourage installations and investments, much confusion and uncertainty lingers regarding policy designed to incentivize renewable energy investment. Investors report not having a solid understanding of the renewable energy technologies, the particular markets, and the future of relevant policies and, as a result, hesitate to invest.⁸²

The following sections consider the landscape of environmental infrastructure opportunities, highlighting attractive spaces for project finance investment prospects and explaining how and why they are promising for investment. These sections are not, however, comprehensive, as they do not cover the range of other investment possibilities, such as growth equity opportunities.⁸³ These sections also expound on promising sub-segments within the broader environmental infrastructure landscape that merit special attention from specialist investors going forward, and also briefly note why other sub-segment prospects may not be as attractive in light of current market dynamics.

⁸² Ernst and Young, “Pension and insurance fund attitudes toward investment in renewable energy infrastructure,” *Institutional investor survey results*, November 2013.

⁸³ For a more comprehensive exposition of these rise and development of environmental market segments, please see the companion essay in the NewWorld series *On Matters That Matter*, titled “The Rise of Environmental Business Markets.”

A. Solar

The solar PV segment is one of the most attractive segments for project finance. The U.S. solar industry is an \$11.5 billion market with over 360,000 systems in place.⁸⁴ Since 2008, solar capacity additions have exhibited a compound annual growth rate of over 50%, with strong gains anticipated in the coming years.⁸⁵ As of 2014, cumulative operating PV solar capacity has now eclipsed the 15 GW mark, and through the first half of 2014, more than a half-million homeowners and commercial customers have installed solar PV.⁸⁶ In particular, continuing the trend of the past several years of strong growth, utility-scale solar PV alone made up over 20% of energy capacity added in the United States in 2013, helped in part by falling technology costs as well as state RPS programs and a supportive federal regulatory environment.⁸⁷

Investors have recognized and begun acting on this attractive space within environmental infrastructure markets. The solar PV market has seen some gradual compression of returns in the past two years, owing in large measure to its success as investors gain experience, a better understanding of the technology and associated risks, more reliable regulatory environments, declining production costs, and development of consumer financing options and secondary markets. However, much project finance opportunity remains in this thriving segment, particularly in the smaller utility-scale and C&I sub-segments.

1. Utility-scale Solar PV

Utility-scale solar project developers amassed more than 3 GW of new contracts from July 2013 to June 2014, largely propelled by solar power's increasing cost-competitiveness.⁸⁸ Since large utility-scale projects are generally too capital intensive for smaller private equity investors, and typically highly courted by utilities as well as large corporations and strategic investors (*e.g.*, Nextera, GE, NRG, Berkshire Hathaway), some of the most promising project finance opportunities lie in the small utility-scale PV (similar in size to C&I-scale solar) space.

Small utility-scale PV projects are generally lower risk due to several factors, including creditworthy utility offtakers, proven technology, relatively short timescales before revenue is realized, and favorable (and reliable) regulatory environments in most states, which contributes greatly to the attractiveness of the sub-segment from a project finance perspective. Another attractive aspect of these projects is that there is no net metering risk.

The technology for small utility-scale solar is well-understood, has a substantial track record and the risk is thought to be self-mitigated. Development risk in utility-scale solar PV projects is also relatively low, although choosing to invest only in operating projects would more comprehensively mitigate any development risk.

⁸⁴ Travis Lowder, "New NREL Report Explores Solar Securitization," National Renewable Energy Laboratory, June 6, 2014 <https://financere.nrel.gov/finance/content/new-nrel-report-explores-solar-securitization>.

⁸⁵ Travis Lowder, "New NREL Report Explores Solar Securitization," National Renewable Energy Laboratory, June 6, 2014 <https://financere.nrel.gov/finance/content/new-nrel-report-explores-solar-securitization>.

⁸⁶ Solar Energy Industries Association, "Solar Market Insight Report 2014 Q2," September 4, 2014, <http://www.seia.org/research-resources/solar-market-insight-report-2014-q2>.

⁸⁷ U.S. Energy Information Administration, "Half of power plant capacity additions in 2013 came from natural gas," *Today in Energy*, April 8, 2014, <http://www.eia.gov/todayinenergy/detail.cfm?id=15751>.

⁸⁸ Solar Energy Industries Association, "Solar Market Insight Report 2014 Q2," September 4, 2014, <http://www.seia.org/research-resources/solar-market-insight-report-2014-q2>.

The holding period for small utility-scale solar PV projects would likely be relatively short. In terms of exit prospects, there are a variety of options; the role of the small private equity investor in this space is to serve as an aggregator. Potential buyers would include investors with higher minimum investment thresholds, YieldCos, and utilities. There is, therefore, significant potential in rolling up projects into a portfolio to expand the universe of potential buyers. It is worth noting that because of the lower-risk starting point of small utility-scale solar PV, aggregation of these projects does not further reduce risk, which is reflected in little (if any) yield changes. However, a large value proposition in this space is the aggregation itself. There is rich ground for project finance in this sub-segment, particularly for the specialist investor who is able to recognize and take advantage of market inefficiencies in this smaller end of the utility-scale solar PV market segment.

From an environmental infrastructure portfolio perspective, small utility-scale solar PV is also a portfolio risk mitigation measure, used to balance other higher risk-higher return project investments and the slightly higher risk associated with C&I projects.

2. Commercial & Industrial Scale Solar PV

C&I-scale solar PV is another attractive sub-segment for project finance. Like small utility-scale solar PV, the C&I solar PV sub-segment is relatively low risk, with proven and widely understood technology, relatively fast development and construction timelines, and low operating risk.

The C&I sub-segment, however, may be further disaggregated by offtaker in terms of credit risk: there are rated offtakers like industrial and commercial actors; municipalities, universities, schools, hospitals (collectively known as the ‘MUSH market’) or other public sector entities; and finally, unrated offtakers, which involve the most counterparty risk. Electricity rates are also tiered by the scale of the consumer: the bigger offtakers (industrials and large commercial actors) also generally have lower electricity rates, leading to lower returns, versus other offtakers, who would likely have higher electricity rates, with consequently higher returns.

Though the availability of capital for non-residential solar has vastly increased in recent years, developing and financing small C&I projects has remained challenging. This is in large part because, with the exception of industrial and municipal offtakers, C&I solar PV projects often have varying PPA terms, offtakers with difficult-to-assess creditworthiness or no credit ratings, and site-specific project requirements.⁸⁹ All of these factors raise the transaction costs associated with smaller commercial projects.⁹⁰ Some net metering risk may also be involved, since offtakers are not utilities. Without standard screening, selection, and scoring criteria, the C&I PV sector has complexities that inhibit efficient and reliable project development and financing for non-specialist investors.

Holding periods and exit opportunities are expected to mirror those of smaller utility-scale solar PV projects: holding periods would be relatively short with a variety of attractive exit options, from utilities to YieldCos.

⁸⁹ Solar Energy Industries Association, “Solar Market Insight Report 2014 Q2,” September 4, 2014, <http://www.seia.org/research-resources/solar-market-insight-report-2014-q2>.

⁹⁰ Solar Energy Industries Association, “Solar Market Insight Report 2014 Q2,” September 4, 2014, <http://www.seia.org/research-resources/solar-market-insight-report-2014-q2>.

In a larger portfolio context, C&I solar PV projects with creditworthy offtakers also have the potential to play a stabilizing role, providing relatively low risk like small utility-scale solar projects, further adding to their attractiveness as investment prospects.

3. Residential Solar PV

Recently revolutionized by innovative project structures and systematized financing schemes like the solar lease, the residential solar PV market is very active and well-serviced. In particular, the residential PV sector benefits from a longstanding and well-understood credit rating system for homeowners (FICO scores), which has facilitated standardization of residential solar deals and spurred investor appetite. Accordingly, yields in the sub-segment have been generally attractive but are compressing through time.

Given the large number of well-capitalized entities in what is now a very concentrated sub-segment, there does not appear to be much room for smaller private equity investors. However, to the extent that there is project finance opportunity in this space going forward, it will be to engage where larger players are unwilling or unable. This is where the advantages associated with specialized sector knowledge come to bear. For example, there should be some project finance opportunities related to solar gardens (which centralize solar PV installations and allow residential consumers to subscribe by pooling resources to receive power output credit in proportion to their usage) or working with a state Green Bank on credit enhancement projects. This sub-segment is certainly worth exploring for innovative project financing opportunities.

B. Wind

The U.S. wind industry is a \$10 billion industry estimated as of yearend 2014 and is playing a significant role in the U.S. energy landscape.⁹¹ From 2009 to 2013, wind accounted for over 30% of new electricity generating capacity installed in the United States, and the United States has over 61,000 MW of utility-scale wind power capacity already installed.⁹²

Wind alone accounts for over 4% of total electricity generated in the United States as of 2014, the largest source of renewable power generation after hydro.⁹³ In 2013, 12 states accounted for 80% of U.S. wind-generated electricity: Texas, Iowa, California, Oklahoma, Illinois, Kansas, Minnesota, Oregon, Colorado, Washington, North Dakota, and Wyoming.⁹⁴ As of 2014, 39 states have operating utility-scale wind projects.⁹⁵ In 2013, Independent Power Producers (IPPs)

⁹¹ Wind Energy Foundation, "Interesting Wind Energy Facts," <http://www.windenergyfoundation.org/interesting-wind-energy-facts>. Accessed December 2014.

⁹² American Wind Energy Association, "Wind Energy Facts at a Glance," <http://www.awea.org/Resources/Content.aspx?ItemNumber=5059>; Wind Energy Foundation, "U.S. Wind Industry Fast Facts," updated August 17, 2014, <http://www.windenergyfoundation.org/about-wind-energy/us-wind-industry-fast-facts>.

⁹³ U.S. Energy Information Administration, "What is U.S. electricity generation by energy source?," *Frequently Asked Questions*, June 13, 2014, <http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3>.

⁹⁴ U.S. Energy Information Administration, *Electric Power Monthly*, March 2014; Wind Energy Foundation, "Interesting Wind Energy Facts," <http://www.windenergyfoundation.org/interesting-wind-energy-facts>. Accessed December 2014.

⁹⁵ American Wind Energy Association, "Wind Energy Facts at a Glance," <http://www.awea.org/Resources/Content.aspx?ItemNumber=5059>; Wind Energy Foundation, "U.S. Wind Industry Fast Facts," updated August 17, 2014, <http://www.windenergyfoundation.org/about-wind-energy/us-wind-industry-fast-facts>.

owned 83% of wind power capacity in the United States, while utilities owned 15%, with 2% owned by others (*e.g.*, towns, schools, commercial customers, farmers).⁹⁶

With free feedstock, technological advances, and favorable federal incentives (the PTC), the cost of wind deployment has declined over the past 15 years, resulting in rapid growth of wind capacity. From 2006 to 2012, wind power capacity grew at an average annual rate of approximately 30% and the costs of new installed wind dropped by 22%.⁹⁷ In 2013, with the expiration of the PTC, wind power capacity additions in the United States moderated.⁹⁸ Still, through the third quarter of 2014, as much generating capacity as of all of 2013 (1,254 MW) came online.⁹⁹

The utility-scale wind sub-segment is attractive for project financing because it is relatively lower risk and well-understood. (It is worth noting that unlike in the solar PV segment, the very-small-residential wind market does not lend itself well to project finance, and no C&I wind market sub-segment exists.¹⁰⁰) Recent cost decreases have made onshore utility-scale wind projects more cost-competitive with other traditional energy sources: utility-scale wind projects are or very nearly affordable for many areas of the United States, ranging from \$37-\$81/MWh LCOE, depending on the region.¹⁰¹ While wind power is around grid parity in certain regions of the United States¹⁰², indicating strong economics even without any changes in production incentives, further significant growth of the wind sector in the U.S. will likely depend on a potential extension of the PTC, as of yearend 2014.

Utility-scale wind projects are generally large, have utility offtakers, and generate stable returns. While wind projects usually have higher operational risk compared to solar PV because of their technological complexity (wind turbine-generators are rotating equipment and require substantial operations and maintenance), those risks are well understood. Although returns may be relatively low, cash flows from utility-scale wind projects are stable and are derived from low-risk, creditworthy offtakers with no net-metering risk, which is an attractive feature of these investments. Indeed, long-term contracted sales to utilities remain the most common offtake arrangement for wind projects.¹⁰³

The holding period for utility-scale wind projects is likely to be slightly longer than solar, but investments in wind projects offer upside exit strategies that are increasing in popularity and appeal, as investors look for consistent cash flows. There should also be compelling project

⁹⁶ National Renewable Energy Laboratory, *2013 Wind Technologies Market Report*, August 2014.

⁹⁷ U.S. Department of Energy, "The Production Tax Credit is Key to a Strong U.S. Wind Industry," April 10, 2014, <http://energy.gov/articles/production-tax-credit-key-strong-us-wind-industry>.

⁹⁸ National Renewable Energy Laboratory, *2013 Wind Technologies Market Report*, August 2014.

⁹⁹ American Wind Energy Association, "Record low costs drive opportunities in U.S. wind energy," October 20, 2014, <http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=6904>.

¹⁰⁰ "U.S. electric utilities investing heavily in wind energy," *Electric Light & Power/ POWERGRID International*, February 22, 2013, <http://www.elp.com/articles/2013/01/u-s--electric-utilities-investing-heavily-in-wind-energy.html>.

¹⁰¹ Lazard, *Lazard's Levelized Cost of Energy Analysis Version 8.0*, September 2014.). The low end is the Midwest, ranging from \$37-\$61/MWh to the Southeast, which ranges from \$78-\$122/MWh.

¹⁰² According to Lazard analysis, certain regions in the United States with high levels of onshore winds can already consistently provide renewable power at a lower cost than fossil fuel plants. As reported in Will Nichols, "Fresh reports reveal how solar and wind are closing in on grid parity," October 28, 2014, *Business Green*, <http://www.businessgreen.com/bg/analysis/2377993/fresh-reports-reveal-how-solar-and-wind-are-closing-in-on-grid-parity>. Also see Lazard, *Lazard's Levelized Cost of Energy Analysis Version 8.0*, September 2014.

¹⁰³ On a cumulative basis, utilities own (15%) or buy (54%) power from 69% of all wind power capacity in the United States, with merchant/quasi-merchant projects and competitive power marketers accounting for 23% and 8%, respectively. National Renewable Energy Laboratory, *2013 Wind Technologies Market Report*, August 2014.

finance opportunities to acquire existing utility-scale wind projects for financial and technical upgrades. Another attractive project finance option would be a play into the residual interests of existing and operating utility-scale projects, particularly as tax equity terms near their end. For at least these reasons, utility-scale wind projects are likely to be among attractive investment prospects for the specialist private equity investor.

C. Hydroelectric

Hydroelectric power is a \$6 billion-dollar industry, accounting for the majority of renewable power generation in the U.S. and a substantial portion of the power generation mix. Almost all of the large hydroelectric capacity was installed during the 1970s, and is operated by federal agencies, with most utility-scale sites (major waterfalls, dams, lakes) either already developed or now protected by environmental legislation.¹⁰⁴ In short, large-scale hydropower is a government activity.

In contrast, smaller-scale, low-head hydroelectric plants are attractive project finance opportunities for several reasons, including free feedstock and well-understood technology. Low-head hydropower projects use river or tidal flows to produce energy, and do not require dams or water retention structures.¹⁰⁵ Though there is scarce market-sizing data, the United States had over 80,000 unused dams, many with low head (under 50 feet), and small-scale (0.3 to 40MW) hydroelectric potential, as of 2011. DOE research has shown that at least 165,000MW of untapped hydroelectric power may be available.¹⁰⁶ Installing low-head hydro projects to take advantage of these sites is potentially a great source of power generation capacity.¹⁰⁷

Compared to solar PV or wind, the low-head hydro sub-segment has higher complexity associated primarily with permitting and development and, to some degree, with construction. In particular, site-specific challenges pose a certain amount of construction technical risk, particularly in terms of complexity and potential for project delays. Accordingly, there are associated cost barriers: for example, the development costs (such as permitting) can be cost prohibitive.

Development risk for low head, small-scale hydro can be high, although there are some opportunities to upgrade existing projects. However, in terms of construction and operational risks, low-head hydro projects are similar to wind—particularly for projects already in operation. Any operational risk would moreover be largely mitigated by secure offtake agreements for power, and offtakers could range from creditworthy industrials to other rated offtakers.

Despite low-head, small-scale hydro's advantages, this sub-segment has not received much project funding to date, suggesting that there are market opportunities and inefficiencies that may have been overlooked by non-specialist private equity investors. The risk profile of small-scale, low-head hydro could entail commensurately higher returns for these projects, which could serve as upside in an environmental infrastructure portfolio.

¹⁰⁴ U.S. Energy Information Administration, "How much U.S. electricity is generated from renewable energy?," *Energy in Brief*, April 14, 2014, http://www.eia.gov/energy_in_brief/article/renewable_electricity.cfm.

¹⁰⁵ Low-head hydro uses water flows that are 20 meters (roughly 65 feet) or less to generate electricity.

¹⁰⁶ As described in Small Business Innovation Research, "Power-Dense Lightweight Hydro Turbine/Generators for 20,000+ Low-Head US Dams," 2012, <https://www.sbir.gov/sbirsearch/detail/408792>.

¹⁰⁷ As described in Small Business Innovation Research, "Power-Dense Lightweight Hydro Turbine/Generators for 20,000+ Low-Head US Dams," 2012, <https://www.sbir.gov/sbirsearch/detail/408792>.

D. Water

The U.S. drinking water and wastewater infrastructure is aging, overburdened, and underfunded.¹⁰⁸ There are ample market inefficiencies and upgrading opportunities in this segment. In 2010, the cost of the capital investment required to maintain and upgrade drinking water and wastewater treatment systems alone across the U.S. was estimated to be \$91 billion of which only \$36 billion was funded, leaving a substantial gap.¹⁰⁹ Investment challenges have not disappeared. Reflecting funding shortages, among other pressures, the U.S. water resources and reclamation market was estimated to be \$59 billion in 2013, with an annual growth rate of 3% to 4% through 2015.¹¹⁰ However, in the coming years, this market is broadly expected to have strong and sustainable market growth, growing end-consumer demand, increasing government support, and a near-term need for improved efficiency, infrastructure management, and treatment for municipal, industrial, and agricultural users. Capitalizing on these trends, some of the most attractive spaces in the broader water market are projects related to operations and management of existing facilities, or water reclamation, reuse, or processing through treatment.

Though the water infrastructure segment may be thought of as solely consisting of traditional, large-scale infrastructure rather than environmental project finance, several sub-segments in particular merit active exploration for project finance investment opportunities as the water reuse and reclamation markets continue to develop.

1. Water Facilities Operations and Management

Down-market in the large-scale, traditional water infrastructure space, there is attractive project-financing potential in the water facility operations and maintenance sub-segment; specifically, through projects that acquire and upgrade existing facilities. Rather than amassing capital to construct new facilities, along with the development that such a project would entail, project financing assets that would provide operational changes, incremental modifications, and technical upgrades to existing water facilities could make attractive investments.

Upgrading existing water facilities in this manner are appealing from a project finance perspective for several reasons. First, such upgrades would be undertaken with the intent of significantly improving the facility's cash flows, which would be attractive and enhance liquidity substantially. Since the facilities would already be operational, development risk would be mitigated.

These upgrade projects would also involve evolutionary, not revolutionary, technologies. From a project finance perspective, technology and construction risks could vary, depending on the specifics of the upgrade, but would be relatively low. Offtake risk would also be relatively low, since the projects or facilities would already have offtake agreements in place prior the acquisition. Holding periods would likely be relatively short, largely depending on the extent of the modification and time it would take to demonstrate improved cash flow. But exits to larger financial players could entail higher yields, based on the new and improved cash flow profile, contributing to the attractiveness of these project finance opportunities.

¹⁰⁸ American Society of Civil Engineers, *Failure to Act: The Economic Impact of Current Investment Trends in Water & Wastewater Treatment Infrastructure*, 2011.

¹⁰⁹ American Society of Civil Engineers, *Failure to Act: The Economic Impact of Current Investment Trends in Water & Wastewater Treatment Infrastructure*, 2011.

¹¹⁰ NewWorld calculations.

2. Water Treatment

Water treatment project finance opportunities are limited at the present, but this sub-segment is worth exploring, given positive larger market dynamics.

The water reuse and recycling market has proven technology and is experiencing growing awareness of its attractiveness, but lacks sufficient financing incentives (such as tax credits similar to the ITC or the PTC) for substantial expansion. Due to the relatively low technology risk, certain smaller-scale water reclamation or desalination infrastructure projects may have project finance investment potential. However, this would be largely contingent on offtake arrangements with reliable counterparties. These agreements could take the form of a long-term water purchase agreements (similar to a PPA in the solar and wind energy sectors), which would provide a predictable source of revenue to make the economics work for investors while also providing long-term cash flow certainty. Distributed residential water treatment and reclamation projects also hold some promise in theory, although the market has not developed yet.

Projects that provide water treatment, reuse, or recycling services on-site to industrial players should be contenders for project financing. To the extent such services are contracted on a long-term basis with creditworthy offtakers, who would likely be commercial or industrial actors, there is likely opportunity for attractive project financing. This is another space in the sub-segment that is still relatively nascent, but worth following.

E. Geothermal Heat Pump Systems¹¹¹

The U.S. geothermal market segment is among the largest in the world, with 3,442 MW of installed capacity in 2013.¹¹² However, from an environmental infrastructure and project finance perspective, the geothermal sub-segment of most interest is the geothermal heat pump market sub-segment (also known as “ground-source heat pumps”), which is distinct from other sub-segments, such as large-scale geothermal power projects or enhanced geothermal systems.

The U.S. ground-source heat pump industry began in the early 1970s. In 2009, the U.S. ground source heat pump market was nearly \$4 billion, with projected strong growth¹¹³, spurred in part by the federal ITC for systems in place before the end of 2016. Ground-source heat pump systems range from residential to utility-scale. Currently, there are several larger-scale projects in the United States (largely at universities), either in construction or operation.¹¹⁴ As larger-scale projects demonstrate success (such as the Ball State University project), geothermal

¹¹¹ The larger market segment is called “geothermal”, but the ground source heat pump sub-segment, also commonly referred to as “geothermal” more broadly, is distinct from large-scale geothermal systems and enhanced geothermal systems.

¹¹² Meg Cichon, “Global Geothermal Market Saw Huge 2013 Growth, Says GEA,” *Renewable Energy World*, April 22, 2014, <http://www.renewableenergyworld.com/rea/news/article/2014/04/geothermal-market-saw-huge-2013-growth-as-countries-catch-up-with-us-says-gea>.

¹¹³ Tom Rogers, “Super Energy Saver: Ground Source Heat Pump,” Presentation, Oak Ridge National Laboratory (2011).

¹¹⁴ See, for example, the large-scale retrofit at Ball State University District Geothermal System. Another example is the Richard Stockton College District Geothermal ground source heat pump system, which was, for many years, the largest GSHP systems in the United States after being installed in 1994. As described in “Geothermal Energy Case Studies,” *Clean Energy*, http://www.cleanenergyactionproject.com/CleanEnergyActionProject/Geothermal_Technologies_Case_Studies.html. Accessed December 2014.

installers and developers are gaining more confidence to implement the technology on a wider scale.¹¹⁵

As larger-scale ground-source heat pump systems show the way, smaller-scale project financing opportunities should follow. This is helped in part by several favorable attributes of these renewable energy systems, including relatively low technology risk since the technology has been available, known, and economical in many respects since the 1940s. Back as far as 1993, the EPA called it “the most efficient, environmentally clean, and cost effective space conditioning system today.”¹¹⁶ Construction risks for ground-source heat pump projects are also fairly low.

Ground-source heat pump projects thus represent well-established technology but have ample potential for innovative applications of project finance. For example, there are project finance opportunities in the well-installation space of ground-source heat pump systems, which is often the most expensive part of the process. To the extent that projects can consist of a collection of wells with a credited-rated counterparty paying a fixed, long-term rate for the capacity the project produces, these projects could be underwritten in a risk-mitigated, attractive manner. There may also be an aggregation role to be played by project finance in this sub-segment.

A substantial hurdle for further market development remains, however, due to the large transaction costs that are currently associated with ground-source heat pump projects, most of which are bespoke. Overcoming this hurdle would open this sub-segment substantially for project finance. For example, transaction costs could be reduced by standardizing lease agreements and developing robust pipelines of similar deals.

The geothermal ground-source heat pump space is thus ripe for opportunity with the right developer and a solid pipeline of projects. It is worth drawing a parallel to the solar PV segment: indeed, the geothermal market today somewhat resembles the solar market of a decade ago, with proven technology, growing awareness of its attractiveness, but lacking the appropriate financing incentives to make it affordable and widespread.

This is another nascent market sub-segment worth exploring for creative and attractive project finance prospects as the market continues to develop.

F. Combined Heat and Power

The U.S. economy is highly energy inefficient. Thanks in part to higher relative resource prices and concerns about inefficient resource management, many actors and companies are seeking energy efficiency gains, driven by the prospect of cost savings in not only energy consumption but also in production and operation. The U.S. energy efficiency market is large and growing: in 2013, it was a \$62 billion industry, with annual growth rates projected at 7-9% to 2016 and beyond.¹¹⁷ Some sub-segments are growing more rapidly.

Two of the most attractive sub-segments in the energy efficiency landscape (which includes traditional gas turbine combined cycle projects) are in the combined heating, cooling, and power

¹¹⁵ Christopher Williams, “Construction of the Largest U.S. Geothermal Heat Pump System Underway,” Climate Progress, February 23, 2012, <http://thinkprogress.org/climate/2012/02/23/430745/largest-us-geothermal-heat-pump-system/>.

¹¹⁶ Christopher Williams, “Construction of the Largest U.S. Geothermal Heat Pump System Underway,” Climate Progress, February 23, 2012, <http://thinkprogress.org/climate/2012/02/23/430745/largest-us-geothermal-heat-pump-system/>.

¹¹⁷ NewWorld calculations.

sub-segment (CHP) and cogeneration sub-segment. Those sub-segments of interest capitalize on combined cycle technology, which takes advantage of the waste heat from electricity production to provide both electricity and useful thermal energy from a single energy source. The simultaneous production of heat and electricity is a more efficient use of fuel than traditional power generation, creating more usable energy while consuming less fuel.

1. Combined Heat and Power (CHP)

The U.S. CHP industry is poised for growth, thanks in part to concerns about stable and reliable energy supplies, energy efficiency, and higher retail electricity prices. CHP projects are the smaller-scale combined cycle projects with lower quality steam that may be used not only for heating but also for cooling. Instead of purchasing electricity and producing heat on-site, a CHP generator provides both energy services efficiently in one project.¹¹⁸ In 2011, there was roughly 70 GW of CHP generating capacity in the United States.¹¹⁹

CHP projects have significant potential from a project finance perspective, as they have proven and lower-risk technology and substantial track record of success broadly. The economic landscape for CHP is favorable in many areas, as high electricity rates and comparatively cheap fuels—such as natural gas—make CHP projects highly cost effective.

CHP projects do entail certain risks that require careful consideration. For example, CHP projects are typically bespoke and designs are site-specific, which tend to raise transaction costs and extend execution schedules. Standardizing power plant designs and lease structures would go a long way to reducing transaction costs. For example, from a project finance perspective, a portfolio of small, similar CHP installations would reduce these transaction costs, becoming more attractive to a specialized private equity investor.

Construction delays, cost over-runs or performance shortfalls are also risks that should not overlooked. Additionally, due to counterparty credit risks and siting challenges, there are also risks associated with operations. Even with creditworthy counterparties, there is particular risk associated with CHP because projects are embedded within host sites and, as a consequence, integration is tight.

Returns in this space should be higher, commensurate with the higher risks. As a result of these risk factors, CHP projects would possibly entail a relatively longer holding period, as a longer track record would likely be required, given the system complexity. While CHP has been a part of the energy mix for decades in Europe and Japan, it is just beginning to develop in the U.S., and should hold good promise.

¹¹⁸ U.S. Energy Information Administration, “Combined heat and power technology fills an important energy niche,” *Today in Energy*, October 4, 2012, <http://www.eia.gov/todayinenergy/detail.cfm?id=8250>.

¹¹⁹ U.S. Energy Information Administration, “Combined heat and power technology fills an important energy niche,” *Today in Energy*, October 4, 2012, <http://www.eia.gov/todayinenergy/detail.cfm?id=8250>.

2. Cogeneration

The industrial sector consumes 30% of all energy in the United States, and with these levels of consumption come significant costs.¹²⁰ These industrial combined cycle projects, called cogeneration projects, are generally larger-scale than CHP, and have higher quality steam (defined as higher temperature and higher pressure) that is used in industrial applications. Over 85% of all generating capacity sited at industrial and commercial facilities uses combined generation technology.¹²¹

Similar to CHP, the industrial cogeneration sub-segment is attractive from a project finance perspective. However, also similar to CHP, construction risks and certain operational risks can be significant due to integration with the ‘steam host’ or offtake counterparty. Over time, the steam host may change if a facility or property is sold, potentially surfacing additional operational risk. A way to mitigate these counterparty risks is to ensure that partners are creditworthy, for example.

Commensurate with the higher risks, returns in this space should be higher which, when properly underwritten and navigated, could prove to be attractive for some portfolio upside.

G. Waste-to-Value

Waste generation in the United States has grown strongly since the 1980s, without a corresponding increase in the ability to recover and dispose of the waste in many areas. This mismatch in the context on environmental concern yields great opportunities in the U.S. waste-to-value market. Today, roughly 54% of waste generated in the United States still goes directly into landfills,¹²² in many cases polluting the land and generating methane gas emissions while failing to recover valuable reusable materials.

In 2012, total MSW generation in the U.S. was 251 million tons, and just over one-third was recycled (35%).¹²³ Though this represents big advances over the past few decades, there remains much room for improvement in the waste-to-value segment, especially as resource management pressures continue to grow. As a consequence, projects centered on waste reuse and recycling are emerging more prominently as landfills expand and pollutants increase, and penalties on hard-to-dispose waste increase (such as landfill tipping fees).

To the extent that waste continues to be produced and consumers look to minimize their waste and associated costs, much opportunity lies within the waste-to-value space in North America. Several sub-segments within waste-to-value hold promise for project finance, although they may be characterized as falling in the higher risk-higher return category and, due to the complexity of some of the plants, often require one to two years of steady-state operations before an exit can be realized.

¹²⁰ Office of the Press Secretary, “Executive Order: Accelerating Investment in Industrial Energy Efficiency,” The White House, August 30, 2012, <http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency>.

¹²¹ U.S. Energy Information Administration, “Combined heat and power technology fills an important energy niche,” October 4, 2012, <http://www.eia.gov/todayinenergy/detail.cfm?id=8250>.

¹²² U.S. Environmental Protection Agency, “Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012,” 2012.

¹²³ U.S. Environmental Protection Agency, “Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012,” 2012.

1. Waste-to-Energy

Waste-to-energy projects offer the opportunity to produce energy from waste products that would otherwise be unutilized. The waste-to-energy sub-segment is generally MSW diversion, such as composting and landfill gas or methane recovery. Biomass plants also fall in this sub-segment. In 2012, the waste-to-energy market was projected to reach \$29.2 billion by 2022, treating over 250 million tons of waste while producing 283 TWh of electricity and heat per year.¹²⁴ Annual growth rates for this sub-segment are expected to be roughly 10% to at least 2016.¹²⁵

From a project finance investing perspective, however, this is a sub-segment that must be carefully navigated because of project economics involving complexity and management of multiple revenue streams.

First, waste-to-energy projects tend to be large in scale and can be expensive and complex. Projects at the C&I scale are more manageable investment prospects, but they are still bespoke and entail project-specific designs, whether using incinerator, biomass, or anaerobic digester technology, meaning that transaction costs for individual investments tend to be relatively high.

Construction of these projects can be likewise complex potentially resulting in cost increases or delays. Finally, despite feedstock and offtake agreements (in addition to tipping fees that sometimes accompany feedstock procurement), the ability to rely on these contracts or prices on a long-term basis is typically less certain than for clean energy projects. Holding periods would likely be longer, as successful operating performance of waste-to-energy projects would need to be demonstrated (and projects frequently go through a ramp up period of 1 to 2 years before reaching stable operations). As a consequence, higher returns are typically sought to compensate the higher risks and careful analysis and consideration should accompany these investments.

From an overall portfolio perspective, waste-to-energy projects may provide attractive upside due to several favorable attributes, balancing out the lower risk-lower returns space in the overall mix.

2. Waste-to-Materials Recovery

As materials prices rise and natural resources are depleted, e-waste and other high-value industrial waste recovery services are becoming increasingly valuable. The U.S. electronics recycling industry has shown tremendous growth over the past decade (estimated to be a \$20 billion market, up from less than \$1 billion in 2002). Moreover, the U.S. scrap recycling market is \$90 billion, with over 135 million tons of material processed annually.

This sub-segment, which includes recycling and materials recovery, is rapidly developing in the larger waste-to-value market context, exhibiting attractive dynamics for project financing prospects. Similar to the waste-to-energy sub-segment, the projects with capacity to extract materials from recycled finished products could be a good investment opportunity when there is a long-term offtake agreement for the materials being extracted. For example, waste-to-materials recovery projects may have feedstock that is not only undervalued (or nearly free), but that may also provide an additional source of revenue in the form of tipping fees. There is also promise in

¹²⁴ According to Pike Research, as described in 13D research (2012).

¹²⁵ NewWorld estimates.

projects that carve out a small piece of the overall waste-to-materials recovery system and provide specialized services (such as sorting feedstock).

Investment prospects in this sub-segment can provide attractive portfolio upside, due to their higher risk-higher return profile. In general, projects that can demonstrate long-term feedstock and offtake agreements should represent attractive project finance opportunities.

* * *

Environmental infrastructure markets are complex, with technologies that vary in risk, performance records, economic returns, and more. Project risks are often not comparable across type of project, jurisdictions, and stage of development, making broad characterizations difficult or inaccurate. For example, investors should expect different returns from solar projects than from waste-to-energy projects, due to differing technology, market developments, and policy environments.

Market development across segments and sub-segments varies widely, requiring investment specialists who know how to identify and take advantage of attractive opportunities, as well as when to wait for nascent markets to develop further. Given the varying policy environment, technology developments, investment risks and returns, project profiles and stages to invest, many different types of investors can participate with varying objectives. Much of the opportunity in project investing comes from underwriting and allocating risks that others are not prepared (or do not have the expertise) to accept, or spending time and money to aggregate smaller projects to reach sufficient scale to attract a larger buyer base at exit. By seeking to invest in different locales, taking some development responsibility, and addressing some level of variability in offtake pricing, a portfolio of environmental infrastructure assets can credibly have an attractive blended target return.

Like environmental opportunities more broadly, investing in environmental infrastructure generally yields broader positive outcomes in addition to attractive economic returns, as the societal co-benefits of such investments are usually quite significant. For example, improved or reduced resource use should lead to many public benefits, such as less polluted air and water and reduced waste generation. Such societal co-benefits help make environmental infrastructure markets attractive for investment not only for single bottom line profit, but also for impact—without the need to trade-off between either objective. With many resource management challenges urgently needing to be addressed, environmental infrastructure markets are rich with opportunities for impactful investing that can deliver strong economic returns while benefitting society in important ways.¹²⁶

The complexity of environmental infrastructure markets, segments, and sub-segments provides an advantage to specialist investors who have deep sector knowledge and experience, who understand the intricacies of different policy, technology and market environments, and who can underwrite investments with consideration of appropriate risks to determine an acceptable risk and target return profile.

¹²⁶ For a discussion of the opportunity to engage in top-tier returns while also creating valuable societal co-benefits in environmental investing, please see the essay titled “Impact Investing: Trading Up, Not Trading Off,” in the NewWorld Essay Series *On Matters that Matter*.

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