

## Investments in Infrastructure

August 2017

*Over the past 20 years, infrastructure has grown from an emerging niche asset class to one of the leading real asset sectors in terms of fundraising and investor demand. The popularity of the infrastructure asset class is rooted in its underlying thesis of generating strong cash flows from contracted operations that are defensible and inflation sensitive. Cliffwater considers investments in the infrastructure sector to be a core allocation within a diversified real asset portfolio. Infrastructure provides a stable, diversifying return stream relative to other real asset sectors including energy, agriculture, timber, and other natural resources. Infrastructure investments are intended to provide exposure to long lived assets that generate stable income and a total return expected to be in excess of the required return for pension funds and insurance companies.*

*This paper seeks to provide institutional investors with a perspective on the infrastructure asset class and how it fits within a broader real asset portfolio. The paper begins with an overview of the market and how institutional investors are participating. Then, a comparison of performance between infrastructure and other real assets including energy, agriculture and timber is provided. A discussion on private investment fundraising, fund structures, and historical investor allocations is also discussed. Finally, we discuss portfolio construction and the benefits of including infrastructure in a real asset portfolio.*

*Institutional investors have available to them multiple vehicles and structures that provide access to the sector. Investment structures include open- and closed-end funds, direct investment portfolios and liquid equity funds. Most infrastructure investment firms have utilized the closed-end fund structure based on prior private equity strategies. The open-ended vehicle can provide a better match to the long-dated lives of the physical structures and their corresponding contracts. Direct investors, including large pension plans and sovereign wealth funds, have structured their portfolios as quasi open-ended structures.*

*Currently, the market is competitive, with an imbalance between available investment capital and available transactions. An efficient market solution to resolve the imbalance between investor demand and investment supply is needed. Public Private Partnerships ("PPP") is one vehicle that provides the opportunity to develop new infrastructure assets that involves both the support of government and the use of private capital. However, the PPP structure is uniquely structured by country, province, state, and local governing authorities. In the U.S., there is no standard or streamlined PPP structure that will facilitate expedited transactions. However, there has been growing interest in PPPs in recent years, and 35 U.S. states now have some form of PPP legislation. PPPs can take three to five years from formation to bidding, to construction, and operation. Private capital is not drawn until late in the development cycle.*

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## *Infrastructure Market Overview*

Infrastructure investments can be defined as representing the basic physical systems required to allow a business, community, or nation to function. Infrastructure assets can be publicly or privately owned and are located across the globe. Infrastructure sectors include transportation, energy, water and waste water, telecommunication, and social, which includes physical public structures such as courthouses, hospitals, and schools. The exhibit below shows the primary categories of infrastructure assets.

Exhibit 1  
Infrastructure Sectors

<b>Transportation</b>	<b>Energy</b>	<b>Water</b>	<b>Telecommunications</b>	<b>Social</b>
-Roads & Toll Roads	-Oil and Gas Processing, Transportation, & Storage	-Fresh Water Systems	-Data Centers	-Court Houses
-Bridges & Tunnels	-Electricity Transmission	-Waste Water Systems	-Fiber Optic Networks	-Hospitals
-Airports	-Conventional & Renewable Power	-Desalination Plants	-Wireless Towers	-Education Facilities
-Sea Ports			-Cable Networks	-Police Facilities
-Rail & Rolling Stock			-Broadcast Towers	-Correctional Facilities
-Parking			-Satellites	

Infrastructure is synonymously categorized along the real estate risk and return spectrum including core, core-plus, value-add, and opportunistic depending on their risk profile and amount of leverage used to achieve target returns.

### *Private Equity Investment in Infrastructure*

The infrastructure asset class for third-party institutional investors got its start in the mid-1990s when the Australian government mandated that the country's pension funds, or Superannuation Funds, invest in certain of the country's infrastructure assets. The sector has since grown to \$484 billion<sup>i</sup>, utilizing multiple structures across private and public markets. From June 30, 1997, the inception of the Cambridge Associates Private Infrastructure Index, through December 31, 2016, private infrastructure funds have underperformed the other major real asset sectors, as shown in Exhibit 2a. However, over the most recent ten years, as infrastructure funds have matured and entered a period of stable cash flows infrastructure performance has improved on a relative basis. Over the ten-year period ended December 31, 2016, as shown in Exhibit 2b, infrastructure underperformed agriculture but has been on par with energy and timber and even outperformed real estate. Over that same period both private energy and private real estate experienced a higher level of volatility with lower returns.

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<sup>i</sup> Preqin, as of May 2017.

Exhibit 2a  
Real Asset Performance - Since Inception  
June 30, 1997 to December 31, 2016

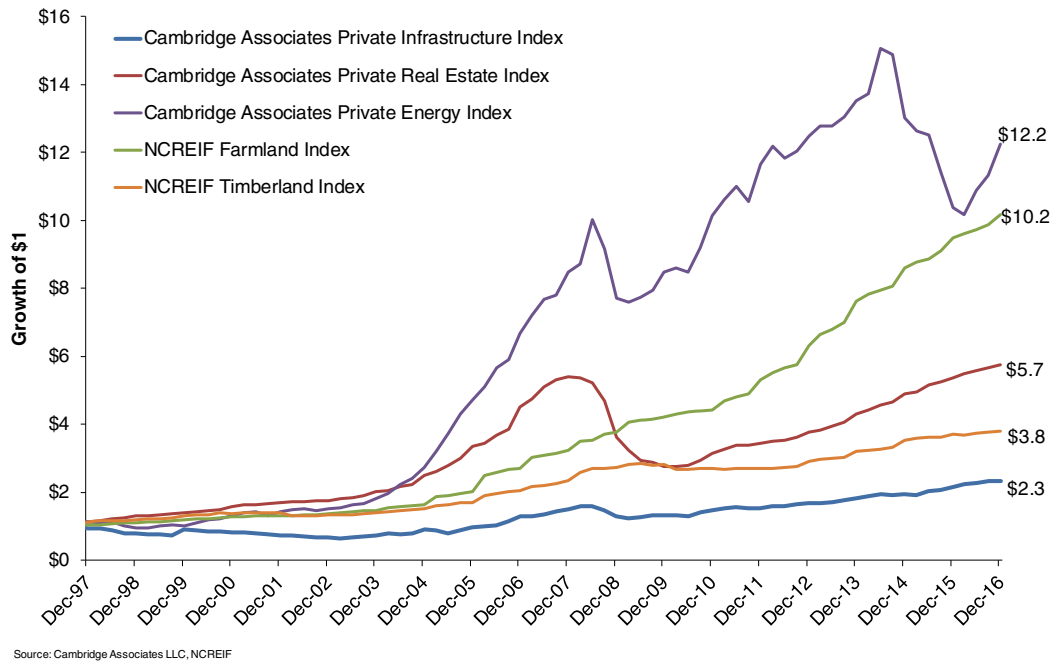
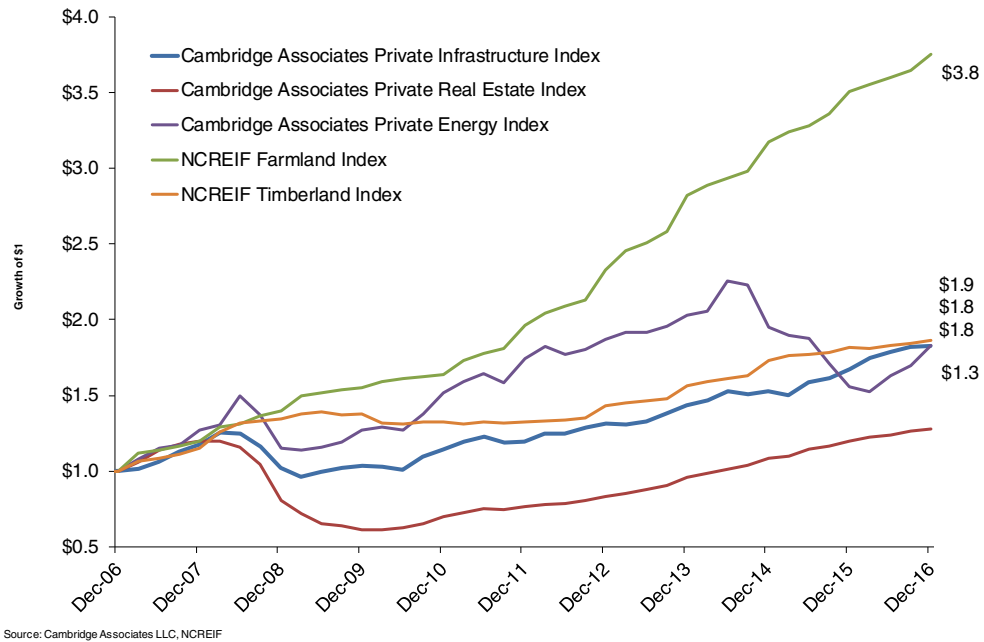


Exhibit 2b  
Real Asset Performance - Ten Years  
December 31, 2006 to December 31, 2016



Compared with other real asset classes, infrastructure is relatively nascent. Additionally, infrastructure assets are characterized by having long lives and are not traded frequently. As a result, performance data reflecting the full cycle of investment, from acquisition to exit, is limited.

Because of this extended investment cycle, infrastructure performance is not directly comparable with that of certain other real assets such as upstream energy. Upstream energy often employs a short term de-risking of assets and a realization within three to five years. Infrastructure funds are expected to generate cash yield from operations, which should be their primary source of return during most of a fund's hold period. In some instances, such as the PPP structure, all the asset's return comes from cash yield from operations.

Exhibit 3 provides a comparison of return and risk for the various real asset categories. Both the Cambridge Associates Private Energy Index and the Cambridge Associates Private Real Estate Index have outperformed the Cambridge Associates Private Infrastructure Index since the inception of the infrastructure index on June 30, 1997 through December 31, 2016 (19.5 years). However, over the 10-year period ending December 31, 2016, infrastructure generated equal performance to energy and has outperformed real estate. Consistent with the yield-oriented nature of infrastructure assets, the volatility of infrastructure was below energy over both the 19.5-year and 10-year periods and below private real estate over the 10-year period.

Exhibit 3  
Private Real Asset Performance  
Annualized Return and Risk

	Cambridge Associates* Private Infrastructure Index	Cambridge Associates Private Real Estate Index	Cambridge Associates Private Energy Index	NCREIF Farmland Index	NCREIF Timberland Index
Since Inception Ending December 31, 2016*					
Return	4.5%	9.4%	13.7%	12.6%	7.1%
Risk**	11.1%	10.0%	14.2%	7.0%	5.4%
Return/Risk	0.40	0.94	0.97	1.80	1.31
10 Years Ending December 31, 2016					
Return	6.2%	2.5%	6.2%	14.1%	6.4%
Risk**	7.7%	12.2%	13.3%	5.6%	4.9%
Return/Risk	0.81	0.20	0.47	2.52	1.31

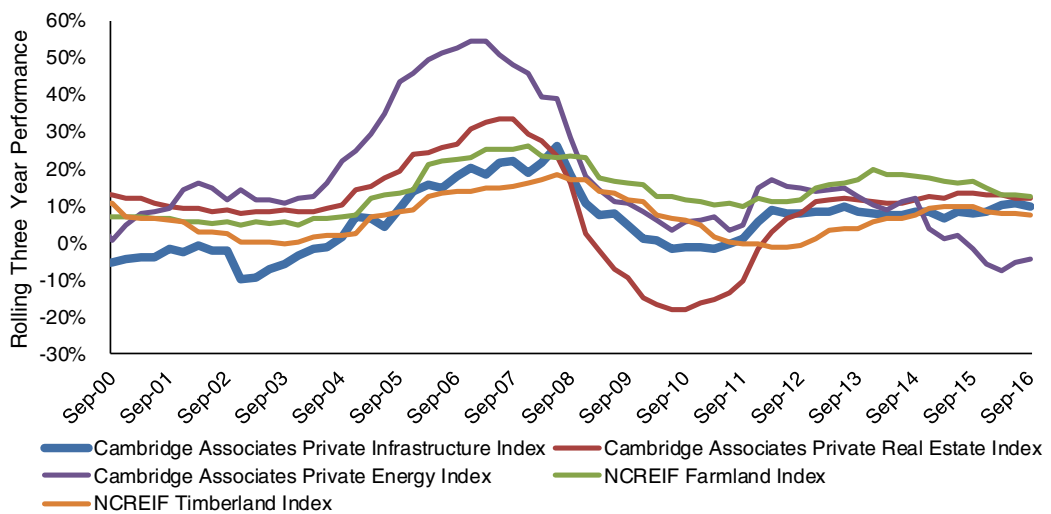
\*The Cambridge Associates Private Infrastructure Index inception date is June 30, 1997.

\*\*Risk is calculated as annualized standard deviation of historical returns.

Source: Cambridge Associates LLC, NCREIF

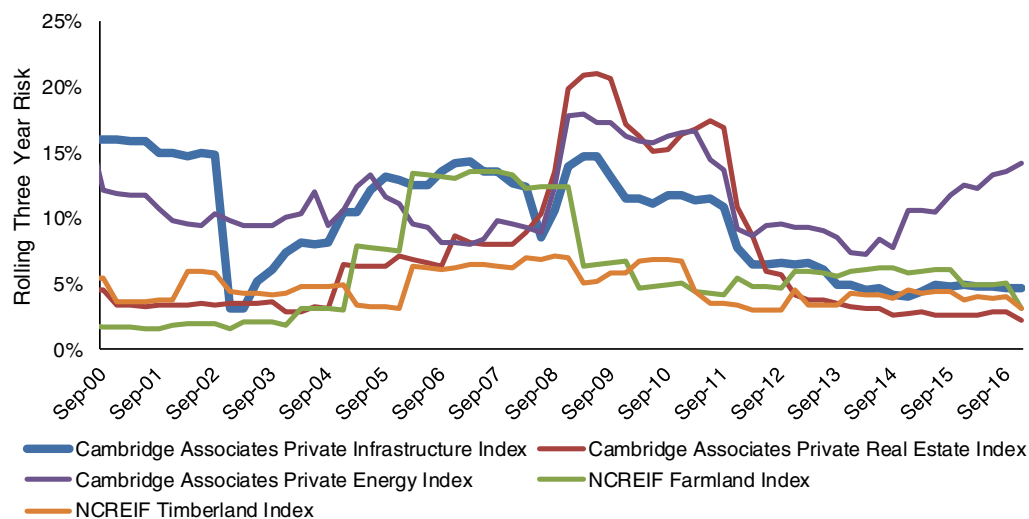
Infrastructure has generated less cyclical performance than energy and real estate, as shown in Exhibits 4a and 4b on the following page. During the early years of the Infrastructure Index, volatility was higher due to the lack of institutional funds and initial j-curve effect. Once the asset class grew and experienced a higher level of ongoing cash flow, volatility fell and has been relatively low since then.

Exhibit 4a  
Real Asset Three Year Annualized Rolling Performance  
June 30, 2000 to December 31, 2016



Source: Cambridge Associates LLC, NCREIF

Exhibit 4b  
Real Asset Three Year Annualized Rolling Standard Deviation  
June 30, 2000 to December 31, 2016



Source: Cambridge Associates LLC, NCREIF

Exhibit 5 compares the quartile performance of private infrastructure (as represented by the Preqin Infrastructure Performance Benchmarks) and private energy (as represented by the Cambridge Associates Energy Benchmarks) by vintage year. Private infrastructure has generated consistently higher performance across most quartiles and vintage years. Given the infrastructure investment thesis (i.e., lower risk, stable return), it makes sense that the median and lower quartile performance of infrastructure would exceed the median and lower quartile performance of energy, which tends to be more volatile. However, given the higher expected risk with private energy investments, it is surprising that the upper quartile performance of infrastructure has been consistent with or exceeded the upper quartile performance of energy. Cliffwater believes the consistent, positive median and lower quartile performance of private

infrastructure across business cycles supports an allocation to the sector. However, the Preqin Infrastructure Performance Benchmarks only include private infrastructure fund performance from infrastructure investment firms providing adequate cash flow information to calculate IRRs. This may have created a reporting bias to the more successful funds. The number of funds included in each vintage year range from a low of six in 2004 to a high of 25 in 2012 with 22 funds included in the 2014 vintage year. Additionally, the Preqin Infrastructure Benchmarks do not separate funds by risk category and include higher risk and return generating strategies that may be positively skewing performance.

**Exhibit 5**  
Comparison of Preqin Infrastructure Benchmark Performance versus Cambridge Associates Energy Benchmark Performance, by Quartile and Vintage Year

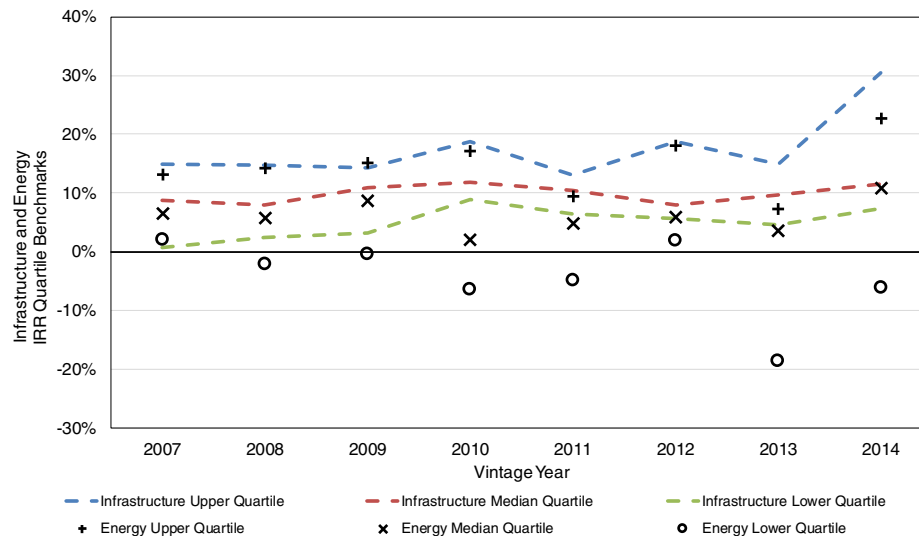
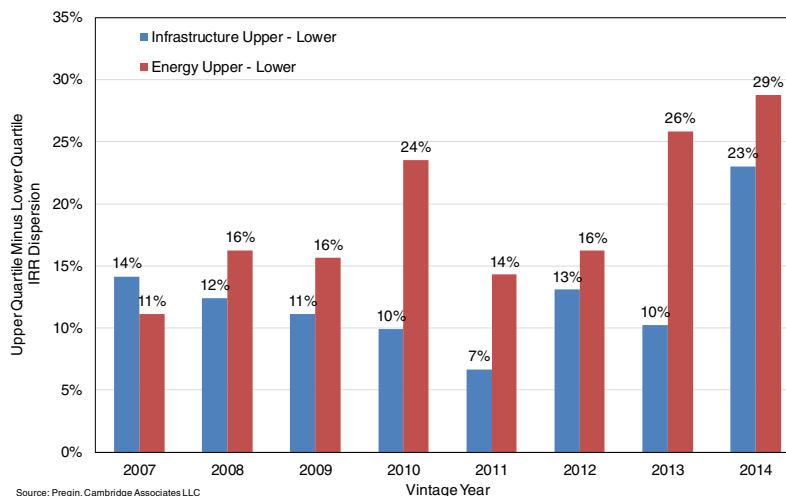


Exhibit 6, below, charts the absolute spread between upper and lower quartile performance for private infrastructure and private energy investments. The higher risk energy partnerships have a corresponding higher dispersion compared to infrastructure. However, the return dispersion for private infrastructure investment, while less than energy, is large enough to warrant careful manager selection.

**Exhibit 6**  
Infrastructure and Energy Performance Dispersion  
Upper Quartile Minus Lower Quartile



### Public Markets Comparison

Exhibit 7a and 7b provide rolling three-year performance and risk for the public market infrastructure and energy benchmarks. As is typically the case, the public market benchmarks have generated more volatility than their private market counterparts. Public market infrastructure performance, as measured by the Dow Jones Brookfield Infrastructure Index ("DJBI"), has outperformed public market energy as measured by the Russell 3000 Energy Index for the 10-year period ended December 31, 2016. Cliffwater believes this is because, unlike energy and other natural resource investments, infrastructure is generally shielded from commodity price volatility through contracted inflation adjustments or energy cost pass through arrangements.

Exhibit 7a  
Real Asset Three Year Annualized Rolling Performance  
December 31, 2006 to December 31, 2016

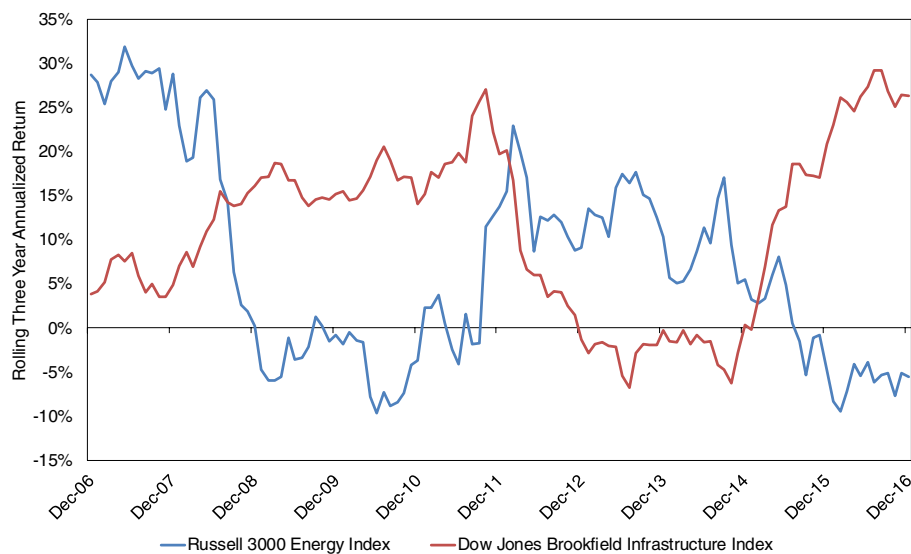
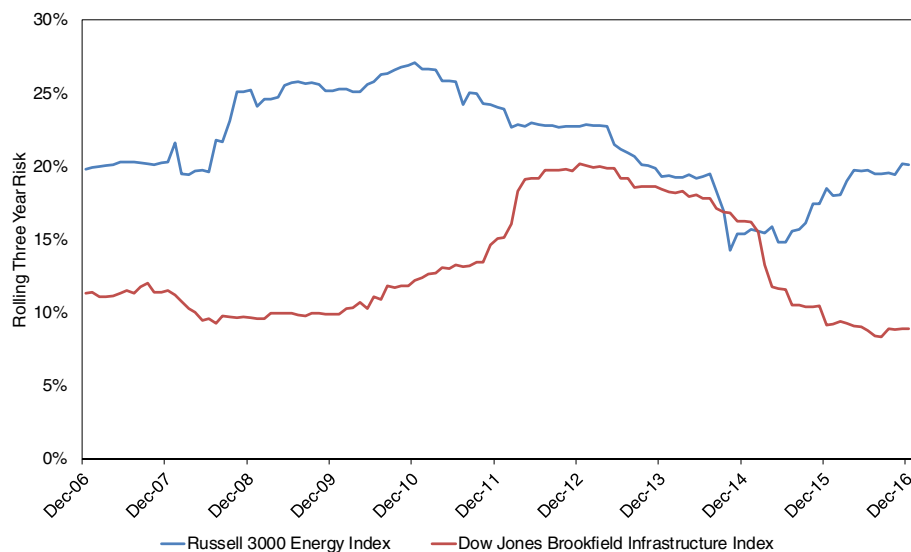


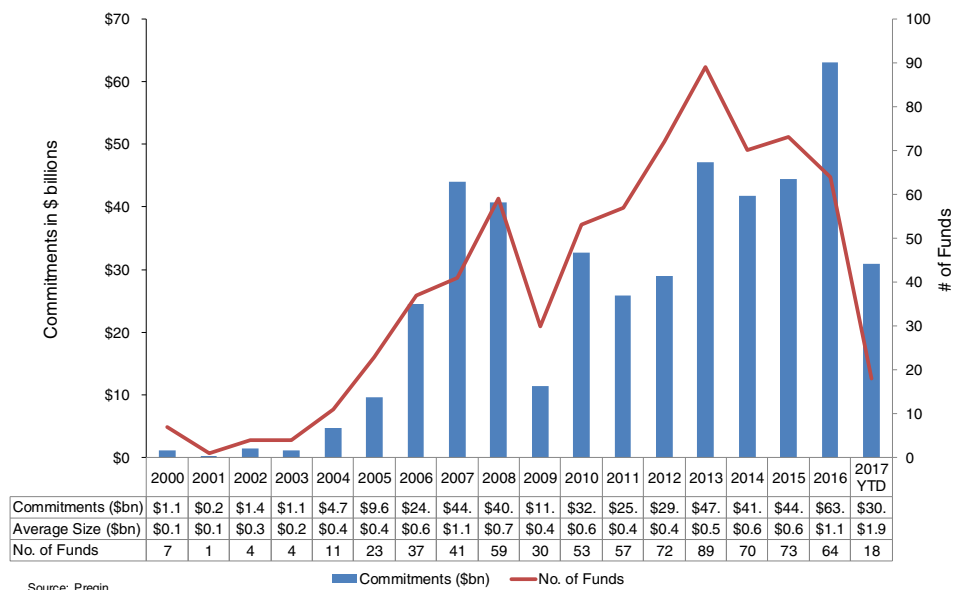
Exhibit 7b  
Real Asset Three Year Annualized Rolling Standard Deviation  
December 31, 2006 to December 31, 2016



## Private Infrastructure Partnership Capital

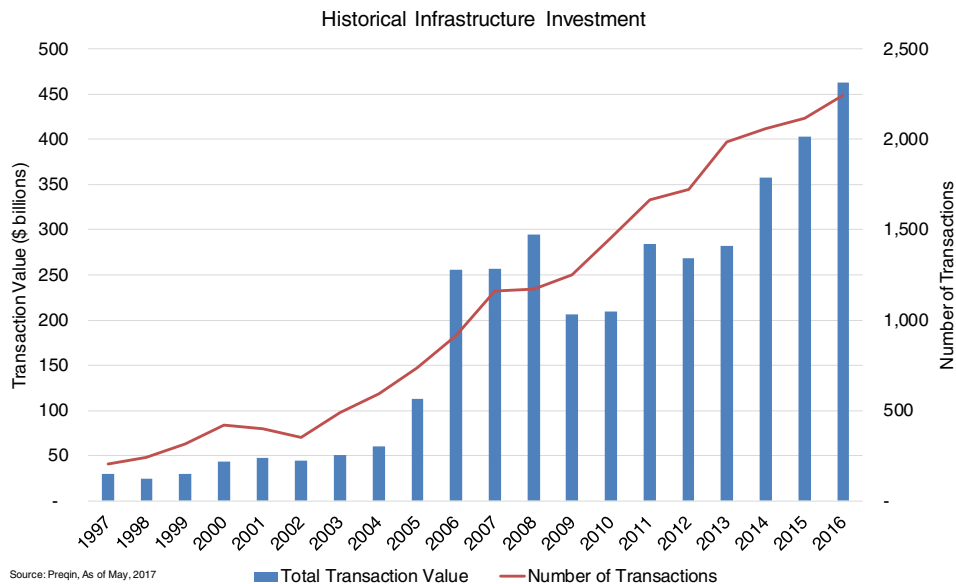
Institutional investors have been investing in infrastructure assets since the early 1990s but this has become a widely adopted strategy only over the past ten years. Infrastructure fundraising has grown rapidly over the past five years, reaching a peak in 2016 with \$63 billion of capital raised, as shown in Exhibit 8. About half of the \$454 billion of infrastructure partnership capital raised since 2000 was added since 2011. It has also become a market dominated by larger funds – since 2006, the median fund size has increased from \$157 million to \$1.9 billion. In 2016 and 2017, two private infrastructure investment managers raised then-record sized funds at \$14 billion and \$16 billion, respectively. In April 2017, another private infrastructure investment firm announced a joint venture with a middle eastern sovereign wealth fund to raise \$40 billion (\$100 billion purchasing power including leverage) to invest in infrastructure in the U.S. and the middle east. Many repeat funds are currently seeking larger fund sizes, ranging from \$1 billion to \$5 billion.

Exhibit 8  
Historical Infrastructure Partnership Fundraising



The growth in infrastructure fundraising has increased alongside the growth in institutional investor demand for the asset class. Transaction volume has also grown. Prior to institutional investor interest in infrastructure, private infrastructure investment had occurred on a one-off basis by large construction companies and other strategic investors rather than through diversified blind pools. Historically, core infrastructure assets were funded through public debt and managed by government employees. As the ability for governments to issue debt has diminished, private capital has taken its place. Infrastructure transaction activity has correspondingly increased with investor demand and a lack of government funding.

## Exhibit 9 Historical Infrastructure Transaction Activity



### *Strategic Investors in Infrastructure*

Strategic investors include construction companies and operators, such as Marubeni Corporation, which invests heavily in the agriculture sector and supporting infrastructure. Today, the largest strategic investors are the large Spanish, French, and U.S. infrastructure construction companies such as Abertis Infraestructuras S.A., VINCI Concessions, and Kiewit Corporation. Large construction companies target large projects and may specialize in sub-sectors such as toll roads. To create alignment between the infrastructure asset sponsor, the public, and the construction company awarded the construction contract, a construction company will typically be required to invest equity in the asset. These large infrastructure assets will often be structured through a Public-Private Partnership that includes a concession to manage the new infrastructure asset for a pre-defined period of time. In other cases, the asset being built or sold is privately owned. For example, in the U.S., most power generation plants are privately owned.

## Exhibit 10 Most Active Infrastructure Investors

Top 10 Investors by Number of Investments*					
Infrastructure Fund	Location	Number of Investments	Infrastructure Fund	Location	Number of Investments
InfraRed Capital Partners	UK	293	Kiewit Corporation	US	655
Macquarie Infrastructure and Real Assets (MIRA)	UK	245	StatKraft	Norway	383
3i Infrastructure	UK	209	E.ON	Germany	340
DIF	Netherlands	197	EDF Group	France	313
Innisfree	UK	155	RWE Group	Germany	259
Brookfield Asset Management	Canada	142	Engie	France	231
Equitix	UK	128	Duke Energy	US	225
John Laing Capital Management	UK	101	Fluor Corporation	US	200
Amber Infrastructure Group	UK	95	Marubeni Corporation	Japan	188
AMP Capital Investors	Australia	86	NextEra Energy Resources	US	180

\*Source: Preqin, as of May 2017

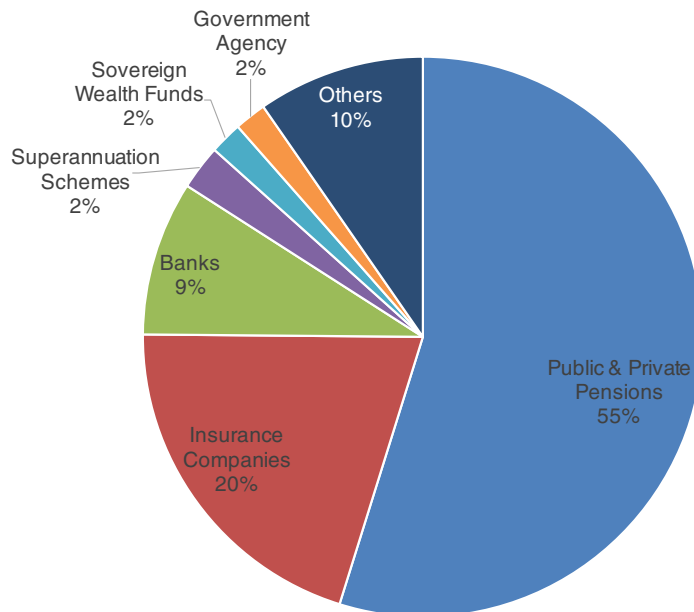
### Top 20 Investors by Amount Invested\*

Investor	Investor Type	Country	Invested (\$ billions)
Japan Bank for International Cooperation	Government Agency	Japan	\$40
CPP Investment Board	Public Pension Fund	Canada	\$21
National Pension Service	Public Pension Fund	South Korea	\$16
Ontario Teachers' Pension Plan	Public Pension Fund	Canada	\$13
OMERS	Public Pension Fund	Canada	\$13
CDPQ	Public Pension Fund	Canada	\$11
ABP	Public Pension Fund	Netherlands	\$10
APG - All Pensions Group	Public Pension Fund	Netherlands	\$10
PGGM	Public Pension Fund	Netherlands	\$9
Khazanah Nasional	Sovereign Wealth Fund	Malaysia	\$9
UniSuper	Superannuation Scheme	Australia	\$8
Future Fund	Sovereign Wealth Fund	Australia	\$7
AustralianSuper	Superannuation Scheme	Australia	\$7
Manulife Financial	Insurance Company	Canada	\$7
NORD/LB	Bank	Germany	\$7
Public Sector Pension Investment Board	Public Pension Fund	Canada	\$7
Kyobo Life Insurance	Insurance Company	South Korea	\$6
British Columbia Investment Management Corporation	Public Pension Fund	Canada	\$6
Fubon Life Insurance	Insurance Company	Taiwan	\$6
Hanwha Life Insurance	Insurance Company	South Korea	\$5

\*Source: Preqin, as of May 2017

According to Preqin, \$19.75 trillion has been invested since 1994. The largest investor type is pensions (55% of investments). More specifically, public pensions have represented 41% of investments.

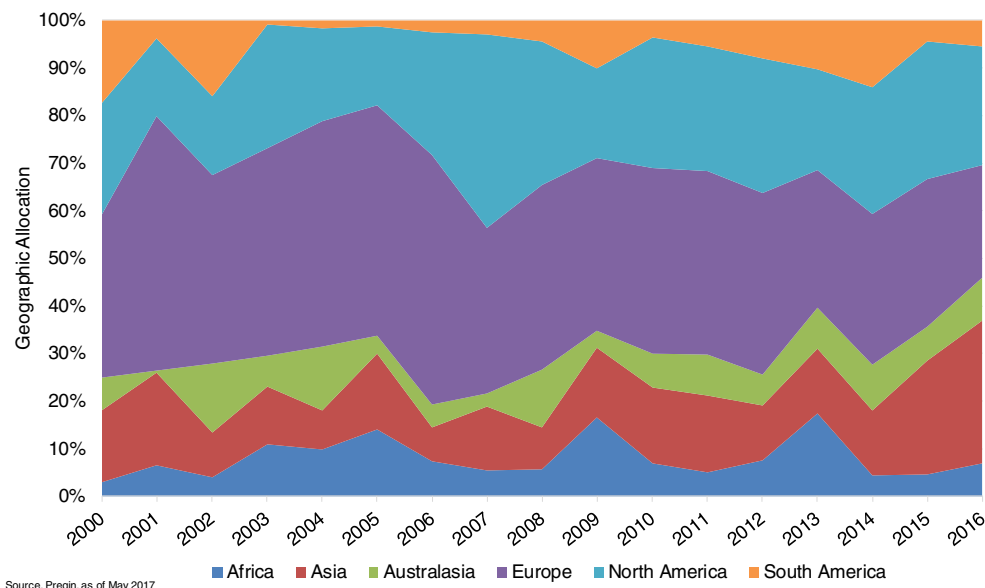
Exhibit 11  
Infrastructure Investor by Type



Source: Preqin, as of May 2017

Since January 1, 2000, more than \$3.6 trillion<sup>ii</sup> of infrastructure assets have transacted. Of the total, 36% of all transactions, or \$1.3 trillion, occurred in Europe followed by 26% (\$962 billion) in North America. Over the past three years, Asian-based infrastructure transactions have increased. For the quarterly period ending December 31, 2016, Asian infrastructure investments represented 30% of the \$463 billion in total transactions closed, followed by 25% in North America and 24% in Europe<sup>iii</sup>. There are few infrastructure funds targeting Asia. Most Asia infrastructure investment is coming from sovereign wealth funds and other strategic investors.

Exhibit 12  
Historical Infrastructure Transaction Activity by Geography

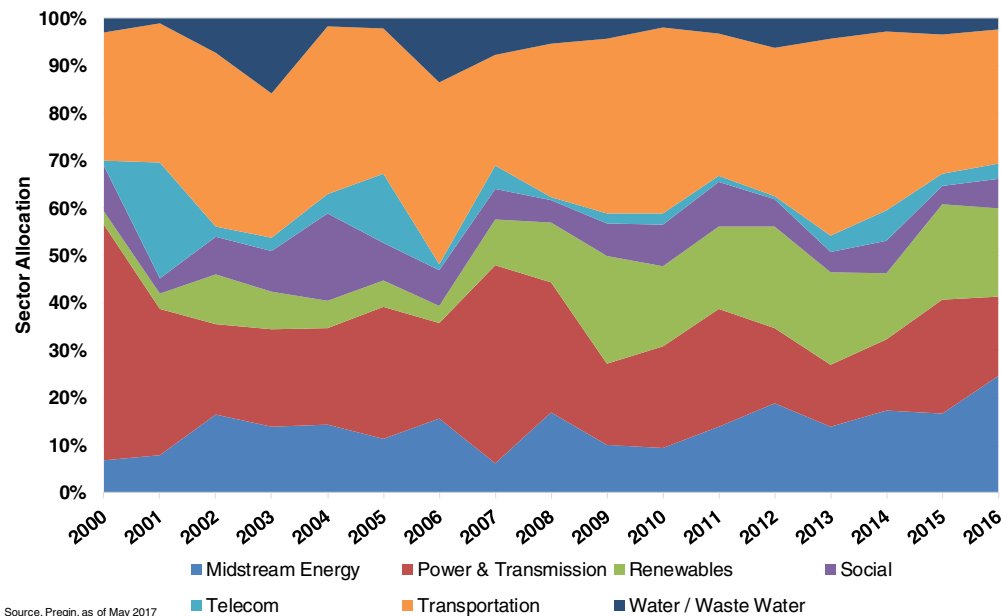


In terms of sector activity, the transportation sector has consistently received the largest amount of investment. For our analysis, we have consolidated the transportation sector to include roads, airports, sea ports, and rail systems. Individually, these are typically the largest and most expensive assets to construct but contribute to an economy's productivity by providing an efficient, low cost means of transporting all manner of goods and materials, and people. Energy related infrastructure also represents large capital expenditures and contribution to productivity. Combined, the midstream energy, power and transmission, and renewable power sectors represent 52% of all infrastructure transactions since January 1, 2000, compared to 33% for transportation assets. In North America, energy assets represent 68% of all transactions since January 1, 2000. Renewable energy investment has increased steadily since January 1, 2000 and currently represents 19% of total transaction volume.

<sup>ii</sup> Enterprise Value, Preqin

<sup>iii</sup> Preqin, as of May 2017

Exhibit 13  
Historical Infrastructure Transaction Activity by Sector



#### *Private Infrastructure Portfolio Construction*

Institutional investors investing in private infrastructure partnerships have allocated the investments to a broad range of portfolio categories. Some have a specific infrastructure category or will allocate their infrastructure investments in a broader diversified real asset or inflation sensitive portfolio (some include these within their Opportunistic programs). According to Preqin, the infrastructure allocation among public pensions investing in the sector ranges from low single digits to up to more than 30%.<sup>iv</sup>

Cliffwater believes that the investment thesis supporting infrastructure investment should provide stable, low risk cash flows over long periods of time that are inflation sensitive, monopolistic, and GDP insensitive. The profile of such cash flows can also provide a hedge against long-term liabilities of pension funds. Cliffwater believes that an investor's mature infrastructure portfolio should provide a stable cash yield of 5% or more over a multiple-year horizon.<sup>v</sup>

Cliffwater views infrastructure, real estate, and energy as the core sectors within a diversified real asset portfolio. Infrastructure provides a more stable, yield-oriented return stream, while energy, particularly upstream strategies, provides higher total returns, with a commensurately higher level of risk. Real estate falls in the middle in terms of the tradeoff between cash yield and total return.

Within a real asset portfolio, infrastructure provides diversification to other real asset sectors. As shown in Exhibit 14, from June 30, 1997 through December 31, 2016, the correlation coefficient between infrastructure and other major real asset sectors ranged between 0.10 and 0.44. Over the more recent 10-year period, correlations ranged from -0.03 (farmland) to 0.74 (real estate). The relatively high correlation to real estate is likely the result of leverage having a significant contribution to returns for both asset classes along with CPI related adjustments to operating

<sup>iv</sup> Preqin, as of May 2017

<sup>v</sup> Any expected return is not a prediction or a guarantee of future performance. There can be no assurance that any expected return will be achieved.

income. Relatedly, the 10-year correlation between infrastructure and CPI of 0.47 was second only to real estate (0.71), which is widely viewed as an inflation hedge. This reflects one of the primary reasons for investment in infrastructure, to provide a measure of inflation protection.

#### Exhibit 14 Private Real Asset Diversification

June 30, 1997 (Since Inception*) through December 31, 2016**						
	Cambridge Associates Private Infrastructure Index	Cambridge Associates Private Real Estate Index	Cambridge Associates Private Energy Index	NCREIF Farmland Index	NCREIF Timberland Index	CPI
Cambridge Associates Private Infrastructure Index	1.00					
Cambridge Associates Private Real Estate Index	0.44	1.00				
Cambridge Associates Private Energy Index	0.27	0.43	1.00			
NCREIF Farmland Index	0.10	0.04	0.09	1.00		
CPI	0.10	0.19	0.41	-0.04	0.04	1.00

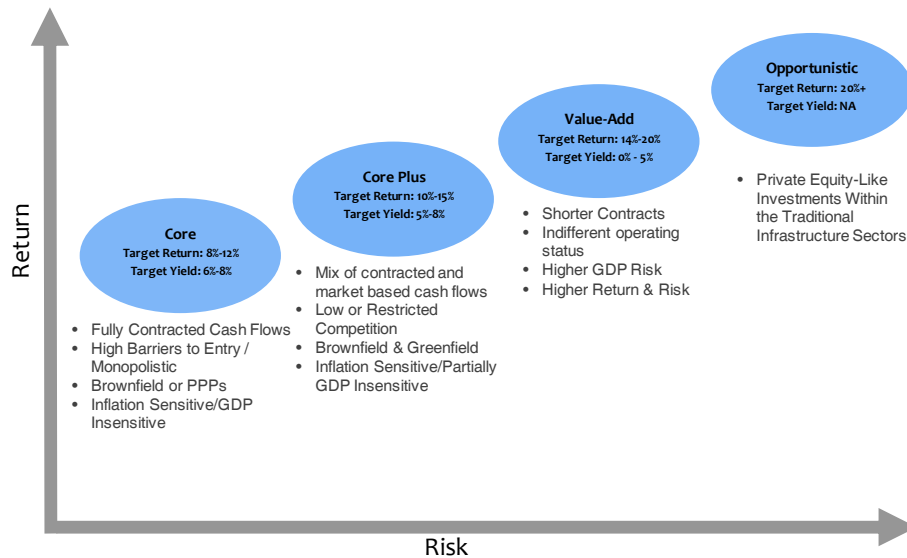
\*The Cambridge Associates Private Infrastructure Index inception date is June 30, 1997.

10 Years Ending December 31, 2016**						
	Cambridge Associates Private Infrastructure Index	Cambridge Associates Private Real Estate Index	Cambridge Associates Private Energy Index	NCREIF Farmland Index	NCREIF Timberland Index	CPI
Cambridge Associates Private Infrastructure Index	1.00					
Cambridge Associates Private Real Estate Index	0.74	1.00				
Cambridge Associates Private Energy Index	0.49	0.42	1.00			
NCREIF Farmland Index	-0.03	0.11	0.01	1.00		
CPI	0.47	0.71	0.44	-0.20	-0.16	1.00

\*\*Source: Cambridge Associates LLC, NCREIF, BLS

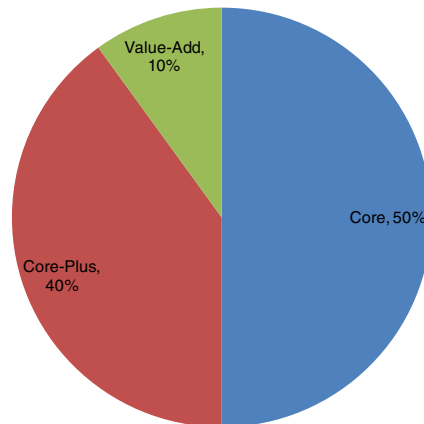
The investible universe of private infrastructure funds has evolved since its inception to include distinct risk categories similar to private real estate, including core, core-plus, value-add, and opportunistic. Core and core-plus represent the risk and return profile typically modeled by Cliffwater for the infrastructure asset class for the purpose of portfolio optimization. Value-add strategies can provide return enhancement to a mature infrastructure portfolio. Cliffwater believes that the characteristics of opportunistic infrastructure are inconsistent with the role of the infrastructure asset class and should instead be considered actually closer to the risk/reward makeup of private equity. Private infrastructure funds include both closed-end, finite life funds and open-end funds. Open-end funds may be better suited to the long lives of infrastructure assets and the investment horizons of institutional investors. However, there can be alignment of interest challenges between the managers of, and investors in, these open-end funds. Most closed-end funds have fund lives that are similar to those of private equity or real estate, i.e., 10 to 12 years. However, some recent PPP-focused funds have stated lives of 25 years or more. Also, some managers have included mechanisms in their fund documents which facilitate the manager transferring ownership of fund investments to interested limited partners that desire to retain the cash flow characteristics of those investments beyond the end of the fund term.

Exhibit 15  
Infrastructure Risk Category Risk and Return Profile<sup>vi</sup>



Cliffwater has developed a target infrastructure portfolio to represent its views on optimal allocations for a diversified infrastructure portfolio.<sup>vii</sup> As Exhibit 16 shows, the bulk of Cliffwater's target infrastructure portfolio consists of core and core plus strategies, with a modest allocation to value-add infrastructure as a return enhancer.

Exhibit 16<sup>viii</sup>  
Target Infrastructure Risk Category Diversification



<sup>vi</sup> Any target return is not a prediction or a guarantee of future performance. There can be no assurance that any target return will be achieved.

<sup>vii</sup> The target infrastructure portfolio was developed for illustrative purposes only. The information contained herein should not be relied upon as investment advice or a recommendation by Cliffwater regarding the use or suitability of the target portfolio. Actual weightings will vary depending on a client's specific circumstances. There is no guarantee that a client's portfolio will be allocated as shown herein.

<sup>viii</sup> Any target return is not a prediction or a guarantee of future performance. There can be no assurance that any target return will be achieved.

Risk Category	Target Allocation	Target Yield	Return	
			Target Total Return	Premium Above Core
Core	50%	6.0%	6.7%	0.00%
Core-Plus	40%	5.5%	8.7%	2.00%
Value-Add	10%	4.0%	11.7%	5.00%
Total	100%	5.6%	8.0%	1.3%

### *Investment Opportunity Set for Infrastructure*

Exhibit 17 shows Cliffwater's target infrastructure portfolio allocated by geography and sector. Our target portfolio is diversified by both measures and primarily allocated to OECD countries, which have represented a majority of investor capital historically. Europe, the U.K., Australia, and Canada have experienced the largest amount of investment from the private sector, having adopted various infrastructure privatization programs, with a supportive regulatory framework. The U.S. has been slow to adopt privatization of public infrastructure, though the PPP model is gaining traction with 35 states adopting legislation allowing the structure. President Trump has indicated the support of a substantial government investment plan totaling up to \$1 trillion of infrastructure investment. However, it is unclear whether that plan will be implemented and whether this will be managed at the federal, state, or local level.

Despite the lack of a definitive federal infrastructure plan, favorable trends indicate that the U.S. will provide substantial investment opportunities going forward, which Cliffwater believes supports a 50% target allocation to North America in a diversified infrastructure portfolio. Canada has a relatively small and mature infrastructure sector and may not represent meaningful opportunities. Investment in Mexico and other developing economies in Central and South America would be considered part of an opportunistic allocation.

Northern Europe (the DACH, Benelux, and Nordic countries) and the U.K. and Ireland continue to offer substantial investment opportunities, have a well-developed infrastructure sector, and have a strong rule of law supporting underlying infrastructure concessions and contract enforcement. Eastern Europe is developing private infrastructure investment programs and should be targeted opportunistically.

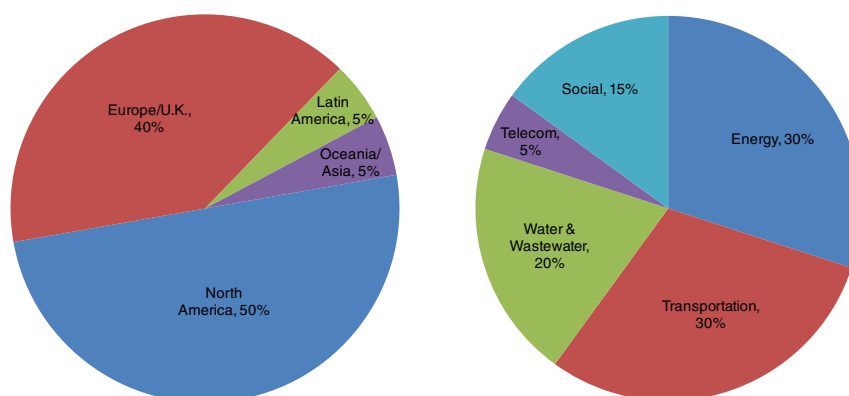
Investment in the Asian countries and Australia have been mixed. Having initiated material institutional investment in the infrastructure sector in the 1990s, the Australian market is now mature with limited transactions. China has invested massive amounts in transportation and other economic infrastructure which is state owned. There have been few private capital investments in China with uncertain results from a full investment cycle. India is now offering investment opportunities in transportation and power generation assets. Japan offers a sound rule of law and strong industrial base. However, Japan has not offered material private investment opportunities other than a small number of renewable power generation investments.

Both the transportation and energy sectors (power, transmission, and renewables) are expected to represent a meaningful portion of investible assets going forward. The midstream energy market continues to provide a large source of transactions for funds focused on North America. Natural gas fired power generation plants and renewable energy assets will require capital investment as coal fired plants continue to be decommissioned or transitioned. Both the expectation of prolonged low natural gas prices and an increasing demand from states for renewable power support the long-term demand for new power generation plants. Water infrastructure has represented 20% of prior investments and represents a large potential sector for new investment. However, the water market is highly fragmented with many privately owned

small companies which has been a deterrent to large funds. Large water utilities and large projects such as desalination plants and large waste water facilities provide some opportunity though there have been few historical transactions. Smaller funds focusing on the sector can provide an opportunistic allocation to the sector. Telecom investments have historically focused on cell towers and broadcast towers. With a continuous growth in wireless data, investment in other telecom sectors including data centers and large under-sea cables have increased. Additionally, investment in the build-out of fiber networks from data centers to end users has also increased. Investment in social infrastructure has historically been a focus for non-U.S. investors. Social infrastructure investment is typically structured through Public Private Partnerships which have also been more widely used outside of the U.S.

Exhibit 17  
Target Infrastructure Geographic and Sector Diversification

Geography	Target Allocation	Sector Category	Target Allocation
North America	50%	Energy	30%
Europe/U.K.	40%	Transportation	30%
Latin America	5%	Water & Wastewater	20%
Oceania/Asia	5%	Telecom	5%
Total	100%	Social	15%
		Total	100%



### *Public Private Partnerships*

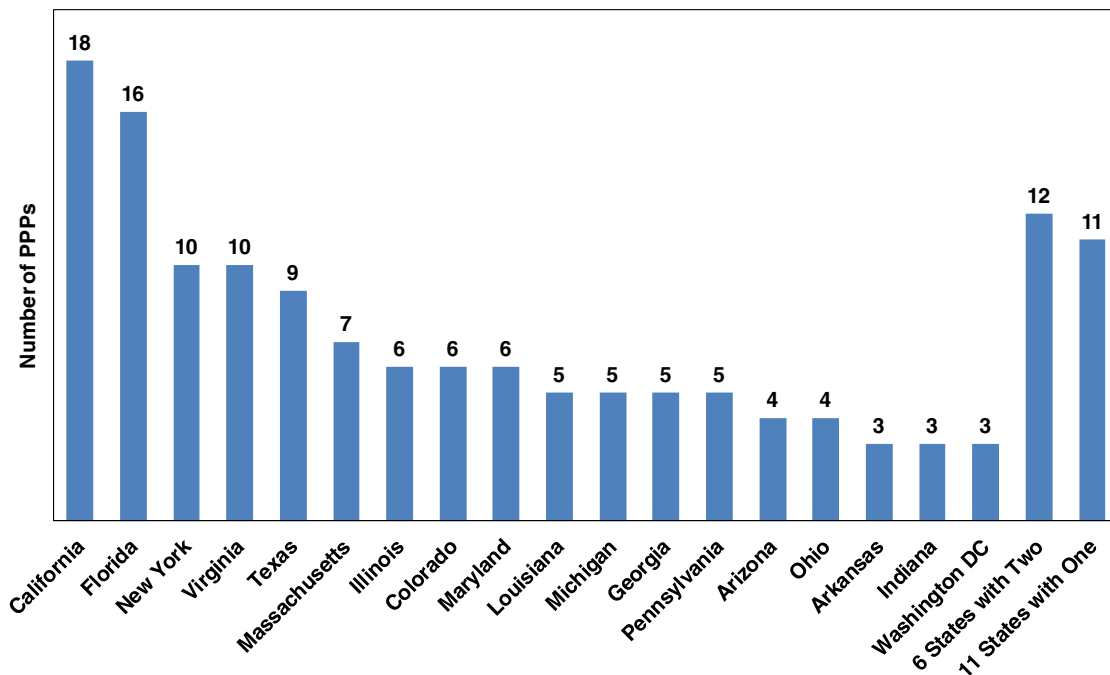
The PPP structure has been used to develop infrastructure assets for many years but gained institutional investor attention in the early 1990s. The PPP model was developed from the Private Finance Initiative (“PFI”) structure that was developed in the U.K. and later adopted throughout Europe, Australia, and Canada. Using a PPP structure allows a governing authority to transfer the risk of construction and operation of an infrastructure asset to the private sector. Additionally, the use of private financing, both equity and debt, for the construction of the project reduces the need of the governing authority to source funds from unpopular taxes or from having to access debt markets. The PPP structure has allowed financially strained governments to avoid potential high cost debt issuance in the face of lower and potentially declining credit ratings.

The development of a new or primary PPP will normally include the formation of a special purpose vehicle (“SPV”) that will be owned and governed by a private sector consortium. The SPV will have the contractual authority to develop, build, maintain and operate the infrastructure asset over the term of the contract. The SPV consortium will typically include an engineering and construction company, an operator or maintenance company, and financial sponsors including

equity and debt investors. The SPV contracts with the governing authority and will subcontract with the contractor and operator. Infrastructure assets structured through a PPP agreement are attractive targets for project finance lenders due to the stable and contracted cash flows produced from the investments.

As PPP markets have evolved, a secondary market for post construction PPP projects with contracted cash flows has developed. Through the financial crisis, investors seeking yield began to competitively acquire secondary PPP cash flows resulting in decreased yields for these investments. The secondary PPP market in Europe is well developed and active. A secondary PPP market in the U.S. is developing but is small.

Exhibit 18  
PPP Projects by U.S. State



Source: Meridiam, as of March 2017

In the U.S., the governing authority for the development of public infrastructure is not centralized but rather delegated to state and local bodies. As a result, the PPP market has been fragmented with each state building its own program and process. During the early formation of the PPP market, several high-profile projects failed. Most of the initial U.S. PPP projects were structured around existing infrastructure assets that had historically been managed by the public sector. Some of these projects failed as a result of political controversy, for example the Pennsylvania Turnpike in 2008, while others failed due to an inability to secure adequate financing, for example the Chicago Midway Airport in 2009. The U.S. PPP market now primarily focuses on new construction (“greenfield”) projects where the private consortium is responsible for design, construction, operations and management of the infrastructure asset. Today there are 35 states with PPP legislation and an active list of 148 projects in various stages of development and execution.

A key characteristic of PPP projects is the level of demand or revenue risk associated with projected cash flows. In some cases, a PPP project will have little or no demand risk. Cash flows will be paid to the SPV based on the availability of the asset to the public. PPP projects with limited demand risk are typically those where the governing authority is seeking to provide

essential services such as courthouses, schools and hospitals. Typically, the governing authority has a vested interest to ensure that these essential services are available to the public in both good and bad economic environments. Availability payments are contractually mandated regardless of utilization. In other cases, a higher level of demand risk will be structured into the contract. PPP projects with higher demand risk include transportation assets such as roads and quasi toll roads. These projects will include downside risk protection in the form of contracted minimum cash flows to the SPV but will bear the risk of not achieving higher expected volumes. In some cases, the SPV may bear all of the demand or revenue risk.

The U.S. infrastructure investment program has the potential to materially influence the infrastructure investment sector. Both U.S. political parties agree on the need to invest. The American Society of Civil Engineers (“ASCE”)<sup>ix</sup> estimates a funding gap for U.S. infrastructure of \$2 trillion by 2025. The ASCE has evaluated the primary U.S. infrastructure sectors and has assigned an average grade of D+. The U.S. is lagging other countries in using private capital for infrastructure. Since 2010, \$1.7 trillion of private investment has been made to infrastructure worldwide. The U.S. represents 9% of this capital compared to 46% in Europe.<sup>x</sup> Australia alone has invested \$280 billion in transportation, water and waste.<sup>xi</sup> The FAA Airport Pilot Private Program in the U.S. started 20 years ago with two airport privatizations occurring in the prior three years. Airports in the U.K. and Australia are nearly all privatized.

A sustainable approach to U.S. infrastructure investment needs to be developed to fully unlock the market. At a recent U.S. presidential infrastructure forum, the focus was on what the U.S. could do. The message to the President was that there is the opportunity to replicate the broad privatization program that occurred in the U.K. under Prime Minister Margaret Thatcher’s tenure. President Trump could also follow the Australia model of selling state assets and providing support to those states that participate.

### *Conclusion*

As the infrastructure sector has matured, returns have stabilized, while the energy and real estate sectors have experienced greater volatility. Cliffwater believes that infrastructure strategies can help improve the risk/return profile of an institutional investment portfolio, increase cash yield, and provide a measure of inflation protection, but manager selection is critical. The infrastructure market is competitive, with large financial and strategic investors competing for core investments, leading many to acquire assets further out on the risk spectrum to meet their return targets. High demand risk assets with weak balance sheet structures may not provide the intended purpose of the asset class.

Cliffwater believes the opportunity to invest in the infrastructure asset class will continue to expand globally. In the U.S., Cliffwater expects the infrastructure market to continue to grow as the PPP market expands and as the federal government implements an expanded infrastructure investment program. Investors should remain cautious with respect to the amount of risk being assumed by some value-add and opportunistic infrastructure strategies.

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<sup>ix</sup> ASCE 2017 Infrastructure Report Card. <https://www.infrastructurereportcard.org/ASCE>

<sup>x</sup> Inframation Deals database

<sup>xi</sup> Inframation Deals database

## Appendix: Sector Descriptions

<b>Energy</b>	
Midstream	Energy assets used to process, transport, store, and market hydrocarbons. Many new sources of crude oil and gas require new midstream assets.
<u>Power Generation</u>	
Conventional	Power generation plants using hydrocarbon-based fuel sources such as coal, natural gas, and fuel oil.
Renewable	Power generation plants using renewable-based sources, such as solar, wind, and hydro-electric, that do not require the burning of hydrocarbons.
Transmission	The connection of power transmission lines from the source to end users. Developers, owners, and operators will receive a fixed rate fee for the maintenance and operation of the power lines.
<b>Transportation</b>	
Roads	Infrastructure investment in roads, bridges, and tunnels may be structured under tolling arrangements where the investor has more exposure to economic fluctuation compared to availability contracts where the counterparty assumes more risk.
Airports	Airport investments are typically backed by concession agreements that generate low returns. As the operator of a regulated airport, the investor will rely on its ability to efficiently manage the facility and increase performance through retail revenues. Non-regulated airports offer better control of revenue streams but will have more demand risk exposure.
Sea Ports	Sea ports are exposed to demand risk and labor constraints. Many ports have initiated automation which is reducing labor issues. Partnering with large shipping companies is often required in order to maintain cash flow.
Rail	Most rail based investments have mostly occurred in the U.K. with early investors generating outsized returns. In the U.S. there has been an increase of PPP structured light rail opportunities including in Colorado and Maryland. The ownership of private rail systems has also occurred in the U.S. though not on a large scale.
<b>Water &amp; Wastewater</b>	
Water Utilities/Cos.	Infrastructure investment in water may come in the form of acquiring a large publicly owned utility or through smaller privately owned companies. Most water companies are regulated where how much an investor can earn is pre-determined by the regulator. These investments are typically structured with little downside risk and a moderate cash yield.
Desalinization	Investments in processing plants that purify sea water for human consumption and general use are gaining popularity in low water supply areas that include California, the Middle East, and Australia, but the sector remains small.
Wastewater Facilities	Much of the wastewater infrastructure in the U.S. and abroad is in need of repair and replacement. Additionally, new environmental standards are pushing businesses and waste management companies to recycle organic waste. The organic waste is used to generate power and in some instances can generate water that is recycled.
<b>Telecom</b>	
Cell Towers	Infrastructure funds have invested in physical cell tower systems where telephone companies lease space on the tower to install cell phone transponders. The demand for wireless data has shown steady growth that is expected to continue that will result in increased demand for cell tower space and proliferation.
Fiber Optic	The build-out of fiber optic networks to outlying communities offers some infrastructure like characteristics. Local networking of large buildings, sports facilities and other public spaces offer some investment opportunity.
Radio/TV Transmission	National systems in Europe have been privatized with strong contracted cash flows. Few new investment opportunities remain.
<b>Social</b>	
Hospitals	Social infrastructure investments provide specific essential services to a community. Social infrastructure sectors are typically structured through a PPP where a facility is constructed and then operated by the PPP consortium. Healthcare infrastructure assets may include research facilities and public hospitals, and education infrastructure assets may include housing or special purpose education centers.
Courthouses	
Education	
Detention	