Making the Case for Norwegian Sovereign Wealth Fund Investment in Renewable Energy Infrastructure

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Executive Summary

Making the Case for Norwegian Sovereign Wealth Fund Investment in Renewable Energy Infrastructure

The Sector is Growing, Returns Are Reliable, the Outlook is Positive

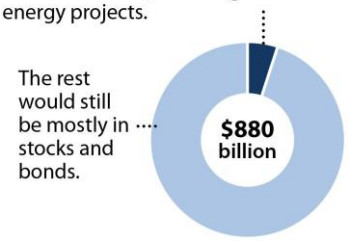
Global investment markets in renewable energy infrastructure are growing rapidly, returns are reliable, and the sector benefits from a positive outlook.

These are the essential findings of this report, which describes how assets bought and sold across this space—in wind farms and solar plants—yield returns and retain value.

In June, lawmakers will consider granting a mandate for the US$880 billion Government Pension Fund Global (GPFG) to invest in infrastructure including renewable energy, which has become by far the most significant sub-sector in this asset class.

5 Percent for Infrastructure

Norway is considering investing up to 5 percent of its sovereign wealth fund in infrastructure, including renewable energy projects.

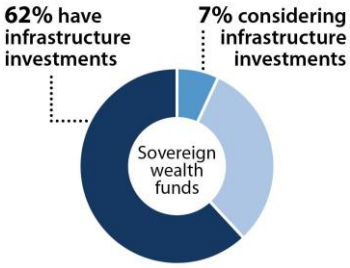


The manager of the Fund, Norges Bank, recommends up to 5 percent of the Fund be invested in global infrastructure. Norway's Finance Ministry has been reluctant to approve such a move, however, citing concerns over assorted risks, but Parliament has the authority to advance the mandate. This report is meant to inform the dialogue.

Infrastructure is an established asset class embraced by many of the world's leading investment funds. In 2016, 62 percent of sovereign wealth funds held infrastructure investments, and an additional 7 percent were considering doing so.

Many Sovereign Funds Already Invest in Infrastructure

In 2016, a majority of sovereign wealth funds held infrastructure investments, and more were considering doing so.



This report focuses on unlisted infrastructure, a sector that is dominated by renewable energy but also includes public roads, ports, railways, and water and sanitation facilities. Renewable energy infrastructure accounts for roughly 42 percent of all unlisted infrastructure transactions, and is becoming a separate investment vehicle.

Well-managed infrastructure investments bring returns of 12 to 15 percent annually, with investments in renewable infrastructure producing steady, stable returns that exceed expectations. Brookfield Asset Management, among the examples mentioned in this study, operates exemplary funds that return 10 to 20 percent annually.

The renewables sector is no longer the experimental space it was, having entered a long-term growth cycle with a strong outlook driven by low costs, competitive prices, policy

advances and rapid uptake. The sector is also diversifying by adding wind and solar investments to long-held hydropower portfolios.

Unlisted infrastructure investments do come with risks. These include financial risk related to liquidity, complexity and transaction costs, and regulatory and political risks that vary by location. That said, well-managed funds have developed robust methods to mitigate such risks.

Five Recommendations for How to Proceed:

1) Establish an investment mandate that requires managers of the Government Pension Fund Global to invest 5 percent of the fund's assets in unlisted infrastructure, including unlisted renewable energy investments.

2) Guide the Fund's investments in unlisted infrastructure by expanding in-house professional staff resources, with a focus on developing a long-term team comparable in quality to those at other top institutional investors.

3) Create partnerships with established investment funds that have a track record in the unlisted infrastructure field, and co-invest with those funds under mutually beneficial arrangements.

4) Reserve a portion of the Fund's infrastructure funds for investments in listed utility companies that have significant and promising portfolios in renewable energy.

5) Develop a firm and prudent commitment to investing in infrastructure projects in emerging markets.

The opportunity in infrastructure investment is enormous. The risk is manageable.

Background: Evolution of the Fund's Portfolio Strategy

From Stock and Bond Holdings to Inclusion of Unlisted Real Estate; the Current Dialogue on Unlisted Infrastructure

During the spring 2017 legislative session, the Norwegian Legislature ("the Storting"), the Norwegian Finance Ministry ("the Ministry"), and Norges Bank ("the Bank)" will explore a mandate allowing the national Government Pension Fund Global (the "Fund) to invest in unlisted infrastructure.

This issue and others related to expanding the scope of the Fund's asset allocation have been a topic of dialogue between the Finance Ministry and Norges Bank since 2006.

In December 2006[1], Norges Bank, which manages the Fund, assessed the Fund's long-term investment strategy. The Fund that year was investing only in equities and bonds, a tradition the Bank would change as the Fund grew, as markets evolved, and as the investment universe changed.

The key trend identified by the Bank in its 2006 review was the emerging market in unlisted real estate and infrastructure assets. These unlisted assets presented an opportunity and an investment challenge for the Fund, as its asset-allocation plan relied on equity and bond investments. While stock and bond holdings provide significant levels of transparency, liquidity and valuation, unlisted investments—while capable of generating attractive risk-adjusted returns— were illiquid, and not easily valued in the real-time market in the way that stocks and bonds are.

The Bank noted that the Fund had some indirect exposure already to unlisted investments through the ownership of the equities of companies involved with such holdings. The Bank also noted that the market for unlisted investments was growing more rapidly than for listed investments and that returns could be benchmarked somewhere between those of stocks and bonds. The Bank concluded that the Fund, to keep in step with the times, would need to engage this sector and shift its asset allocation balance "in favor of greater emphasis on illiquid investments with a liquidity premium."

The Bank recommended specifically that the Fund adopt an investment mandate that would allocate up to 10 percent of its assets to infrastructure and real estate and up to 5 percent to private equity investments.

Within three years, the Fund had begun to follow the 2006 Bank recommendations. The Ministry of Finance's 2009-2010 annual report acknowledged the Fund's 5 percent commitment to a real estate portfolio. In its report, the Ministry also explicitly addressed the Fund's previous need to devise strategies and manage risks associated with investments in assets with less external transparency and liquidity than those of stocks and bonds[2].

[1] http://www.norges-bank.no/en/Published/Submissions/2006/submission-2006-10-20/

[2] https://www.regjeringen.no/contentassets/2cc99f646be747ffa9b6cec9459d830c/en-gb/pdfs/stm200920100010000en_pdfs.pdf, p. 16

In December 2014, the Ministry announced plans to consider inclusion of unlisted infrastructure in the Fund's investment portfolio, and in March 2015 the Ministry requested additional advice on this issue from the Bank. The Bank responded in December 2015 with a letter[3] and two companion studies[4] that explored how fund managers should look at rate-of-return questions on renewable energy and, more generally, how the Fund should approach risk in less mature markets.

A key excerpt from the correspondence:

"The Bank considers it possible to invest in infrastructure for renewable energy with the same required rate of return as for the other GPFG's other investors. Infrastructure investments in less mature markets will be more demanding."[5]

Norges Bank managers had acknowledged. in short, the rising potential for investing in renewable energy while sounding a note of prudence on the due diligence required to proceed.

The Ministry's position nonetheless remains unchanged: That the Fund should not move forward with unlisted infrastructure investments now. The Ministry cites political, reputational, financial, market and concentration risks as the basis for its opposition.[6] The Ministry cites an expert economist study[7] it commissioned on the subject that was published in December 2015 and a more extensive risk analysis it commissioned by McKinsey & Company published in December 2016. Both explore risks related to unlisted infrastructure investments.[8] The McKinsey study also contains a discussion of how institutional investors manage such risks, and the expert economist report supports the Norges bank request for the unlisted mandate.[9]

The dialogue between the Norges Bank and the Finance Ministry has now been joined by the Storting as it takes up the issue of whether to invest in unlisted infrastructure, renewable energy and emerging markets.

[3] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

[4] https://www.nbim.no/en/transparency/discussion-notes/2015/renewable-energy-investments/
and https://www.nbim.no/en/transparency/discussion-notes/2015/infrastructure-investments-in-less-mature-markets/

[5] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

[6] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

[7] https://www.regjeringen.no/contentassets/f353169233704a55b3af6b0b36fb3129/ekspertrapport_eiendom_infrastruktur.pdf

[8] https://www.regjeringen.no/contentassets/312e6001471045cc80be9b86b1fdae4d/risks_in_unlisted_infrastructure.pdf

[9] https://www.regjeringen.no/contentassets/f353169233704a55b3af6b0b36fb3129/ekspertrapport_eiendom_infrastruktur.pdf
See specifically Recommendations 5, 8, 11,12,13 and 14 on pages 7 and 8 of the report.

Potential for Investment in the Global Infrastructure and Renewable Energy Sectors

This section describes the unlisted infrastructure market, and considers its growth prospects in both mature and emerging economies. It also covers renewable energy and its rise as the most actively transacted sub-sector of this asset class.

The infrastructure investment market is made up of essential community facilities that have long lifespans. These facilities include roads, ports, airports, railways, water and sanitation service, power transmission and distribution, and telecommunications. They can be further categorized as follows:[10]

- Community and social: Housing, hospitals, schools, prisons and stadiums;
- Regulated assets: Gas/electric transmission and distribution, water and wastewater treatment;
- User-pays assets: Airports, toll roads, railways, ports
- Competitive assets: energy retail and generation, logistics, telecom services.

The Size of the Infrastructure Investment Market is Bigger than Previously Thought

Since infrastructure is broadly defined as the services and facilities that are necessary for an economy to function, estimates vary widely as to the size of the market, and vary especially as to the size of the unlisted infrastructure market.

The infrastructure market is divided into two broad categories of investments: listed infrastructure and unlisted infrastructure.[11] The listed infrastructure market[12] is comprised of publicly traded companies that own or operate infrastructure assets. The unlisted infrastructure market is comprised of privately held direct equity and fund-managed investments not traded on an exchange.

MSCI[13] in its analysis to the Ministry of Finance puts the overall size of the "institutional/investable" unlisted infrastructure market at US$600 billion.[14] This number is based on a third-party headline number (from RARE[15] infrastructure, in 2012). This same figure is quoted in the McKinsey & Company report to the Ministry of Finance.[16] A more recent RARE analysis, dated June 30, 2016 (see Table 1: *Breakdown of Global*

[10] RARE infrastructure. (2016). What are Global Listed Infrastructure Assets? http://www.rareinfrastructure.com/infrastructure/what-are-global-listed-infrastructure-assets/
[11] See Appendix III for a comparison of key characteristics of the two investment vehicles.
[12] For a concise description of the listed infrastructure market see: https://russellinvestments.com/-/media/files/emea/institutions/brochures/brochure-listed-infrastructure-investing-2008-11.pdf
[13] MSCI is an independent, research driven provider of market information to institutional funds. https://www.msci.com/
[14] MSCI. (February 2016). Global Markets & Returns Drivers, Analysis for the Ministry of Finance, Norway.
[15] RARE Infrastructure is an investment manager specializing in global listed infrastructure. http://www.rareinfrastructure.com/#
[16] McKinsey & Company. (December 2016). Unlisted Infrastructure Investments, External review of Political, Regulatory, and Reputational Risks, Report for the Norwegian Ministry of Finance.

Infrastructure Assets) puts the investable universe of equity in unlisted infrastructure market at US$1.142 trillion,[17] more than double its 2012 estimate.

Table 1: Breakdown of Global Infrastructure Assets

	North America		Europe		Asia Pac		Developing		Totals	
Investable market (USDbn)	Unlisted Market	Listed Market	Unlisted Market	Listed Market	Unlisted Market	Listed Market	Unlisted Market	Listed Market	Unlisted Market	Listed Market
Community & Social Assets	18		42		15		7		81	
Regulated Assets	70	1,544	100	512	23	111	25	495	218	2,663
User Pays Assets	75	390	102	249	52	226	108	161	337	1,026
Competitive Assets	182		155		26		143		506	
Total (Infrastructure)	**344**	**1,934**	**399**	**761**	**116**	**337**	**283**	**656**	**1,142**	**3,688**

Source: As at 30 June 2016. FactSet Research Systems, Preqin (last 10 years of transactions, duplicates removed) and RARE calculations.

The majority of the infrastructure market is listed, and the infrastructure market in this respect differs from real estate, where most of the market is unlisted. It has been argued[18] that permitting investment in unlisted infrastructure would do less to expand the Fund's investment opportunities than unlisted real estate. However, unlisted infrastructure represents almost a quarter (24 per cent) of the total global US$4.83 trillion infrastructure market (both listed and unlisted) (see *Breakdown of Global Infrastructure Assets* Table 1).

From now until 2030, about 3.8 percent of global GDP, or an average of US$3.3 trillion a year, will be required in infrastructure investment to support expected economic growth. Emerging economies will account for some 60 percent of that demand.[19] And as governments in both mature and emerging economies face fiscal budget constraints, demand for financing from an array of institutional investors will become more pressing.

Many Institutional Investors Have Made Allocations for Unlisted Infrastructure

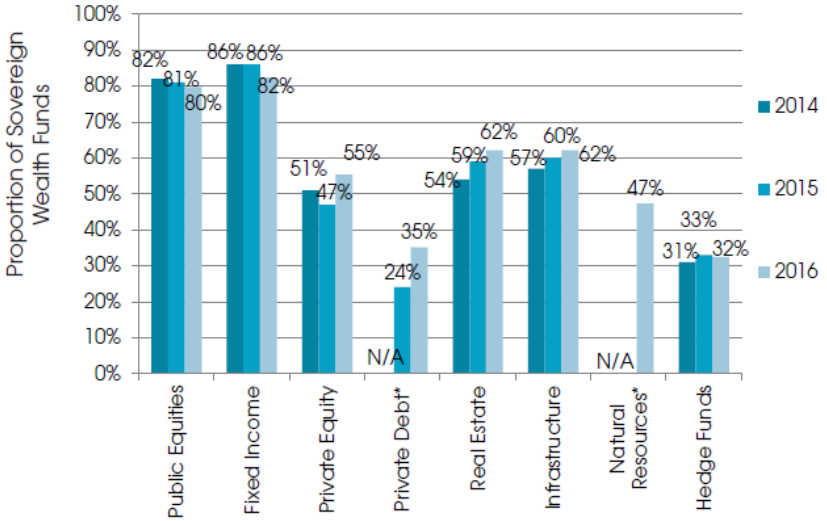
A growing proportion of sovereign wealth funds are investing in unlisted infrastructure, and participation has increased from 57 percent of such funds in 2014 to 62 percent in 2016.[20] (See Table 2: *Sovereign Wealth Funds Investing in Each Asset Class, 2014-2016*). This is the same proportion as those that invest in real estate.

As Funds look to broaden their investments universes and balance risk and reward with traditional investment allocations to equities and bonds, real estate and infrastructure have become the most commonly sought-after sectors. Roughly 7% of sovereign wealth

[17] RARE infrastructure. (November 2016). The Infrastructure Opportunity: Listed versus Unlisted.
[18] Report no. 23. (2015-2016). Report to the Storting (white paper), The Management of the Government Pension Fund in 2015, preliminary and unofficial translation from Norwegian.
[19] McKinsey Global Institute. (2016, June). Bridging global infrastructure gaps. Retrieved January 2017, from http://www.mckinsey.com/industries/capital-projects-and-infrastructure/ourinsights/bridging-global-infrastructure-gaps/
[20] Preqin. (May 16). Real Assets Spotlight. The data is drawn from Preqin Infrastructure Online, which has profiles of over 2,900 institutional investors actively or considering investing in infrastructure funds.

funds that have not done so yet are considering investing in infrastructure, suggesting that this asset class is likely to see further growth.

Table 2: Sovereign Wealth Funds Investing in Each Asset Class, 2014- 2016



Source: 2016 Preqin Sovereign Wealth Fund Review

A number of notable sovereign wealth and institutional investment funds are currently investing in infrastructure.[21] (See Table 3: *Notable Sovereign Wealth Funds Currently Investing in Infrastructure*)

Table 3: Notable Sovereign Wealth Funds Currently Investing in Infrastructure

Investor	Location	Assets under Management ($mn)	Geographic Focus	Route(s) to Market
Abu Dhabi Investment Authority	United Arab Emirates	773,000	Global	Direct, Listed, Unlisted
China Investment Corporation	China	746,730	Global	Direct, Unlisted
State Administration of Foreign Exchange	China	599,510	Europe	Direct
Kuwait Investment Authority	Kuwait	592,000	Global	Direct, Listed, Unlisted
GIC	Singapore	344,000	Global	Direct, Listed, Unlisted
National Social Security Fund - China	China	274,595	Greater China	Direct, Unlisted
Qatar Investment Authority	Qatar	256,000	Global	Direct, Listed, Unlisted
Temasek Holdings	Singapore	189,797	Global	Direct, Listed, Unlisted
Abu Dhabi Investment Council	United Arab Emirates	110,000	Global	Direct, Unlisted
Future Fund	Australia	85,598	Global	Direct, Listed, Unlisted

Source: 2016 Preqin Sovereign Wealth Fund Review

[21] Ibid.

Table 4: 10 Institutional Investors Ranked by Current Total Allocation to Infrastructure

Rank	Investor	Location	Current Allocation to Infrastructure ($bn)	Current Allocation to Infrastructure	Assets under Management ($bn)
1	Japan Bank for International Cooperation	Japan	41.6	24.0%	JPY 18,463.8
2	CPP Investment Board	Canada	15.3	5.5%	CAD 367.4
3	OMERS	Canada	12.5	22.0%	CAD 77.0
4	CDPQ	Canada	9.9	5.2%	CAD 248.0
5	Ontario Teachers' Pension Plan	Canada	9.6	8.2%	CAD 152.4
6	APG - All Pensions Group	Netherlands	9.1	2.0%	EUR 413.0
7	AustralianSuper	Australia	6.9	10.0%	AUD 92.0
8	Alberta Investment Management Corporation (AIMCo)	Canada	6.1	8.9%	CAD 9.0
9	British Columbia Investment Management Corporation	Canada	6.0	6.0%	CAD 130.0
10	PGGM	Netherlands	6.0	3.0%	EUR 180.0

Source: Preqin Infrastructure Online

Infrastructure allocations among institutional funds that have such investments range in size from 3 percent to 24 percent of their total portfolio. The financial characteristics of infrastructure investments make them an attractive choice for these funds (See Table 4: *10 Institutional Investors by Current Allocation to Infrastructure*) for several reasons. Infrastructure assets are long term in nature and therefore offer a good match for the long-term liabilities of institutional investors. Infrastructure investments are generally publicly regulated by way of stable revenue contracts with highly rated counterparties. And because many of these revenue contracts are linked to inflation, the underlying investments can provide a hedge against inflation. They also exhibit low correlation against other asset classes such as equities and fixed income which enables portfolio diversification for institutional investors.

While data on capital allocation by specific sovereign wealth funds is not available, allocation to unlisted infrastructure assets by institutional investors as a whole increased from an average of 3.3 in 2012 to 4.3 percent in 2015. Most funds are still below their target allocations, however, which stand on average at 5.7 percent,[22] indicating that future allocations will increase.

Investment Strategies Carry Varied Risk/Return Profiles and Suit Investors' Divergent Needs

Several options exist for institutional investors considering an asset allocation to unlisted infrastructure:

- Greenfield or brownfield development. Greenfield development involves the building of a new venture from the ground up, and entails greater risk than brownfield development. Brownfield development involves the acquisition or expansion of an asset that is already operational, typically circumventing permitting and construction risks, and likely to face fewer challenges in engaging with affected communities;

[22] Preqin. (2016). 2016 Preqin Global Infrastructure Report.

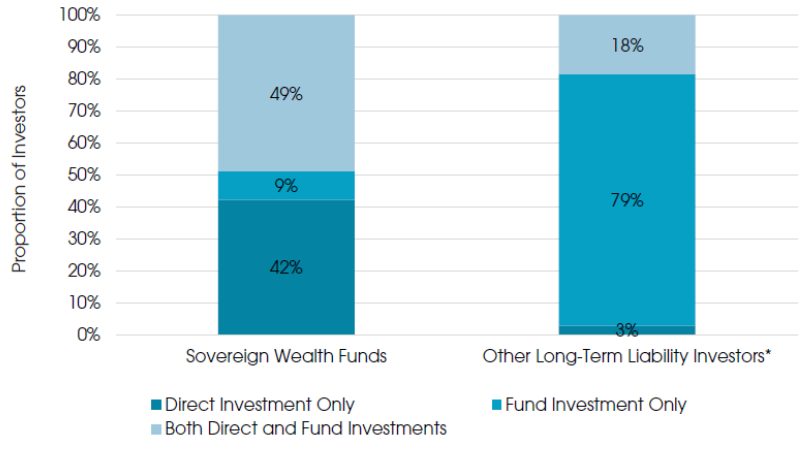
- Unlisted infrastructure funds, co-investment, or direct investment—the funds approach requires less in-house expertise but tends to come with higher management costs;
- Debt or equity finance. Most unlisted infrastructure funds invest in equity. Infrastructure debt funds are a relatively new entrant to the unlisted infrastructure market, and a majority (74 percent) of them are managed by firms with no prior experience in this market;[23]
- Emerging-market investment. While emerging markets are commonly perceived as being higher risk due to their less developed legal and regulatory frameworks, these markets are also associated with a higher proportion of greenfield investments. While the risks are real, they are offset considerably by the fact that emerging markets encompass growing economies.

Choosing which strategies to follow, or which combination to follow, involves assessing likely levels of returns, volatility, liquidity, portfolio diversification potential, investment expertise and risk.

Sovereign wealth funds tend to have the in-house human and capital resources required for direct investment in infrastructure projects. Direct investment entails lower costs than would be incurred in management fees for third-party fund managers and enables a higher degree of control over the assets, which helps mitigate risk. Roughly 42 percent of sovereign wealth funds invest in infrastructure solely through direct holdings, while 49 percent combine direct and unlisted fund investment; by contrast, 79 percent of other long-term liability investors access the asset class solely through fund vehicles, with only 3 percent investing exclusively through direct holdings.[24] (Table 5: *Preferred Method of Exposure to Infrastructure Sovereign Wealth Funds Vs. All Other Long-Term Liability Investors*)

Norges Bank has concluded that direct investments in unlisted infrastructure debt and equity are the most suitable options given the Fund's size[25] and resources.

Table 5: Preferred Method of Exposure to Infrastructure Sovereign Wealth Funds Vs. All Other Long-Term Liability Investors



Source: Preqin Infrastructure Online

[23] Preqin. (September 2016). Preqin Special Report: Infrastructure Debt
[24] Preqin. (May 2016). Real Assets Spotlight.
[25] Norges Bank. (December 2015). Government Pension Fund Global – Investments in infrastructure. https://www.nbim.no/contentassets/e2fa918bf88642a5abe3f07cd6034c11/2015-12-02-nb_gpfg---investments-in-infrastructure.pdf

Table 6 (*Largest Infrastructure Fund Managers by Aggregate Capital Raised for Unlisted Infrastructure Funds in the Past 10 Years*) also shows the scale of capital raised for unlisted infrastructure over the past 10 years. Toronto-based Brookfield Asset Management raised a total of US$25.9 billion in closing on six funds in the past 10 years; the firm's most recent fund, Brookfield Infrastructure Fund III, accounts for most of this total, securing US$14 billion in 2016 and making it the largest infrastructure fund to reach closing.[26]

Table 6: Largest Infrastructure Fund Managers by Aggregate Capital Raised for Unlisted Infrastructure Funds in the Past 10 Years

Firm	Headquarters	Aggregate Capital Raised in Past 10 Years ($bn)	No. of Funds Raised in Past 10 Years	No. of Funds Currently in Market
Macquarie Infrastructure and Real Assets (MIRA)	London, UK	29.5	16	2
Brookfield Asset Management	Toronto, Canada	25.9	6	0
Global Infrastructure Partners	New York, US	13.9	2	3
EIG Global Energy Partners	Washington DC, US	13.2	4	0
ArcLight Capital Partners	Boston, US	13.1	4	0
Energy Capital Partners	Short Hills, US	12.4	4	0
GS Infrastructure Investment Group	New York, US	9.8	3	1
KB Asset Management	Seoul, South Korea	8.8	42	0
Morgan Stanley Infrastructure	New York, US	7.6	2	1
Alinda Capital Partners	Greenwich, US	7.1	2	1

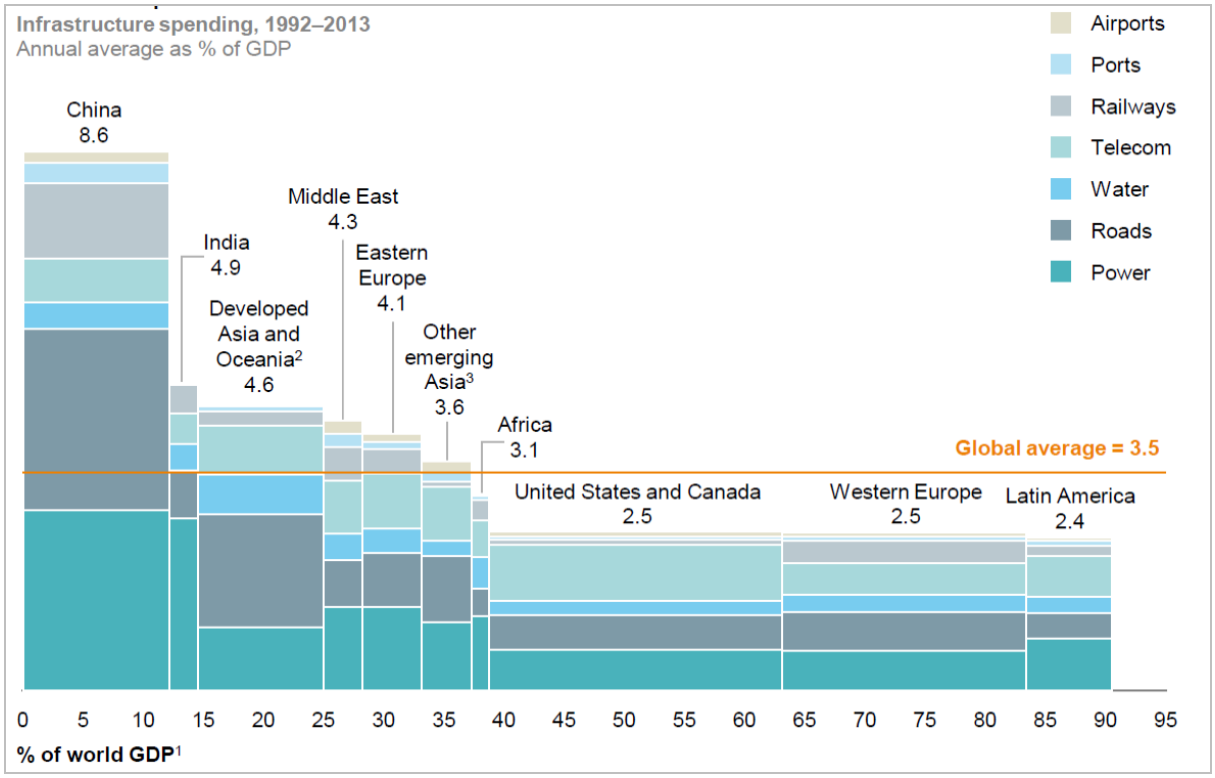
Source: Preqin Infrastructure Online

Infrastructure Investment Opportunities by Geography

The need for stable investment returns and diversification are the main drivers for institutional investors to participate in unlisted infrastructure, and this momentum is occurring in tandem with a trend toward more governments privatizing infrastructure assets (Table 7: *Infrastructure Spending: 1992-2013*). Globalized infrastructure investing enables institutional funds to hedge risks and obtain returns, typically by assembling a portfolio in select countries that suits each fund's parameters. Over the past two decades, infrastructure investment has averaged 3.5 percent of global GDP.[27]

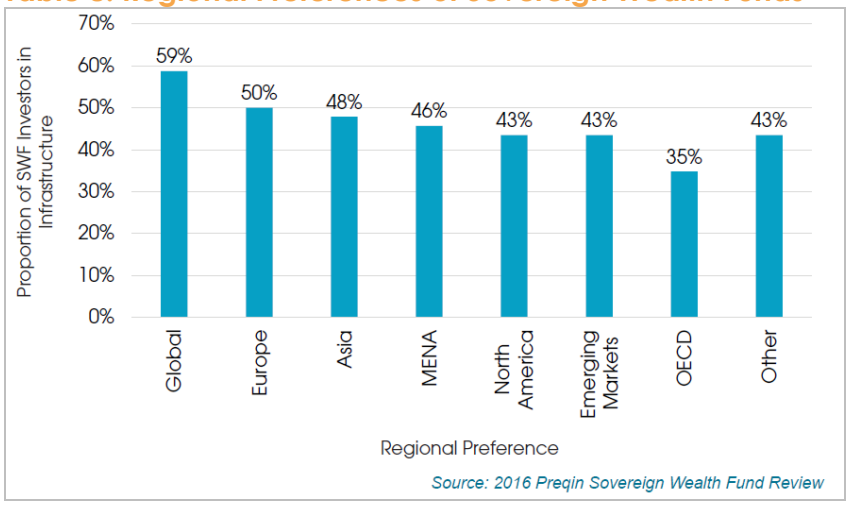
[26] Preqin. (August 2016). Real Assets Spotlight.
[27] McKinsey Global Institute. (2016, June). Bridging global infrastructure gaps. Retrieved January 2017, from http://www.mckinsey.com/industries/capital-projects-and-infrastructure/ourinsights/bridging-global-infrastructure-gaps/

Table 7: Infrastructure Spending: 1992-2013



A majority—58 percent—of sovereign wealth fund investors maintain global infrastructure investments (Table 8: *Regional Preferences of Sovereign Wealth Funds*), and about the same proportion of these investors have a regional preference for Europe (50 percent), followed by Asia. Emerging markets as a stand-alone category attract 43 percent of sovereign wealth fund unlisted infrastructure investments, offering the potential for higher returns as compensation for the greater risk tolerance required.

Table 8: Regional Preferences of Sovereign Wealth Funds



Mature Markets Growth

Infrastructure investments in mature markets are commonly seen as less risky.[28] This is due in part to the availability in these markets of so many brownfield investments, which do not come with the risk associated with the development and construction phases of a greenfield project. Mature markets have relatively well established and stable political, regulatory and financial systems, implying lower sovereign risks that include expropriation risks, policy reversal risks, and currency risk.

Europe has seen over US$170 billion in institutional activity in infrastructure investment since 2002.[29] The most popular sectors have been water and waste treatment (33 percent), airports (18 percent) and oil and gas infrastructure (16 percent).[30] Europe offers especially good opportunities in regulated sectors that include energy utilities that are divesting their assets; such sales are motivated primarily by regulation or regulatory change (e.g. the EU's unbundling directive) or the drive to reduce unsustainable debt loads accrued before the financial crisis.

In North America, key opportunities are in energy, water and greenfield transportation sectors.[31] The overall quality of roads, bridges, schools and other basic national and local facilities in the U.S. received a grade of D+ from the American Society of Civil Engineers in 2013. The disrepair of American infrastructure presents both greenfield and brownfield investment opportunities.

In Australia, a wave of privatizations since 2010 has attracted corporate, foreign and domestic institutional investors. The capital recycling model used in New South Wales – where privatization proceeds are earmarked for reinvestment into greenfield infrastructure – is proving successful, and this encourages continuity of infrastructure investment opportunities. Most of the privatization opportunities are in core assets such as water, ports, and electricity grid networks.[32]

Growth in Emerging Markets

Infrastructure investment in emerging markets focuses typically on greenfield projects. In addition to the risks associated with infrastructure investments in general, emerging market infrastructure investments come with heightened risks that stem from the fact that infrastructure, by its very nature, generates returns over a long period of time, involves greater social and political sensitivities around foreign investments in public property, and exposes investors to local currency fluctuations for the life of a project.

Nonetheless, sovereign wealth funds have been making infrastructure investments in these markets in response to high demand for long-term private capital. A number of additional factors are driving this market, as explained by Bhattacharya, A. et al.[33]

First, global trade is playing an increasingly important role in nation-state development,

[28] See below discussion on Brookfield Asset Management for how this insight is operationalized into an investment portfolio.
[29] Colonial First State Global Asset Management, First State Investments. (July 2014). Bottlenecks and bonanzas: brownfield infrastructure activity.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Bhattacharya, A. et al. (2013). Infrastructure for Development: Meeting the Challenge, policy paper. Centre for Climate Change Economics and Policy, Grantham Research Institute on Climate Change and the Environment.

triggering a rise in demand for transport infrastructure that includes roads, railways and ports.

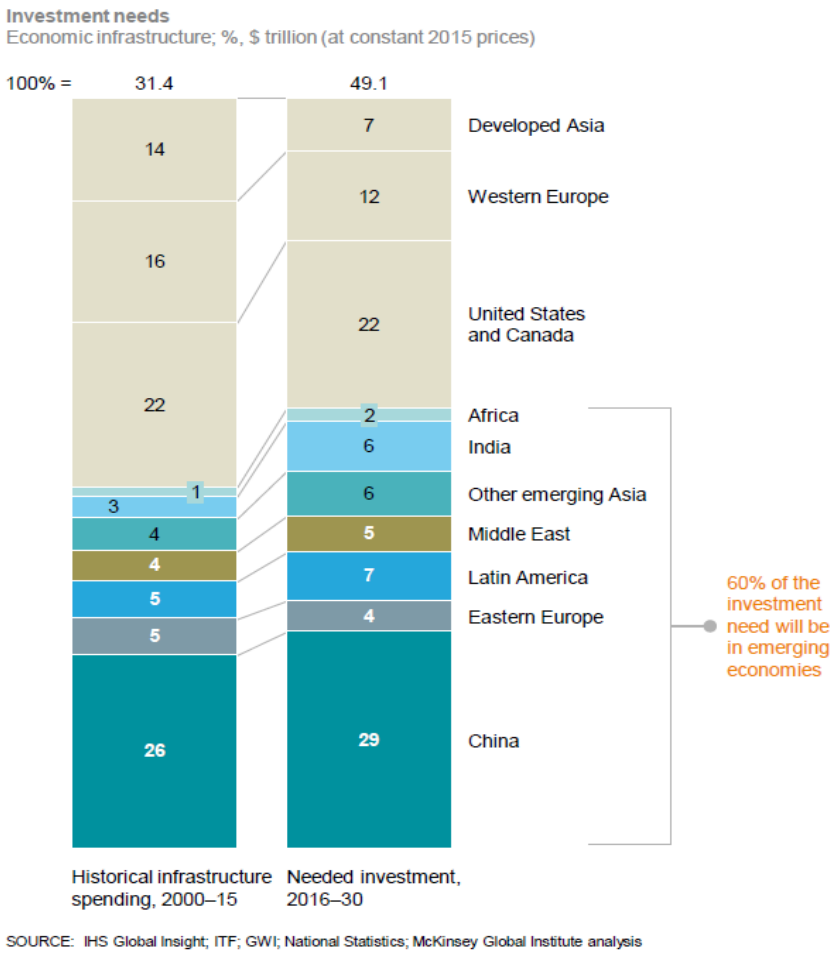
Second, urbanization trends are driving increased infrastructure spending, most of which is taking place in the developing world. Electricity, water and transport are expected to account for the bulk of this spending.

Third, from 10 to 15 percent of infrastructure investments can be attributed today to sustainable infrastructure that is being built because of demand for lower emissions, higher efficiency and resilience to climate change.

Fourth, emerging and developing markets have under-invested in the maintenance of current infrastructure. Just to meet the requirements for infrastructure maintenance, annual infrastructure spending in less mature markets must more than double by 2020[34]. As seen in Figure 9 *(Infrastructure Spending Will Continue to Shift to Emerging Markets*), 60 percent of the investment demand will come from emerging economies[35].

Finally, Basel III requirements, a set of international finance regulations that require banks to hold more capital to underpin long-tenor loans, are making commercial bank financing of long-term infrastructure costlier. Hence, institutional investors become an important alternate funding source.

Figure 9: Infrastructure Spending Will Continue to Shift to Emerging Markets



SOURCE: IHS Global Insight; ITF; GWI; National Statistics; McKinsey Global Institute analysis

[34] Change Economics and Policy, Grantham Research Institute on Climate Change and the Environment.
[35] McKinsey Global Institute. (2016, June). Bridging global infrastructure gaps. Retrieved January 2017, from http://www.mckinsey.com/industries/capital-projects-and-infrastructure/ourinsights/bridging-global-infrastructure-gaps/

Renewable Energy is the Most-Transacted Sub-Sector of Infrastructure Investment

Renewable energy has emerged recently as the most transacted of all sub-sectors in the infrastructure asset class, accounting for about 42 per cent of all transactions.[36] A number of factors have driven the sector's growth, and its growth relative to other infrastructure sub-sectors.

First, falling costs for renewable energy equipment and components have substantially reduced the levelized cost of electricity (LCOE).[37] Renewable energy is particularly sensitive to declining costs of equipment because having no fuel costs during the operational phase of a project means a significant portion of the LCOE of renewable energy is accounted for by the initial capital cost.

Second, the cost of capital to finance renewable energy projects has dropped. Unlevered internal rate of return (IRR) expectations were 13 percent and above in the U.S. a decade or so ago. However, in 2016, average unlevered IRRs range from 6 percent to 10 percent in the U.S. This is occurring because investors are becoming more comfortable with renewable energy technologies, warranties and company balance sheets.[38] In developed economies, too, the cost of debt in general is relatively low by historical standards, a circumstance that helps safeguard the competitiveness of renewable energy, where most costs are incurred up front and can be locked up for the duration of the contract rather than released during operation.

Third, more countries have established national renewable energy policies, targets and incentives. A total of 164 countries had adopted at least one type of renewable energy target as of mid-2015, up almost four-fold from the 43 countries that had done so by 2005. Emerging economies lead the pack, accounting for 131 of the 164 countries with targets in place.[39]

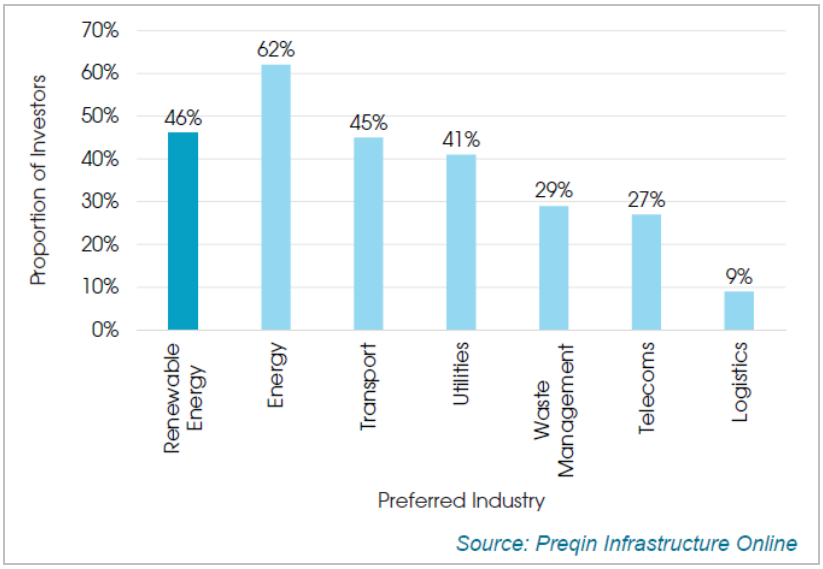
Fourth, energy, as an overall category, has been and is currently the top preferred industry for investment. And renewable energy is now growing so rapidly that it is breaking out of the general energy category and becoming the second-highest preferred industry itself. (Figure10: *Institutional Investors in infrastructure by Industry Preference)*. This trend will continue as conventional fossil-fuel- powered energy sources are beset by price volatility and rising stranded asset risks.[40]

[36] https://www.preqin.com/docs/samples/2017-Preqin-Global-Infrastructure-Report-Sample-Pages.pdf
[37] http://ieefa.org/ieefa-report-finds-eight-signs-that-timing-is-right-for-further-investment-in-global-energy-market-transformation/ and see also: https://irenanewsroom.org/2015/12/29/the-falling-costs-of-renewable-energy-no-more-excuses/
[38] Dr. Chris Wedding. (November 2016). The Mainstreaming of Renewable Energy Infrastructure Investing: Risks, Returns and Emerging Sectors.
[39] International Renewable Energy Agency (IRENA). (June 2015) Renewable Energy Target Setting.
[40] For a comparison of the financial trajectories of the oil, gas and coal versus solar and wind sectors, see Appendix II.

The Hunt Among Institutional Investors for Yield in Renewables

The trends described above have not gone unnoticed by institutional investors, of which 46 percent show a preference for investing in renewable energy, higher than all other infrastructure sub-sectors.[41] See Figure 10 (*Institutional Investors in Infrastructure by Industry Preference*).

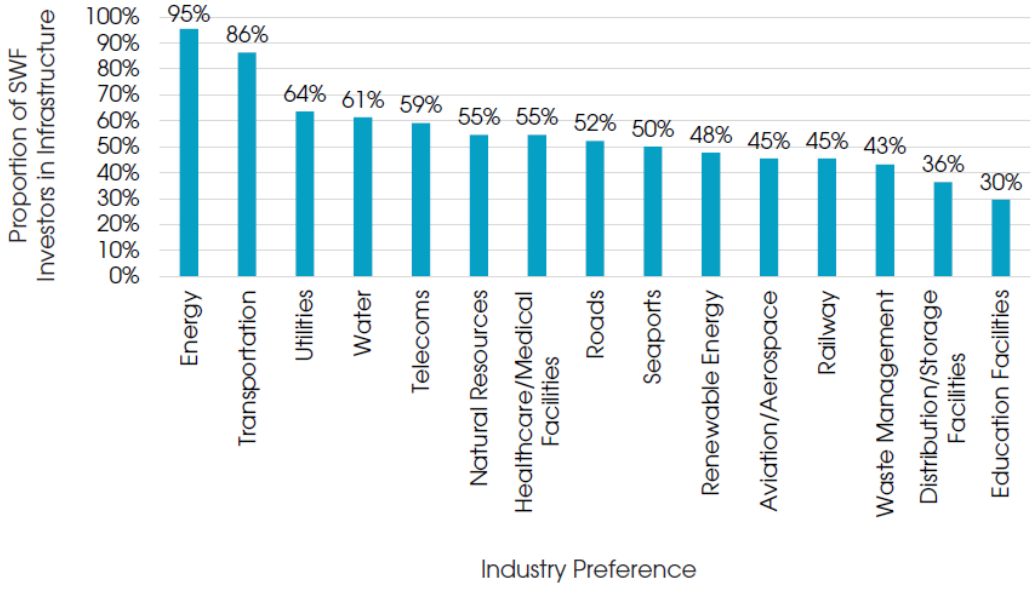
Figure 10: Institutional Investors in Infrastructure by Industry Preference



[41] Preqin. (May 2016). Real Assets Spotlight.

Renewable energy holds similar appeal to sovereign wealth fund investors—48 percent of sovereign wealth funds with infrastructure holdings have a renewable energy portfolio.

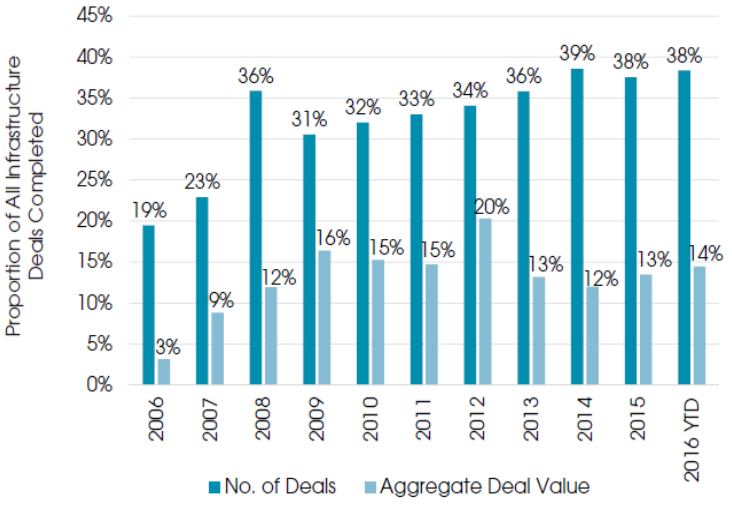
Figure 11: Industry Preferences of Sovereign Wealth Funds Investing in Infrastructure



Source: Preqin Infrastructure Online

The importance of renewables to the infrastructure sector is shown in Figure 11 (*Industry Preferences of Sovereign Wealth Funds Investing in Infrastructure*). Renewable energy deals grew as a proportion of all completed infrastructure deals from 2006 to 2016.

Figure 12: Renewable Energy Deals as a Proportion of All Completed Infrastructure Deals, 2006-2016



Source: Preqin Infrastructure Online

These investments are mainly in mature markets such as North America and Europe, and the technologies of investment choice are wind and solar[42]. (See Figure 13, *Breakdown of Completed Renewable Energy Infrastructure Deals by Region, 2008-2015 and* Figure 14, *Breakdown of Completed Renewable Energy Infrastructure Deals by Industry 2008-2015*).

Figure 13: Breakdown of Completed Renewable Energy Infrastructure Deals by Region, 2008-2015

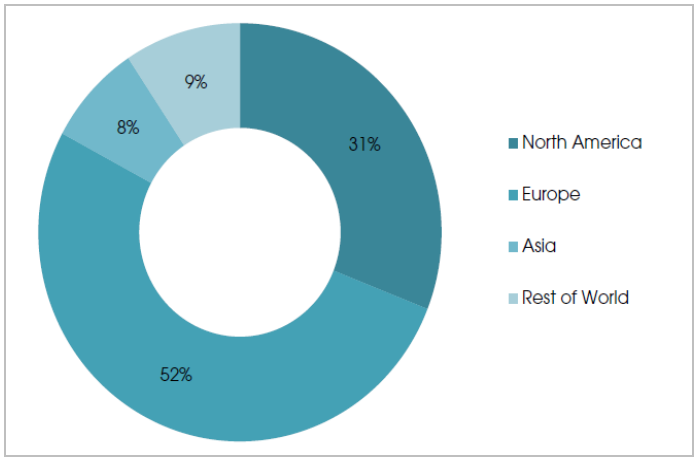
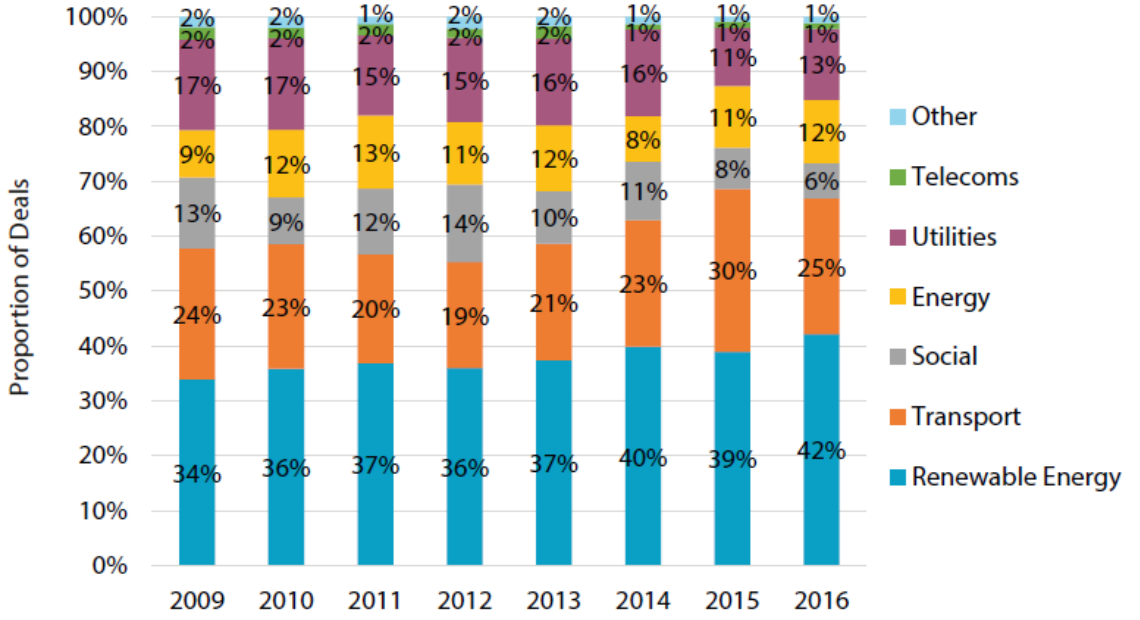


Figure 14: Infrastructure Deals by Industry 2008-2016

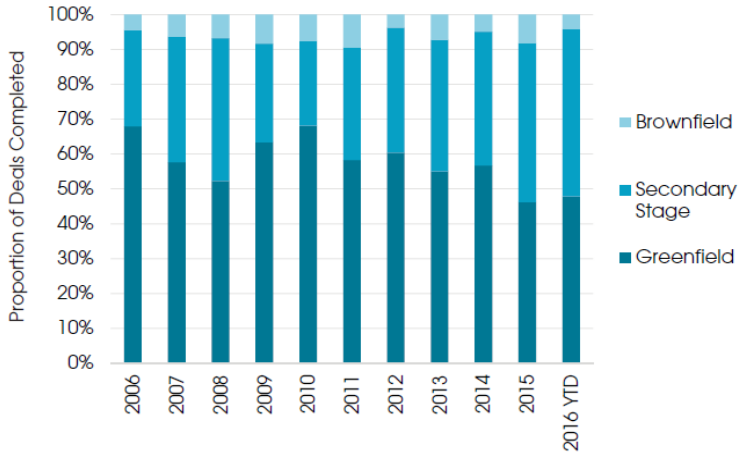


Source: Preqin Infrastructure Online

[42] Preqin. (2016). 2016 Preqin Global Infrastructure Report.

By project-stage metrics, brownfield projects have increased gradually, reflecting the maturity of the market, which has a greater supply of fully operational assets after over a decade of policy support and technological development. (See Figure 15 *Completed Renewable Energy Deals by Project Stage, 2006-2016*).

Figure 15: Completed Renewable Energy Deals by Project Stage, 2006-2016



Source: Preqin Infrastructure Online

Renewable Assets Match the Particular Needs and Timeframes of Sovereign Wealth Funds

Renewable energy investments are relatively recent additions to institutional investment portfolios. They nevertheless have the same attributes as other longstanding sub-sectors under the infrastructure asset class, such as utilities. They must meet the same investment criteria, for instance, and many of the projects offer downside protection through guarantees and/or political risk insurance by host governments or export credit agencies. They also come with long timeframes that match the liability profiles of sovereign wealth funds. Developed renewable projects offer a steady stream of cash flow and inflation protection features (where there are inflation-linked power purchase agreements in place), ensuring a bond-like annuity-return profile.

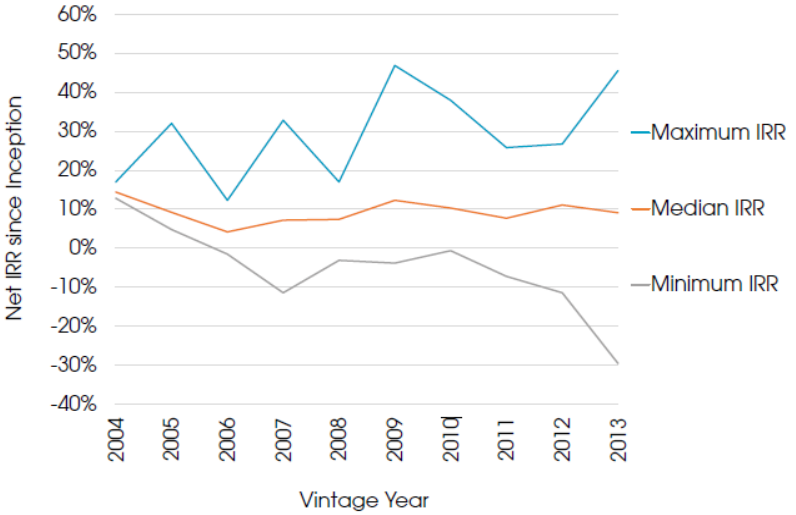
The most recent performance data for infrastructure— while it does not reflect the return on renewable energy investments specifically[43]—shows that the median net IRR for all vintages is approximately 10 percent, which is typical of an investment favored for its relatively stable returns (Figure 16: *Maximum, Median and Minimum Net IRRs for Unlisted Infrastructure Funds by Vintage Year*).

Furthermore, as shown in Figure 17: *Median Net IRRs by Vintage Year and Strategy*, infrastructure returns are among some of the least volatile of all private capital strategies. Bearing in mind that renewable energy has become the most transacted sector in the

[43] See discussion below on Macquarie and Brookfield Asset Management

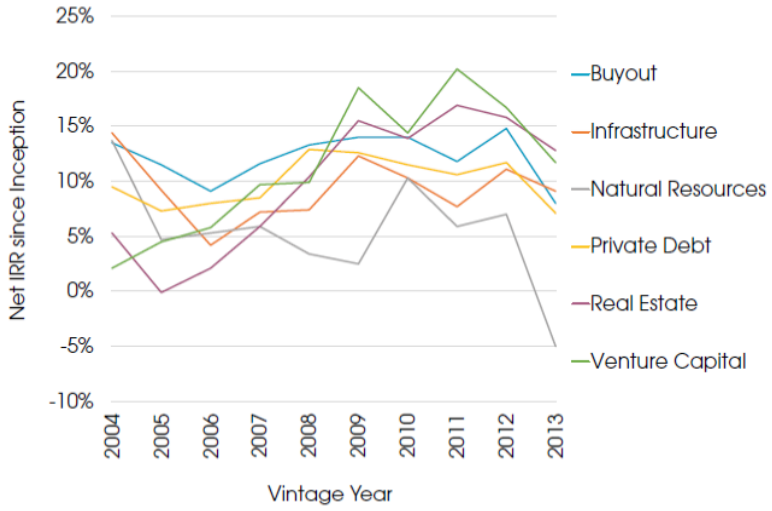
infrastructure space, the overall returns trend is further evidence of how renewable energies are contributing to the relative stability of the infrastructure investment class.

Figure 16: Maximum, Median and Minimum Net IRRs for Unlisted Infrastructure Funds by Vintage Year



Source: Preqin Infrastructure Online

Figure 17: Median Net IRRs by Vintage Year and Strategy



Source: Preqin Infrastructure Online

The Upward Trajectory in Capacity Addition and Investment is Strong

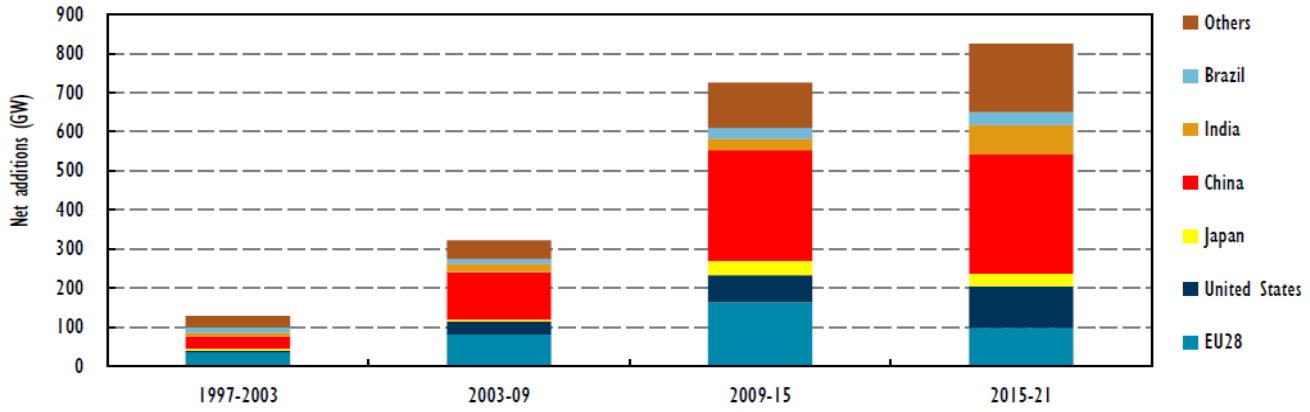
In 2016, a total of US$287 billion was invested in renewable energy globally. This was a falloff of 18 percent from the record US$ 348 billion reported in 2015.[44] The reduction was attributed to slower growth in the Chinese economy and falling prices for solar panels and other equipment (which means investors can build more for the same cost). A record 70GW of solar power was added in 2016 globally, up from 56GW in 2015, and 56GW of new wind energy came online.

The downward blip recorded in the 2016 value of investments, then, does not alter the strong upward trajectory for total renewable energy capacity installations. Since 2015, renewables have accounted for more than half of net yearly additions to power capacity, overtaking coal in terms of world cumulative new installed capacity.

US$11.4 trillion is expected to be invested in new power generating capacity over the next 25 years at an average of US$454 billion a year. More than two-thirds of this will be renewable energy, led by solar and followed by onshore wind.[45]

The IEA estimates that by 2021, six markets will have provided close to 80 percent of new renewable additions since 2015 (Figure 18: *Global Renewable Energy Net Additions to Power Capacity*). China will remain the largest market with 37 percent of additional renewable capacity.[46] The U.S. becomes the second-fastest-growing market globally over the next five years, superseding the European Union. India emerges as a key driver of renewable energy as it pursues its aggressive electricity market transformation. Renewable expansion remains robust in Brazil and Japan despite macroeconomic challenges in those countries. Emerging economies will account for more than two-thirds of the capacity expansion of renewables.[47] As these geographic trends take deeper root, institutional investors looking to diversify their geographical holdings will find a range of opportunities in renewable in both developed and emerging economies.

Figure 18: Global Renewable Energy Net Additions to Power Capacity



[44] Bloomberg New Energy Finance. (January 2017). Liebreich and McCrone: The Shift to 'Base-Cost' Renewables: 10 predictions for 2017.
[45] Bloomberg New Energy Finance. (June 2016). New Energy Outlook 2016.
[46] http://ieefa.org/ieefa-report-china-set-dominate-%E2%80%A8global-renewable-energy-boom-expands-lead-u-s/
[47] International Energy Agency. (2016). Renewable Energy Medium-Term Market Report, Market Analysis and Forecasts to 2021.

Emerging Markets Are Especially Suitable for Institutional Investors

Developing countries invested more in renewable energy than developed countries for the first time in 2015.[48] These economies are appealing for a number of reasons.[49] The economic viability of renewable energy in emerging market depends considerably on resource quality, especially in solar, and emerging economics have the edge on this point. As the International Renewable Energy Agency (IRENA) has noted, "Latitude is a key factor, and cloud cover also plays a role."

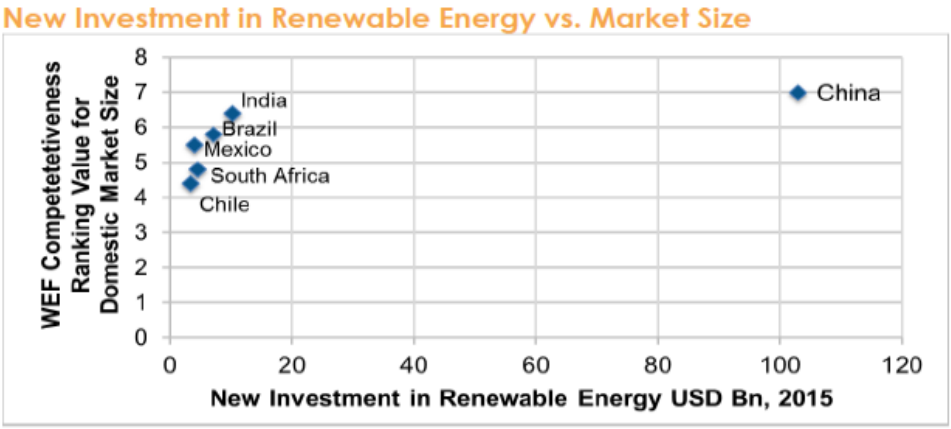
Annual yield on solar is up to three times higher in developing countries than in developed countries. This makes solar PV a particularly compelling investment for developing countries.[50]

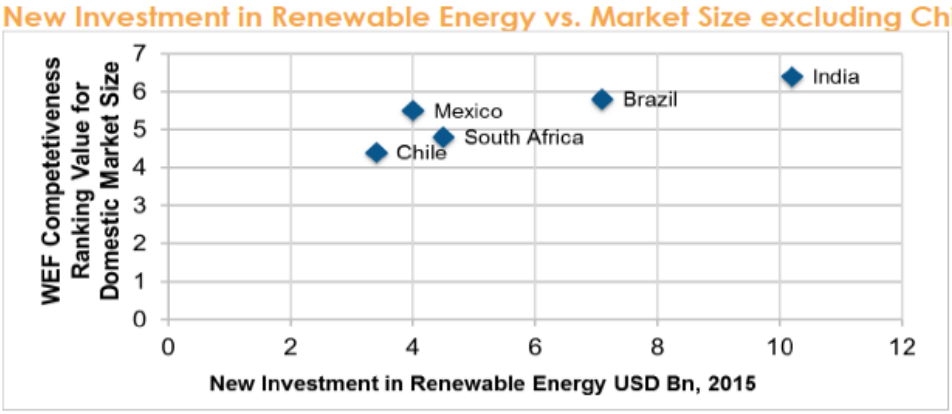
Further, while global GDP growth has stayed at 3 to 3.5 percent annually, average growth rates in developing countries have been higher, and are expected to remain so, at 4.6 percent compared to 1.8 percent in developed countries (according to the latest International Monetary Fund forecasts). Relatively high GDP growth rates in developing economies and high energy-demand forecasts in these countries make these markets relatively attractive for new energy investors.

Economies of scale are also creating new advantages for renewables everywhere, especially in emerging markets, where growth potential is especially strong in countries where favorable policies and economies of scale have brought down total installation costs (in India, solar tariffs have fallen by 40 percent in just the past 18 months).

China and India are especially attractive markets, as is Brazil. The graph below (See: *New Investment in Renewable Energy Vs. Market Size and New Investment in Renewable Energy Vs. Market Size excluding China*) plots World Economic Forum's domestic market size index versus 2015 new investments in renewables. China is an outlier because of its size and in terms of the amount of investment it attracts (given the exceptionally strong long-term policy endorsement of the Chinese government as part of is war on pollution and its aim to develop low-emission industries of the future); there seems to be a correlation nonetheless between market size and renewable investments per country.

[48] http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf
[49] Buckley, T. (2016). IEEFA Update: Emerging Markets Lead Global Investment in Renewables. http://ieefa.org/wp-content/uploads/2016/11/IEEFA-Update-Emerging-Markets-Lead-Global-Investment-in-Renewables-November-2016.pdf
[50] International Renewable Energy Agency. (2016). Letting in the Light, How Solar Photovoltaics Will Revolutionize The Electricity System. http://www.irena.org/menu/index.aspx?CatID=141&PriMenuID=36&SubcatID=2735&mnu=Subcat





Source: IEEFA calculations based on WEF and UNEP statistics

Deflationary cost expectations in renewables are appealing in the context of investors' search for yield. With expectations for a 3 to 4 percent annual increase in efficiency and 3 to 4 percent annual reductions in costs, tariffs on new solar projects will likely continue to go down by 5 to 8 percent year on year. For markets that provide a price guarantee and a valid growth story, deflationary costs make such infrastructure investments attractive.[51]

For investors and/or policy-makers,[52] renewable energy presents an opportunity to diversify energy holdings within the same countries, especially where they rely extensively on imported fossil fuels. China is seeking to increase its renewable energy capacity from 508GW currently to 770GW by 2020. The recent Chinese government announcement that it intends to put US$360 billion into renewables globally by 2020 is evidence that markets are expanding and new markets will develop.[53] Chinese global leadership on the renewables front includes exporting technology, finance and new business models.[54]

India plans to reach 225GW in renewables by 2022 from its current 97GW total (and aims to achieve 350GW of renewables capacity by 2030). Brazil's plan is to reach 174GW by 2024 from the 106GW it reported at the end of 2014.

[51] Mints, P. Renewable Energy World. (September 2016). http://www.renewableenergyworld.com/articles/2016/08/notes-from-the-solar-underground-the-solar-roller-coaster-and-those-along-for-the-ride-first-solar-sunpower-q-cells.html

[52] http://search.myway.com/search/GGmain.jhtml?searchfor=why+institutional+investors+choose+unlisted+infrastructure+investments+&n=782b4a5c&p2=%5EBSB%5Exdm093%5ES17547%5Eus&ptb=4C5EEEC7-84B3-4FF9-8F67-2FEF20869367&qs=&si=CIzN_oGtg9ACFcFEhgodFDgFLw&ss=sub&st=tab&trs=wtt&tpr=sbt&ts=1486126605332

[53] https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html?_r=0

[54] http://ieefa.org/ieefa-report-china-set-dominate-%E2%80%A8global-renewable-energy-boom-expands-lead-u-s/

Recent examples of more developed markets with expanding renewables industries include Denmark,[55] Germany and South Australia, where trends suggest that these countries' concerns about renewable technology grid integration are being addressed[56] [57] and that renewable investment targets are being revised upward.

Renewable Energy Will Not Require Subsidies to Be Competitive

A trend toward policies that support competitive auctions with long-term contracts over government-guarantee tariff programs has improved the risk perception of renewables.

This trend supports the development of increasingly competitive and lower-cost financing.

Auctions drive price discovery by the markets, and competition imposes downward pressure on tariffs, resulting in cheaper costs as opposed to those driven by regulator-imposed feed-in tariffs. Offtakes are perceived to be more likely to honor long-term power purchase agreements and more like to avoid retroactive changes when a tariff is market driven.

Further, growing involvement in the preparation of renewable competitive auction/tender schemes by equipment manufacturers, financers, insurance companies, operation and maintenance (O&M) service providers, and legal firms has resulted in a deeper and broader understanding and management of project risks.[58]

Events of note that have achieved historically low tariffs and that have been oversubscribed include:[59]

- Recent auctions in Mexico and Argentina yielding prices far better than initial expectations. Mexico's auction yielded US$33-35 per megawatt hour (MWh) for wind and solar compared with US$39-45/MWh six months earlier.
- A recent Argentina tender for US$48-65/MWh for wind-powered electricity and US$60-75/MWh for solar, significantly below government expectations and six times oversubscribed.
- Chilean auction prices this past August averaging US$50/MWh2, less than half the auction prices seen in 2014 (Us$108/MWh) and below the cost of new imported-thermal-power generation.
- Dubai Electricity & Water Authority receiving a record low bid in May 2016 of US$29.90/MWh to develop 800 megawatts (MW) of solar-power projects, followed by an even lower bid, of US$24.20/MWh, for a 350-megawatt solar photovoltaic (PV) project for Abu Dhabi in September.

[55] Ea Energy Analyses. (2015): The Danish Experience with Integrating Variable Renewable Energy. Study on behalf of Agora Energiewende.
[56] Parkinson, G. (August 2016). South Australia signalling the death of base-load generation. http://reneweconomy.com.au/south-australia-signalling-death-base-load-generation-43868/
[57] Hepburn, S. (October 2016). South Australian blackout: renewables aren't a threat to energy security, they're the future. http://theconversation.com/south-australian-blackout-renewables-arent-a-threat-to-energy-security-theyre-the-future-66405
[58] IEA. (2016). Renewable Energy Medium Term Market Report 2016, Market Analysis and Forecasts to 2021.
[59] http://ieefa.org/wp-content/uploads/2016/11/IEEFA-Update-Emerging-Markets-Lead-Global-Investment-in-Renewables-November-2016.pdf

- Record low solar tariffs awarded in India in January 2016 of US$60/MWh, fixed flat in nominal terms for 25 years. Pricing of Indian solar projects has dropped 25 percent since 2015. India saw upwards of 15GW of solar projects awarded in 2016.

Renewable Portfolios Produce Consistent, Attractive Returns: Case Studies

This section looks at well-managed activity in the infrastructure and renewables space.

The case studies included here show how prudently managed portfolios are producing steady, stable revenues and returns exceeding expectations. These return performances reflect robust market conditions in several countries, with buyers and sellers alike finding value. These four examples—Brookfield Asset Management's **Brookfield Infrastructure Partners** and **Brookfield Renewable Partners,** Australian Commonwealth Bank's **Colonial First State Global Asset Management** and the **Abu Dhabi Investment Authority—** also show how infrastructure and renewable markets have demonstrated resilience and how such assets retain value even as individual companies enter and leave the market due to management and/or company-specific financial stress.

Brookfield Asset Management (NYSE:BAM) (TSX:BAMA.TO)

Brookfield Asset Management (BAM) is a Toronto-based global alternative asset manager specializing in real assets, with $250 billion under management.[60] BAM's focus is on property, renewable energy and private equity assets.

BAM manages a range of public private investments, products and services for institutional and retail clients. The company earns asset-management income and aligns its interests with its clients by investing alongside them. The company has $30 billion in capital investments, principally in its four listed partnerships: Brookfield Property Partners, Brookfield Infrastructure Partners, Brookfield Renewable Partners, and Brookfield Business Partners.

The company focuses on three areas of strategic value creation: 1) asset management; 2) investor and capital allocation, and 3) owning/operating assets.

Two of Brookfield's four partnerships—**Brookfield Infrastructure Partners (BIP) and Brookfield Renewable Partners (BRP)**—are deeply involved in the renewable energy and infrastructure sectors. BRP is BAM's dedicated public vehicles for renewable power, and BIP's mandate includes renewables and other forms of infrastructure investment.

Brookfield Infrastructure Partners[61] (NYSE: BIP) (TSX: BIP.UN) owns and operates a diverse, global infrastructure network with investments in utilities, transportation, energy and communications. It invests in hard assets: transmission and telecommunication lines, toll

[60] https://bam.brookfield.com/reports-and-filings/financial-reports/q3-2016-letter-to-shareholders
[61] https://bip.brookfield.com/~/media/Files/B/Brookfield-BIP-IR/recent-posts/november-2016-bip-investor-presentation.pdf, p.5.

roads, ports and pipelines. The company has an equity market capitalization of US$11.7 billion and a history of steady, stable returns. BIP has an investment-return target of 12 to 15 percent. Both BIP and BRP invest alongside institutional partners when making new investments in their respective sectors.

Table 19: BIP Annualized Returns[62]

	1-Year	5- Year	Since Inception
BIP (NYSE)	29%	20%	18%
BIP (TSX)	30%	27%	23%
S & P 500	5%	13%	8%
S & P Utilities Index	17%	11%	6%
Alerian MLP Index	1%	1%	7%
DJB Infrastructure Index	9%	6%	5%

BIP owns and operates assets in Australia, Europe, India, North America and South America. Since its inception in 1998, BIP has had total annualized returns of 18 percent, outpacing the Standard and Poor's 500 Index and several peer-group indexes. BIP carries a Standard and Poor's credit rating of BBB+.

BIP's partnership business model focuses on investments with stable cash flow (long-term contracts), diversification throughout the infrastructure space, and in stable jurisdictions.[63] To support its annualized return goals and capex program, the company opportunistically sells mature/low-growth assets. The business model avoids reliance on unrelated revenues as a source of support for operations and distributions.

Brookfield Renewable Partners (NYSE:BEP) (TSX: BEP.UN) owns and operates 260 electricity-generating facilities in Europe, North America and South America. The company is a global leader in hydroelectric power generation. It is also a seasoned wind-farm operator, with assets in Brazil, Europe, North America and South America.

BRP has a long-term annualized total return target of 12 to 15 percent and has provided steady annualized returns to investors (including through reinvestment of dividends).

[62] https://bip.brookfield.com/~/media/Files/B/Brookfield-BIP-IR/recent-posts/november-2016-bip-investor-presentation.pdf, (includes dividend reinvestment for all indexes with exception of DJB Infrastructure Index), p.5

[63] https://bip.brookfield.com/~/media/Files/B/Brookfield-BIP-IR/recent-posts/november-2016-bip-investor-presentation.pdf, p.12.

Table 20: BRP Annualized Return[64]

	One Year	Three Year	Five Year
BEP.UN (TSX)	17%	21%	15%
BEP (NYSE)	19%	11%	10%
S&P/TSX Composite	14%	8%	8%
S&P 500	15%	11%	16%

The company's principal area of activity in the renewable technology space is hydropower (88 percent of generation assets). BRP is currently increasing its hydropower holdings in Brazil and in 2006 closed on a 3,000-MW hydroelectric power portfolio in Colombia.[65]

The company is also successfully invested in wind farms (11 percent of generation assets). BRP operates 38 wind facilities in six countries with an installed capacity of 1,600 MW. The company has over a decade of experience in the acquisition and management of wind farms, and focuses on five strategic factors when making wind-investment decisions:

- Quality of the underlying wind resource;
- Scarcity value of a project in a given location;
- High-value power markets;
- Long-term, utility-grade purchase power agreements;
- Tier 1 turbines (GE, Siemens, Vestas, Enercon, Nordex).

BRP bought 321 MW of wind-powered assets in Ireland for US$950 million in 2014. This wind farm project, known as Board Gais Eireann (BGE), gave the company a 15 percent stake in Ireland's wind energy industry.[66] Since then, the wind energy market in Ireland has grown, and the company recently announced it was exploring the possible sale of select wind properties in Europe as part of its capital-recycling activities.[67] As many as 40 investors are interested in the properties, according to published reports.[68] in 2016, BRP announced additional investments in wind-generation projects in Ireland.[69]

In 2016, BRP and its co-investors acquired a 35 percent interest in TerraForm Power, a yieldco with 3000 MW of wind and solar assets[70] formed and controlled by Sun Edison but not part of SunEdison's bankruptcy filing in 2015. It remains a viable asset[71] and is currently

[64] https://bep.brookfield.com/~/media/Files/B/Brookfield-BEP-IR/events-and-presentations/bep-profile-november-2016.pdf, p. 8.
[65] https://bep.brookfield.com/press-releases/2016/01-13-2016
[66] https://bep.brookfield.com/press-releases/2014/03-25-2014a
[67] http://renewables.seenews.com/news/brookfield-starts-sale-of-137-mw-of-irish-wind-farms-report-543361 http://renewables.seenews.com/news/brookfield-starts-sale-of-137-mw-of-irish-wind-farms-report-543361
[68] http://renewables.seenews.com/news/brookfield-starts-sale-of-137-mw-of-irish-wind-farms-report-543361
[69] http://www.marketwatch.com/story/brookfield-renewable-announces-third-quarter-results-2016-11-03-61604611
[70] https://bep.brookfield.com/~/media/Files/B/Brookfield-BEP-IR/events-and-presentations/transcript-q3-2016.pdf
[71] https://www.bloomberg.com/news/articles/2016-07-20/terraform-global-rises-amid-talks-with-sunedison-to-sell-stake

in the process of dissolving its relationships with SunEdison.[72] BRP is the largest shareholder of TerraForm Power stock, and has recently made a bid to buy the company outright.[73] Other major investors are also interested in TerraForm Power.[74]

Brookfield is planning to expand[75] its portfolio holdings in real estate investments in India to include infrastructure and renewable energy[76] over the next several years.

Colonial First State Global Asset Management

Colonial First State Global Asset Management (CFS GAM) is owned by Commonwealth Bank of Australia, which is the country's largest bank and has an equity market capitalization of US$105 billion (Commonwealth Bank is also Australia's largest domestic fund manager, with total assets under administration of over US$146.2 billion as of Dec. 31, 2016[77]).

CFS GAM has operated in the unlisted infrastructure sector since 1994, and in 2014 was rated as one of the 10 largest global infrastructure investors.[78]

CFS GAM's has invested in 58 unlisted infrastructure investment companies globally over the past two decades. This portfolio currently holds 18 companies and was worth A$7 billion (U.S.$5.5 billion) as of Dec. 31, 2016, spanning industry exposures in water, electricity and gas distribution systems, airports, parking facilities, fuel storage and distribution sectors. CFS GAM has invested recently in two renewable energy infrastructure assets: Finerge, a Portuguese wind farm owner, and Coriance, a district-heating operation in France.

The company's unlisted-infrastructure teams reported an overall portfolio internal annual rate of return of 12.7 percent over 20 years (after fees and expenses) as of Dec. 31, 2016. By comparison, the largest unlisted fund currently in operation is the European Diversified Infrastructure Fund (EDIF) with a Net Asset Value (NAV) of €2.2666 billion and return since inception in August 2009 of 12.3 percent annually, comfortably ahead of its benchmark target of "EICP +5% p.a. after fees".[79] The second-largest unlisted infrastructure fund is the Global Diversified Infrastructure Fund (GDIF) with a NAV of US1.2 billion as of Dec. 31, 2016, and a gross since inception in January 2007 of 10.3 percent, (after fees and expenses).

CFS GAM is highlighted in this paper in part for its relatively recent inclusion of two renewable energy infrastructure assets to its portfolio:

- Finerge (acquired by CFS GAM in September 2015) is the third-largest portfolio of wind farms in Portugal with a gross installed capacity of 862MW (642MW of equity share) and a reported value of €900 million.[80] With an index-linked feed-in-tariff spanning 16 years, this holding is a long-life asset delivering clearly-defined, stable cash returns exceeding the benchmark target absent any financial leverage.

[72] http://www.restructuringupdates.com/
[73] https://pv-magazine-usa.com/2017/01/11/brookfield-bids-to-take-over-terraform-power-global-on-the-cheap/
[74] https://www.bloomberg.com/news/articles/2016-10-05/sunedison-said-to-take-steps-to-map-out-reorganization-course
[75] http://economictimes.indiatimes.com/markets/expert-view/we-will-be-in-india-forever-bruce-flatt-brookfield-amc/articleshow/54693460.cms
[76] https://bep.brookfield.com/~/media/Files/B/Brookfield-BEP-IR/events-and-presentations/transcript-q3-2016.pdf
[77] CBA's share price of A$82 per share as of 30 January 2017. Assets under Administration as of September 2016 of A$137bn both converted at US$0.75/AUD. https://www.commbank.com.au/content/dam/commbank/about-us/shareholders/pdfs/shareholder-information/8-nov-media-release.pdf
[78] Towers Watson Global Alternatives Survey 2014 – includes listed and unlisted infrastructure funds.
[79] EICP = European Index of Consumer Prices; returns calculated to September 2016.
[80] https://ijglobal.com/articles/98599/details-emerge-for-first-state-acquisition-of-portugals-finerge

- A French district-heating business (acquired by CFS GAM in June 2016) in which the majority (50 percent in 2015, rising to a target of 57 percent in 2016) of the fuel source is derived from biomass, geothermal and energy-from-waste renewable energy sources. This unlisted infrastructure asset is also backed by concessions with an average life of 16 years, plus strong government policy support.

The Abu Dhabi Investment Authority

Sovereign wealth funds over the past three to five years have made significant shifts toward unlisted investments and emerging markets, according to a survey published in December 2016 by State Street and the International Forum of Sovereign Wealth Funds.

The average sovereign wealth fund now holds a portfolio with 53 percent in fixed income, 34 percent in equities, 8 percent in infrastructure and real estate, and 5 percent in hedge funds.[81]

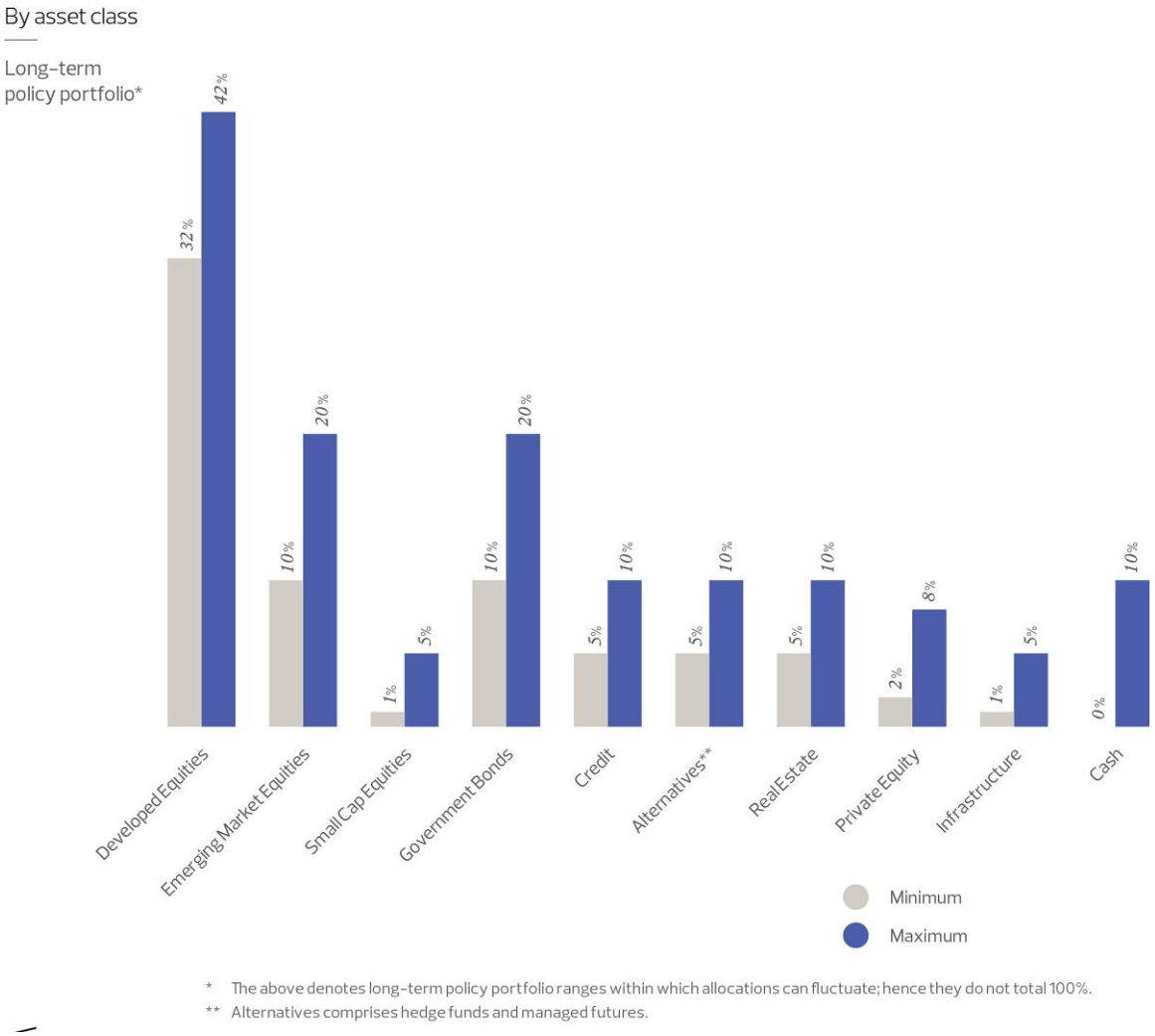
The ***Abu Dhabi Investment Authority*** (ADIA), the sovereign wealth fund of the Emirate of Abu Dhabi, has moved forward notably with a program of unlisted infrastructure in emerging markets and renewable energy.[82] The core focus of its investment for this class is on "assets with strong market-leading positions and relatively stable cash flows, including utilities, transport infrastructure and energy. The primary strategy is to acquire direct minority equity stakes alongside proven financial and strategic partners, with an emphasis on developed markets but also an increasing focus on emerging markets. An ability to invest via externally managed funds, the listed market as well as mezzanine debt, complements the strategy. The Infrastructure team does not seek to control or operate the assets in which it invests."[83]

[81] Institutional Investor. (January 2017). How Sovereign Wealth Funds are Changing Direction. http://www.institutionalinvestor.com/article/3652230/investors-sovereign-wealth-funds/how-sovereign-wealth-funds-are-changing-direction.html#/.WJLIY38jzmB

[82] These investments are being undertaken by ADIA as part of a broader strategy to position the fund for the future by taking greater control of its investments through real estate and infrastructure allocations and greater reliance on in house management. http://www.reuters.com/article/emirates-swf-adia-idUSL8N1A54OH

[83] ADIA. (2016). 2015 Annual Review. http://www.adia.ae/En/pr/ADIA_Review_2015_Web.pdf

Table 21: ADIA's Asset Allocation.[84]



In October 2015, ADIA made its first direct investment in renewables in an emerging market—a significant minority stake in ReNew Power, one of India's largest clean energy companies. In June 2016, ADIA announced its second investment in the sector in India, making a US$150 million investment in Greenko Energy Holdings, one of the largest green energy power producers in the country, with an affiliate of GIC Singapore, the principal shareholder of the company. GIC, Singapore's sovereign wealth fund, invested $US80 million. Post fund infusion, GIC owns about 60 percent in the company and ADIA holds close to a 15 percent stake.[85]

The key to successful infrastructure investing, according to ADIA's global head of infrastructure division John McCarthy, is flexibility: "By flexible I mean the ability to invest in emerging markets and developed markets, higher-risk infrastructure and core, through funds or direct, and listed and unlisted."

[84] Ibid.
[85] The Economic Times. (June 2016). Greenko Energy Holdings pegged at $1 billion after ADIA, GIC arms invest $230 million. http://economictimes.indiatimes.com/industry/energy/power/greenko-energy-holdings-pegged-at-1-billion-after-adia-gic-arms-invest-230-million/articleshow/52645657.cms

"Flexibility is an advantage," he says.[86] One of ADIA's competitive advantages is the long investment horizon, the fact that it has a 75-year view for when the capital is needed. This also means that it does not invest for the sake of income, but is a total return investor.[87]

ADIA's 20-year and 30-year annualized rates of return were 6.5 percent and 7.5 percent, respectively, in 2015, down from 7.4 percent and 8.4 percent in 2014.[88]

ADIA does not disclose the size of its portfolio, but it is estimated by the Sovereign Wealth Fund Institute to have assets of US$792 billion.

Investment in the renewable sector through direct investment and through funds requires additional risk assessment.

These risks have been described in detail in several papers and letters produced by the staff of the Norges Bank,[89] the Finance Ministry,[90] and commissioned experts,[91] and can be broken down into four parts:

Financial Risk: The Fund is invested principally in equities and bonds. Unlisted infrastructure and renewable investments have yet to generate enough return data to support an investment argument on returns data alone. The illiquid nature of these investments make valuation difficult to monitor compared to regular market reporting mechanisms that support equity and bond markets. Illiquidity can also make these investments difficult to sell in the event of adverse market events. These investments are complex and require a high degree of specialization. They come with high transaction costs and limited transaction on costs of investment management.

Political Risk: Political changes in host nations have resulted in investors sometimes having to accept delays, renegotiation of existing contracts and unfavorable tariff changes. Such events can result in significant cost overruns to development budgets and revenue reductions or cost increases on the operating side. There is uncertainty around where the Fund should invest geographically and how such decisions will be made.

Regulatory Risk: Unlisted infrastructure and renewable investments are typically made based upon complex regulatory schemes that are different from country to country. These variations can have an impact on major terms and conditions of the investments, most notably on the flow of revenue.

Reputational Risk: Energy investments by institutional investors are usually large and are involved with high-visibility public goods and services that have an impact on significant

[86] Institutional Investor. (May 2015). Despite demand ADIA still sees value in infrastructure http://www.top1000funds.com/profile/2015/05/29/despite-demand-adia-still-sees-value-in-infrastructure/

[87] Ibid.

[88] ADIA. (2016). 2015 Annual Review.

[89] See from the Norges Bank: a) 2006 initial recommendation: http://www.norges-bank.no/en/Published/Submissions/2006/submission-2006-10-20/; b) July 2010 reiteration of policy recommendation: https://www.nbim.no/en/transparency/submissions-to-ministry/2011-and-older/2010/development-of-the-investment-strategy-for-the-government-pension-fund-global/; c) 2015 bank opinion on renewables: https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/; d) Rate of return issues: https://www.nbim.no/en/transparency/discussion-notes/2015/renewable-energy-investments/; e) infrastructure in less mature markets: https://www.nbim.no/en/transparency/discussion-notes/2015/infrastructure-investments-in-less-mature-markets/; f) Recommendations regarding renewable investments: https://www.nbim.no/contentassets/e2fa918bf88642a5abe3f07cd6034c11/2015-12-02-nb_gpfg---investments-in-infrastructure.pdf;

[90] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

[91] https://www.regjeringen.no/contentassets/f353169233704a55b3af6b0b36fb3129/ekspertrapport_eiendom_infrastruktur.pdf and https://www.regjeringen.no/contentassets/312e6001471045cc80be9b86b1fdae4d/risks_in_unlisted_infrastructure.pdf

numbers of people. Public controversies are not uncommon. Investment funds have sometimes drawn criticism when local controversies affect such holdings.

That said, funds have developed financial, governance and operating strategies to manage such risks. Valuable lessons have been learned that can be used by the Fund as it moves forward. The track record of financial performance of unlisted infrastructure investment is complemented by a positive outlook. On the renewable energy side, technological improvements have driven down costs, thereby improving competitiveness, the regulatory environment and public acceptance of such holdings.

Unlisted infrastructure investments have the potential of providing returns that are not correlated to the Fund's equity and bond portfolio, and can therefore serve as a hedge against the cyclical ups and downs of the equity and bond markets. Unlisted infrastructure investments, including in renewable energy, are a growth market offering annual returns in the 12 to 15 percent range. Well-managed infrastructure funds are integrating new renewable investments that can meet this return target. Industry indexes are now available to track investment returns in the sector.

Unlisted and renewable energy infrastructure is a growth market worthy of the Fund's participation.

Investment in Renewables Through the Fund's Equity Portfolio Offers Attractive Returns

Investment in listed utility companies with growth potential in renewable energy can expand the Fund's benefits from the renewables sector.

The market success of unlisted infrastructure, particularly unlisted renewable assets, has driven the expansion of investment vehicles in the listed market. GPFG already benefits from participation in the market with these renewable sector investments through its investments in publicly listed asset managers and utilities that have growing portfolios of renewable assets.

Many companies that manage investment capital in unlisted infrastructure are themselves listed entities. The Fund historically includes these investments in its portfolio through its utility and general equity holdings and participation in the fixed income market.[92] For example, GPFG currently owns shares of Brookfield Asset Management, Macquarie Group, and Commonwealth Bank of Australia (owner of Colonial First State).[93]

The Fund can enhance its returns on this front by participating more fully in the renewables equities market.

The financial performance of utilities globally shows a correlation between increased engagement with the renewables sector and rising market capitalization and share

[92] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

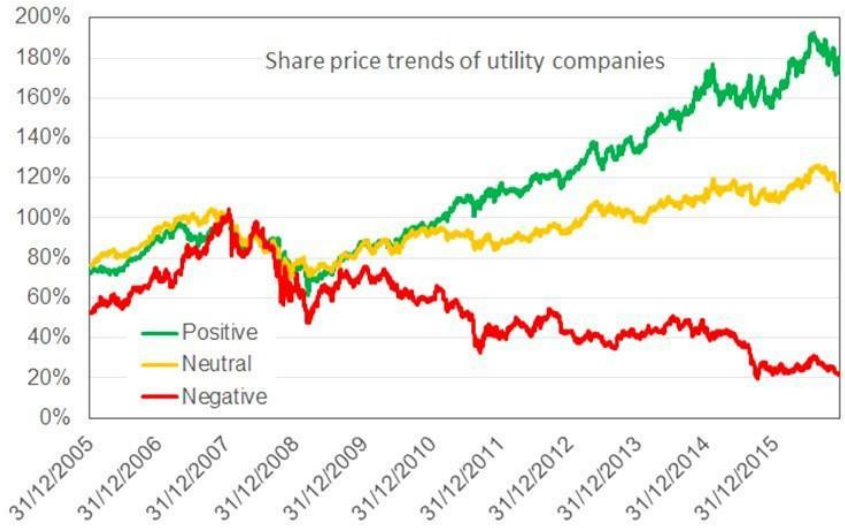
[93] https://www.nbim.no/en/the-fund/holdings/

prices.[94] A recent study by Philip Wolfe, the founder of BP Solar and a noted expert on renewable energy, groups utilities into three categories: 1) Those that owned utility scale solar assets, the most "positive" group; 2) utilities that have not built solar and wind capacity into their outlooks but have adopted off-take participation, and 3) utilities that have done little to engage with renewable energy.

Table 22: Selected Utilities Grouped by Level of Engagement with Renewable Energy: Positive, Neutral and Negative

Positive	Neutral	Negative
Duke Energy	Pacific Gas	RWE
Dominion Resources	Centrica	Eon
Enel	Southern California Edison	
Consolidated Edison		

Figure 23: Share Price Trends by Listed Utility Companies, Averaged by Group Depending on their Approach to Investment in Renewables[95]



U.S. investment organizations continue to actively chart the size, intensity and speed of utility sector engagement with the renewables and energy efficiency markets. [96] There is little indication that as a result of the presidential election utilities will be moving capital resources back into fossil fuel generation.[97]

[94] http://renewables.seenews.com/news/analysis-utilities-risk-decline-unless-they-embrace-renewables-549836
[95] http://renewables.seenews.com/news/analysis-utilities-risk-decline-unless-they-embrace-renewables-549836
[96] https://www.ceres.org/press/press-releases/clean-energy-utility-benchmarking-report
[97] Darren Sweeny and Garrett Devine, *Trump election hasn't changed utilities coal retirement plans,* SNL, November 21, 2016 and Jasmin Melvin, *Outlook for utilities 'positive' under Trump: Analyst,* SNL, December 19, 2016.

NextEra Energy

By way of example, NextEra Energy Inc. (NEE) is a utility with a long history of sustained investment in the renewable energy space.

The company manages a portfolio of new and mature generation facilities. NEE owns 45,400 MW of capacity primarily through two main subsidiaries, Florida Power and Light (FPL) and NextEra Energy Resources, LLC (NEER).

NEE's energy portfolio includes nuclear, natural gas, coal, and oil assets owned principally through its FPL subsidiary. The company owns generation assets in 27 states in the U.S. and in four Canadian provinces.

NEER is the company's primary tool for developing and running wind and solar generation. NEER owns 18 GW of wind and solar assets, making it the largest wind and solar generator in North America.

It owned 15 percent of all wind generation and 9 percent of all U.S. utility-based solar as of December 2015. In 2016, NextEra Energy commissioned a record 2.5GW of renewable energy capacity.

With total annual revenues of US$17.45 billion, NEE is the largest utility by market capitalization in the U.S. Its total shareholder return over the past 10 years is roughly 250 percent, more than twice the return on the Standard and Poor Utility Index over the same period. In 2015, FPL produced 66 percent of NEE's revenue and 60 percent of net income, while NEER produced 33 percent of revenues and 40 percent of net income.

Recommendations for Government Pension Fund Global

IEEFA has presented information and analysis in support of the Norges Bank request for a new investment allocation to unlisted infrastructure and renewable energy. We do this based on our assessment of market conditions and the important success stories of investors, developers and utilities.

This is a growth market worthy of the Fund's participation. How the Fund participates in this growth sector determines whether it reaps the benefits.

IEEFA offers five recommendations related to the approval of a mandate for unlisted infrastructure investments with a particular emphasis on renewable energy. These recommendations are presented individually but they work together to create an investment strategy that can secure investment benefits for the long term while minimizing risks.

Five Recommendations

Our five recommendations are presented here individually but will work best in combination.

1. **Establish an Investment Mandate**

   Norges Bank suggests—and we concur—that the Fund receive a mandate to invest in unlisted infrastructure, including in unlisted renewable infrastructure. The most recent investment target offered by the Bank suggests that an overall investment of 5 percent in this sector would be appropriate.[98] This modest investment would take a few years to build out, allowing the Fund and its staff and advisors to gain the experience needed to make prudent decisions on future allocations.

   The mandate we propose would give Norges Bank the impetus to explore such investments. The main challenge lies in managing several incremental sources of risk that include political risk, regulatory risk, and management and governance risk.

2. **Invest in Staff**

   The benefits and risks that come with an expansion of the Fund into unlisted infrastructure require the expansion of the Fund's staffing and skill sets. Investment in in-house staff resources is essential. The Fund has a learning curve, but it is one that has already been started with its investments in unlisted real estate. Capacity building for the Fund will be the critical ingredient to its success. Long term investment in staff capacity creates an institutional memory that protects the Fund and uses its experiences to grow the assets. Long term staff capacity provides: an in-house skill base essential for investment selection, geographic and political considerations, market analysis and business networks. The Finance Ministry's economic experts accepted the Norges Bank recommendations to expand the portfolio to unlisted infrastructure and renewable investments, including exploration into developing markets.

   The management mandate should give Norges Bank the opportunity to continue to build up its internal real estate investment team for both its listed and unlisted portfolios, as it does today. We recommend that Norges Bank also start building a team with expertise in listed and unlisted infrastructure. Institutional investors of a certain size have achieved lower costs, and higher gross returns, with internal rather than with external management, both in the unlisted and listed space. GPFG's size should allow it to fully exploit these economies of scale.

   We recommend that the Ministry open the management mandate to Norges Bank to unlisted emerging-market infrastructure investments. This would give Norges Bank the opportunity to explore such investments. Listed EM infrastructure investments have shown strong historical performance, after accounting for standard sources of risk. The enormous need for all types of infrastructure in developing countries and the shrinking role of traditional funding sources provides a compelling rationale for

[98] https://www.nbim.no/en/transparency/submissions-to-ministry/2015/government-pension-fund-global--investments-in-infrastructure/

continued growth. The main challenge lies in managing several incremental sources of risk such as political risk, regulatory risk, and management and governance risk.

The growing market shows the opportunity, but it will be the selection of partners, staff development and ultimately project selection that turns opportunity into material benefits for the Fund.

3. Create Co-Investment Partnerships

The Fund is uniquely positioned to form partnerships with investment houses that have a track record in the unlisted infrastructure field. These co-investment partnerships can provide the basis for building out the Fund's portfolio according to proven financial standards with proven investors. In the early phase of the Fund's implementation of its new mandate, co-investment resources will be critical for selecting the best places and projects. The build out/partnership period will also give the Fund's staff access to industry best practices and top-flight talent.

4. **Invest in the Stocks of Utilities That Are Engaged with Renewable Energy**

The Fund should establish and implement an in-house goal of shifting investments toward utilities that have demonstrated significant engagement with renewable energy and energy efficiency. New research shows that utility companies that are constructively engaged with regulators and local efforts are showing promising financial results.

5. Invest in Emerging Markets

Staff and partnership resources should be deployed immediately to research and devise strategies for expansion of infrastructure investment in emerging markets, including in renewable energy. The Finance Ministry and Norges Bank should provide a working draft of an appropriate business plan for public discussion within 18 months of establishing a mandate. Where appropriate, the Fund should explore as part of its research how joint ventures can be established with national and regional international financial institutions.

Appendix I: Frequently Asked Questions

Q: What is this report proposing?

A: The report includes five recommendations that are designed to secure investment returns from the unlisted infrastructure market and to manage the risks associated with that action. The Fund should: 1) be given a mandate to invest 5 percent of its assets in unlisted infrastructure, including in unlisted renewable energy investments; 2) hire in-house professional staff to manage the development of the Fund's investments in this area; 3) create partnerships with established investment funds, and co-invest with those funds in order to secure returns and build the skill base to drive its own initiatives in this space; 4) set aside a portion of the funds to invest in listed utility companies with significant portfolios of renewable investments, and 5) deploy staff to undertake necessary diligence to develop a program of infrastructure investments including renewable energy in emerging markets.

Q. Why take this action?

A. Prudently-managed unlisted infrastructure investments that include renewable energy can produce returns of 12 to 15 percent annually.

Q. Would there be additional benefits?

A. Yes. This move would allow the Fund to capture value from a growing market that offers stable returns. These investments would not be correlated to the Fund's equity and bond portfolio, which is to say they would add risk diversification. They would provide steady cash flow and they would be anti-inflationary.

Q. What strategies could the Fund adopt to minimize its risks?

A. Unlisted infrastructure investments, including those in renewable energy, come with financial, regulatory, political and reputational risks, but well-managed funds have developed methods to address those risks and achieve investment returns. Choice of investment strategy (choosing among options regarding avenue to market via unlisted funds; co-investment or direct investment; developed or emerging markets; greenfield or brownfield development) and the selection of assets with downside protection, such as guarantees from host governments or export credit agencies, mitigate the associated risks.

Q. The Ministry of Finance commissioned a study of unlisted infrastructure risk known as the McKinsey Study. Have you reviewed that study?

A. Yes. Because the mandate of that study was to highlight the political, regulatory and reputational risks of unlisted infrastructure investments, the McKinsey Study is a narrow document that suggests such investments are mostly about risk. The study cites examples

of reputational damage from unlisted infrastructure investments, but notes such cases are "relatively unusual and the operating companies seem to have received most of the negative publicity" (as opposed to the institutional investors in the projects). Renewable energy is no more immune to regulatory and political risks than sub-sectors that include telecommunications and transportation. While negative repercussions can come from events such as retroactive changes to feed-in-tariffs for solar projects, our report notes that many countries are moving from government-set tariffs to competitive auctions with long-term contracts. This, among other factors, has improved the risk associated with renewables, leading to lower-cost of financing. We find a wide spectrum of risk/return profiles in infrastructure investing to suit various institutional investors' appetites. We recommend that risk be assessed on an asset-by-asset basis, and we believe risk mitigation can be accomplished through a combination of in-house expertise, co-investment and strategic investment.

Q. Why should this investment be undertaken now?

A. The market in question is growing fast, and it will take time once the mandate is provided for the Fund to actually make investments. Many large global funds are already enjoying the benefits of investing in this growing market. There are opportunities now in developed and developing economies.

Q. Is the Fund being used on this issue to make a political point about climate change?

A. No. Our recommendation to invest in unlisted infrastructure is based upon the Fund's interest in maintaining solid returns and in prudently managing risks. Global institutional investors are expanding into the unlisted infrastructure space to help meet demand for an estimated $3.3 trillion in such investment over the next several years.

The renewable energy sector is producing returns commensurate with the infrastructure sector's financial requirements. The industry outlook is positive. Government regulators and energy ministries in most countries are finding that wind and solar developers are offering competitive prices. This lowers the cost of electricity for host-country businesses and households. Governments recognize also that technology-driven, market-based renewable energy solutions will help address climate change.

Q. Would the Fund be showing leadership by taking this step?

A. Yes. The Fund is large and prestigious. Changes in its asset-allocation strategy would be noticed, studied and replicated. While many institutional investors have moved into such holdings, the Fund's action would intensify momentum into this growing market.

Appendix II: Brief Comparison of Current Financial Performance and Outlook for Renewable Energy Versus Fossil-Fuels

IEEFA has published considerable research on the past and current financial performance of renewable assets with that of the oil, gas and coal sectors. Unlike renewable energy, with its strong annual return performance and a positive outlook, fossil fuels suffer from weak near-term performance and an outlook clouded by uncertainty.

The renewable sector has proceeded in recent years from a technological experimentation phase into a growth-sector phase. Its current performance provides stable revenues and it demonstrates performance as a value proposition. The sector outlook is positive as: i) constructive regulatory models have developed under various governmental forms, ii) assets have retained value through adverse market events, iii) existing investments have matured, iv) renewable energy capital finance is now looking to expand into emerging markets, v) levelized costs of electricity derived from solar and wind sources have achieved grid competitiveness in many countries and in some places undercut costs of fossil-fueled power generation.

Ever since the Industrial Revolution, the fossil fuel sector has contributed heavily to global economic growth, with oil and gas at the forefront of economic expansion. For most of the past 40 years, the industry produced consistent revenues, and offered solid value with a robust outlook. However, fossil fuels now face competition from alternative technologies in the energy and transportation sectors. Coal, oil and gas assets run the risk of becoming stranded, with their owners' balance sheets over-valuing their market worth. Financial performance in the coal sector over the past half-decade has made it a last-in-class investment. Recent price rebounds have mitigated some financial stress but the increases are not of sufficient size, duration or outlook to put a dent in coal's short- and long-term market-share losses.

The oil and gas industry has suffered from a price collapse driven by supply and demand imbalances, technological change, political destabilization and public concern over climate change. Oil and gas producers' financial metrics show revenue declines, lower profits/government revenues, lower capital investment, significant project cancellations and asset write-downs. Like those seen in coal, recent oil price spikes are lower than what is needed to re-establish the sector as an economic engine or a major profit center for the institutional investors.

IEEFA's coal, gas and oil studies provide additional information and data to support this thesis.

We have published reports on the status of the renewable energy sector in China, India, U.S. and in emerging markets. Recent examples:

IEEFA Report: China Set to Dominate U.S. in Global Renewables Boom; $32 Billion in Overseas Investments in 2016 Alone

IEEFA Texas: The Beginning of the End for Coal-Fired Electricity Across One of the Biggest Power Markets in the U.S.

IEEFA Update: Emerging Markets Lead Global Investment in Renewables

IEEFA Testimony: Comments on the Puerto Rico Power Authority's Integrated Resource Plan

We have published and contributed to reports on the status of the oil and gas industry in general, and on ExxonMobil, the status of oil sands investment in Canada. Recent examples.

IEEFA Report: Red Flags on ExxonMobil

Material Risk: How Public Accountability is Slowing Tar Sands Development

Unconventional Risk: The Growing Uncertainty of Oil Investments

We have published market and policy reports on the coal industry in the U.S., China, India, Australia, Japan, Germany, Turkey, Kosovo and Bangladesh. Recent examples:

IEEFA China: Why the Rally in Coal Prices Is Unsustainable

IEEFA Update: Coal Decline Steepens in 2016

IEEFA U.S. Coal Outlook 2017: Short-Term Gains Muted by Prevailing Weaknesses in Fundamentals

Additional country-specific coal analyses can be found at IEEFA.org.

Appendix III: Unlisted Versus Listed Infrastructure Investments: Critical Characteristics Compared

	Listed	Unlisted
Market Size	$3.3 Trillion	$1.1 Trillion
Returns	Stable	Stable
Inflation Protection	Yes	Yes
Valuation	Publicly available market quotes	Periodic mark-to-market
Liquidity	Very Liquid	Illiquid
Volatility	Low	Equity Market
Investment Access	Traditional	Traditional/Unique
Governance	Shareholder Passive	Shareholder Active
Reporting	Public disclosure requirements	Private disclosures - negotiated
Management Control	Arms-Length	High
Fees	Moderate	Low/High

Institute for Energy Economics and Financial Analysis

The Institute for Energy Economics and Financial Analysis (IEEFA) conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy and to reduce dependence on coal and other non-renewable energy resources.

More can be found at www.ieefa.org.

IEEFA would like to acknowledge the assistance of Alan Lindsay for his technical and financial modelling input.

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Tom Sanzillo, director of finance for IEEFA, is the author of several studies on coal plants, rate impacts, credit analyses, and public and private financial structures for the coal industry. He has testified as an expert witness, taught energy-industry finance training sessions, and is quoted frequently by the media. Sanzillo has 17 years of experience with the City and the State of New York in various senior financial and policy management positions. He is a former first deputy comptroller for the State of New York, where he oversaw the finances of 1,300 units of local government, the annual management of 44,000 government contracts, and where he had oversight of over $200 billion in state and local municipal bond programs and a $156 billion pension fund.

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