WWW.POWERFINANCERISK.COM VOL. XIX, NO. 28 / July 18, 2016

Power Finance & Risk

Exclusive Insight on Power M&A and Project Financing

By the publisher of GlobalCapital

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Elias Hinckley, partner at **Sullivan & Worcester**, argues that new tax equity investors will kick-start renewable development. Page 10

Brookfield Puts Ontario Wind Projects on Block

Richard Metcalf

Brookfield Renewable Partners has hired two financial advisers to auction a portfolio of three operational wind projects and a development-stage expansion project in Ontario.

Scotiabank and **TD Securities** are running the sale process for the assets, which comprise the 166 MW Comber project in Lakeshore, the 51 MW Gosfield project in Kingsville, and the 189 MW Price project in Sault Ste. Marie, according to a teaser dated June.

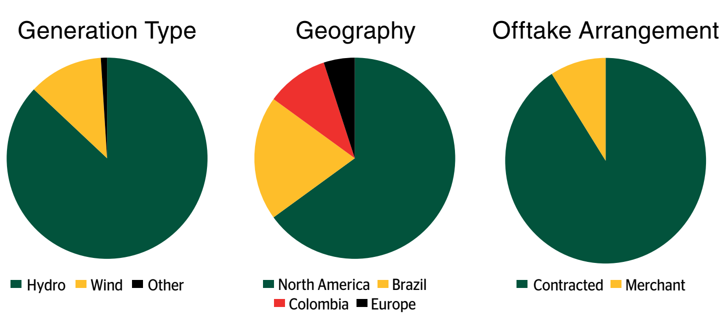
The portfolio comes with an up-to-90 MW expansion project, called Victor, at the Comber project site.

The output of the three operational projects is contracted with the **Ontario Independent Electricity System Operator** under separate power purchase agreements with a revenue-weighted average life of 14 years.

The Comber and Gosfield PPAs expire in November 2031 and December 2032 respectively.

The Prince project was constructed in two phases. The PPA for phase one, PAGE 6 »

Brookfield's Operating Portfolio



Source: Brookfield Renewable Partners investor presentation

California Shop Seals "Largest Storage PF Deal to Date"

Olivia Feld

Macquarie Capital has invested equity in a $200 million portfolio of distributed commercial and industrial storage projects totaling 50 MW under development in California.

"We believe that this is the largest storage project financing to date," **Kelly Warner**, president of **Advanced Microgrid Solutions**, tells *PFR*. "It's a distributed resource that has its own set of financing intricacies. It's a really monumental deal in that regard."

San Francisco based-AMS designs, finances, installs and manages behind-the-meter storage facilities for commercial, industrial and government buildings.

Macquarie is looking to raise debt financing PAGE 5 »

Financiers Pitch Revived Turbine Loans

Olivia Feld

Financiers and wind project sponsors are discussing the comeback of the turbine supply loan, say multiple market participants, with one project financier predicting that it could become a billion dollar industry by the end of the year.

Turbine loans allow sponsors to qualify development projects for the production tax credit under the safe harbor rules, by financing the purchase of a sig- PAGE 2 »

Joint Venture Buys Google-supported North Carolina Project

Fotios Tsarouhis

A joint venture between **Southern Power** and **Turner Renewable Energy** has closed its acquisition of the 74 MW Rutherford Farm wind project in Rutherford County, N.C., from **Cypress Creek Renewables**.

Duke Energy Carolina will purchase the project's output and sell it to businesses that have signed up to the utility company's Green Source Rider pro- PAGE 7 »

POWER UP: CHECK OUT A SELECTION OF THE WEEK'S POWER AND UTILITY NEWS ON TWITTER @POWERFINRISK

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PROJECT FINANCE

Financiers Pitch Revived Turbine Loans

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nificant number of wind turbines prior to projects being shovel ready.

"Bankers are starting to pitch the idea that wind companies ought to borrow to stockpile turbines. I don't know any company that has taken them up on such a loan yet," **Keith Martin**, partner and co-head of the project finance group at **Chadbourne & Parke** tells *PFR*.

"I can see the value to developers of turbine loans, since developers may be holding stockpiled equipment for several years before it is used in projects," says Martin.

The PTC steps down by 20% next year and will continue to do so by a further 20% each year for the following two years. The **Internal Revenue Service** has established two alternative ways in which projects under development can qualify for the PTC, through either a physical work test or demonstrating that 5% of the total project cost has been spent. Once construction begins, sponsors have four years to complete the project.

The last time turbine loans were utilized was shortly before the financial crisis. In 2007, there was high demand for turbines and a significant backlog from suppliers and manufactures.

"As a result, developers had an abundance of potential projects and a long lead time for wind turbines that didn't sustain their growth," says **Mike Lorusso**, group head and m.d. at **CIT Energy Finance**.

However, the market struggled in the crisis and a number of turbine loan deals were restructured through work-outs or asset sales. "The financial crisis hit and the whole wind development market dried up at once. The last deals done didn't end gracefully," adds Lorusso.

Turbine loans were also used during the merchant market build out in the early 2000s. As with wind turbines before the crisis, suppliers of gas turbines could not keep up with high demand for inventory. As a result, some sponsors bought gas turbines before they were required for specific projects, says Lorusso.

"When the merchant market blew up they didn't do well. The lenders didn't learn from their mistakes," he adds.

Turbine loans are yet to materialize again but banks, mezzanine debt lenders and equity investors are discussing how they might be used in the run up to the expiring PTC, says the project finance banker.

"We may well see a revival of interest in turbine loans," adds Martin. "It will be interesting to see the terms on offer from the banks. It will be interesting to see how many banks offer the product in view of the less than entirely happy experience with them the last time." ■

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Feel free to contact **Richard Metcalf**, editor, at (212) 224-3259 or richard.metcalf@powerfinancerisk.com

GENERATION AUCTION & SALE CALENDAR

These are the current live generation asset sales and auctions, according to Power Finance and Risk's database.
A full listing of completed sales for the last 10 years is available at http://www.powerfinancerisk.com/AuctionSalesData.html

Generation Sale DATABASE

	Seller	Assets	Location	Advisor	Status/Comment
●	Ares-EIF	Northampton (112 MW Waste coal)	Northampton, Pa.		Olympus Power has acquired the project (see story, page 7).
●	Alcoa	Narrows (108.8 MW Hydro)	Stanly County, N.C.		The portfolio of hydro assets, know collectively as the "Yadkin Project", are being sold to Cube Hydro, I Squared Capital's hydro platform (see story, page 8).
		High Rock (39.6 MW Hydro)			
		Tuckertown (38.04 MW Hydro)			
		Falls (29.94 MW Hydro)			
	American Electric Power	Cardinal Unit 1 (595 MW Coal), Consesville (1.15 GW Coal), Stuart (603 MW Coal MW), Zimmer (330 MW Coal)	Jefferson, Coshocton, Brown and Clermont counties, Ohio	Goldman Sachs	AEP is considering selling stakes in four coal-fired facilities in Ohio (PRF, 5/9).
●	Grupo BMV	Parque Solar Coahuila (22.5 MW Solar)	Coahuila state, Mexico	Ernst & Young (buyer)	The project is Macquarie Mexican Infrastructure Fund's first solar acquisition in Mexico (see story, page 7).
●	Brookfield Renewable Partners	Price (189 MW Wind)	Sault Ste. Marie, Ontario	Scotiabank and TD Securities (Seller)	Brookfield Renewable is selling the three facilities, plus an expansion project, in a portfolio (see story, page 1).
		Comber (166 MW Wind)	Lakeshore, Ontario		
		Gosfield (51 MW Wind)	Kingsville, Ontario		
	Calpine Corp.	South Point (550 MW Gas)	Bullhead City, Ariz.		Nevada Power and Sierra Pacific Power, both owned by NV Power, are buying the project from Calpine (PFR, 6/13).
●	Cypress Creek Renewables	Rutherford Farm (74 MW Solar)	Rutherford County, N.C.		The project, which has been acquired by a Southern Power and Turner Renewable Energy JV, will power a Google data center (see story, page 1).
	Development Authority of Washington County	Washington (796 MW Gas)	Linton, Ga.		Carlyle-backed Southeast PowerGen is nixing its lease agreement for the project (PFR, 7/11).
	EDF Renewable Energy	Slate Creek (150 MW Wind)	Sumner and Cowley counties, Kan.		Axium Infrastructure, Industrial Alliance Insurance and Financial Services are acquiring a stake in the project (PFR, 7/11).
	Effingham County Industrial Authority	Effingham (597 MW Gas)	Rincon, Ga.		Carlyle-backed Southeast PowerGen is nixing its lease agreement for the project (PFR, 7/11).
	GE Energy Financial Services	Grandview (211 MW Wind)	Carson County, Texas		Blackrock has agreed to acquire GE EFS's 50% stake in the project (PFR, 6/27).
	Hydro-Québec	Centrale Hull 2 (27 MW Hydro)	Gatineau, Québec		Hydro Ottawa is acquiring the project (PFR, 7/5).
	Invenergy	Wake Wind (257 MW Wind)	Floyd and Crosby counties, Texas		Southern Power is acquiring a 90% stake in the project (PFR, 6/20).
	KDC Solar	Portfolio (164 MW Solar)	New Jersey	Moelis & Co.	The private equity-backed developer is offloading its entire solar portfolio (PFR, 6/20).
●	Kinder Morgan	Southern Natural Gas (7,600-mile pipeline)	Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, Tennessee, Texas		Southern Company is taking a 50% stake in the pipeline (see story, page 6).
	NextEra Energy Resources	Cedar Bluff (199 MW Wind)	Ellis, Ness, Rush and Trego counties, Kan.		NextEra is dropping the project down into NextEra Energy Partners (PFR, 7/11).
		Golden Hills (86 MW Wind)	Alameda County, Calif.		
	NRG Energy	California Valley Solar Rancy (250 MW)	Santa Margarita, Calif.		NRG plans to drop down its 51.05% interest in the project to its yieldco (PFR, 5/9).
	Panda Power Funds	Liberty (Gas 829 MW), Stonewall (778 MW), Patriot (829 MW)	Bradford County, Pa., Loudoun County, Va., Lycoming County, Pa.	Goldman Sachs	Panda Power Funds is selling a 2.5 GW portfolio of assets in PJM (PFR, 5/16).
	Quantum Utility Generation	Quantum Pasco Power (123 MW Gas)	Dade City, Fla.	Merit Capital Partners (Seller)	Quantum is selling two peakers in Florida and Nevada (PFR, 6/6).
		Nevada Cogeneration Associates 2 (85 MW Gas)	Las Vegas		
	Pattern Development	Broadview (324 MW Wind)	Curry County, N.M.		Pattern Development has dropped the project down into Pattern Energy (PFR, 7/11).
	RES Americas	Lamesa (102 MW Solar)	Dawson County, Texas		Southern Power has closed its acquisition of the project from RES (PFR, 7/11).
	SunEdison	King Pine (600 MW Wind)	Aroostook County, Maine	Rothschild	Pattern Energy has agreed to acquire the project (PFR, 6/27).
		Mount Signal 2 (201 MW Solar)	Imperial County, Calif.		Mount Signal 2 and Mount Signal 3 are being acquired by affiliates of 8minutenergy and D. E. Shaw (PFR, 7/11).
		Mount Signal 3 (245 MW Solar)			
	Talen Energy Corp.	Portfolio (16 GW Gas, oil, coal, nuclear)	U.S.	Citi (seller), Goldman Sachs, RBC Capital Markets (both buyer)	Riverstone Holdings, a 35% stockholder in Talen, is acquiring the company and its 16 GW generation portfolio (PFR, 6/13).
	TerraForm Power shareholders	TerraForm Power Class A Shares (2.978 GW Renewables)	U.S., U.K., Canada, Chile		Brookfield Asset Managements and affiliates have acquired 12% of the yieldco's class B shares and options to acquire a further 13% (PFR, 7/5).
	TransCanada	Portfolio (4,510 MW Gas, duel-fuel, wind, hydro)	U.S.	JP Morgan	TransCanada is selling the assets to partly finance its $13B acquisition of Columbia Pipeline Group (PFR, 3/28).
●	Tri Global Energy	Bearkat (366 MW Wind)	Glasscock County, Texas		The projects have been acquired by Copenhagen Infrastructure II, a fund of Copenhagen Infrastructure Partners (see story, page 8).
		Blue Cloud (150 MW Wind)	Bailey and Lamb counties, Texas		

● **New or updated listing**

The accuracy of the information, which is derived from many sources, is deemed reliable but cannot be guaranteed.
To report updates or provide additional information on the status of financings, please call Fotios Tsarouhis at (212) 224 3294 or e-mail fotios.tsarouhis@powerfinancerisk.com

PROJECT FINANCE

Deal Book is a matrix of energy project finance deals that Power Finance & Risk is tracking in the energy sector.
A full listing of deals for the last several years is available at http://www.powerfinancerisk.com/Data.html

Live Deals: Americas

Sponsor	Project	Location	Lead(s)	Loan	Loan Amount	Tenor	Notes
Ares-EIF, Oaktree Capital	Linden (943 MW Gas)	Linden, N.J.	Morgan Stanley, MUFG, Barclays, Investec, GE Energy Financial Services, ICBC	Debt	$1.125B	7-yr	The financing package consists of a $1 billion senior secured loan, and a $125 million senior secured loan (PFR, 6/20).
Advanced Power	Cricket Valley (1 GW Gas)	Dover, N.Y.	GE Energy Financial Services, BNP Paribas, Crédit Agricole, ICBC, Bank of America Merrill Lynch	Debt	TBA	TBA	Arrangers of the debt financing are meeting with other financial institutions about backing the deal (PFR, 6/20).
E.On Climate & Renewables North America	Colbeck's Corner (200 MW Wind)	Carson and Gray counties, Texas	Allianz Capital Partners, State Street	Tax Equity	TBA		The Allianz subsidiary and State Street have agreed to take tax equity stakes in the project (PFR, 5/31).
Freeport LNG	Freeport LNG Train 2 (4.64M mtpa)	Quinatana Island, Texas	TBA	Project Bond	TBA	22-year	Freeport LNG is roadshowing a project bond to refinance the debt associated with train 2 (PFR, 7/5).
Invenergy	Lackawanna (1.5 GW Gas)	Jessup, Pa.		Equity, Debt			Invenergy has hired Lazard to raise equity for the project (PFR, 6/13).
Invenergy	Roncevaux (75 MW Wind)	Québec	National Bank Financial Markets, Sun Life Assurance Company of Canada	Debt			The lenders have closed financing for the project (PFR, 7/11).
● Advanced Microgrid Solutions	Portfolio (50 MW Storage)	California	Macquarie Capital	Equity			Macquarie Capital has invested equity in the distributed commercial and industrial storage portfolio (see story, page 1).
Mainstream Renewable Power	Sarco (170 MW Wind), Aurora (129 MW Wind)	Atacama region, Chile; Los Lagos region, Chile	SMBC, MUFG	Debt	$450M	17-yr	The sponsor is in the late stages of negotiations (PFR, 6/20).
NextEra Energy	Portfolio (258.25 MW Solar)	U.S.	JPM Capital Corp.	Tax Equity			The J.P. Morgan vehicle is taking tax equity in the 260 MW portfolio (PFR, 7/5).
NextDecade	Rio Grande (27 mtpa LNG), Rio Bravo (137-mile pipeline)	Brownsville, Texas	Sumitomo Mitsui Banking Corp.	Debt	TBA		NextDecade has requested permission to build the $20 billion project (PFR, 5/16).
			TBA	Equity	TBA		
NRG Energy	Portfolio (100 MW Community Solar)	U.S.		TBD	$80M		NRG is looking to raise $80 million to finance a 100 MW portfolio of development projects (PFR, 5/9).
NRG Energy	Carlsbad Energy Center (632 MW Gas)	Carlsbad, Calif.	TBA	Debt	$650-$850M	TBA	Banks are competing to arrange financing for the Princeton, N.J.-based energy company (PFR, 4/18).
NTE Energy	Killingly Energy Center (500 MW Gas), Reidsville Energy Center (500 MW Gas), Pickaway Energy Center (1 GW Gas)	Killingly, Conn.; Rockingham County, N.C.; Pickaway County, Ohio	TBA	Debt	$2B		NTE is planning to raise $2 billion to finance the three projects (PFR, 4/25).
Panda Power Funds	Mattawoman (850 MW Gas)	Brandywine, Md.	TBA	Debt		TBA	The sponsor plans to seal financing in mid-2016 (PFR 2/1).
Quantum Utility Generation	Moundsville (549 MW Gas)	Marshall County, W. Va.	TBA	Debt	$500M	TBA	Quantum, which has approached prospective arrangers to finance the project, has mandated BNP Paribas to sell a stake in the project (PFR, 6/6).
● SunPower	El Pelícano (100 MW AC Solar)	Near Coquimbo and Atacama regions, Chile	Sumitomo Mitsui Banking Corp., MUFG, Korea Development Bank, Crédit Agricole	Debt	$200M		The debt financing has closed. Crédit Agricole advised SunPower on the deal (see story, page 5).
SunPower	Residential Solar Portfolio	San Jose, Calif.	Credit Suisse	Warehouse Facility	$60M		SunPower is preparing for the company's inaugural asset-backed securitization of a portfolio of resi solar leases (PFR, 5/2).
Sowitec	Vientos de Pastorale (53 MW Wind)	Villa Pastora, Flores department, Uruguay	Deutsche Bank, Intensa Sanpaolo	Bridge Loan	$92M		The sponsor plans to take out the bridge loan with a local project bond (PFR, 7/11).
			Bow Power	Equity	$40M		
Valhalla	Cielos de Tarapacá (600 MW Solar)	Tarapacá Region, Chile	Not officially mandated	Equity			Valhalla is in talks with Marathon Capital to arrange financing for the project (PFR, 6/27).
	Espejo de Tarapacá (300 MW Hydro)						
Vivint	Portfolio	U.S.	Investec	Debt	$300M		Investec is arranging the $300 million loan for Vivint (PFR, 6/20).

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To report updates or provide additional information on the status of financings, please call Managing Editor Olivia Feld at (212) 224-3260 or e-mail olivia.feld@powerfinancerisk.com

PROJECT FINANCE

SunPower Secures $200M for Chilean Project

SunPower has closed a debt financing for a 100 MW solar project near the municipalities of La Higuera and Vallenar in Chile. The deal closed on July 8.

Crédit Agricole advised SunPower on the roughly $200 million loan backing the El Pelícano project, which was arranged by **Sumitomo Mitsui Banking Corp.**, **MUFG**, **Korea Development Bank** and Crédit Agricole.

The tenor and pricing could not be immediately established, but the loan is thought to have a long tenor in line with other Chilean project financings. **Banco BCI** is providing a VAT facility (PFR, 8/6).

The facility is slated to be online by the end of 2017. **Metro de Santiago** has a 20-year power purchase agreement with the project to provide 42% of the generation required for the Chilean capital's metropolitan rail system (PFR, 6/2).

UPCOMING AUCTION

Later this month, the Chilean **National Energy Commission** (CNE) will auction 20-year power purchase agreements to begin in 2021. CNE is aiming to contract more than 13,750 GWh, the equivalent of one third of the power consumption of its regulated customers.

The auction, which is open to all types of generation assets, will likely attract around 100 bids, says a project finance banker who is speaking with a number of potential bidders.

Acciona Energía and **Aela Energía**, the Chilean joint venture between London-based private equity firm **Actis** and **Mainstream Renewable Power**, won government contracts in the last auction, in December 2014 (PFR, 1/9/15).

Spokespeople and representatives for SunPower in San Jose, Calif., and Crédit Agricole, Sumitomo Mitsui Banking Corp, MUFG and Korea Development Bank in New York either declined to comment or did not respond to inquires.

FAST FACT

750 MW

Chile's installed PV capacity at the start of 2016, according to the country's Production Development Corporation.

California Shop Seals "Largest Storage PF Deal to Date"

« FROM PAGE 1 for the portfolio, says a deal watcher, who adds that the Australian bank is already speaking with other banks about the transaction. A representative for Macquarie declined to comment.

The equity investment is the first deal of its kind between Macquarie and AMS, and the bank is looking to put more capital to work in the storage sector.

"We are interested in investing equity in these types of projects and we believe that other infrastructure investors will as well," **Rob Kupchak**, head of U.S. power, utilities and renewables at Macquarie Capital, tells *PFR*. "We think that if the projects are appropriately structured to be project financeable there will be interest from us and others to invest equity into them."

"We are looking at all the verticals within storage," adds **Will Demas**, a senior v.p. at Macquarie Capital who worked on the deal. "This is specifically C&I but we'd be open to dealing with other parts of the sector as well."

Southern California Edison has a 10-year power purchase agreement with the projects contained in the AMS portfolio to service customers in the utility's West Los Angeles Basin service territory.

AMS was founded two and a half years ago by **Susan Kennedy**, who has previously served as chief of staff to Gov. **Arnold Schwarzenegger** and as commissioner on the **California Public Utilities Commission**. The sponsor's projects have multiple revenue streams, including merchant components. AMS is eying build-out in California and other U.S. states and eventually international expansion, adds Warner.

Neither party used a financial adviser. **Orrick, Herrington & Sutcliffe** and **Wilson Sonsini Goodrich & Rosati** acted as legal counsel to Macquarie and AMS, respectively.

S&P Downgrades Southeast PowerGen

S&P Global Ratings has downgraded **Southeast PowerGen** from BB to BB- with a negative outlook following its failure to fully re-contract two gas-fired assets in Georgia.

The downgrade was a result of Southeast PowerGen's inability to renew tolling arrangements for its 597 MW Effingham facility in Effingham County and units of its 640 MW Sandersville facility in Washington County, according to S&P analyst **Michael Ferguson**.

The report also noted the collapse of U.S. merchant power prices as a factor in the rating. The two facilities' exposure to spot markets, "especially in the somewhat less liquid southeastern U.S." is credit negative, according to the report.

The downgrade from S&P is Southeast PowerGen's second this year. In February, **Moody's Investors Service** downgraded the rating assigned to the company's $545.5 million senior secured credit facilities to Ba3 from Ba2, also with a negative outlook. Moody's also cited the company's failure to recontract the gas-fired facilities.

Southeast PowerGen is in the process of unwinding lease arrangements for the Effingham facility and the 796 MW gas-fired Washington facility, which, like Sandersville, is located in Washington County (PFR, 7/7). The company entered into the leases with the **Development Authority of Washington County** and the **Effingham County Industrial Authority** as part of an industrial revenue bond financing deal.

Southeast PowerGen is 75.05% owned by two funds of **The Carlyle Group**, with **GE Energy Financial Services** holding the additional 24.95% interest. The company owns an approximately 2.8 GW portfolio of gas-fired assets in Georgia.

Carlyle acquired its stake in Southeast PowerGen from **ArcLight** in 2014 (PFR, 10/31/14).

MERGERS & ACQUISITIONS

Southern Takes Stake in Kinder Pipelines

Southern Company has taken another step into the natural gas transportation market by acquiring a 50% stake in a **Kinder Morgan** pipeline system in the southern U.S for $1.47 billion.

The announcement of the investment in Kinder Morgan's Southern Natural Gas system follows Southern's roughly $8 billion acquisition of gas distribution company **AGL Resources**, which closed on July 1.

The SNG deal is part of a trend of utilities investing in master limited partnerships, according to a note written by **Shalini Mahajan**, m.d. for U.S. utility, gas and power corporations at **Fitch Ratings**.

"Attracted by the growth opportunities in both the downstream and the midstream segments, utility companies have been keen to diversify in the natural gas sector," writes Mahajan.

The investments are welcomed by the MLPs because although commodity prices have rallied in recent months, boosting investor confidence in the sector, "capital market access for most MLPs remains constrained," she adds.

At the same time, the low cost of debt for utility companies "provides more ammunition for them to go and look for targets," says **Ali Agha**, an equities analyst at **SunTrust Robinson**.

Consolidated Edison's planned acquisition of a 50% stake in **Stagecoach Gas Services**, a **Crestwood Equity Partners** midstream gas venture, earlier this year is another example of the trend, and other similar transactions could follow, says Agha.

"The theme of gas gathering much more market share as a source of power generation and the infrastructure needed to support that trend is a theme that's been embraced by almost all the utility management teams that are out there," he says. "I would not be surprised if there were other transactions."

SNG consists of 7,600-miles of pipelines that transport natural gas from basins in Texas, Louisiana, Mississippi, Alabama and the Gulf of Mexico to markets in Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina and Tennessee.

The purchase price of $1.47 billion for a 50% equity stake implies an enterprise value for SNG of about $4.15 billion, including existing debt.

Kinder Morgan plans to use the proceeds of the sale to repay some of its own debt. The company will continue to operate the pipelines.

FINANCING

Southern did not disclose how it would fund the acquisition, announcing only that it would finance the purchase "in a credit-supportive manner." A spokesperson for the company in Atlanta, Ga., declined to comment.

Southern has previously tapped the bond market on a large scale to fund major acquisitions.

The financing for the AGL Resources deal included Southern's first ever junior subordinated debt, also known as hybrid capital, which is viewed partly as equity by the rating agencies and can therefore bolster a borrower's credit ratings. The hybrid transaction, which was priced in October, also helped Southern tap into a new investor base, a spokesperson for the company said at the time (PFR, 10/6).

Southern went on to issue an $8.5 billion seven-tranche senior unsecured bond for the AGL acquisition in May, which was the largest ever bond issuance by a U.S. utility company (PFR, 5/20). ■

Brookfield Puts Ontario Wind Projects on Block

« FROM PAGE 1 which has a capacity of 99 MW, expires in September 2026, while the PPA for phase two, which is 90 MW in size, expires in October 2028.

The portfolio, not including the Victor expansion project, is forecast to produce an average annual Ebitda of $110 million for the next 10 years, says the teaser.

The assets are expected to fetch about $400 million, according to a deal watcher, who adds that the portfolio has about $600 million of project debt.

Canadian companies such as Oakville, Ontario-headquartered **Algonquin Power & Utilities** and Calgary, Alberta-based **Enbridge** are among the likely bidders, says the deal watcher.

Brookfield will consider a partial sale of the portfolio, according to the teaser. The minimum stake it will sell to one buyer is 25%, and it will also consider selling stakes to multiple investors. In the event of a partial sale, Brookfield intends to retain a stake of at least 25%.

Brookfield will also provide operations and maintenance services as part of any deal.

Calls to **Thomas Kufurst** and **John Kroeker**, both based in Toronto, who are leading the sale process at Scotia and TD respectively, were not returned by press time. A spokesperson for Brookfield in Toronto declined to comment. ■

Brookfield Closes $14B Infra Fund

Brookfield Asset Management has closed a $14 billion infrastructure fund. The Brookfield Infrastructure Fund III is the largest unlisted private equity infrastructure fund ever raised, according to the Toronto-based company.

The fund's mandate includes renewable assets, and Brookfield's commitment towards these investments will be made through **Brookfield Renewable Partners**, a spokesperson for the company tells *PFR*.

Brookfield has already committed over $3 billion from the fund, with acquisitions including a portfolio of hydro facilities in the U.S. from **Talen Energy** (PFR, 4/4), Colombian utility **Isagen** (PFR, 1/14) and a portfolio of transmission projects in Brazil.

Over 120 institutional investors participated in the fund, including public and private pension plans, sovereign wealth funds, financial institutions, endowments, foundations and family offices.

Brookfield itself committed $4 billion to the fund through **Brookfield Infrastructure Partners** and Brookfield Renewable Partners. ■

FAST FACT

120+

Number of institutional investors that participated in the fund.

MERGERS & ACCQUISITIONS

Joint Venture Buys Google-supported North Carolina Project

« FROM PAGE 1

gram, including **Google**'s data center in Lenoir, N.C. (PFR, 11/24).

Under the terms of the program, Google and any other companies that sign up will purchase capacity from the **Duke Energy** subsidiary under the applicable rate schedule, but will also be billed for the cost of renewable energy and renewable energy certificates.

Google was a driving force behind the development of the scheme and was the first company to enroll.

While non-utility offtake agreements have risen in prominence in deregulated energy markets, where Google has signed power purchase agreements directly with several renewables projects, the trend has struggled to gain traction in more heavily regulated states such as North Carolina.

"We've had to go through hoops in some of those markets to get access to renewable power," said **Rick Needham**, Google's director of energy and sustainability said at the **REFF Wall Street** conference in New York last month (PFR, 6/22).

Cypress Creek is developing and constructing Rutherford Farm, and will run operations and maintenance for the project once it is opperational. Construction is slated to begin in February, with the facility expected to be operational in December 2017.

The purchase of the project, situated on 489 acres in western North Carolina, represents Southern Power and Turner's second joint solar acquisition in the state, and the joint venture's tenth solar acquisition overall, bringing the capacity of its solar portfolio to 415 MW.

Before the acquisition of the Rutherford Farm project, Southern Power and Turner's most recent acquisition was the 20 MW Calipatria solar project in Imperial County, Calif., from **Solar Frontier Americas** (PFR, 2/16). **Southern Company** subsidiary Southern Power and **Ted Turner** launched the joint venture in January 2010.

The purchase price for the Rutherford Farm project was not disclosed. A spokesperson for Cypress Creek in Santa Monica, Calif., declined to comment. Spokespeople for Southern Power and Turner Renewable Energy, both in Atlanta, did not respond to inquiries. ■

Ares-EIF Sells Pennsylvania Waste Coal Facility

Ares-EIF has sold the 112 MW Northampton waste coal-fired facility in Northampton, Pa.

Morristown, N.J.-based independent power producer **Olympus Power** acquired the plant in a deal that closed on June 14, according to paperwork filed with the U.S. **Federal Energy Regulatory Commission**.

The purchase price could not immediately be learned.

The project, which has been online since 1995, has been merchant since cancelling a power purchase agreement with **Metropolitan Edison Co.** in May 2013, when the project was in bankruptcy proceedings. It now sells its output into the **PJM Interconnection** market (PFR, 1/8/13).

The project filed for Chapter 11 protection in December 2011 after breaching its debt service reserve covenants. The facility had been hit by rising fuel costs and the PPA did not contain a fuel pass-through agreement.

The pricing of the PPA, which would have expired in 2020, was frequently below what the generation would have fetched in the spot market at the time of the Chapter 11 filing (PFR, 12/9/11).

As part of the restructuring deal which allowed the plant to exit bankruptcy in 2013, **Energy Investors Funds**, which owned a 77.5% stake in the project, acquired the remaining 22.5% from **Cogentrix Energy**. The project also issued about $50 million in bonds as part of the deal.

Ares Management acquired EIF on Jan. 1, 2015. The project was held by two Ares-EIF funds, **United States Power Fund II** and **United States Power Fund III**, prior to the sale to Olympus.

The Olympus acquisition included the assumption of the remaining project-level debt, a deal watcher tells *PFR*. How the company financed the acquisition could not immediately be established.

A representative of Olympus Power declined to comment. A spokesperson for Ares-EIF did not immediately respond to inquiries. ■

Macquarie Mexico Fund Makes First Solar Acquisition

A Mexico-focused Macquarie fund has made its first solar investment with the acquisition of the Parque Solar Coahuila project in the Mexican state of Coahuila from **Grupo BMV**.

The Macquarie Mexican Infrastructure Fund has paid 758 million pesos ($41 million) for its 100% equity stake in the 22.5 MW project.

The project will be completely equity-backed, a spokesperson for Macquarie in New York tells *PFR*.

Coahuila represents the second renewables acquisition for the fund, which in 2013 acquired a 49% stake in the 30 MW San Rafael hydro project in the state of Nayarit.

The Parque Solar Coahuila project has four separate power purchase agreements, under which it will supply the government of Coahuila, the cities of Torreon and Matamoros and a private Mexican company that could not immediately be identified.

Spain's **Grupo TSK** has been selected as engineering, procurement and construction contractor for the project. Construction is slated to begin in the third quarter of 2016.

Ernst & Young acted as **Macquarie**'s financial adviser.

New York-based **Linklaters** and Mexico City-based **Mijares** served as legal advisers to Macquarie. Mexico City-based **Ritch Mueller** acted as legal adviser to BMV. **G-Advisory**, which is a consulting arm of law firm **Garrigues**, and **Eosol** served as technical advisers to Macquarie.

Representatives of Grupo BMV in Mexico City were not immediately available for comment. ■

MERGERS & ACQUISITIONS

Cube Hydro to Buy North Carolina Portfolio

Cube Hydro Partners, the hydro platform of infrastructure investment manager **I Squared Capital**, is acquiring four hydro facilities from a subsidiary of aluminum producer **Alcoa**, following exclusive bilateral negotiations.

The assets, located along a 38-mile stretch of the Yadkin River in central North Carolina and totaling approximately 216 MW, are known collectively as the Yadkin project and include the 108.8 MW Narrows project, the 29.94 MW Falls project, the 39.6 MW High Rock project, and the 38.04 MW Tuckertown project. The facilities were completed in 1917, 1919, 1927 and 1962, respectively.

Cube Hydro plans to upgrade and modernize the facilities, which sell their generation into the **PJM Interconnection** and **SERC Reliability Corporation** wholesale markets. The facilities are awaiting re-permitting by the U.S. **Federal Energy Regulatory Commission**.

"Cube Hydro Carolinas will be investing over several years to continue to improve the quality of the Yadkin River following receipt of the new FERC license," **Andreas Moon**, m.d. at I Squared Capital in New York, tells *PFR*.

The company plans to explore the possibility of contracting the facilities' output through power purchase agreements with offtakers "that are interested in having a reliable supply of baseload clean energy power the future," he adds.

Alcoa had been in talks with several potential buyers of the assets before entering into negotiations with Cube.

"We know they were talking to a few select buyers but we went to full exclusivity with Alcoa given our long-term relationship with them," says Moon.

Enduring Hydro, the consultancy firm which formed Cube Hydro with backing from I Squared in January 2014, previously advised hydro facility owners including Alcoa on tax incentives and grants.

One deal watcher said that a private equity firm was among the other potential buyers that had expressed interest in the assets.

A spokesperson for Alcoa in Badin, N.C., declined to comment on the sales process.

The decision to sell the dams and generation facilities follows the resolution of Alcoa's years-long dispute with the **State of North Carolina** over the land rights of the facilities.

The administrations of Democratic Gov. **Bev Perdue** and her successor, Republican **Pat McCrory**, argued the Yadkin project no longer served the public interest after Alcoa shuttered an aluminum smelting plant in Badin, N.C. The state claimed that it, rather than Alcoa, rightfully owned the land under the dams, and opposed the facilities' re-permitting by FERC.

The issue was ultimately settled in September 2015, when the U.S. **District Court for the Eastern District of North Carolina** ruled in Alcoa's favor.

Davis Polk & Wardwell served as legal adviser to I Squared Capital on the purchase, which is expected to close in the next two to three months. ■

Northland Review May Lead to Sale

Northland Power has launched a strategic review which could lead to the sale of the company. The Toronto-based independent power producer has hired **CIBC** and **JP Morgan** as financial advisers.

Northland could make an attractive development arm for a buyer, wrote **TD Securities** analysts **Sean Steuart** and **John Mould** on July 12, adding that they do not anticipate a break-up of the company given that its chairman, **James Temerty**, owns or controls roughly a third of the stock.

The company has a net operating capacity of 1,388 MW and a further 642 MW in late-stage development with power purchase agreements in place. An additional 2,750 MW of "long-term prospective projects" complete the company's pipeline, according to the TD report.

Northland believes its experience developing offshore wind projects in Europe could be transferred to other jurisdictions, including the U.S., the company's ceo, **John Brace**, told the TD analysts recently, according to the report.

Nordsee Two and Nordsee Three, two such projects under construction off the coast of Germany, are among the company's most attractive assets, wrote **Nelson Ng**, an analyst at **RBC Capital Markets**, who added that the projects appear to be ahead of schedule and could be completed below budget.

In addition to its onshore and offshore wind portfolio, Northland owns interests in gas-fired, solar and biomass assets in the U.S., Canada, and Germany, and has a development team in Mexico. ■

Danish Fund Buys Texas Wind Projects

A fund of Denmark's **Copenhagen Infrastructure Partners** has closed its acquisition of two development-stage Texas wind projects totaling 516 MW from **Tri Global Energy**.

The 366 MW Bearkat project in Glasscock County and the 150 MW Blue Cloud project in Bailey and Lamb counties are both "very late-stage development assets with [production tax credit] qualifications in hand," a Tri Global spokesperson tells *PFR* from Dallas.

Tri Global Energy will assist CIP with the development of the projects, both of which are expected online before 2018. Whether the projects have secured power purchase agreements or other offtake arrangements could not immediately be established.

Copenhagen Infrastructure II closed with 14.7 billion Danish kroner ($2.2 billion) of commitments in July last year. Investors in the 20-year "buy and hold" fund include several Nordic pension funds and other institutional investors, including the **European Investment Bank** and a UK pension fund managed by **The Townsend Group**.

The fund invests primarily in renewable projects in Northern and Western Europe and North America.

The Tri Global spokesperson declined to comment on the purchase price or how the project would be financed. Representatives of Copenhagen Infrastructure Partners in Copenhagen were not immediately available for comment.

Winston & Strawn served as Tri Global's legal adviser on the deal. ■

STRATEGIES

Transelec, EnLink Get Warm Reception in Bond Mart

Corporate bond issuances by Chilean transmission company **Transelec** and oil and gas master limited partnership **EnLink Midstream Partners** have been well received by investors eager to buy dollar-denominated assets amid uncertainty in Europe.

Transelec came first, issuing a $350 million 12.5-year bond on July 7 after a four-day roadshow.

Citigroup, **JP Morgan**, **Scotia Capital** and **Santander** were the leads on the transaction, which amassed approximately $3 billion of orders, according to a banker away from the deal.

The pricing landed at 260 basis points over U.S. Treasuries, 40 bps inside initial price thoughts.

The banker said that, using the company's bonds maturing in 2025 as a guide, the pricing represented a negative new issue concession of 10 bps, but he cautioned that the 2025s, issued two years ago, were not very liquid. "For a name like that, there's no point getting too scientific about it," he said.

Transelec will use the proceeds to repay debt, in particular a series of local bonds maturing in September, according to ratings reports from **S&P Global Ratings** and **Fitch Ratings**. The ratings agencies have both given the senior unsecured bonds a BBB rating. **Moody's Investors Service** rates Transelec Baa2.

OUTLIER OF THE WEEK

Enlink's deal, which was also preceded by a roadshow, came to the market on July 11. **Bank of America Merrill Lynch**, JP Morgan and **SunTrust Robinson Humphrey** were the bookrunners.

Initial price thoughts on the 10-year bond were between 387.5 bps and 400 bps over Treasuries, guidance was quickly set in the area of 350 bps and the deal was priced early in the day at 345 bps.

The speed of the execution surprised the syndicate banker, who said it indicated that there had been strong interest in the deal. "These deals don't typically do that, so you can imagine. It was upsized as well, from $400 million to $500 million, and tightened nearly 50 bps, so it's pretty impressive," he said.

A second banker was also impressed, describing the deal as the 'outlier' of the week. The deal was popular because it offered investors a rare opportunity, he said. "There hasn't been much in that sector, so there's an appetite for that."

The size of the order book for Enlink's deal could not be established by press time.

Enlink is rated Ba2, BBB- and BBB- by Moody's, S&P and Fitch, respectively. The MLP will use the proceeds of the deal to repay borrowings under its revolving credit facility, according to the ratings reports.

Investors are eager to buy dollar assets because of uncertainty around Europe following the U.K.'s decision to leave the European Union in a June 23 referendum.

The unexpected result of the vote caused credit spreads to widen, even for U.S. issuers with little or no exposure to Europe, and there was no supply for several days afterward. Confidence has since returned however, and spreads are now tighter than their pre-Brexit levels, says the first banker. ■

Distributed Wind Shop Seals Equity, Hunts Debt

Distributed wind developer **United Wind** has obtained an equity commitment from **Total** and is in talks with lenders to arrange debt financing for its fourth and largest project fund.

Total has taken a stake in the company, which develops small-scale rural wind projects for clients under a lease program through its venture capital arm, **Total Energy Ventures**.

The French energy company is the second oil major to take a stake in United Wind, after Norway's **Statoil** invested $3 million through its own venture capital subsidiary, **Statoil Energy Ventures**, in March. Following Total's investment, the two energy companies are co-leads on the start-up's series B equity financing round, along with **Forum Equity Partners**.

The size of Total's investment could not be learned by press time. Representatives of Total in Paris did not immediately respond to inquiries.

Oil-focused energy companies like Total and Statoil have been increasing their presence in renewables in recent years. Total is the majority owner of San Jose-based solar shop **SunPower**, which develops residential, commercial and industrial and utility-scale projects in the U.S. and Latin America, while Statoil has previously sought to develop a wind project off the coast of Maine. Stavanger, Norway-based Statoil shelved its plans for the 12 MW Hywind project in October 2013.

PROJECT FINANCE

Brooklyn, N.Y.-based United Wind is also looking for debt and tax equity to back its fourth project fund, which will finance the construction of about 1,000 projects with an average capacity of 100 kW in the Midwest. The company secured a $200 million equity commitment for the fund from Forum Equity Partners in January (PFR, 1/6).

"We are in talks with debt providers," says United Wind's ceo **Russel Tencer**. "Our expectation is to close financing on our fourth fund some time over the next several months, which would be a combination of the Forum commitment, which is already in place, tax equity and project debt."

Tencer declined to comment on the size of the debt and tax equity commitments it is seeking.

United Wind obtained a $4 million construction loan from **New York Green Bank** and a $9.5 million tax equity commitment from **U.S. Bank** for its other active fund, through which it is developing a residential wind portfolio totaling about 1.6 MW in New York.

Its first two funds financed 26 projects ranging from 10kW to 50kW in size, also in New York. ■

INDUSTRY CURRENT

Opening the Floodgates for U.S. Clean Energy Deployment

In this Industry Current **Elias Hinckley**, partner and leader of the energy group at **Sullivan & Worcester** in its Washington, D.C., office, argues that a swath of new investors in the tax equity market could herald a period of unprecedented growth in renewable project development.

The biggest obstacle to renewable energy growth in the U.S. is the availability of tax equity investment supporting project construction. There is not nearly as much tax equity investment as is needed to support financing and building all of the renewable projects in development. As a result the pace of project financing and construction is being severely constrained.

Investors have been slow to enter the tax equity market for renewable power because it is complex and challenging. In the face of the huge unmet demand, many new investors will overcome the challenges of tax equity investing and will enter the market, pursuing outsized returns with virtually no risk in this significantly undersupplied investment market. The participation of these new tax equity investors will usher in a period of unprecedented growth in the construction of renewable projects.

THE STRANGE MARKET OF TAX EQUITY INVESTING

Capital invested in renewable projects comes from three broad sources:

(1) Project Equity – investment by the owners of the clean energy facility, which carries the risks associated with operation and the long-term value of the asset. The market is well supplied with developers and other project equity investors willing to participate as the equity owners of renewable projects.

(2) Debt – this is generally traditional project finance lending, and as with project equity there are plenty of sources—big banks, small banks, and private debt funds—ready to lend to all kinds of renewable projects. For these traditional sources of financing, project risks are increasingly well understood and, provided there is confidence that project revenues will cover debt repayment, this money is readily available.

(3) Tax Equity - this third and vital source of capital comprises actual investments made in a project that will be repaid primarily through tax credits and other tax savings to the tax equity investor rather than through cash repayment. There simply is not currently enough tax equity to support the pace of growth in renewable power development in the U.S.

> **"While the absolute value of the tax benefits supporting a solar or wind project are substantial, actually realizing that value can be extremely challenging for the project owner or developer."**

To the surprise of most people in the clean energy industry, renewable power received long-term, stable extensions of the two primary economic supports for renewable generation projects when Congress approved multi-year extensions for both the production tax credit (which primarily supports wind power, but can also be used for biomass, geothermal and other clean energy projects) and the investment tax credit (which primarily supports solar) in December of 2015. These tax credits (as well as certain other tax benefits) are the primary federal tool in place to support the development and deployment of clean energy in the U.S., and are typically the single largest incentive available to finance one of these projects.

While the absolute value of the tax benefits supporting a solar or wind project are substantial, actually realizing that value can be extremely challenging for the project owner or developer. Investments in generating assets are appealing because the underlying generating equipment has a relatively long life and these assets have historically provided relatively stable, if modest, long-term returns.

The challenge with tax credit-based subsidies arises because long-term stable returns do not match up well with getting fair value for the front-loaded tax incentives (the ITC is generally returned and realized in year one as a dollar for dollar reduction in taxes paid, but can be carried forward 20 years). The owner/operator of the renewable generation assets typically does not have enough income in the early years to use the tax incentives.

The longer use of the credits or deductions is delayed, like any investment return, the less they are worth. Also, for many types of owners or investors—electric cooperatives, municipal power companies, pension funds, etc.—there may never be an opportunity to use the tax incentives.

For reasons deep in the byzantine psychology of Congress, tax credits can't technically be sold from the party that creates the right to another taxpayer that can use the credits. Despite this prohibition on sales it is widely understood that not allowing the transfer of tax credits is arbitrary, undermining value for a taxpayer vs. a non-taxpayer, and undermines investment in the exact activity the subsidy is meant to spur.

> **"For reasons deep in the byzantine psychology of Congress, tax credits can't technically be sold from the party that creates the right to another taxpayer that can use the credits."**

Despite the prohibition on sales of tax benefits, there are actually ways to move the value of these tax benefits to a taxpayer who can use them effectively and efficiently: struc-

INDUSTRY CURRENT

tured investments and shared ownership in the project where a tax investor makes an investment in exchange for the value of the tax benefits, and the capital of any other investors or lenders is returned using the cash value created by the project (cash flow or sales proceeds). These kinds of structured investments are used to mirror the sale of tax credits, and fundamentally are how tax equity investments are made.

The role of tax equity is vital to successfully financing a project. If a project is not able to attract a tax equity investment, it is generally understood that the project is not economically viable and has virtually no chance of being financed and built. Yet in the current market many—quite likely the vast majority of—renewable energy projects in development cannot attract the necessary tax investments; not because the projects are not good, economically viable projects, but simply because there is not enough available tax equity in the market.

There are relatively few tax investors currently active in the U.S. clean energy market and as a result there is a very limited amount of tax equity investment available for projects. This undersupply of these special investment dollars puts an absolute limit on how many projects can be financed and built each year regardless of how much interest there is in building more renewable energy projects.

OUTSIZED RETURNS AND A HUGE NEW MARKET

The undersupply of tax equity also means that the market for tax equity does not operate efficiently. It allows tax investors to be far more selective and conservative in choosing projects than would happen in a fully supplied investment market. Returns are outsized to risk. Tax equity returns—which are heavily front-loaded and typically insulated from much of the operational risk—commonly run higher than the returns for equity investors who are first in line to absorb project losses. This is exactly backwards to what would be expected in a normally operating market (and is opposite from how tax investment returns work in real estate tax investing).

With returns larger than the associated risk, it would be expected that new investors would flood into the market, but that has not happened. For more than a decade the renewables industry has expected a wave of tax-paying corporations to arrive and add liquidity to the tax equity market. In 2015, U.S. corporations paid $344 billion in income taxes and total tax equity investment for in the renewable power sector was reported to be $11.5 Billion (PFR, 2/11). So there is plenty of investment capacity available (more than $1.5 trillion in individual income tax was paid during this same period, but tax investment by individuals is subject to a special set of passive loss rules, which make these investments extremely rare and require sophisticated professional guidance to navigate).

"With returns larger than the associated risk, it would be expected that new investors would flood into the market, but that has not happened."

New investors have been slow to the market for a few reasons. Renewable tax credits has been unstable and unpredictable—the result of Congressional infighting. The absence of a long-term framework has made potential investors hesitant to put in the time and effort necessary to gain the knowledge for these investments. Energy investing can be complicated. The necessary tax structuring is complicated and the related accounting is complex. Transaction costs can be high and poorly planned investments can have a short-term negative impact on reported earnings for publicly traded companies.

"Countless projects that otherwise would not be built will become financeablewith tax equity participation, unleashing a period of tremendous growth for clean energy."

Now, the recent long-term tax credit extensions coupled with huge growth projections for renewables has the industry again expecting an inflow of new tax investment from financial institutions and ultimately spurring a waterfall of corporate tax equity. The potential for several years of very strong returns on investment will help new investors overcome concerns about complexity and perceived risk. Sustainability mandates and opportunities for green branding are also creating new appeal for potential tax equity investors. This inflow of new tax investors is starting to happen—anecdotally several new institutional investors have emerged looking for guidance on whether to enter the market and how best to do it.

Elias Hinckley

New tax equity will provide the foundation for a huge increase in financed and constructed renewable projects. As new investment comes into the market, several non-core renewable markets, like rooftop solar for commercial and industrial buyers, corporate buyers of large utility scale renewables and utility-scale projects with merchant power risk, will see easier access to project financing. Countless projects that otherwise would not be built will become financeable with tax equity participation, unleashing a period of tremendous growth for clean energy.

There will be significant rewards for those who can move quickly into the expanding tax investment market. Because of the undersupply, returns for these investments will remain outsized to risk for a least a year or two. Additionally, as more tax equity flows into the market, knowing how the transactions work will allow early entrants to better control transaction costs and efficiencies, giving these investors a critical advantage in an increasingly competitive market. ■

PEOPLE & FIRMS

Infra Principal Departs Lending Firm EIC

A principal in infrastructure lending has left **Energy and Infrastructure Capital**.

John Dannan, who ran the firm's infrastructure lending platform, departed earlier this month. Dannan joined the firm when it was founded in April 2014.

During his time at EIC, the shop arranged debt financing for **Coronal Group**'s 35 MW Avalon solar project in Pima County, Ariz. Coronal bought the project from a subsidiary of hedge fund **Centaurus Capital** (PFR, 9/23/14)

Dannan was previously a v.p. at **Deutsche Asset & Wealth Management**, where he worked on investment strategy and capital raises.

John Dannan

Headquartered in Stamford, Conn., EIC is backed by the **Harbinger Group**. **Jerry Polacek** is ceo and chief investment officer. **Matt Ordway** is cfo and chief operating officer. To date EIC, which is focused on North America, has invested over $100 million in solar, gas-fired and oil and gas projects through construction and term debt offerings, according to the company's website.

Michael Midden was head of power and renewables at EIC until January, when he left the firm, according to **LinkedIn**. Midden started a new job as v.p. of finance at **Petra Systems** in March.

It could not be immediately established whether Midden or Dannan have been replaced. A spokesperson for EIC did not respond to requests for comment. ■

IFM Hires Debt Associate Director

IFM Investors has bolstered its North American infrastructure debt investment team with the hire of an experienced deal originator and executor from **Hastings Funds Management**.

Joseph Braun began working in IFM's New York office on July 13 as an associate director, the same title he held at Hastings. He reports to **Rich Randall**, global head of debt investments at IFM.

Joseph Braun

The appointment "strengthens our experience and capabilities in North America as we look for infrastructure debt opportunities to address the needs and goals of our investors," said Randall in a statement.

Before joining Hastings in July of last year, Braun worked at **RBC Capital Markets**, where he rose from associate to v.p. in the power and utilities team. He joined RBC in October 2012 from **BBVA**'s power and energy practice, where he was an associate.

Braun also has experience in project construction, having worked at **R.J. Griffin & Co** and **Chicago Bridge & Iron Co**.

IFM is owned by 29 Australian pension funds and manages approximately $4 billion of infrastructure debt globally. ■

ALTERNATING CURRENT

"Bacterial Windfarm" Could Generate Power on Microscopic Scale

Improvements in wind turbine technology in recent years have made it possible to construct ever taller towers and wider blade diameters, but the future of power may be smaller—much smaller—according to recent research.

A study published in the scientific journal *Science Advances* describes how microscopic turbines, driven not by the wind, but by the movement of bacteria, could power man-made devices.

"Many of society's energy challenges are on the gigawatt scale, but some are downright microscopic," said **Oxford University**'s Dr. **Tyler Shendruk**, who co-authored the study. "One potential way to generate tiny amounts of power for micro-machines might be to harvest it directly from biological systems such as bacteria suspensions."

The researchers ran a computer simulation to discover what would happen if a lattice of microrotors was immersed in a swarm of bacteria, and found that the single-celled organisms pushed the rotors around in a way that could be used to generate power.

"The amazing thing is that we didn't have to pre-design microscopic gear-shaped turbines. The rotors just self-assembled into a sort of bacterial windfarm," says Dr. Shendruk.

Developers probably do not have to worry about these bacterial power plants making their wind projects obsolete, however. At least, not yet. ■

QUOTE OF THE WEEK

"Bankers are starting to pitch the idea that wind companies ought to borrow to stockpile turbines. I don't know any company that has taken them up on such a loan yet."

Keith Martin, partner and co-head of the project finance group at **Chadbourne & Parke**, on the revival of the turbine loan (see story, page 1).