

# FINANCE QUARTERLY

Q4 2017

A WORD ABOUT WIND 

## SPAIN FIGHTS BACK

We look at new  
wind auctions,  
and meet the US  
arm of Spanish  
giant Iberdrola



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# EDITORIAL



By Richard Heap  
Editor, A Word About Wind

**Vicious cuts to subsidies between 2010 and 2013 have done severe damage to investor confidence in Spain's wind sector. The country may still be Europe's second-largest wind market by installed capacity – over 23GW – but it is also the worst example of how a government can take a thriving wind sector and kill it within a matter of months.**

For many, the wounds are still raw. The Spanish government has faced 30 legal challenges in the international courts from investors over the financial impact of these retroactive cuts, but only two have been resolved so far and this is only an option for overseas investors. Spanish businesses are likely to get little in the way of damages through the Spanish courts.

So when we see that Spain is trying to kickstart its wind sector again (see page 15), we cannot help but be cynical. The country has given backing for wind farms totalling 4GW this year, but it will take a hell of a lot more for it to rebuild investor confidence. Trust is easy to break but hard to rebuild. For Spain, a bull market is a long way off.



*Spain has backed wind farms totalling 4GW this year, but it will take a hell of a lot more for it to rebuild investor confidence.*



Of course, some Spanish firms managed to adapt in the face of their tough home market. One of the most high-profile examples is Iberdrola, which started a major period of global growth ten years ago – just before the global financial crash of 2008 wrought havoc.

In this report, we have interviewed Laura Beane, CEO of Avangrid Renewables (see page 8), which is the US renewables arm of Iberdrola and owns a 6GW wind portfolio. Beane was promoted to the role six months ago after 22 years at the company, and has spoken to us about its plans for offshore and the US market.

The other big theme in this Finance Quarterly is floating wind. Our headline sponsor DNV GL has given us their insights into the opportunities that floating turbines offer to investors (see page 12), and our member Q&A is with Alla Weinstein from Trident Winds (see page 18), which is proposing a 1GW floating wind farm off California.

And, given that this special report is a Finance Quarterly, we have also delved into our database to bring you tables of key project M&A, power purchase and corporate M&A deals done in the last three months (see pages 4-7), as well as the latest news offshore.

Thanks to DNV GL for their support, and to you for reading. ■

# CONTENTS

**4 WIND DATABANK:  
DEALS INFORMATION**

**7 CORPORATE M&A:  
KEY DEALS IN Q3**

**8 PROFILE: LAURA  
BEANE, AVANGRID**

**12 ANALYSIS: DNV GL  
ON FLOATING TECH**

**15 COUNTRY ANALYSIS:  
SPAIN**

**18 MEMBER Q&A: ALLA  
WEINSTEIN, TRIDENT**

**19 KEY DATES:  
EVENTS AND MORE**

## A WORD ABOUT WIND

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# WIND DATABANK

In this Databank feature, we have delved into our archive to pick out some of the key stories for the last quarter, with a focus on project M&A transactions (table 1), major power purchase agreements (table 2) and key developments offshore (table 3).

Big deals include the €1.2bn purchase of 50% of Borkum Riffgrund 2 by Global Infra. Partners; and Northland Power's purchase of the 252MW Deutsche Bucht, ahead of its €1.3bn financial close. In PPAs, we saw a major Dutch transaction alongside the usual crop of US activity.

In all three tables we have tried to be as comprehensive as possible, but we are also keen to hear about deals we might have missed, and future transactions. If you have deals you would like us to include next time, please get in touch: [editorial@awordaboutwind.com](mailto:editorial@awordaboutwind.com)

## 1. KEY WIND PROJECT M&A DEALS REPORTED IN Q3 2017

BUYER	SELLER	PROJECT(S)	SIZE (MW)	LOCATION	COMMENT
Engie	EDP Renovaveis	Moray	1,100	UK	Engie buys 23% of EDPR arm managing Moray for €21m
GE / Macquarie	Svevind	Markbygden 1**	650	Sweden	GE and Macquarie to buy up-to-650MW Swedish project
Engie	Renova Energia	Umburanas**	605	Brazil	Renova is to sell the wind complex for \$4.8m to Engie
EDF Energy Ren.	PIR	Portfolio deal	600	UK	EDF buys 11 sites with potential for 600MW in Scotland
Munich Re	Starwood Energy	Portfolio deal	460	US	Munich Re buys 49% of two projects totalling 460MW
Global Inf. Partners	Dong Energy*	B. Riffgrund 2	450	Germany	GIP buys 50% of 450MW Borkum Riffgrund 2 for €1.2bn
China Three Gorges	EDP Renovaveis	Portfolio deal	422	Portugal	CTG subsidiary acquires a 422MW portfolio for €248m
Vattenfall	Wieringermeer group	Wieringermeer	360	Netherlands	Vattenfall buys 115MW to grow ownership to 295MW
Alliant Energy	Apex Clean Energy	Upland Prairie	300	US	Alliant's subsidiary buys 300MW scheme from Apex
Northland Power	Highland Group	Deutsche Bucht	252	Germany	Northland buys project from Lord Laidlaw's Highland
Sojitz / MUFG / Kansai	Invis Energy	Portfolio deal	223	Ireland	Japanese group buys 60% of 223MW Irish wind portfolio
Pattern / PSP Inv.	Pattern Dev.	Meikle Wind	179	Canada	Pattern buys 51% of project for \$68m, and PSP buys 49%
John Laing	Akuo Energy	Rocksprings	149	US	John Laing buys majority stake in Rocksprings for \$85m
Octopus Inv.	Blue Energy	Portfolio deal	149	UK	Octopus buys 149MW portfolio in UK from Blue Energy
Southern Co.	RES Americas	Cactus Flats	148	US	Southern buys 148MW Cactus Flats from RES Americas
Saeta Yield	Grupo ACS	Portfolio deal**	144	Portugal	Saeta acquires nine wind farms in Portugal for €104m
Arise	Bergvik Skog	Svartnäs	115	Sweden	Arise buys 115MW in Sweden from Bergvik Skog
Falck Renewables	E.ON	Portfolio deal	115	Sweden	Italy's Falck buys two projects totalling 115MW for €7m
John Laing	Infinity Renewables	Buckthorn	101	US	John Laing buys 91% of 101MW Infinity project in Texas
Muirhall / WWS	Terra Firma	Portfolio deal	90	UK	Terra Firma sells 90MW owned by investee firm Infinis
Greencoat UK Wind	JP Morgan clients	Portfolio deal	90	UK	Greencoat UK Wind buys two wind farms for £105m
Pattern Dev.	WKN	Vivaldi	80	US	Pattern buys 80MW from PNE's US subsidiary WKN
Acciona	Suncor	Ripley	76	Canada	Acciona buys 50% of Ripley wind farm it didn't own
Gaia Infrastructure	Gestamp	Noblesfontein	74	South Africa	Gaia acquires a majority stake in Noblesfontein for €47m
Greencoat UK Wind	Invenergy	Corriegarth	70	UK	Greencoat UK Wind buys Scottish scheme for £118m
Falck Renewables	Svelgen Kraft Holding	Portfolio deal	70	Norway	Falck acquires 80% of two projects in Norway for €2.2m
Transeastern Power	OMV Petrom	Dorobantu	45	Romania	Transeastern buys 45MW in Romania for €23m
Alterra	Jawbone Wind Energy	Jawbone	40	US	Alterra buys 40MW wind project in the state of California
Wind Estate	Greentech Energy	Portfolio deal	16	Denmark	Wind Estate buys wind portfolio of 16MW for €3.3m
Innogy	Dromadda Beg	Dromadda Beg	11	Ireland	Innogy acquires first scheme in Republic of Ireland
Undisclosed	Airvolution Energy	Kinegar	5	UK	JLL advises on sale of Kinegar to an undisclosed investor
ABP	Dutch Infra. Fund	Portfolio deal	-	France / Germany	ABP buys wind and solar projects for €125m from DIF

\* Dong has since changed its name to Ørsted \*\* Deal not confirmed at time of reporting

## 2. KEY POWER PURCHASE AGREEMENTS SIGNED IN Q3 2017

BUYER	BUYER TYPE	OWNER	PROJECT	PROJECT SIZE	LOCATION	COMMENT
Target	Corporate	Infinity	Solomon Forks	474	US	Target signs 100MW PPA to power 150 stores
Kimberly-Clark	Corporate	Invenergy	Santa Rita	300	US	Kimberly-Clark to buy 42% of Santa Rita output
Anheuser-Busch	Corporate	Enel G.P.	Thunder Ranch	298	US	Brewing giant agrees 152.5MW at Enel scheme
Flow Power	Utility	RES + others	Ararat	240	Australia	Flow Power signs 50MW PPA at 240MW Ararat
Austin Energy	Public sector	Avangrid	Unknown	200	US	Avangrid wins 200MW PPA to power Texas city
General Motors	Corporate	Swift Current	Hilltopper	200	US	GM signs 100MW PPA at up-to-200MW project
Kimberly-Clark	Corporate	EDF RE	Rock Falls	154	US	Kimberly-Clark to buy 78% of Rock Falls output
WPPI Energy	Utility	Invenergy	Bishop Hill 3	132	US	WPPI to buy power from Bishop Hill 3 until 2040
General Motors	Corporate	Starwood	Northwest Ohio	100	US	Car giant to buy all power from 100MW scheme
US financial firm	Corporate	Capital Power	New Frontier	99	US	Undisclosed firm signs 86MW 12-year contract
Cummins	Corporate	EDPR	Meadow Lake	75	US	US engine group Cummins concludes 75MW deal
CS Energy	Utility	Windlab / Eurus	Kennedy En. Park	61	Australia	This project is a hybrid, of which 44MW is wind
Royal Schiphol	Corporate	Eneco	Unknown	Unknown	Netherlands	Four Dutch airports to use 200GWh each year
Welsh Water	Utility	Dong Energy*	Unknown	Unknown	UK	Welsh signs five-year deal to power 4,000 sites

## 3. OFFSHORE PROJECT ACTIVITY TRACKER FOR Q3 2017

PHASE	PROJECT(S)	SIZE (MW)	COUNTRY	OWNER	COMMENT
Decommissioned	Vindeby	5	Denmark	Dong Energy *	First offshore project taken down
Operational	Burbo Bank Extension	256	UK	Dong / PKA / Kirkbi (Lego)	Ofgem picks DTP to run grid link
Construction	Borkum Riffgrund 2	450	Germany	Dong / Global Infra. Partners	GIP buys 50% stake for €1.2bn
Construction	Arkona	385	Germany	E.ON / Statoil	Moved into construction phase
Commissioned	Sandbank	288	Germany	Vattenfall / Stadtwerke München	Completed three months early
Commissioned	Tahkoluoto	42	Finland	Suomen Hyötytuuli	Finish line for Finnish project
Development	Hornsea 2	1,400	UK	Dong Energy	Dong pushes on after CfD win
Development	East Anglia 3	1,200	UK	Scottish Power Renewables	SPR wins planning permission
Development	D. Bank Creyke Beck A	1,200	UK	SSE / Statoil	Pair take over as Forewind splits
Development	D. Bank Creyke Beck B	1,200	UK	SSE / Statoil	Pair take over as Forewind splits
Development	D. Bank Teesside A	1,200	UK	SSE / Statoil	Pair take over as Forewind splits
Development	D. Bank Teesside B	1,200	UK	Innogy	Innogy takes over from Forewind
Development	Moray East	950	UK	EDPR / Engie	Engie buys 23% stake for £21m
Development	Moray East	950	UK	EDPR / Engie	Wins CfD at £57.50/MWh
Development	Triton Knoll	860	UK	Innogy / Statkraft	Wins CfD; signs MHI Vestas deal
Development	Borssele 1 & 2	752	Netherlands	Dong Energy	Siemens Gamesa turbines deal
Development	Borssele 3 & 4	740	Netherlands	Shell / Eneco / Van Oord / Diamond	Put out request for EIB support
Development	Deutsche Bucht	252	Germany	Northland Power	Northland buys; €1.3bn close
Development	Fujian	250	China	Fujian Energy Group	\$305m NDB construction loan
Development	Coastal Virginia	12	US	Dominion Energy / Dong Energy	Dominion partners with Dong
Early stage	Haida	2,000	Canada	NaiKun Wind Energy Group	NaiKun to partner with Dong
Early stage	Hiumaa	1,100	Estonia	Nelja / Hiumaa Offshore	Cost concerns halt 1.1GW plan
Early stage	New York WEA	1,000	US	Statoil	Fishermen fight Statoil lease
Early stage	near Taoyuan	363	Taiwan	WPD	Larger project in WPD MoU
Early Stage	South Fork Extension	210	US	Deepwater Wind	Long Island rejects proposal
Early stage	First Offshore	200	India	Indian government	COWI surveys for India debut
Early stage	near Taoyuan	160	Taiwan	WPD	Smaller project in WPD MoU
Early stage	Kashima Port	94	Japan	Hitachi / Wind Power Energy	Duo win development rights

\* Dong has since changed its name to Ørsted

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# CORPORATE M&A DATABANK

In each Finance Quarterly, we cover the most notable corporate M&A deals in wind in the last quarter, and look at one key deal

**L**ow oil prices and global climate change action have forced more oil and gas giants to pursue growth in the wind sector in recent years. It is now impossible to avoid the likes of Engie, Iberdrola and Statoil.

But some have stubbornly kept out of large wind, including France's Total. It invested \$1.4bn in solar group Sunpower in 2011; bought battery storage firm Saft in 2016 for €1bn; and invested in distributed wind start-up United Wind last year. But it has not yet made inroads into utility-scale wind.

Until now. Last month, Total bought a 23% stake in solar and wind developer Eren for €238m. Eren does not have a large wind portfolio, with only 120MW of its 650MW capacity in wind, but the deal still puts wind on Total's agenda.

Is Total going to be a big name in wind? It has the essential mix of ambition and money but, in our view, it will be tough unless it makes further acquisitions.

Offshore wind schemes would be most attractive given that they are far larger than onshore projects, with returns to match. However, Eren is not an offshore specialist, and competition from large utilities in the offshore sector is fierce.

We expect Total to focus onshore, given that it can marry its financial clout with Eren's solid expertise of onshore wind.

There is potential, but let's remember Total's other big corporate M&A deal of recent months: its \$7.5bn of Maersk Oil. That shows where its priorities remain.

We aim to be comprehensive but, if we have missed your big deal, contact us at [editorial@awordaboutwind.com](mailto:editorial@awordaboutwind.com)

## DEALS DONE: M&A DEALS IN WIND (COMPLETED Q3 2017)

TARGET	BUYER	DEAL VALUE	COMMENT	TARGET COUNTRY	BUYER COUNTRY
WS Atkins	SNC-Lavalin	€2.45bn	SNC-Lavalin completes C\$3.6bn takeover of Atkins	UK	Canada
EDP Renovaveis	EDP	€296m	EDP buys extra 5% of EDPRE to grow its stake to 82.6%	Spain	Portugal
Boralex	CDPQ (Quebec)	€260m	Quebec's La Caisse acquires 17.3% of developer Boralex	Canada	Canada
Eren RE	Total	€238m	Oil giant Total acquires a 23% stake in green utility Eren	France	France
Sembcorp Green Infra.	Sembcorp	€184m	Sembcorp buys out its Indian subsidiary Green Infra	India	Singapore
Futuren	EDF En. Nouvelles	€97m	EDF grows stake in onshore wind firm Futuren to 87.5%	France	France
A2SEA	GeoSea	-	GeoSea acquires A2SEA from Dong Energy and Siemens	Denmark	Belgium
JDR Cable Systems	Tele-Fonika Kable	-	TFKable closes acquisition of subsea cables supplier JDR	UK	Poland
MP2 Energy	Shell En. N.A.	-	Shell acquires renewable energy company MP2 Energy	US	US
Offshore Wind Solutions	Reetec (EDF EN)	-	EDF EN subsidiary Reetec acquires O&M specialist OWS	Germany	France
TurboWind Energie	EWE	-	Utility EWE acquires wind developer TurboWind Energie	Germany	Germany

## FIVE TO WATCH: ONGOING WIND M&A DEALS

TARGET	BIDDER	DEAL VALUE	COMMENT	TARGET COUNTRY	BUYER COUNTRY	STAGE
Equis Energy	Engie	€4.1bn	Engie and others mull bids for Singapore's Equis Energy	Singapore	France	Early stage
TerraForm Global & Power	Brookfield A.M.	€1.3bn	Talks ongoing for troubled SunEdison's two yieldcos	US	Canada	Deal agreed
Renova Energia	Brookfield A.M.	€57m	Acquisition of 20.3% stake in Brazilian developer Renova	Brazil	Canada	Deal agreed
Guodian Group	Shenhua	-	Shenhua set to buy Guodian to form €232bn power giant	China	China	Deal agreed
EDP	Gas Natural	-	Gas Natural in talks to merge with EDP to form €35bn firm	Portugal	Spain	Early stage

*Laura Beane,  
CEO of Avangrid  
Renewables, meets  
Richard Heap to talk  
about US offshore,  
storage and wind's  
resilience despite  
President Trump*



Stepping up: Laura Beane became CEO of Avangrid Renewables in April

# BEANE IN THE USA

**Y**ou make your own luck. That's the old saying and, for Spanish giant Iberdrola, it might be true. The utility kicked off a major period of overseas expansion just before the global financial crisis hit in 2008, and concluded deals in the US and UK that gave it some protection from Spain's deep downturn.

That adage could also apply to Laura Beane, chief executive of Iberdrola subsidiary Avangrid Renewables, which owns over 6GW of wind and solar projects in the US worth a reported \$10bn. She became CEO six months ago after working for the firm in various guises for 22 years – and it might not have happened without Powerpoint.

A Word About Wind met Beane on a recent trip to London to talk about the evolution of the firm including its planned expansion into offshore wind – via its purchase of a 50% stake in the 1GW Vineyard Wind scheme in May – and her take on the key trends in US wind, with a focus on the prospects for wind under President Trump.

**Same but different**

There has been plenty of change since Beane joined utility Pacificorp as a secretary in 1995 with no long-term contract and plans to go to law school.

But skills gained in Adobe Illustrator and Microsoft Powerpoint in her undergraduate year changed that.

“The gentlemen I was working for were putting together a business plan, and they were absolutely dreadful at the presentation side,” she says. “I used to answer the phone, get their coffee, took lunch orders, and I printed things out from them. I saw some of the presentations and I thought: ‘Oh god, these men are really smart but this isn’t going to go anywhere.’ I was bored, so I started redoing their presentations.”

They liked it and, after nine months as “Powerpoint girl”, they offered her a full-time contract and financial backing for a Master of Business Administration: “I didn’t want to incur a lot of student debt [going to law school] so I jumped right on that.”

She then volunteered to work on Pacificorp’s first foray into renewables in 1997 and ended up at the part of the firm that was spun out into affiliated firm PPM Energy. It was a key step as, in late 1998, Scottish Power bought Pacificorp for £4.5bn and PPM ended up as the British utility’s US energy arm. Scottish Power held on to PPM when it sold Pacificorp to US billionaire Warren Buffett for £5.1bn in 2005.

More change came in 2007 when Iberdrola bought Scottish Power for £11.6bn, with its subsidiaries including PPM. Iberdrola invested further in the US in 2008 when it bought utility Energy East for \$4.7bn to form Iberdrola USA. Finally, the business became Avangrid in late 2015 when Iberdrola paid \$3bn for UIL Holdings. In total, Avangrid has 6,800 staff working in 27 US states, with 900 focused on renewables.

Over the years, Beane has held jobs including director of market structure & policy and, most recently, vice-president of O&M. She became president and CEO of Avangrid Renewables in April after

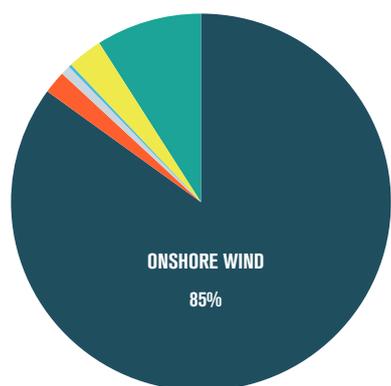
her predecessor Frank Burkhartsmeier left for natural gas firm NW Natural, and says she was “honoured” to take on the role.

One month later, Avangrid concluded the most significant deal of Beane’s tenure so far as it purchased 50% of the 1GW Vineyard offshore project in waters off the coast of Massachusetts. It bought the stake from Copenhagen Infrastructure Partners, which owns the other 50% split between its Copenhagen Infrastructure II and III funds.

This would be Avangrid’s first offshore wind project, but is not its first offshore wind deal. In March, the company won the right to develop up to 1.5GW of capacity off the coast of North Carolina after securing a lease of the site for \$9.1m. Vineyard has an estimated completion date of 2021/22, while Kitty Hawk would be in the late 2020s.

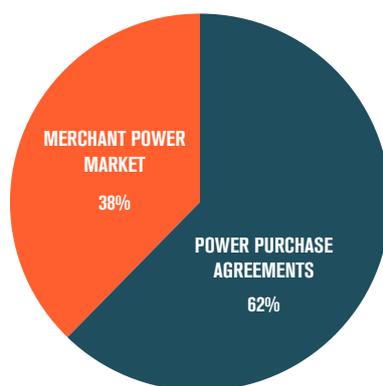
Avangrid will also benefit from the experience of its parent group. Iberdrola was the first Spanish firm to complete an offshore wind farm, in 2014, as the

**Technology split in Avangrid Renewables portfolio (as of June 2017)**



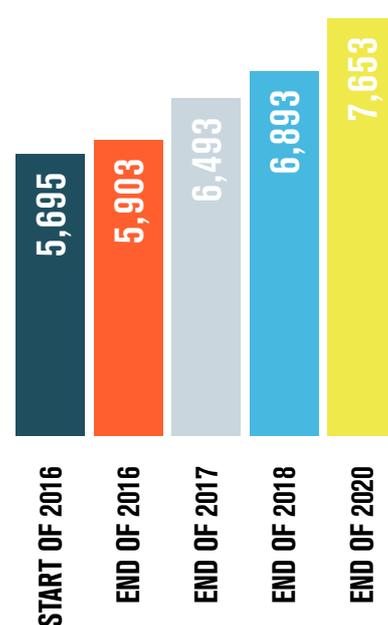
● ONSHORE WIND	85%
● HYDRO	2%
● SOLAR	1%
● FUEL CELLS	>1%
● PEAKING GENERATORS	3%
● KLAMATH COGENERATION	9%

**Proportion of Avangrid Renewables portfolio backed by PPAs (at the end of 2016)**



● POWER PURCHASE AGREEMENTS	62%
● MERCHANT POWER MARKET	38%

**Avangrid Renewables wind and solar portfolio growth projections (MW)**





Now running: Avangrid switched on a 208MW wind farm for Amazon in February



*There are three-and-a-half years left of this administration, and I don't think it's going to stop anything. People are determined.*



389MW West of Duddon Sands, and is due to complete the 350MW Wikingen in the German North Sea next month. It is also preparing to start work on the 714MW East Anglia 1, and its other developments including the 1.2GW East Anglia 3 and 496MW Saint-Brieuc.

Beane says Avangrid does not have a fixed target for expansion in offshore wind, but that there is a lot of optimism about the sector in the US.

She explains: "For many years, people were really sceptical about offshore in the States because we have so much land... but in these northeast markets, all of a sudden it's making sense."

This is being driven by cities like New York with high electricity demand, ambitious renewables targets, and too little land to build onshore renewables. Beane expects offshore wind to grow more quickly than it has in Europe

because of the work done already to bring costs down: "It's amazing what we've seen," she says.

#### **Wind and the tech revolution**

The company has a clearer goal for onshore wind and, in May, announced a plan to step up development activity by adding an extra 2GW of capacity by 2020, to take its total capacity to around 8GW. Avangrid grew its portfolio slowly in the last five years, and did not complete any wind farms in 2016, but is now looking to address that.

Some of this activity is backed by corporates power deals. In February, it completed a 208MW project in North Carolina for retail giant Amazon, and last month started building the 202MW Montague wind farm in Oregon, where it has a 20-year power purchase agreement with Apple.

In addition, it secured a PPA to supply

electricity to the city of Austin, Texas, from a 200MW wind farm that is due to complete by 2019. And its other projects under construction include the 298MW El Cabo in New Mexico and 131MW Tule in California.

Beane says backing for renewables from corporates and city governments is key to growth in the absence of backing from President Trump's administration. Thirty-five US cities have committed to source 100% of electricity from renewable sources by 2035, while firms from Apple to General Motors have made similar commitments.

"There's a lot of momentum," she says. "There's three-and-a-half years left of this administration, and I don't think it's going to stop anything. People are determined."

Specifically, there is determination from those in the industry to make wind

farms more cost-competitive as the wind production tax credit comes to an end from 2020. Beane is positive.

“We’re there. We’re seeing the numbers. We are definitely cost-competitive in certain regions already, and the technology continues to improve... We’ve got projects that we’re exploring in certain markets that are high-40% capacity factors, and I’ve even heard some of competitors suggest high-50% to 60% capacity factors,” she says.

There is also huge potential electricity demand from tech firms to power their data centres, including Amazon Web Services, Google and Microsoft.

Cisco reported in November that the amount of data stored in remote ‘cloud’ facilities, rather than in local storage, would grow almost fourfold to 14.1ZB a year by 2020. One of the key factors is growing demand for video streaming and social media on smartphones.

“I think about the data I use, just me, and it’s exploding,” Beane says. “The

demand for data and everything at our fingertips.”

As a result, Cisco forecast that the number of large ‘hyperscale’ data centres would grow from 259 in 2015 to around 485 by 2020. That is a big potential source of new electricity demand, as is the anticipated growth in the global electric vehicles market.

#### Balancing act

Beane says another sizeable challenge that Avangrid is focused on is grid stability, and how wind and solar can be seamlessly integrated into the grid.

She says Avangrid has been working on this challenge since 2010, and is already balancing the intermittent generation from its wind farms in northwest US.

The firm is using its 1.4GW fleet in the northwest, including hydro, and a combined cycle plant in Oregon to help balance production from its wind farms; and also has deals in place with third parties. This is vital to helping maintain grid stability.

“A lot of times in this industry people say: ‘You don’t understand. You just plug into the grid and expect everyone else to deal with you. You don’t know how difficult it is.’ Now we can say: ‘No, actually we do understand.’

“And it does get dicey in certain periods, when a big ramp comes up and you’re making sure that you’ve got what you need, but we’ve done it now. We’ve been doing it since 2010,” she says. The firm manages its fleet from one location near its headquarters in Portland, Oregon.

Avangrid is not yet investing in storage, though. Beane says the firm is watching this part of the market as battery storage could be “the next big thing”, and she expects it to become cost-competitive in the near future. As with the evolution of turbines, there should be a huge amount of innovation from which firms like Avangrid could benefit.

That is not down to luck, but rather to technical innovation backed by utilities like Avangrid. US wind is making its own luck – with or without Trump. ■

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# WHAT FLOATING TURBINES MEAN FOR INVESTORS



On the pull: The final turbine for Hywind Scotland is towed from Statoil’s Stord facility

Source: Statoil

*The completion of Hywind Scotland is a big moment for floating turbines, but DNV GL says more must be done to de-risk projects for investors.*

**The fifth and final turbine for the 30MW floating scheme Hywind Scotland completed its trip across the North Sea in August. It was an important moment for floating wind.**

The scheme is 75% owned by Norway’s Statoil and 25% by Masdar, and is due to be commissioned this year. This is the first time such large turbines – 6MW Siemens Gamesa machines – have been used on floating foundations, and is also the world’s first full floating wind farm.

Previously Statoil’s 2.3MW Hywind 1 off the coast of Norway and Principle Power’s 2MW WindFloat project with EDP off the coast of Portugal were the highest-profile deployments of floating turbines. Hywind Scotland is the first in a 348MW pipeline of floating projects planned in European waters (see table). This also opens up new opportunities for investors. We spoke to Magnus

Ebbesen, senior consultant at DNV GL, about the opportunities and risks for investors in floating wind projects.

**Head-to-head above water**

Floating wind turbines draw heavily on systems widely used in the oil and gas sector. There are currently three main types of floating foundations being used in wind: spar buoy, semi-submersible and tension-leg (see image).

Statoil has used the spar buoy on Hywind, with the key benefits of simple construction, a low centre of gravity and a small cross-section at the water surface to minimise wave loading. Meanwhile, Principle’s WindFloat is a semi-submersible foundation, which gains its stability from its low centre of gravity and wide water plane area. The benefit of this structure is a low draft which allows for a wide area of sites and simple installation.



Three contenders: spar buoy, semi-submersible and TLP foundations

Source: NREL

## EUROPE'S 348MW PIPELINE OF FLOATING OFFSHORE WIND PROJECTS

PROJECT NAME	CAPACITY	DUE	COUNTRY
Hywind Scotland	30MW	2017	UK
Dounreay Tri	2 x 5MW	2018	UK
Kincardine	48MW	From 2018	UK
WindFloat Atlantic	30MW	2018/19	Portugal
Four French projects	4 x 25MW	2020	France
Gaelectric	30MW	2021	Republic of Ireland
Atlantis / Ideol	100MW	2021	UK

Source: WindEurope

The third type, tension-leg platforms (TLPs), are tethered to the seabed with taut tendons. The key benefits with TLP is the low weight of the substructure. While this has not yet been used for floating wind, it has been deployed widely in oil and gas since the 1980s.

But despite this experience, there are big differences between supporting an oil platform and a 6MW wind turbine.

These turbines create large forces that must be considered in design and stability calculations. For example, the Hywind system is 258 metres tall, of which 178 metres are above water and 80 metres are beneath.

"There are strong winds and waves impacting the structures that cause complex dynamic behaviour, and that affect both the turbine and the substructure design," says Ebbesen.

These turbines need new types of controllers to angle the blades and control drive train torque so they can control the motion of the turbine and the floater, maintain optimal production, and reduce wear and tear. Failing to do this could affect their energy yield and required maintenance and repair, which would affect investors' returns.

Ebbesen says turbine manufacturers may be reluctant to offer performance and defect warranties at the same level as conventional wind. This could affect the developer's chances to obtain financing on similar terms. And there are other technical challenges, including the dynamic cables and new maintenance processes. The industry has a lot of work to do to commercialise the technology.

But it is worth doing. There is great potential for floating wind to benefit from some of the cost reductions that

are helping fixed-foundation schemes, including larger turbines. The floating sector should also enable developers to use simpler and less costly vessels, and thus reduce the cost of building at sea.

Ebbesen adds floating foundations are nearly commercially viable: "When you have several floating demonstration parks in different areas, I think you are very close to having something commercially viable. My understanding is that it's more than five years away, but there is great interest in the market."

### Making the investment case

For now, floating foundations are more expensive than fixed foundations, but for how long? In January, the UK's Carbon Trust said floating wind could be cost-competitive in the next decade.

It said these projects could achieve a levelised cost of energy of around £85/MWh by 2026, assuming there were enough developments to commercialise the sector. But this was before low-price offshore wind won government backing in the UK and Germany, and many of the assumptions in those projects – notably the falling cost of offshore turbines – would also help the floating sector.

In June, WindEurope said costs would fall rapidly, with up to 50% reductions possible by 2050, and could fall faster if projects with floating foundations follow their fix counterparts. It added that turbines of between 12MW-15MW could fit on floating foundations.

Ebbesen is confident this change is coming. The UK's Carbon Trust has said that 80% of the offshore wind resource in Europe and Japan is on sites that would need floating foundations, and 60% in the US, particularly off the west coast. Hypothetically, there is potential to install projects of 7,000GW globally.

"There are huge markets that it opens up and I think the next few years will be the dawn for floating wind. You have projects that will de-risk the technology, show opportunities for cost reduction, and improve the total interest in floating wind," says Ebbesen.

Hywind Scotland's final turbine has completed its travels but the journey for floating wind is just starting. ■



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Shock market: Fallout from the financial crisis prompted Spain to cut wind subsidies

Source: Shutterstock

# COUNTRY ANALYSIS: SPAIN

Spain's leaders want to kickstart growth in wind, but they need to rebuild investor trust, says Ilaria Valtimora

**H**ow do you rebuild trust after it has been broken? This is a question that wind investors in Spain will rightly be asking themselves.

Five years ago, Spain was a global leader in wind, with 23GW of installed wind capacity at the end of 2012, putting it fourth only to China, the US and Germany. This rapid growth was too much for Spain's leaders, who moved to rein in high subsidies, with disastrous effects. Since then, just 250MW of new

wind farms have been added to the grid, with 2015 being Spain's worst year with not a single megawatt installed.

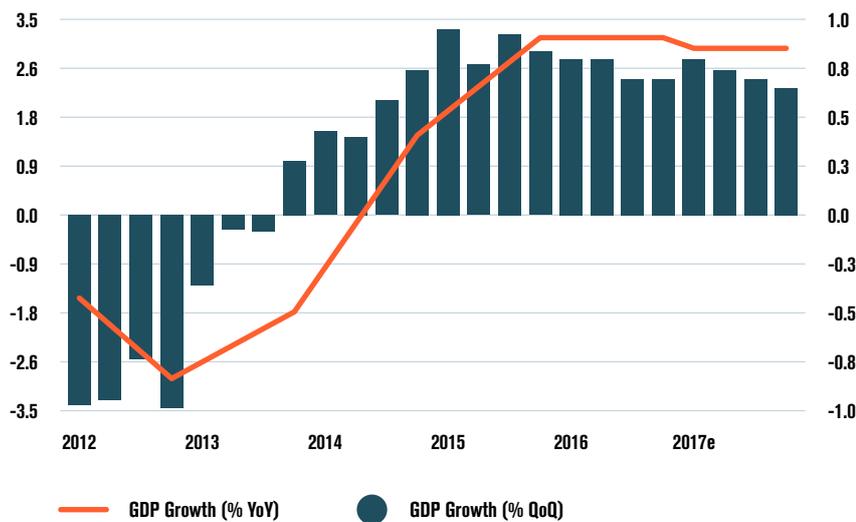
The government now wants to change this. It held two renewables auctions, in May and July, and is looking to add 4.1GW of new wind capacity by 2020. This new-found interest in wind came as a big news to the industry. But there is a long way to go if Spain is to give investors the confidence that there is a long-term plan and their money is safe.

## End of the bull market

The seeds of the current malaise were sown 20 years ago.

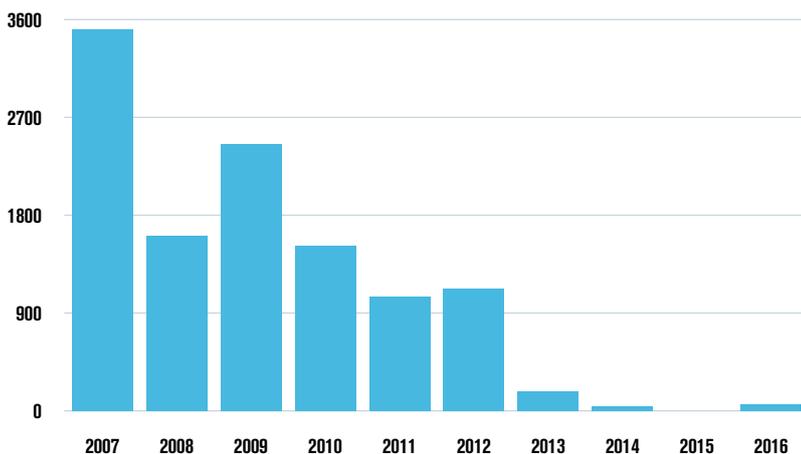
In 1997, Spain launched its plan to spur growth in renewables, and by 2007 had installed 15GW of wind farms. That year, the government led by the Spanish Socialist Workers' Party's José Luis Rodríguez Zapatero began offering generous subsidies, with above-market rates for green energy producers. Its aim was to attract foreign investors.

## Spain GDP Growth (%)



Source: OECD

## Spain: Annual Installed Wind Capacity (MW)



Source: Wind Energy Data



*Stop-and-go policies like this are extremely disruptive for the wind supply chain.*



In 2008, the global economic crisis hit. Spain fell into recession in 2009 and again in 2012 and 2013. But despite the severe contraction in its economy, Spain added more than 50% of additional wind capacity – 8GW – between 2008 and 2012, fuelled by generous subsidies.

It could not last. As part of a package of austerity measures aimed at helping Spain out of the crisis, the government led by conservative People’s Party Mariano Rajoy, which took office in 2011, brought in a series of laws to retroactively cut subsidies to the wind sector. This culminated in the government’s reforms in 2013, which

axed feed-in tariffs and set the levels of “reasonable returns” that owners could generate from their wind farms.

The results were brutal. For example, in 2013, utility Acciona reported a €2bn loss as a result of the changes, and the government has faced 30 legal claims from overseas investors in international courts, but only two have been resolved. This offers no respite for Spanish firms, who are not able to seek restitution in the international courts and so are at the mercy of the Spanish court system, with the long trials that this entails.

That is a long way from being fixed. But at least, ten years on from the crash, Spain’s economy is improving. It recorded growth of 3.2% in 2015 and 2016, and is on track for 3% GDP growth in 2017, according to forecasts from the OECD and the International Monetary Fund. This sustained economic growth has spurred new interest in renewables.

### Boom to bust and back

In the last five months, Spain has held two technology-neutral and subsidy-free renewables auctions, and given consent for projects totalling 8GW to be completed by 2020, half of them wind farms. The first was held in May, where 2.9GW of wind projects were given support, and a further 1.1GW in July. Most of the rest was made up of solar.

There is still a long way to go if Spain is to become a global wind powerhouse.

Giles Dickson, chief executive at WindEurope, is sceptical. He argues that the auctions came out very close to each other and were unexpected by the wind sector, which suggests a lack of planning: “Stop-and-go policies like this are extremely disruptive for the wind supply chain,” he says.

The Spanish Wind Energy Association (AEE) said installing 4GW of new wind farms would require total of investment of €4.5bn, but Dickson argued that long-term planning was essential to give investors the confidence to do these deals.

Dickson says there should be three years of visibility on the size of future auctions; a clear timetable for auctions; and visibility on other forms of support on offer in the next three years: “What

the Spanish government is doing is nothing compliant with these three requirements,” he says.

The “reasonable return” on wind projects, currently 7.39%, represents further uncertainty. The government is set to change this in 2019, which affects returns on projects retroactively, and speculation is that this could be cut as low as 4.5%. This would affect existing wind farms, as well as the confidence of investors in the new projects. It would also make it harder for developers to secure finance for new schemes.

The need for auction-winning projects to reach financial close by 2020 will also cause difficulties. Rodrigo Berastegui, partner at law firm Watson Farley & Williams, said it would likely penalise wind farms more than solar photovoltaic (PV) projects because it is harder to complete wind farms in the timescale.

“PV projects are usually very close to their substations, while wind farms are located in mountains, with difficult



The axeman: Prime Minister Mariano Rajoy led wind subsidy cuts

Source: EPP via Flickr

access to the grid. [Wind farms] also require an affirmative environmental impact assessment, which requires time. Banks would be more willing to finance a project that is more likely to be completed,” he says.

The two auctions are the first steps to bringing Spain’s wind energy market back on track, but stop-go policymaking does not give investors the certainty they need. The nation is a long way from revisiting its glory days. ■

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**VAISALA**

# MEMBER Q&A: ALLA WEINSTEIN

In each edition we interview a member of the A Word About Wind community. Today, Richard Heap talks to Alla Weinstein, founder of Trident Winds.

**Two years ago, Trident revealed plans for a 1GW floating wind farm off California. How far have you got with that?**

It is still very early. We initiated the project under a provision that allows the developer to make an unsolicited lease request. Then Statoil expressed an interest in the site, which put the process in a competitive mode, so now the federal government has to work with state government to identify the best wind areas.

Until we showed up, nobody was thinking about offshore wind in California. The continental shelf on the west coast of the United States is very narrow. The water becomes very deep – 800-1,000 metres depth – within a few kilometres. Until floating technology became mature or even developed, they couldn't even consider offshore wind. Now they are.

**It is a big scheme. Are you bringing in co-investors?**

Not yet. Soon. You're right that this is not a project that can be done by one small company.

**How have you found the transition to being a developer?**

I've been in marine renewables since 2001. I'm an electrical engineer by training and have been in project management for many years. When I started my first company AquaEnergy Group, in 2001, we ended up doing both so I feel comfortable in both areas.

You need a project, you need the technology, and somebody has to put it together. That is what I'm doing with Trident Winds. I was CEO of floating foundations firm Principle Power, which I set up in 2007, so I knew the technology would be available when we needed it.



**Are you still involved with Principle?**

No, I left in January 2015 and launched Trident two months later. There is no link between the companies. I am a shareholder in Principle Power but, as a developer, I have to choose the best solution, especially in California, where there are no feed-in tariffs. Our project has to compete with all other sources.

**It seems like floating tech has developed faster than people imagined. Is that fair?**

In 2008, I came to the European Wind Energy Association [now WindEurope] as we were looking for a roadmap of European Commission money to do technology demonstrations. Back then, even EWEA said: 'No, you're too early. We're expecting you in about 15 years.'

Then Statoil installed their device at their first Hywind project in 2009, and that was the first installation. Then

when, at Principle, we installed our 2MW WindFloat 1 prototype in 2011, people started paying attention. You have to initiate something and then people wake up.

Today, Hywind and WindFloat have been through five years of testing, and demonstrated survivability and performance, and those are the two leading principles. One is that spar buoy and one is the semi-submersible. We are going through the maturity process.

**How do they compare on cost to fixed foundations?**

Floating offshore wind could surpass fixed foundations on cost because it eliminates a lot of high costs and uncertainties of installation. You don't need jack-up barges. You don't need a lot of offshore work. It is conceivable that it could become a lower-cost alternative. ■

# KEY DATES

Top decision-makers in wind energy finance trust A Word About Wind to deliver news, analysis and new business connections.

**M**embers of A Word About Wind are able to access our full events and reports programme, and receive our intelligence briefings three times every week. And it is set to be a busy three months as we move into 2018.

Our members can still sign up to attend our annual Financing Wind conference on 9th November, to hear from a line-up of top industry speakers discussing the key trends in wind industry financing. For more details and to book your place, please visit: [www.financingwind.com](http://www.financingwind.com)

Conference attendees will get a sneak peek at our sixth-annual Top 100 Power People report, which we are due to send to all members on 14th November.

And on 16th November we will host our Q4 Quarterly Drinks with guest speaker, Vattenfall's Piers Guy. Get in touch now to join us, and our sponsors Swiss Re Corporate Solutions and additional sponsor Papertrail. Don't miss out!

**Not a member? Get a free 30-day trial at:** [www.awordaboutwind.com](http://www.awordaboutwind.com)

## EVENTS

9th November  
Annual Conference

16th November  
Quarterly Drinks Q4

1st March (TBC)  
Quarterly Drinks Q1

## REPORTS

7th November  
Top 100 Power People

9th January '18  
Finance Quarterly Q1

10th April  
Finance Quarterly Q2

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A WORD ABOUT WIND

