

# RECAI

Issue 39

Renewable energy country attractiveness index

November 2013

## Innovating for the future

A global energy imperative is making technological innovation critical to a low-carbon future, but we must start preparing today for the disruptions of tomorrow.

## IPOs: here today, gone tomorrow?

Although a new wave of renewable energy IPOs could merely be the latest fashion in fundraising, robust foundations suggest public markets may offer a sustainable source of asset finance.

## A new opportunity for pension funds

With pension funds managing approximately US\$28t in assets, what's required to wake the sleeping giant that could transform the financing landscape for renewables?

## EU protectionism – who gains?

In the solar trade war between China and Europe, who stands to gain and lose as the repercussions unfold, and more critically, what happens once the current deal runs out at the end of 2015?

## The big "P" of politics

Delayed decisions, inconsistent messaging and policy overhauls are keeping renewables in the dark in some markets, while others have their sights firmly set on large-scale deployment.



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November  
2013

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# Chief Editor's note



Ben Warren, RECAI Chief Editor

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## The small "p" of policy and the big "P" of Politics.

Making an unpopular decision is one thing. The market adapts, and life goes on. But delayed decisions, inconsistent messaging and policy overhauls are another thing altogether. We talk about the impact of policy and regulation on the stability and attractiveness of renewable energy markets, but it is too often politics, rather than policy, in the driving seat.

Political posturing, bipartisan ideologies, election uncertainty, incoming coalitions – it rarely ends well. We only need to look at experiences in the US, UK, Germany, Australia and Poland to find boom-bust cycles, delayed investment, abandoned projects and market exits. Current political squabbling in the UK, for example, is hampering any tangible cohesive long-term energy strategy, leaving wind farm developers and gas suppliers alike in the dark on what the future holds.

But surely energy is too important, too fundamental, to be subject to the big "P" of politics. With most countries facing an energy imperative of some kind, whether surging electricity demand or the decommissioning of old plants, governments must work harder to create stable markets for conventional and clean energy that are free from bureaucratic obstacles and political point-scoring.

The Intergovernmental Panel on Climate Change's latest report concludes with 95%-100% certainty that climate change is caused by human activity. This, combined with other fundamental factors such as continuous population growth, accelerated urbanization and increasing power consumption across emerging markets, highlights the desperate need to focus on the low-carbon energy strategies of tomorrow.

Renewable technology innovation therefore represents an opportunity. Given we are currently exploiting only a fraction of the world's natural renewable resources, we need to stretch our ingenuity and utilize all the elements around us to maximize the potential of renewable energy, rather than just relying on the cheapest sources today. Importantly, we must also be in a constant state of innovation – new business models, new financing solutions and new tools to mitigate risk – to create the right conditions for the disruptive technologies of tomorrow.

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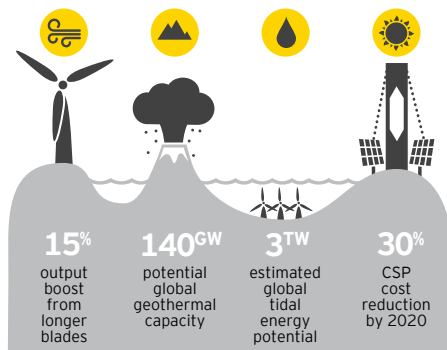
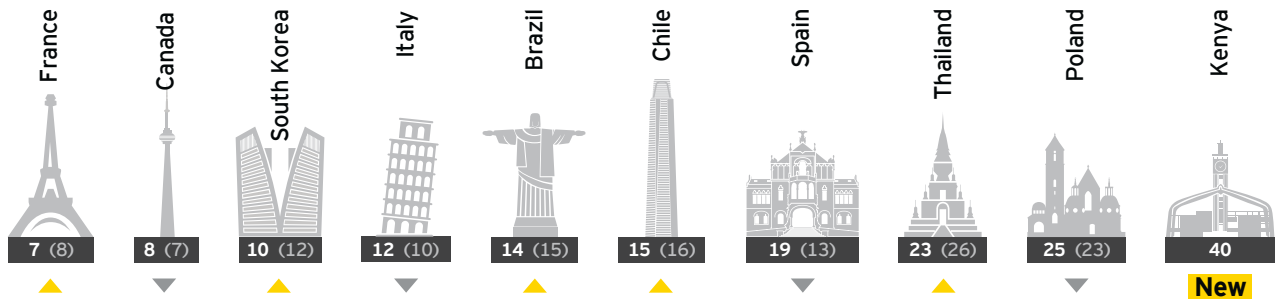
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# At a glance ...

A wave of IPOs, the awakening of a new investor class and changing EU-China dynamics signal interesting times ahead for the renewables sector.

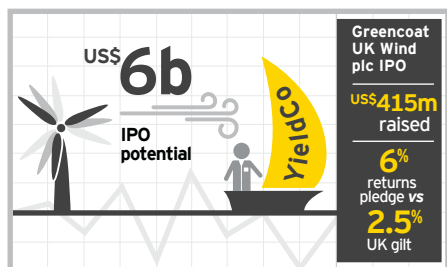
## Key index movements

( ) = Previous ranking



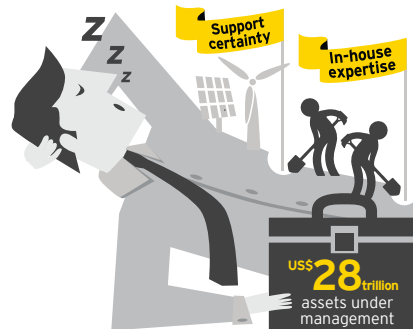
Leveraging all the elements is key to technological innovation and sustainable energy.

Stable yields trigger a wave of renewable IPOs in 2013 ...



... but market recovery may take floats elsewhere.

Pension funds: what's required to wake the sleeping giant that could transform the financing landscape for renewables?



## Quarterly developments

Where's "hot" ...

**Brazil**  
Sees the light

**France**  
Finances transition

**US**  
Green bank bonanza

...and "not"?

**Australia**  
Swings its axe

**German**  
Pressures mount

**UK**  
Energy squabbles



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# Summary

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An overview of this issue

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## Preparing for disruption

**Technological innovation remains critical** to driving down renewable energy costs and addressing intermittency challenges. However, complacency over more mature technologies and a short-term focus on affordability must not jeopardize the exploitation of a broader range of renewable resources that can offer a more sustainable energy mix in the long run.

**Our feature article** surveys some of the interesting technological innovations expected to reach commercial scale in the short, medium and long term, forcing us to look at how we can create the right conditions today for the disruptions of tomorrow.



## Pension funds: waking the giant

In the absence of traditional project finance, developers are increasingly turning to other kinds of deep-pocketed investors to fund their projects. And with around US\$28t in assets under management, pension funds may well prove to be the sleeping giant that could transform the financing landscape for renewables in the decade ahead.

Deals are already being done, but the surface has barely been scratched. In a recent EY survey, pension funds cited greater investment transparency, certainty over government support and improved renewable energy in-house expertise as the top three drivers for investment in the sector. Areas such as these must be addressed if the renewables sector is to cash in on pensions before retirement.

## IPOs: the latest fad or here to stay?

**Clean energy appears to be back in favor** with public market investors, with 2013 experiencing a wave of high-profile initial public offerings (IPOs). But can renewable assets rely on this new form of funding in the long term, or will the current levels of investor enthusiasm wane?

**The answer is likely to be a bit of both.** With many IPOs using a “YieldCo” model, this form of capital-raising can result in a stable revenue-delivery mechanism for investors when other growth opportunities are lacking, but economic recovery in the medium term may cause public market investors to stray in search of investments with better yields.

However, in the long term renewable energy IPOs should remain attractive for more risk-averse investors.

## EU protectionism: helping or hindering?

**Solar sector trade wars** centered around anti-subsidy and anti-dumping allegations have dominated the headlines for the last 12-18 months, but European measures to impose duties, minimum pricing and quotas on Chinese solar equipment may have been a shot in the foot rather than a shot in the arm for the EU.

**Looking back, and forward,** we explore who stands to gain and lose as the repercussions unfold and what continues to make this often controversial issue so critical to the future of the sector. And perhaps more importantly, what happens once the price undertaking runs out at the end of 2015 – will Europe fall off the edge or remain afloat?

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# Summary

continued

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## A game of two halves

**Renewables markets now fall into two categories:** first, those in the process of revising their energy strategies, with much of Europe falling into this category, and second, those markets that are striding ahead with large-scale deployment or addressing barriers to that deployment.

## Reviewing, revising, rescheduling

**UK and Germany currently appear to be in stalemate,** with politics hampering the development of clear strategies, prolonging uncertainty and deterring investment. In the UK, the escalation of political infighting in recent months has left the energy sector with mixed signals and unclear direction. Germany is faring a little better, underpinned by strong support for a transition away from nuclear, even if renewables support is to be reduced.

**France, meanwhile, has spent the last 6-12 months reviewing** its strategy and plans to implement an energy transition bill early next year. Recent announcements that this will include a carbon tax and a levy on nuclear power to help fund renewable energy deployment send positive signals, resulting in a move up to seventh place in the index.

**Poland is also looking to revise its support for renewables,** shifting from a green certificate (GC) mechanism to competitive tendering. However, concerns over further delays to implementation and sector reactions to some of the proposals create a bleaker outlook in the short term, resulting in a fall in the rankings. (See our Poland article on page 30.)

**Meanwhile, dramatic reductions in support for renewables in markets such as Spain, Italy and the Czech Republic are starting to impact medium-term deployment outlooks, resulting in significant downward movements for these markets.**

## Getting the job done

**Brazil and Chile feature strongly** in the index, with renewables playing a prominent part of Brazil's 2013 power auctions and creating a healthy project pipeline for 2014 to 2018. Chile is continuing to attract large-scale projects, including the world's largest unsubsidized PV plant, while the Government has officially doubled its target to 20% of renewable electricity by 2025. Both countries have moved up the index. (See our Chile article on page 24.)

**India and Japan are also achieving strong deployment growth** thanks to large-scale auctions and generous feed-in tariff (FITs) respectively. However, critically, both are also now starting to focus on grid infrastructure improvements to accommodate existing and additional capacity, with billions of dollars flowing into various transmission initiatives in both markets. (See India article on page 22.)

**China has introduced additional tax breaks and subsidies** for solar to help meet its ambitious 35GW target by 2015 and is continuing to implement specific measures to facilitate consolidation. A renewed focus on offshore wind will also open up huge deployment opportunities if the Government can overcome previous challenges.

**Markets such as Turkey and Thailand are also stimulating significant interest,** with both targeting renewables as a way to meet surging



energy demand. Thailand jumps to 23rd place this issue, to reflect a 51% increase in its renewables target to almost 14GW by 2021, while high market electricity prices and a robust support framework in Turkey have resulted in significant over-subscription for its renewable energy auctions. (See articles on pages 26 and 28.)

## Markets to watch

**This issue sees Kenya enter the index** for the first time in 40th place. A robust support framework and significant potential to become a hub for renewables in the East Africa region are attracting project and deal activity to meet the surging electricity demand in the region.

**In the second of our "Markets to watch" series,** we look at the significant renewables activity taking place in Russia this year and ask whether a new green giant has emerged or it's simply "here today, gone tomorrow."



# Preparing for the elements

Renewable technology innovations will continue to drive down costs and address intermittency challenges, though we need to draw on a broader range of resources. Some advances are imminent, others will take decades, but we must create the conditions today for the disruptions of tomorrow. EY's Cat O'Donovan reports.

Thirty years ago, the first 1MW solar power station came online in California. Now you can pick up your own solar panels from Ikea in the UK. The first high-power silicon solar cell, developed in 1954, had a maximum efficiency of 6% and cost around US\$286/watt. Today, typical efficiency levels are 15% and rising, while the average solar panel cost is US\$0.80/watt and falling.

Such innovation has been the cornerstone of the renewables sector since day one, covering both the adaptation and improvement of existing technologies, and the introduction of more disruptive technologies that have greater potential to shake up the sector.

## Looking to the four elements

Surging electricity demand and energy security concerns, the impact of climate change and the increasing competitiveness of renewables continue to put an increasing focus on renewable energy as a critical component in the overall energy mix. But this focus cannot just be on one or two technologies. As the shining beacon that is grid parity comes into view for an increasing number of renewables projects, we must not be complacent.

More mature technologies should not cannibalize support available for emerging technologies, while austerity measures and a focus on affordability should drive innovation in cost-reduction rather than simply favor the cheapest technologies. Indeed, the

increasing trend for government-led auctions has created greater competitiveness across renewable sectors, but care must be taken to ensure that the need to foster promising emerging technologies is not ignored. With the Earth's landmass representing only 30% of the total, and populations surging, we must be looking to all the elements – earth, fire, wind and water – to make the most efficient use of our planet's resources if we are to create a truly sustainable and cost-effective energy supply.

## Preparing the way

Innovation is of course largely driven by scientists, researchers, engineers and entrepreneurs. But we must always keep an eye to the future, aware of how the economics of today impact the energy solutions of tomorrow. Governments must create policy environments that achieve the right balance of affordability and certainty, investors need to better understand the risks and rewards in this ever-changing sector, and energy generators must find ways to adapt as new technologies disrupt the global energy mix. Increased engagement by, and with, large corporates can also foster innovation and introduce new capital flows.

At EY, we are also working to facilitate the connections between entrepreneurs, financiers, corporates and government that accelerate the emergence and deployment of clean energy innovation – building a better working world through the promotion of sustainable and cost-effective sources of energy. We know that innovation in

technology must be met by innovative business models and financing solutions, and engagement with stakeholders across the sector becomes ever more critical as a renewed focus on affordability creates new – and often more difficult – dynamics for capital flows and infrastructure deployment. Innovation driven by the need to drive down costs must be supported by operational synergies, efficient tax structuring and cost-effective financing.

## The disruption timeline

So, which new technologies are already creating waves, and which are still up in the air? While the success of emerging technologies can be somewhat unpredictable given ever-changing policy and investment climates, the following section sets out a sample of the key technological innovations that could be disruptive in the short, medium and long term as commercial scale is achieved.

Caution is advised when looking too far into the future, but occasionally a news story will attract the attention of the inner child in all of us who ponders what the world will look like 50 years from now. Even space is apparently no longer off-limits, with ex-NASA scientist John Mankins seeking US\$15b-US\$20b to fund a project that would use mirrors in space to concentrate solar energy onto panels and then beam the electricity down to earth using microwaves.

So, whether it's looking up at the sky or down at the sea, we must all start preparing for the elements to change.



# Short term

## Tidal

Tidal power is generated by exploiting variances between high and low tides via strategically placed barrages (“tidal range”) or by capturing the kinetic energy of the current (“tidal stream”). While construction costs are still relatively high, regular lunar cycles make tidal energy far more predictable than other renewable sources. Four tidal range plants totaling 517MW were fully operational at the end of 2012. Tidal stream is further behind, but prototypes already in the testing phase include technologies from Openhydro, Hammerfest Strøm and Hydra Tidal.

Such progress points to commercial deployment as early as 2015, although there is still heavy reliance on government support until economies of scale can drive down costs. The UK is offering 5 ROCs/MWh for projects under 30MW, while France has launched a tender for 80MW of tidal capacity. With estimated global tidal power potential of around 3TW,<sup>1</sup> investment and deployment of this highly predictable energy source is expected to accelerate.

1. Anthony Lewis, Segen Estefen, John Huckerby, Walter Musial, Teresa Pontes and Julio Torres-Martinez, “Ocean Energy,” *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation*, 2011.



## Concentrated solar

Concentrated solar power (CSP) is unlikely to experience a technology revolution in the next few years, but it can make the most of what it already has. Surging energy demand and the increasing use of competitive capacity tenders, such as those in South Africa and pending in Saudi Arabia, have renewed interest in its potential and called for greater scale, improved efficiencies and more cost-effective materials to help reduce costs.

In the short term, advancements such as molten salt heat transfer fluid, more reflective mirrors and multi-tower fields will help drive the cost of CSP down by an expected 10%-20% by 2015 and 30%-50% by 2020.<sup>2</sup> Global installed CSP capacity totaled just 2.8GW at the end of 2012 compared with 100GW of solar PV. But the potential for cost reductions, combined with the ability to integrate thermal energy storage and provide base-load electricity through hybrid gas turbines, means technology improvements could significantly increase the pace of deployment.

2. *Concentrating Solar Power: Technology Brief*, IRENA, January 2013.

## Onshore wind

Despite being one of the most mature renewable energy technologies, innovation continues to improve the efficiency and cost-effectiveness of onshore wind installations. Design advances, such as a switch from steel to concrete, could make it possible to erect 100-meter towers to take advantage of stronger, steadier winds, boosting output by up to 14% compared with today’s 80-meter towers.<sup>3</sup>

Lighter blades made from carbon fiber or advanced fabric could begin spinning at lower wind speeds, and a step up in blade length from 103 meters to 120 meters could increase output by up to 15%.<sup>3</sup> There are more dramatic modifications in the pipeline too. In August, Irish firm Airsynergy launched a turbine with an innovative “shroud” system around the blades, which the company claims could double the annual power of an equivalent conventional turbine.<sup>4</sup>



3. Brad Gammons and Rolf Gibbels, “Technology Gains are Powering Wind Energy,” *Livescience* website, <http://www.livescience.com/40525-tech-gains-powering-wind-energy.html>, 17 October 2013.

4. “Products,” *Airsynergy* website, <http://airsynergy.ie/product>.



# Mid-term

## Floating offshore wind

Floating offshore wind turbines will be critical in exploiting high-wind sites farther from shore or where deep coastal water makes near-shore fixed turbines unfeasible, as is the case in emerging offshore markets such as Japan, Norway and the US. The ability to assemble floating installations in port to be towed out to site gives these turbines significant advantage over fixed-base turbines in deep water, although they will still need to contend with the technical challenges of operating in a more hostile marine environment.

Getting the right turbine size, substructure design, grid connection and control systems to generate reliable energy far from shore will require years of innovation and testing, but various prototype designs are currently under development, including tension-leg platforms, spar buoys and semi-submersible floating platforms, all tethered via cables to the seabed. Tests on Statoil's Hywind, the world's first full-scale floating wind turbine, have been ongoing off Norway since 2009, while other designs have been developed by Principle Power, Marubeni and Dutch developer Blue H.

## Organic solar

Most traditional solar cells are manufactured from silicon or copper compounds, while organic solar PV (OPV) cells use organic (carbon-based) molecules. These cells have the potential for very low production costs and are much thinner than conventional PV cells. Combined with a high optical absorption coefficient, this makes them light, flexible, translucent and sensitive to low light levels.

These factors mean OPV applications will be critical in supporting localized solar power, benefiting not only emerging markets with poor grid infrastructure, but also the increasing need to integrate energy into everyday applications such as backpacks, laptops, cars and mobile phones. Currently, the market only has a few manufacturers and with technology IP well-protected. The main challenge with OPV has been the low efficiency levels, but January 2013 saw Heliatek announce record efficiency levels of 12%, compared with an average of 15% for traditional solar cells, suggesting commercial deployment is a matter of when, not if.

## Storage

Storage solutions that capture excess energy efficiently to be used on demand will be a key enabler in exploiting the full potential of renewable energy resources given often high intermittency levels. Storage technologies close to commercialization include:

- ▶ Flow batteries: these are rechargeable fuel cells in which an electrolyte flows through an electrochemical cell, converting chemical energy into electricity. An additional electrolyte is stored externally in tanks, and is pumped through the cell to "recharge" the battery.
- ▶ Liquid metal batteries: a molten-salt electrolyte is sandwiched between two liquid metal electrodes, and the difference in composition between the two liquid metals gives rise to a voltage.

Looking further ahead, compressed air has greater potential for large-scale application. Excess energy generation is used to compress air into underground reservoirs, the release of which drives a generator to produce electricity as required. Developers are currently exploring ways to reduce inefficient heat loss that currently necessitates the use of natural gas later in the process.







# Long term

## Ocean thermal

Ocean thermal energy conversion (OTEC) technology has significant potential to provide non-intermittent power to regions where temperature differences between warmer surface water and cooler deep water exceed 20°C. The warmer water converts a fluid with a low boiling point into steam, which drives a turbine to produce electricity. The steam is recondensed using cold water from the deep ocean so that the cycle can be repeated.

The temperature difference restricts OTEC feasibility to tropical and equatorial oceans, although this still covers more than 100 countries and territories and could represent at least 150GW of power capacity in regions where domestic energy sources are scarce.<sup>5</sup> The market is dominated by a few players, including France's DCNS and US-based Lockheed Martin. The costs associated with scaling up are uncertain given the relatively low energy yield, temperature constraints and expensive deepwater pipes, but innovations such as more efficient heat exchangers and improved pipe manufacturing are starting to mitigate some of the risks.

5. Ocean Energy Association, citing a study undertaken by Indicta on behalf of the French Department of Energy and ADEME, 2012.



## Solar application

Innovation will continue to improve the performance and cost-effectiveness of solar technology, but given its relative maturity, it is more likely that the long term will bring disruptive application rather than disruptive technology. Transparent OPV cells – still in their relative infancy given the technical challenge of the inverse relationship between electricity conversion efficiency and the level of transparency – could dramatically expand application potential; MIT researchers project that coated windows could provide more than a quarter of a skyscraper's energy needs without changing its look.

Meanwhile, solar-powered aircraft may offer a cost-effective way to carry sensors, cameras and lightweight cargo to support military, communication and aerospace applications. In May, Swiss firm Solar Impulse set a new record for a manned flight of over 26 hours of flying without fuel, with the unmanned record at two weeks. The current fragility of these vehicles and the inability to carry more than one pilot means that it will still be decades before commercial application really takes off, but the endurance potential remains staggering.

## Geothermal

Geothermal energy harnesses the heat of the earth's core to convert water into steam, which powers a turbine. It provides consistent base-load power and can also be cheaper than other forms of energy in some situations. However, long lead times for development and the risks (and costs) associated with exploration and drilling activities present critical challenges to exploiting the 70GW-140GW of potential geothermal energy globally, compared with just 10GW currently.<sup>6</sup>

Innovations that reveal subsurface temperatures without drilling are therefore key. Progress is being made in the development of seismic profiling technology and the use of innovative airborne exploration methods by Lockheed Martin and others. But these are currently nowhere near able to compensate for physical drilling; therefore, in the short to medium term, the sector will also need to look to the oil and gas industry to exploit synergies and implement more cost-effective techniques.



6. 70GW with present technology and up to 140 GW with enhanced technology. Source: *The possible role and contribution of geothermal energy to the mitigation of climate change*, IPCC, January 2008.

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# Key developments

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## Country-specific highlights

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### Hot



**Brazil sees the light.** Brazil has already awarded more than 3GW of renewables capacity this year, with 15GW of wind and 3GW of solar projects registered for November's A-3 auction and more than 20GW of renewables projects competing in December's A-5 tender. With average wind prices less than US\$50/MWh, this is a welcome result for the fledgling solar sector, along with possible solar-only auctions as early as next year. More than 150 companies have entered the market in anticipation of a solar boom, though Government support remains critical.

**France finances transition.** The introduction of a carbon tax and nuclear levy as part of a new energy transition law, scheduled for early 2014, will help fund the annual €20b (US\$27b) per year required to boost renewables and energy efficiency. The carbon tax will not impact households' transport or heating costs, or industrial companies already covered by the EU's emissions trading scheme, while the nuclear levy will be applied to profits generated by the country's 19 nuclear power plants.

**US green bank bonanza.** September saw the official launch of New York's first green bank, using "limited state resources" to leverage at least US\$1b in private investment for clean energy projects. The first investments are due in early 2014, with an initial US\$165m of public funds providing loan guarantees and package loans for resale into the secondary market to help overcome capital constraints and push private lenders into the market. If successful, this public-private partnership model may be implemented across other states.



**Australia swings its axe.** Australia's new Conservative Government has published draft legislation to abolish the country's carbon pricing mechanism from 1 July 2014. Since September, it has also abolished the independent Climate Change Commission and vowed to close the green development bank, despite reports of profitable trading after just four months. The Labour Party and the Greens hold the balance of power in the Senate, making the passage of the law before July unlikely, though the legislation could be applied retrospectively.

**German pressures mount.** Chancellor Angela Merkel remains in coalition talks with the Social Democrats after negotiations with the Green Party failed in mid-October. While such a deal improves clean energy prospects relative to the previous coalition, prolonged uncertainty continues to slow momentum in the sector. Pressure to end renewables subsidies is also mounting from energy sector lobbying and a further 18% increase in the consumer surcharge used to finance renewables support, despite the fact that direct subsidization costs represent only a portion of that increase.

**UK energy squabbles.** Political point-scoring over rising energy bills has intensified energy policy tensions across the various parties, leaving the renewables sector in a state of heightened uncertainty. A controversial pledge by Labour to freeze energy prices in 2015 (a precursor for a more centrally planned energy market perhaps), a Conservative vow to cut consumer bills by reining back several green energy initiatives and the Liberal Democrats' fierce disagreement suggests unharmonious times ahead.

### Not

# Key developments

## Deal, investment and policy highlights

Offshore wind has dominated high-value deal activity in recent months, with highlights including the following.

**Venture to dominate.** Vestas Wind Systems and Mitsubishi Heavy Industries will form a 50:50 JV in March 2014 that will see the Danish turbine manufacturer finalize its V164-8.0MW turbine in return for a cash injection of €100m, plus another €200m subject to milestone achievements. Vestas will also transfer its V112 offshore order book, existing offshore service contracts and approximately 300 employees to the JV, while Mitsubishi has the option to expand its share to 51% in April 2016. The venture is expected to become a dominant force in the sector.

**Learning the ropes.** Japanese trading company Marubeni is keen to locate itself in all stages of the offshore wind value chain, with October seeing the acquisition of a 25% stake in Irish developer, Mainstream Renewable Power, for €100m (US\$136m). Marubeni is seeking to broaden its development expertise by working with Mainstream, which has developed more than 19GW in seven countries. In August, the Japanese conglomerate also purchased a 50% share of 3.3GW of GDF Suez's Portuguese energy assets for around €400m (\$531m).

**Institutional investors lead the way.** Goldman Sachs is to acquire a 19% stake in Dong Energy, the world's largest offshore wind operator and Denmark's largest utility, for DKK8b (US\$1.5b). The deal will see equity injections from pension funds ATP and PFA for 5% and 2% stakes respectively, helping Dong bolster its balance sheet. The state will retain 60% of the business, and indications are that an IPO will be sought when "conditions are right."

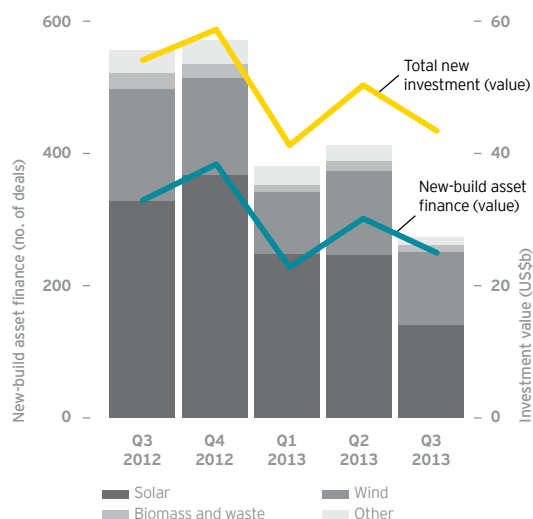
**Large-scale triumph.** Abu Dhabi's state-owned renewable energy developer Masdar has finally reached financial close on its 20% stake in the London Array offshore wind project. The scale and complexity of the project makes this a milestone for the sector, though Masdar's CEO has warned that greater collaboration with institutional investors is still required. The refinancing was provided by Bank of Tokyo-Mitsubishi, KfW, Siemens and Sumitomo Mitsui, plus a £58.6m (US\$93.8m) loan from the UK Green Investment Bank.

**Sharing an interest.** In other news, the European Commission unveiled in September the list of 250 energy infrastructure projects categorized as "projects of common interest" that could be eligible to share €5.85b (US\$7.93b) of funding and benefit from accelerated licensing procedures. The initiative aims to expand trans-European energy infrastructure in the period 2014 to 2020 to help Member States integrate their energy markets and also facilitate the uptake of increasing volumes of renewables capacity.

## New clean energy investment worldwide, Q3 2013

New clean energy investment in Q3 totaled US\$45.9b, a 14% reduction on Q2, making it almost certain that 2013 will mark the second consecutive annual reduction in new investment. This can be attributed in large part to reduced European subsidies and cheap US gas, but also falling technology costs.

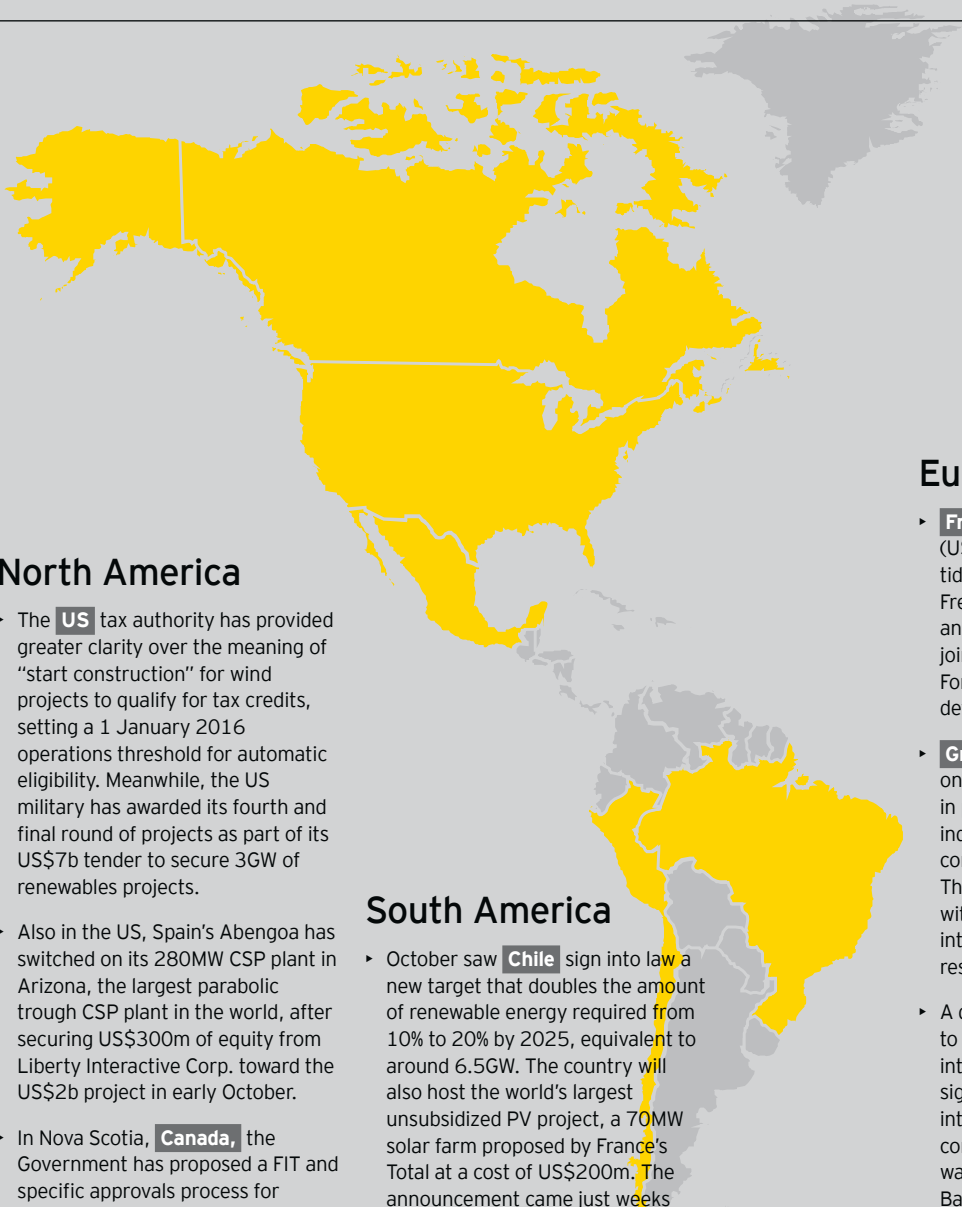
Projections also indicate that solar installations will exceed wind for the first time this year, in part due to the falloff in the US market after the late extension of the production tax credit at the end of 2012.



Source: BNEF project database and *Global trends in clean energy investment* – Q3 2013 fact pack, BNEF, October 2013. Values include BNEF estimates for undisclosed deals.

# Global view

Some markets are revising their strategies; others are executing them on a large scale.



## North America

- ▶ The **US** tax authority has provided greater clarity over the meaning of “start construction” for wind projects to qualify for tax credits, setting a 1 January 2016 operations threshold for automatic eligibility. Meanwhile, the US military has awarded its fourth and final round of projects as part of its US\$7b tender to secure 3GW of renewables projects.
- ▶ Also in the US, Spain’s Abengoa has switched on its 280MW CSP plant in Arizona, the largest parabolic trough CSP plant in the world, after securing US\$300m of equity from Liberty Interactive Corp. toward the US\$2b project in early October.
- ▶ In Nova Scotia, **Canada**, the Government has proposed a FIT and specific approvals process for large-scale tidal power projects as part of its goal to develop 300MW by 2022. Rates are yet to be announced, but the scheme would complement the existing community FIT program for small-scale tidal stream projects receiving C\$652/MWh (US\$624).

## South America

- ▶ October saw **Chile** sign into law a new target that doubles the amount of renewable energy required from 10% to 20% by 2025, equivalent to around 6.5GW. The country will also host the world’s largest unsubsidized PV project, a 70MW solar farm proposed by France’s Total at a cost of US\$200m. The announcement came just weeks after SunEdison reached financial close on its 100MW Amanecer Solar CAP plant, slated to be Latin America’s largest PV plant once complete.
- ▶ For **Brazil**, see our “Key developments” on page 10.

## Europe

- ▶ **France** has launched a €120m (US\$163m) tender for four pilot tidal projects totaling 80MW, with French engineering giant Alstom and developer GDF Suez already joining forces to bid in the auction. For policy updates, see our “Key developments” on page 10.
- ▶ **Greece** has approved a new levy on energy generators to fund a cut in power prices for energy-intensive industries in exchange for reduced consumption during peak hours. The residential sector fared better with the approval of a bill to introduce net metering for residential-scale solar projects.
- ▶ A deal between **Ireland** and the UK to export wind power via subsea interconnectors is now unlikely to be signed until next year, as opposition intensifies across some Irish communities. But confidence is not waning everywhere; Allied Irish Bank confirmed a €200m (US\$272m) fund to be co-invested with the European Investment Bank (EIB) in Irish wind projects.
- ▶ In October, the EIB also provided a boost to small- and medium-scale renewable energy and energy efficiency projects in **Italy**,

## Europe (continued)

approving a framework loan with UniCredit of €400m (US\$541m).

- ▶ **Norway** has been given the green light to build eight new wind farms, totaling 1.3GW and requiring around US\$3.3b of investment, in a bid to double the country's wind power capacity by 2020.
- ▶ **Poland** has released revised proposals for an overhaul of the renewable energy support scheme that would see competitive tenders replace the current GC mechanism

by 2021, though reactions have been mixed. (See our article on page 30.)

- ▶ In **Spain**, an already battered industry has been hit with a draft bill proposing to make consumers pay for self-generated and consumed clean power, making it more expensive than electricity from the grid.
- ▶ The **UK's** planning inspectorate has accepted Forewind's application for the 2.4GW Dogger Bank Creyke

Beck wind farm, slated to be the largest in the world. Meanwhile, Europe's largest tidal turbine energy project has been approved in Pentland Firth, with work to begin on the first 9MW of the 86MW project. The UK also announced new sustainability emissions criteria that will be applied to support for biomass from April 2015. For policy tensions, see our "Key developments" on page 10.

- ▶ For **France** and **Germany**, see our "Key developments" on page 10.

## Asia-Pacific

- ▶ Solar manufacturers in **China** will receive a 50% tax break on the sale of solar power from 1 October 2013 to December 2015, while a tariff of CYN0.42/kWh (US\$0.07) has been introduced for distributed solar projects up to 6MW to reduce strain on the grid. New solar sector consolidation measures include imposing a ban on solar factory expansions and requiring at least 3% of annual revenue to be spent on R&D. In non-solar news, the Government has resumed its offshore wind program after three years.

- ▶ **India** has launched a national tender for 750MW of solar capacity and unveiled plans for a 4GW solar project in Rajasthan state. The country is starting to roll out investment of almost US\$8b on grid expansions and also recently confirmed plans to create a National Offshore Wind Energy Authority to boost the nascent sector. (See our article on page 22.)

- ▶ **Japan** is to build the world's largest grid electricity storage system and has requested an additional US\$500m in next year's budget to strengthen the power grid, help ease transmission constraints and facilitate 22.4GW of approved renewables capacity since July 2012. Meanwhile, the country's state-sponsored 2MW experimental floating offshore wind project has reached the first stage of completion.

- ▶ For **Australia**, see our "Key developments" on page 10.

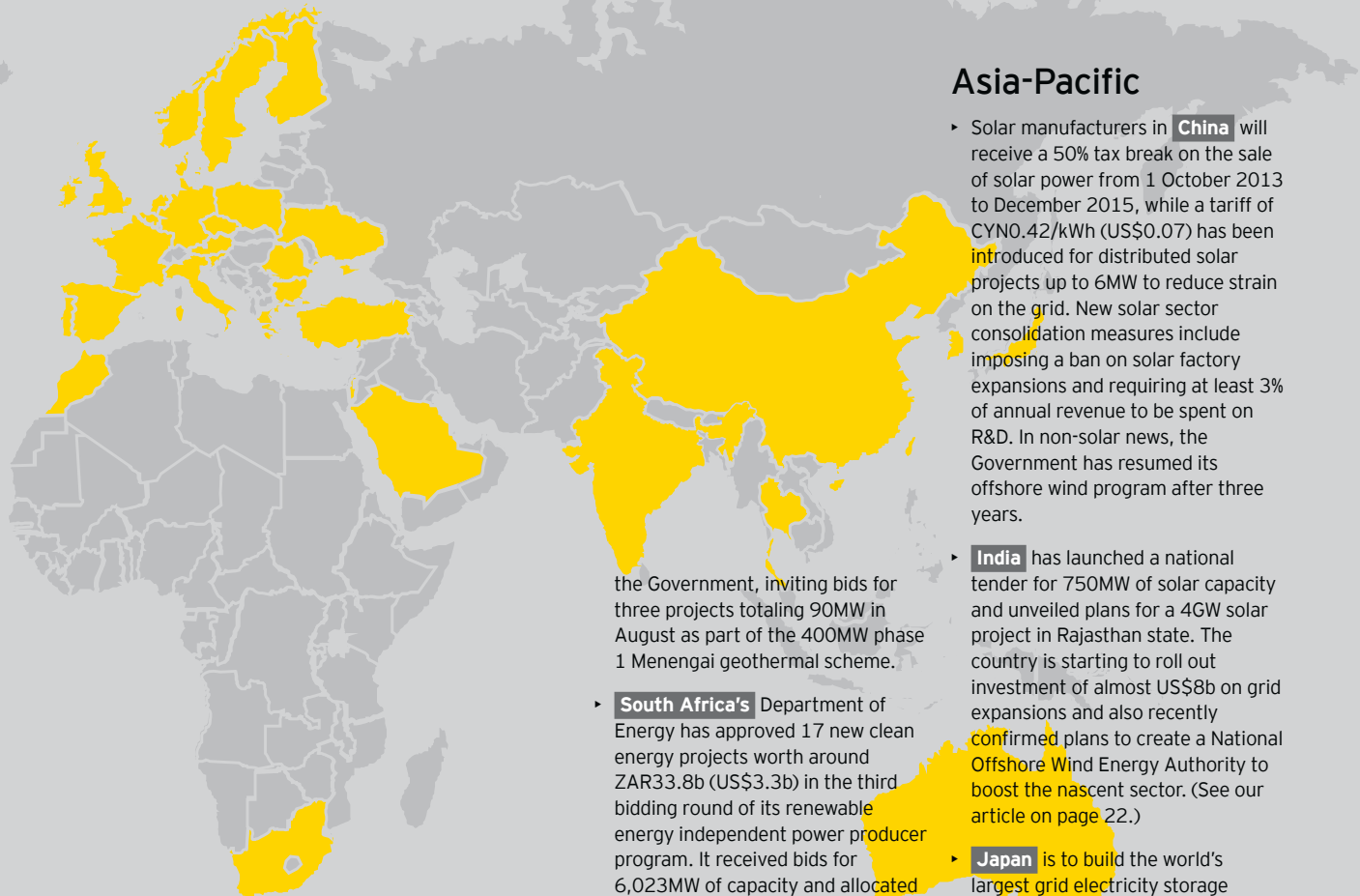
the Government, inviting bids for three projects totaling 90MW in August as part of the 400MW phase 1 Menengai geothermal scheme.

- ▶ **South Africa's** Department of Energy has approved 17 new clean energy projects worth around ZAR33.8b (US\$3.3b) in the third bidding round of its renewable energy independent power producer program. It received bids for 6,023MW of capacity and allocated 1,456MW, comprising seven wind projects, six solar projects (including two CSP facilities), one biomass and one landfill gas project.

- ▶ **Ghana** and **Kazakhstan** have become the latest countries to adopt FITs for a range of renewable technologies, with the latter in particular receiving significant backing from the European Bank for Reconstruction and Development (EBRD).

## Middle East and Africa

- ▶ **Kenya's** fledgling wind sector received a boost as US\$150m in financing was secured to develop the 61MW Kinangop Wind Park. Piedmont Investments Ltd agreed to invest US\$62m in a 31MW plant in Nairobi and China's Dongfang Electric International is looking to develop a 50MW plant. Meanwhile, geothermal remains a hot topic with



# Our index

## RECAI scores and rankings at November 2013

(See page 34 for individual technology indices.)

Rank	Previous ranking	Country	RECAI score	Macro drivers			Energy market drivers			Technology-specific drivers		
				Macro stability	Ease of doing business	Total	Prioritization of renewables	Bankability of renewables	Total	Wind	Solar	Other technologies
1	(1)	US	74.7	65.0	70.8	68.5	57.7	78.5	70.2	70.9	75.6	51.7
2	(2)	China	71.6	66.8	45.9	54.2	58.4	64.0	61.7	77.2	80.5	53.4
3	(3)	Germany	68.1	75.7	61.4	67.1	74.0	73.3	73.6	58.8	58.4	43.4
4	(4)	UK	62.3	79.0	75.0	76.6	61.9	69.5	66.5	58.5	42.1	35.0
5	(5)	Japan	62.2	72.7	61.0	65.7	65.7	70.1	68.3	42.9	58.5	50.1
6	(6)	Australia	60.3	82.3	71.5	75.8	54.9	64.9	60.9	44.9	57.2	33.7
7	(8)	France	58.0	71.2	60.4	64.7	56.0	63.3	60.4	49.4	47.8	39.7
8	(7)	Canada	57.9	80.6	73.2	76.2	48.8	61.9	56.7	51.6	42.7	45.9
9	(9)	India	57.3	52.5	36.7	43.0	59.1	53.8	55.9	49.9	64.4	44.8
10	(12)	South Korea	53.6	67.6	61.4	63.9	60.6	55.3	57.4	40.9	44.2	40.1
11	(11)	Belgium	53.1	69.0	77.4	74.0	60.9	57.4	58.8	42.7	37.5	28.2
12	(10)	Italy	53.0	47.5	44.0	45.4	68.4	64.2	65.9	36.4	47.0	41.5
13	(14)	Denmark	52.8	78.6	72.6	75.0	62.5	60.5	61.3	46.6	29.0	27.9
14	(15)	Brazil	52.6	53.0	37.6	43.8	49.6	54.3	52.4	47.5	47.2	57.0
15	(16)	Chile	52.2	77.2	72.9	74.6	66.3	53.4	58.6	32.4	44.6	33.1
16	(18)	Netherlands	51.9	75.1	61.1	66.7	64.5	61.3	62.6	43.6	31.5	27.2
17	(17)	Portugal	51.4	46.8	65.0	57.8	68.4	58.8	62.6	37.6	38.4	33.9
18	(19)	Sweden	51.2	83.4	73.8	77.6	64.3	63.9	64.1	44.6	20.2	37.5
19	(13)	Spain	50.2	53.2	55.9	54.8	56.7	67.0	62.9	33.3	43.7	20.6
20	(20)	South Africa	49.7	61.2	61.3	61.3	43.2	49.2	46.8	36.6	53.2	24.2
21	(21)	Austria	48.8	72.4	67.2	69.3	69.0	57.1	61.9	32.3	31.8	33.6
22	(22)	Taiwan	48.3	71.1	63.0	66.2	48.6	51.0	50.0	33.7	43.0	29.8
23	(26)	Thailand	47.9	58.0	68.8	64.5	49.9	52.6	51.5	26.2	49.6	26.2
24	(24)	Turkey	47.7	53.2	50.9	51.8	50.8	49.6	50.1	42.3	35.9	36.6
25	(23)	Poland	46.5	66.2	54.2	59.0	62.8	55.6	58.5	39.2	24.3	29.2
26	(27)	Peru	46.4	61.8	66.2	64.4	39.9	56.6	49.9	24.3	44.3	41.3
27	(25)	Ireland	45.9	66.8	72.1	70.0	67.8	60.0	63.1	41.7	12.7	27.0
28	(28)	Norway	45.6	79.2	74.0	76.0	49.4	58.9	55.1	42.9	12.8	36.7
29	(28)	Finland	45.3	80.4	70.2	74.3	61.8	59.5	60.4	42.7	10.1	28.0
30	(30)	Mexico	45.2	56.7	57.4	57.2	44.5	49.8	47.6	36.1	36.1	26.4
31	(30)	Israel	45.0	69.6	67.6	68.4	56.7	52.6	54.3	19.6	46.3	14.6
32	(32)	Morocco	44.3	52.7	44.7	47.9	55.4	38.2	45.1	35.6	45.2	10.2
33	(33)	Romania	44.2	50.8	49.5	50.0	55.1	49.6	51.8	33.9	34.2	22.9
34	(37)	Greece	43.8	36.7	43.1	40.6	61.9	40.9	49.3	30.6	44.5	22.9
35	(34)	Bulgaria	40.8	56.0	55.4	55.7	55.0	38.5	45.1	28.1	33.7	22.3
36	(40)	Ukraine	40.5	37.2	32.9	34.6	43.3	35.8	38.8	35.7	42.4	26.5
37	(35)	Czech	40.4	62.0	55.3	58.0	58.2	47.6	51.8	24.4	28.7	23.6
38	(38)	Saudi Arabia	39.8	64.4	70.0	67.8	34.2	41.5	38.6	18.4	49.4	2.4
39	(36)	Slovenia	39.7	56.5	53.1	54.4	61.5	47.3	53.0	20.9	29.5	28.8
40	(N/A)	Kenya	39.6	44.6	39.2	41.4	53.0	28.7	38.4	31.1	38.5	31.8

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# Index highlights

The top six countries remain unchanged this issue, but a score reduction for **Germany** could destabilize its third-place ranking if a positive coalition agreement is not reached soon. In the **UK**, policy uncertainty – though offset by increased financing activity and improved solar forecasts this issue – could also jeopardize its future position in the index.

**Australia** has held on in sixth position after dropping two places last issue, although its ability to stay there will largely depend on the outcome of the carbon pricing debate, as a victory for Prime Minister Abbott could also put the country's Renewable Energy Target in danger.

Meanwhile **France** and **Canada** battled it out for seventh and eighth place, with both announcing new support regimes for tidal power projects in Q3. It was France, however, that secured the higher spot thanks to a proposed carbon levy and a cap on nuclear-power capacity next year as part of its much-awaited energy transition law.

**Italy** and **Spain** have plummeted down the rankings this issue to 12th and 19th place respectively, as severe support reductions announced over the last 6-12 months begin to impact capacity projections in our four- to five-year outlook. Weak investment climates and damaged confidence in these markets supports these lower rankings in the short term.

**South Korea** has jumped to 10th place thanks to improved wind and solar forecasts in our outlook period, triggered by nuclear shutdowns and the ambitious emissions trading scheme under development.

**Brazil** and **Chile** have both climbed one place to 14th and 15th place respectively. The success of Brazil's 2013 power auctions, and particularly the potential for solar-only auctions as early as next year, is creating a healthy 2014 to 2018 project pipeline. Chile's continued climb up the rankings also reflects strong capacity forecasts and high levels of deal activity, also supported by its recently increased renewable energy targets.

Uplifts for **Sweden** and the **Netherlands** reflect increased levels of high-value deal activity and strong investment climates, with the Netherlands completing two new build asset finance deals worth almost US\$650m, while Sweden saw the sale of hydropower generator Kraftgarden AB by Dong Energy for around US\$770m.

Further down the index, **Thailand** and **Peru** have jumped to 23rd and 26th place respectively, with Peru benefiting from a sovereign credit upgrade and increased solar capacity forecasts. Thailand's uplift reflects more ambitious renewable energy targets and increasing levels of Government support, leading to a greater pipeline for wind and solar projects.

**Poland** has fallen two places to 25th position following the Government's latest proposals to switch to an auction system. While a tender system could boost attractiveness in the long run, prolonged uncertainty and reduced project activity have contributed to its current fall in the rankings.

**Ireland** has also slipped two places. While current levels of wind activity remain robust, claims that the country will not clinch a deal with the UK for the export of wind power until next year has dampened forecasts in the outlook period. The lack of a solar market, current or projected, is also preventing Ireland from rising up the rankings.

Toward the bottom of the index, **Greece** has jumped up three places due to significant improvements in its macroeconomic outlook and a healthy increase in the number of new-build asset finance deals. However, Greece will struggle to rise farther up the index without more consistent support for renewables and a stronger project pipeline.

**Bulgaria** and **Czech Republic** slip down to 35th and 37th position respectively as the impact of severe subsidy reduction programs flows through to a weaker project pipeline.

**Slovenia** falls to 39th place to reflect a weakening finance market and low forecast capacity. **Ukraine** gets a boost to 36th place from 40th, partly due to neighboring movements but also its relatively stable support mechanisms, the recent approval of electricity market reforms and improved solar forecasts.

This issue we welcome **Kenya** into the index, entering at 40th position but expected to climb in the months ahead. Kenya has huge resource potential and a stable FIT regime. The country is already establishing a healthy project pipeline and is expected to become a hub for significant investment activity in the East Africa region.

Kenya's entry comes at the expense of **New Zealand**, moving out of the index after seven years with a lack of formal incentives and an energy surplus stimulating limited interest in the country's renewables market.

For information on the RECAI methodology, please visit [www.ey.com/recai](http://www.ey.com/recai).

# 1

## Finance market



### IPOs: the latest fad or here to stay?

This year has seen a resurgence in renewable energy IPOs, with public offerings coming at the fastest rate since 2010. Ironically, for a sector that has seemed so risky for so long to stock markets, the fuel driving many of these IPOs is the promise of reliable income.

Renewable energy companies went public in the UK, the US, Brazil, New Zealand and Canada, with the total raised in excess of US\$4b. And with two more major IPOs (in New Zealand and the UK) under way as *RECAI* went to press, the total might well reach US\$6b by the end of the year.

### London calling

It all started in March with Greencoat UK Wind plc's public offering, which raised £260m (US\$415m) on the London Stock Exchange and in many ways has typified the majority of this year's renewable energy IPOs.

Greencoat is a renewable infrastructure fund that sought to raise money to buy renewable energy generation assets and that offered investors the promise of a reliable dividend, effectively underwritten by the power purchase agreements (PPAs) applying to those assets. Greencoat's pledge of 6% returns looked very attractive to institutional investors at a time when UK gilts were below the 2.5% mark – and to retail investors, faced with bank returns that were not much better.

Two similar London-based renewable energy infrastructure IPOs followed in July: Bluefield Solar Income Fund raised £130m (US\$208m) with its offer of 4%, rising to an inflation-protected 7% in the year after launch, and The Renewables Infrastructure Group saw its IPO raise £300m (US\$479m) with a 6% dividend. Late October saw asset manager Foresight Group LLP raise £150m (US\$240m) for its solar power investments fund, less than the targeted £200m (US\$319m) but also with a 6% return.

The same approach has been seen across the world in New Zealand, where the partial float of Mighty River Power, with its predicted 6%-7% return, raised NZ\$1.7b (US\$1.4b). In the US, Pattern Energy Group raised US\$352m (the country's first wind IPO) and promised investors a 6.25% return. In the US, Pattern Energy Group raised US\$352m (the country's first wind IPO) and promised investors a 6.25% return, while NRG Yield's US\$431m IPO in July made it one of the top 20 IPOs worldwide in Q3.

These public offerings all have a very different flavor from the aggressive growth propositions put to public markets in early flotations of renewable energy companies, which largely ended in tears as clean energy stocks lost 46% of their value across 2011 and 2012 and reached a nadir of 78% below 2007's pre-crash values.<sup>1</sup> Since mid-2012, clean energy stocks have rallied, with the NYSE Bloomberg Solar Index of 102 companies appreciating 65% between December 2012 and August 2013.

But even taking improving market conditions into account, the enthusiasm with which these successive IPOs have been greeted is remarkable, and it seems that investors' appetites for steady returns in an era of record-low interest rates outweighs desires for high-risk-high-reward stocks.

Julien Dumoulin-Smith, an analyst at UBS Securities LLC in New York, says: "Over the last few years, there has been a desire for a yield-oriented vehicle, and one just frankly has not existed in the power space."<sup>2</sup>

### The YieldCo phenomenon

Several of the IPOs used a "YieldCo" model, in which a new vehicle is set up specifically for the IPO, with the sole purpose of acquiring renewable energy generation assets with long-term offtake contracts in place. If properly structured (see breakout on page 17), these YieldCos make effective revenue-delivery mechanisms that investors find simple to understand and, evidently, attractive. "There's really nothing out there that has more predictable cash flows than a solar farm contracted by an investment-grade utility," says Brandon Blossman, an analyst at Houston-based Tudor, Pickering, Holt & Co.<sup>2</sup>

1. WilderHill New Energy Global Innovation Index, *Global trends in renewable energy investment 2013*, UNEP and BNEF, June 2013.

2. "IPO Boom Grows in Renewables as Dividend Yield Beat Bonds," Bloomberg, 2 August 2013.



**This wave of IPOs appears to be based on robust foundations, indicating a potentially sustainable source of capital.**



Sometimes the YieldCo is used by a utility to put some of its generation assets to work. Greencoat, for example, was created with agreements to buy specific wind-power assets from RWE AG and SSE plc, although it has recently also bought two wind farms in eastern England owned by BayWa of Germany. Other YieldCos are built from scratch, with the aim of picking up generation assets once the IPO is completed. Bluefield, for example, has recently bought its first solar farms from Solar Century and Ikaros.

The YieldCo IPO model is particularly attractive for a renewable energy company that wants to raise fresh and relatively cheap capital while keeping its development arm (potentially funded instead by venture capital or private equity) away from the public markets. “The 10-year closed-end structure was born in the private equity world and was perfectly suited to that, but it’s utterly unsuited to long-term asset ownership,” says Laurence Fumagalli, a partner at Greencoat Capital LLP, which manages the Greencoat fund.<sup>3</sup>

## Will the bonanza last?

A solid and reassuring yield shines strongly in dark times but might fade in the bright light of proper recovery as rates of return from reasonably safe investments may start to deliver better results than renewable energy generation yields. Some types of institutional investors, such as pension funds, or others with defined liabilities to manage, will continue to value long-term predictability of cash flows (and with it some form of indexation) over higher returns, but the renewable energy yield stock always depends on developers’ ability to supply reliable and bankable generation assets. It remains to be seen how dependent the future success of listed YieldCos is on continued government policy that provides the foundation for a reliable income stream.

In the medium to long term, as the renewable energy market reaches grid parity and is no longer hostage to the uncertainty of government-controlled tariffs, it seems likely that the public equity markets will once again start to believe in the renewable energy supply chain and fast-growing and profitable development companies.

## Effective IPO tax structuring

The tax structure of a YieldCo should be determined early on in the planning stage, as soon as its commercial objectives are clarified. A good YieldCo structure should:

- ▶ Be easily understood by investors, offering flexibility to facilitate investment and provide a regular dividend yield. An understanding of the tax and accounting profile of the seed assets is key in ensuring that funds can flow through the structure to deliver the yield.
- ▶ Minimize tax leakage on the flow of funds from investments to the listed entity, benefiting the fund and its shareholders by considering the different jurisdiction tax rules where seed assets are geographically dispersed.
- ▶ Utilize tax assets generated by the investments against other profits of the group and maximize tax relief and VAT recovery on float or acquisition costs.
- ▶ Maximize deductions for interest payments, as acquiring seed assets that go into the structure is often done through debt finance structures. This can be a complex area, so early consideration is important.
- ▶ Be easy to maintain and generate minimal annual running costs, if planned effectively and properly set up.

3. “Greencoat Taps \$63 Billion Wind Assets in U.K. IPO,” Bloomberg, 14 February 2013.

# 2

## Transactions market



### Pension funds: waking the giant

#### Digging deep: a pocket of opportunities

Renewable project developers are looking for investors with deep pockets. With many banks no longer willing or able to provide long-term non-recourse debt to renewable projects – especially in light of Basel III capital requirements – and utilities laboring under weak balance sheets, traditional project financing is hard to come by. Of necessity, developers are increasingly turning to other kinds of deep-pocketed investors to fund their projects, such as sovereign wealth funds, export banks, insurance funds and large corporations.

Pension funds would seem to be good candidates to join the ranks of new capital sources stepping in to bridge the funding gap in the renewables market. Deep pockets they certainly have. With pension funds managing approximately US\$28t in assets globally, only mutual funds surpass them in resources.

What's more, the long-term predictable yields offered by projects based on mature solar and wind technologies fit the pension funds' desired investment profile very well. As a result, pension funds are the object of rising hopes among the renewable energy industry for their emergence as a significant new capital source.

#### Setting a precedent

These hopes have been stoked by a recent spate of pension fund deals and announcements, driven in large part by the desire to improve returns in a period of low bond yields.

PensionDanmark, the €20b (US\$27b) Danish retirement fund, has been at the vanguard, having made several investments in wind assets in Europe and the US over the past few years, including a US\$200m commitment in June 2013 to Cape Wind, the first US offshore wind project.

Another Danish pension fund, Industriens Pension, took a 22.5% stake in the €1.3b (US\$1.8b) Budentiek offshore wind project in Germany at the beginning of this year.

The Dutch pension fund PGGM Investment, with some €130b (US\$178b) under management, has also taken an advanced position on renewables, allocating 15%-20% of its infrastructure portfolio to renewable energy.

In January, it participated in the first offshore wind deal by the UK's Green Investment Bank, the £224m (US\$390m) refinancing of OPW's stake in the 367MW Walney wind farm.

In Canada, pension fund manager Caisse de dépôt et placement du Québec made a US\$500m equity investment in January in 13 wind farms owned by Chicago-based Invenenergy Wind LLC Borealis.

South Africa's Pension Investment Corporation, which invests on behalf of the Government Employees Pension Fund, announced in September that it would allocate ZAR2.3 billion (US\$222m) to renewable energy as part of a broader infrastructure development program.

#### Waking the pension fund giant

While transactions and announcements such as these contribute to a slow drumbeat of progress, in the context of the US\$198b in renewable asset financings completed in 2012 (on the basis of BNEF market size data) and the multitrillion-dollar pension holdings, it hardly represents an overwhelming embrace of the renewable generation asset class.

To be fair, it's not that pension funds have been unaware of renewables opportunities; rather the investments and the format in which they have been presented have not suited the funds to date, and readily available project financing had negated the need for their capital. But these reasons for inactivity are quickly dissipating as developers desperately seek new capital sources, and so pension funds – faced with dismal returns elsewhere – are now waking up to the real potential of renewable investments.

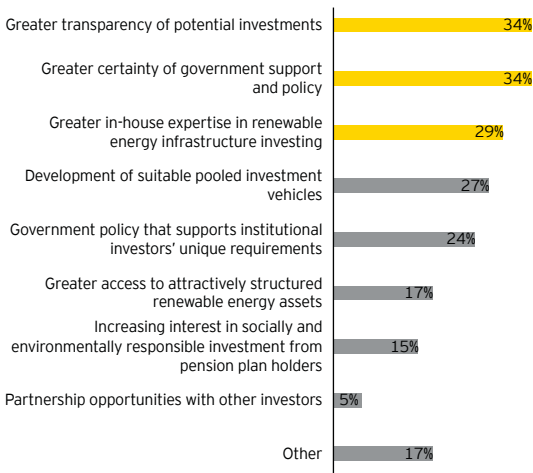
To gain insight into this increasing trend and others related to institutional investment in renewables, EY recently completed a global survey of 75 European and North American pension and insurance funds. The responses of the 31 participating pension funds specifically are illuminating. For pension funds, the top three drivers of renewable energy infrastructure investment are:

1. Greater transparency of potential investments
2. Greater certainty of government support and policy
3. Greater in-house expertise in renewable energy infrastructure

# Pension funds can overcome the lack of renewable expertise by forming consortia to pool money and centralize deal origination.



## Pension funds: drivers for renewable energy infrastructure investments



The issue of transparency relates to the lack of visibility into the projects themselves and the specific risks that vary from project to project. Furthermore, renewable energy is relatively young and lacks the long-term historical performance data that is available for other asset classes. Pension funds would be more likely to invest with an ability to predict asset performance with greater confidence.

Pension funds recognize that the majority of renewable projects depend on government support for economic viability. Yet government support for renewables has been anything but constant. Whether retroactive tariff cuts in Spain and Greece, the frequent cycles of tax credit jeopardy in the US or the ongoing review of renewable supports in a number of countries, instability in government support undermines the ability of pension funds to find predictable, long-term returns in renewables.

Renewables are but a sliver of the infrastructure asset class, which itself is typically only a small percentage of pension fund assets. This makes it difficult for typically sparse pension fund teams to justify developing in-house expertise for prospective investments. As a result, renewable investments, which would really build expertise, are not made.

## So what is to be done?

Several approaches suggest themselves for addressing the risk and knowledge issues highlighted in our survey of pension funds.

It will be important to craft financial vehicles to suit the investment requirements of pension funds. The Greencoat UK Wind listing this year offers institutions the ability to invest in renewable energy projects without the time constraint of venture capital or private equity funds. It seeks to provide investors with a steady income stream over the long term and conveniently packages the investment in the form of listed equities, to which pension funds allocate a significant proportion of their capital.

Developers with a strong track record and robust pipeline of projects can consider approaching pension funds directly with tailored development plans that are executed through direct partnerships or joint ventures. Dong Energy has pursued this approach with PensionDanmark, for example, as well as with other corporate and financial players.

Pension funds can overcome the conundrum of lack of renewable expertise by forming consortia to pool money, share resources and centralize deal origination. The UK Pensions Infrastructure Platform, a new infrastructure fund "for pension funds, by pension funds" subscribed to by 10 major corporate and public sector pensions, is a good example of this approach.

Lastly, and most importantly, the renewable sector must increasingly offer projects that are financially compelling on an unsubsidized basis and are able to compete with other asset classes for pension fund capital. Continuing to lower the price of renewable energy equipment, reducing installation costs and improving efficiencies are important aspects of the solution.

# 3

## Policy and regulation



### EU protectionism: a shot in the arm or a shot in the foot?

If certainty creates a strong platform for sensible business planning, then Europe's solar industry faces a very rough ride over the next two years.

The future business landscape for the sector will be shaped by the settlement of the trade dispute that started last year, when the EU launched separate investigations into accusations that Chinese solar manufacturers were dumping product into Europe below cost price and that they were in receipt of market-distorting levels of subsidy.

The EU Commission concluded that the dumping claims were valid. But its plans to slap an average 47% punitive duty on Chinese solar modules, cells and wafers were heavily watered down after a revolt by EU Member States, amid extensive country-level lobbying by China and fears of an escalating trade war. The resulting negotiated "price undertaking" proposes minimum prices for Chinese-made modules and cells, reported to average €0.56 (US\$0.74) per watt for modules, with an annual import cap of 7GW, i.e., broadly pegged at the 2012 level of Chinese module imports into Europe. The undertaking would last until the end of 2015.

### The waiting game

The solar industry has been waiting for confirmation of the final deal for months, and many elements could change before the planned announcement on 5 December. It seems that wafers will be removed from the undertaking, the import cap levels for modules and cells may change in the light of new forecasts of solar developments in Europe, and the second Commission inquiry may conclude that European manufacturers have been damaged more by illegal subsidies than by dumping and toughen any or all of the terms of the undertaking.

But even after the final deal is revealed, it may change shape. The agreement can be updated at any time (with six months' notice) to reflect changes in panel pricing or European consumption of solar energy. And there is a pending legal challenge in the EU General Court from ProSun, the association lobbying on behalf of some European solar manufacturers; hearings are not expected to start until next year. If European manufacturers are successful in changing the agreement through the Court, it could encourage Chinese manufacturers to launch disruptive challenges of their own.

### Unanswered questions

In the meantime, European developers and installers still have no firm idea what their preferred suppliers will be charging for modules and cells come 2014, as each of the 97 Chinese manufacturing organizations that have signed up to the undertaking will be given their own individual price floor. How big will the spread of prices be? Will some Chinese suppliers be significantly cheaper than others? Nobody knows.

Also, the decision as to which Chinese manufacturers will be allocated an import quota is being taken not by the Commission, but by the China Chamber of Commerce for Import and Export of Machinery and Electronic Products (CCCME), a Government-backed organization. Which suppliers will get a piece of the action come 2014? Nobody in the European industry can be certain.

### Price undertaking? Thank you!

One thing that is certain is that the price undertaking has handed Chinese manufacturers a very welcome boost to their margins. After years of reducing prices as European governments trimmed back their tariffs, China's manufacturers will get guaranteed and fixed prices for their product for two years, with Europe's installers and developers picking up the tab for what is essentially a European subsidy for Chinese industry. As Hanwha SolarOne's CEO, Ki-Joon Hong, told his shareholders in September, "With the EU and China having reached agreement on import duties, we believe our market allocation and higher pricing will lead to good opportunity."<sup>1</sup>

Indeed, China's big seven – Yingli Green Energy, Suntech Power, Trina Solar, Canadian Solar, Jinko Solar, JA Solar and Hanwha SolarOne – have a lot to gain from the deal. Analysts believe CCCME will use its allocation powers to favor the top players, squeezing smaller manufacturers out of European markets, as the Government looks for consolidation in China's solar production sector to reduce overcapacity.

<sup>1</sup> "Hanwha SolarOne Reports Second Quarter 2013 Results," Hanwha SolarOne website, <http://investors.solarfun-power.com/releasedetail.cfm?ReleaseID=789444>, 9 September 2013.

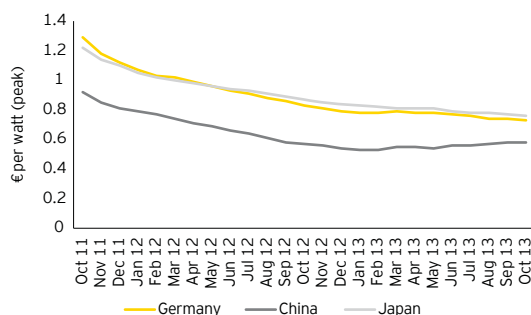
## Europe's solar industry faces two years of artificially frozen product prices, instead of a steady decline.



### Trying times for Europe

Considering that the trade dispute was all for the benefit of European manufacturers, the price undertaking deal is a case of too little, too late. Europe's solar manufacturers held a 19% share of the EU solar market in 2009; by 2012 that had slid to 13%. The new duties are not going to reverse the trend. Data from PVXchange (see the graph below) shows that the average German-manufactured module cost €0.73 in October 2013 – far from competitive with the average €0.56 mooted for Chinese imports under the price undertaking, despite Germany's advantages of being close to European customers, reducing transport costs and lead times.

#### Average domestic-manufactured crystalline solar module cost<sup>2</sup>



And even these advantages are set to be eroded. As some manufacturers from China are looking to manufacture within the EU, plans are likely to be hastened by a desire to avoid the new duties. Jinko Solar is considering setting up a factory in Portugal; ReneSola has already begun producing modules in Poland.

What is absolutely clear is that Europe's solar industry is facing two years of artificially frozen product prices, instead of the steady decline in price that has reliably characterized the market for years. It seems unlikely that other manufacturers can significantly undercut the Chinese importers, especially as they are already working busily to fill the gap in the US market, where punitive

tariffs against Chinese have led to non-Chinese solar suppliers making a huge profit. Taiwan's Neo Solar Power, for example, reported earning US\$444m in the first nine months of 2013, a 30% increase on the previous year's performance.

### The post-2015 cliff

The most damaging uncertainty is what is likely to happen to module prices once the price undertaking runs out at the end of 2015. Some analysts assume that prices will fall sharply. Photon Consulting, for example, forecasts that by 2017 prices in every significant EU marketplace will have dropped by an average of 18% compared with the 2015 price. Numbers like this are likely to lead to some developments being put on hold for the next two years. Navigant Research suggests that newly added EU solar capacity will drop from 2012's figure of 17.5GW to between 13GW and 14GW a year through to 2015, before increasing to more than 18GW once the price undertaking is lifted.

Paul Barwell, CEO of the UK's Solar Trade Association, states: "We're concerned that the deal reached by China and the Commission will ultimately achieve little, as German manufacturers are unlikely to be able to compete long-term with the Asian giants. Meanwhile in the short term, the proposals could do real damage to the UK downstream solar industry and to national deployment levels. They leave the UK non-domestic solar industry in a very difficult position, when in fact the UK is one of the major EU growth markets, and ought to remain so."<sup>3</sup>

It is often said that a good compromise is one that leaves all sides unhappy. But it seems that China and its manufacturers have many reasons to be pretty satisfied about the way this trade dispute has panned out, while the price for Europe is likely to be canceled or delayed renewable energy projects with consequential lost opportunities and jobs and artificially high prices for developments that do go ahead.

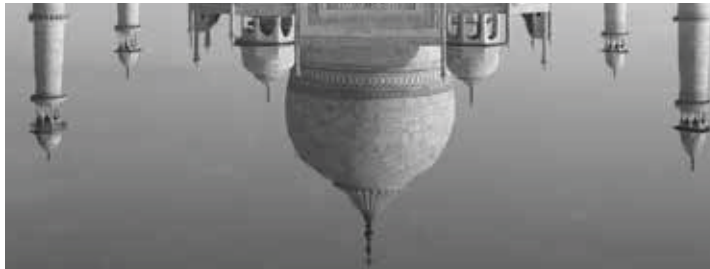
This is a salutary lesson that trade disputes are easy to start but hard to win and that protectionist measures can sometimes lead to unforeseen consequences that are far more damaging than the original supposed injury.

<sup>2</sup> Monthly price index, PVXchange website, [http://pvxchange.com/priceindex/Default.aspx?template\\_id=1&langTag=en-GB](http://pvxchange.com/priceindex/Default.aspx?template_id=1&langTag=en-GB).

<sup>3</sup> "UK Government must adjust either De Gucht solar plan or UK policy framework," Solar Trade Association website, <http://www.solar-trade.org.uk/news.cfm?id=201>, 29 July 2013.



# India



## Highlights

- ▶ **Round 2 of the National Solar Mission is under way, with 750MW on offer as the Government targets 10GW of solar capacity by 2017.**
- ▶ **Grants worth US\$303m covering up to 30% of project costs will be available to successful bidders.**
- ▶ **A public-led JV to develop 4GW solar plant in Rajasthan is slated to be the largest in the world.**
- ▶ **Reinstatement of generation based incentives for power sees 61% increase on cap for total support.**
- ▶ **New 15-minute wind forecasts could jeopardize 15% of revenue.**
- ▶ **Weak grid infrastructure gets a US\$6b boost.**

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**Ding ding, round two.** After a gap of almost two years, India has officially launched phase two of its flagship National Solar Mission, as part of its goal to install 10GW of solar capacity by 2017. The first round of phase two saw the Government invite bids for 750MW of capacity in early October, with submissions due by 29 November. The national program aims to reduce the cost of solar power to compete with other forms of grid-supplied electricity by 2017; the 2GW of current installed capacity has helped cut average costs by about 51% since the auctioning of licenses through the National Solar Mission began in 2010.

**Plugging the gap.** The new auction will see the Government offer a baseline tariff of INR5.45/kWh for projects with capacity 10MW-50MW. Developers will then submit bids for additional funds required – up to 30% of the project cost – in what will effectively be a reverse auction process, the winners being those needing the least funds. This additional support is part of the Government's new "viability gap" funding scheme that will offer around INR18.75b (US\$303m) in grants through the tender process. The Government will stagger disbursement of the grants, with 50% to be paid upon plant completion and the remaining via 10% increments to meet various generation targets.

**Local content restrictions or just restricting?** The latest auction also calls for 50% of the 750MW on offer to be met using domestically manufactured solar cells and panels, with developers permitted to compete in either or both of the open and domestic content categories. This requirement is not expected to have an immediate bearing on the current dispute with the US at the World Trade Organization over domestic content obligations under phase one of the solar mission, but it has still raised some concerns that the restrictions could raise costs and compromise quality given the current lack of a competitive PV manufacturing sector in India.

Rankings snapshot	Issue 39	Issue 38
Total RECAI	9	9
Onshore wind	9	10
Offshore wind	21	22
Solar PV	6	8
Solar CSP	4	4
Biomass	19	19
Geothermal	18	15
Hydro and marine	9	10

## A new decree requiring wind farms to forecast generation for the following day every 15 minutes could hit profits.

**Record breaking solar.** The sector has also been boosted by plans to build a 4GW solar plant in Rajasthan state, expected to be the world's largest and more than doubling India's current installed capacity. In context, the country's biggest PV project to date is a 150MW plant in Maharashtra. There are currently no indications of whether the "Sambhar Ultra -Mega Green Solar Power Project" will be based on PV or CSP technology, or a mixture of the two. The JV set up to run the project, comprising five public sector utilities, hopes to have the first 1GW phase commissioned by the end of 2016.

**Raising the bar.** Mid-August finally saw Cabinet approval for the much-anticipated reinstatement of the generation-based incentive for wind projects, the expiry of which in March 2012 resulted in a 42% plunge in turbine installations this past year. Wind farms built in the period 2012 to 2017 will receive INR500/MWh (US\$8.20), with installations during the hiatus period qualifying retroactively. The updated scheme also increases the cap on the total support a project is eligible for by 61% to INR10m/MW (US\$164,000).

**Too little too late?** The reinstatement has of course been welcomed by the wind sector, but the changes may not be sufficient to enable India to add the 3GW per year required to meet its target of 15GW wind capacity in the period 2012 to 2017. India wind farm developer Simran Wind Project Pvt. had planned to add as much as 150MW annually but halted plans to expand this financial year, saying Government subsidies arrived too late. An estimated 1.5GW of capacity was not built as a result of the expiry last year.

**Crystal ball gazing.** A decree passed in July requiring all wind farms larger than 10MW to forecast their generation for the following day every 15 minutes is also anticipated to make it harder for the sector to play catch-up, with financial penalties incurred where actuals deviate by more than 30%. The Wind Independent Power Producers Association has already filed for an injunction at the Delhi High Court amid claims that the level of accuracy required is not possible and could result in penalties amounting to as much as 15% of revenue according to the CEO of Goldman Sachs-backed ReNew Wind Power.

**Offshore anticipation.** India's offshore wind sector is also playing catch-up, with China relaunching its stalled offshore wind program and Japan already constructing a huge 1GW offshore project. But it looks like India is finally ready to enter the race, with the Government confirming plans to establish a National Offshore Wind Energy Authority to carry out resource assessments and ultimately enter into contracts with project developers. A recent study commissioned by the Government confirmed the huge potential of the country's 7,500km coastline, highlighting the waters off Tamil Nadu State in particular as holding significant resource. A more detailed development strategy by this newly appointed offshore wind body is now eagerly anticipated.

### Infrastructure investment steps up.

Increased levels of policy and project activity in recent months signal a strong outlook for India's renewables sector. However, insufficient transmission infrastructure will continue to be a barrier to large-scale deployments and create risk of further nationwide blackouts.

Acknowledged by politicians and investors alike, things are changing. The Government plans to spend €6.0b (US\$7.9b) on new transmission lines across seven states over the next five to six years, with Germany's KfW development bank contributing €1.0b (US\$1.3b) in loans and grants toward these so-called "green corridors." The first US\$400m tranche of this KfW contribution is expected shortly.

In other positive infrastructure news, India's Rural Electrification Corporation, a leading state-run infrastructure finance company, is looking to raise INR350b-INR370b (US\$5.4b-US\$5.7b) in the year to March 2014 to finance and promote power generation, transmission and distribution. Late September also saw the announcement that the Asian Development Bank will lend US\$500m to Rajasthan to set up a transmission network to support clean energy projects in the state.



# Chile



## Highlights

- ▶ **The renewable energy target has been officially doubled to 20% by 2025, generating an additional 5.5GW capacity gap.**
- ▶ **But the new target represents a compromise on the more ambitious 2020 goal.**
- ▶ **Chile will host the world's largest unsubsidized solar project, a 70MW PV plant.**
- ▶ **Crystallization of the solar pipeline is needed to boost current installed capacity of less than 10MW.**
- ▶ **Significant wind and marine resources are now shining the spotlight on other renewable energy opportunities.**

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**Double or nothing.** The doubling of Chile's renewable energy target has generated significant headlines in recent weeks, as it should. The requirement for utilities with more than 200MW of capacity to generate at least 20% of their energy from renewable resources by 2025 was signed into law on 14 October, replacing the previous obligation to secure 10% of renewable energy by 2024 (both excluding hydropower plants over 40MW). This is equivalent to around 6.5GW of renewables capacity, up from 1GW currently.

The change in law is good news for developers, since it effectively guarantees demand for an ambitious amount of clean energy. The Chilean renewable energy institute estimates the country is currently generating around 5%-6% of energy from renewable sources, leaving significant opportunities for new capacity over the next decade in meeting the target.

**Climbing down.** The significance of the new target passing into law should not be understated, though neither should it be overstated. The 20% by 2025 target represents a compromise after an earlier version of the bill calling for the more ambitious target of 20% by 2020 was passed by the lower house in June but opposed by Energy Minister Jorge Bunster. The rationale cited the inadequacy of the country's transmission system to cope with the additional capacity required to meet this target, particularly given the distance of urban load centers from anticipated solar and wind sites. Therefore, the shifting of the target year to 2025 buys additional time to create a more robust transmission infrastructure but does still represent a slight step down in ambitions.

**Auction backup.** The new legislation also allows for the Government to hold annual auctions to award 10-year power contracts to renewables projects from 2015. This may become necessary if utilities fail to meet the new targets. While credits must be purchased by those energy providers not meeting the renewables quota, the current surplus of clean energy (relative to the current 5% quota) could drive down prices this year, from an average of US\$12/MWh between 2010 and 2012.



Rankings snapshot	Issue 39	Issue 38
Total RECAI	15	16
Onshore wind	25	25
Offshore wind	22	20
Solar PV	13	18
Solar CSP	3	4
Biomass	25	26
Geothermal	12	11
Hydro and marine	14	13

## Chile will host the world's largest unsubsidized solar PV plant.

**Unsubsidized and proud.** The other news putting Chile firmly in the headlines has been the announcement that it will play host to the world's largest unsubsidized solar PV project. The 70MW plant will be developed by Swiss renewable energy producer Etrion, French energy giant Total SA and Spain's Solventus Energías Renovables, taking equity stakes of 70%, 20% and 10% respectively. Construction will start in Q4, with operations expected in early 2015, when it will sell to the spot market, but with the potential for future PPAs. Overseas Private Investment Corporation (OPIC), the US Government's development finance institution, will contribute 70% of the funding for the US\$200m project in US dollar denominated debt, with the remaining coming from equity.

**Setting records.** Other high-profile solar announcements include the financial close of SunEdison's 100MW solar PV plant, expected to be the largest in Latin America once complete in Q1 2014. Funding for the Amanecer Solar CAP plant comprised US\$212.5m of non-recourse debt from OPIC and the World Bank's International Finance Corp. based on a 70:30 split and a local Chilean Peso VAT facility worth US\$45m.

**Breaking records.** SunEdison may not hold the record for long, however. In September, Pattern Energy requested an environmental license for its proposed 306MW Conejo solar park, which will be developed in three phases at a cost of US\$819m. Meanwhile, First Solar Inc., the largest US solar panel manufacturer by shipments, has applied for permits to build a 162.4MW PV plant in the Atacama Desert, comprising 1.7 million solar panels at an estimated cost of US\$370m. In July, the country's Foreign Investment Committee approved a further US\$1.1b investment in PV and awarded land concessions for 17 solar projects with combined capacity of 604MW in August.

**From goal to grid.** It seems that Chile's solar pipeline just won't stop growing, but ironically, current installed capacity still stands at less than 10MW, and construction is yet to begin on over 4GW of approved solar projects, according to the Centro de Energías Renovable. With an estimated solar power potential of up to 200GW, developers need to pick up the pace to get projects from goal to grid. Thus, it is perhaps timely that the recent publication of Chile's Electrical Concessions Law will cut the time developers have to wait to get permits to connect projects to the grid to 150 days from 700 via a more streamlined permitting process.

**Wind woes.** Wind power has been forced to take a bit of a backseat for the moment in Chile's energy revolution given much of the impetus behind solar has been driven by the energy-intensive mining industry – coastal wind resources have not been a good fit for power required in often remote inland desert regions. However, with an estimated 5GW of potential, Chile's wind sector is still very attractive.

**Wind takes the wheel.** Late October saw Pattern Energy install the first turbine for its 115MW El Arrayan wind farm, which the company claims will become Chile's largest once operational in 2014. The high-profile JV between Mainstream Renewable Power and private equity firm Actis, formed earlier this year, has committed to develop around 450MW of wind project, and in August, the Government approved land concessions for seven wind farms totaling 889MW. This is compared to a current installed wind capacity of just over 300MW.

**Marine wades in.** Another renewable resource not prepared to let solar steal the limelight is ocean energy. The Government announced in early October that it will invite bids from developers for US\$14m of grants to build the country's first wave and tidal pilot projects. The winners will be required to match the investment in the pilot projects, with an additional US\$2.4m available from the Inter-American Development Bank. With an estimated 200GW of marine power along its coastline – more than 10 times the capacity of the country's grid – this is one competing technology that will not be silenced by the waves.



# Thailand



## Highlights

- ▶ **Power shortage scares and reliance on gas imports have forced energy back up the political agenda.**
- ▶ **The Government recently confirmed a 51% increase in its 2021 renewables target, equivalent to around 14GW of installed capacity.**
- ▶ **Around US\$13b of investment will be needed to reach this target.**
- ▶ **A new solar FIT will kick-start 1GW of rooftop and village-based solar projects, while existing technology FITs continue to build on an 8GW pipeline.**
- ▶ **However, bureaucratic obstacles and policy instability need to be eliminated to galvanize foreign participation.**

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**Making its debut.** For years, the fast-growing markets of China and India have dominated the Asia renewables landscape, but other markets are now competing for attention. Thailand made its debut in the RECAL in May thanks to growing energy demand, a strong pipeline of solar projects and a well-established incentive regime. But what really makes this market tick?

**Energy options dwindling.** This year has seen energy jump back up the political agenda in Thailand after the Government was forced to prepare the public for potential power cuts when scheduled maintenance halted gas imports from the Yadana pipeline in Myanmar. While Bangkok has not experienced power shortages for decades, the stark reality of the country's energy vulnerability has unsettled both the politicians and the public. Thailand relies heavily on imports of natural gas, which currently generates about 70% of electricity, while many hydropower and coal projects are proving very difficult to implement due to fierce public opposition.

**Big numbers.** Diversification of the energy mix and increased domestic production have therefore become critical political drivers, with 2013 seeing a number of encouraging announcements that put the spotlight firmly on renewables. In July, the Government confirmed a 51% increase in its 2021 renewable capacity target, jumping from 9,201MW to 13,927MW. This is equivalent to 25% of total electricity generation from renewable sources, compared with around 8% now.

According to Energy Minister Pongsak Raktapongpaisal, around THB400b (US\$13b) of investment by state and private entities will be needed to reach this target. The Government has also broken down this capacity target by technology to indicate the opportunities available. Expected contributions are 3GW from solar power, 1.8GW from wind, 4.8GW from biomass, 3.6GW from biogas, and 0.7GW from hydropower and waste.

**Fundamental barriers.** However, the Government still has a lot to do if it is to come close to meeting these targets. Investors have been somewhat deterred by a relatively unstable regulatory environment resulting from an incoherent energy agenda, while the domination of

Peru ranking snapshot	Issue 38	Issue 37
Total RECAI	23	26
Onshore wind	31	32
Offshore wind	40	40
Solar PV	10	12
Solar CSP	20	19
Biomass	20	21
Geothermal	28	25
Hydro and marine	33	30

## A new FIT will target 1GW of rooftop and village-based solar energy projects.

state-owned Electricity Generating Authority of Thailand has also slowed the rate of deregulation and restricted competition across the energy market. A lack of transparent policy-making have raised concerns over corruption.

**Recognition.** Notwithstanding the long road ahead, the Government does seem aware of the need to improve its investment climate and deal with bureaucratic obstacles to better incentivize foreign participation. In a speech earlier this year, Energy Minister Pongsak vowed to eliminate regulations that hinder the growth of renewables and to introduce more incentives, soft loans, subsidies and project finance.

**New FIT boost for solar.** Indeed, the solar sector is already benefiting from such expedited growth initiatives following the introduction in July of a new FIT for rooftop and village-based solar energy projects. Subsidies will be used to top up the difference between the wholesale power price and the guaranteed tariffs. The scheme will support up to 1GW of solar projects under 25-year PPAs, allocating 200MW to rooftop installations that must be built by the end of this year and 800MW to community-owned PV plants to come online by the end of 2014.

The Government will work with the Village Fund, a state-run microcredit provider, to award the community-based subsidies, with fixed tariffs of THB9,750-THB4,500 per MWh (US\$332-US\$153) over the course of the agreement. Rooftop installations, meanwhile, could receive as much as THB6,960/MWh (US\$236) for the smallest projects, around 57% above the global average of crystalline PV projects, according to BNEF. At least half of these rooftop projects must be less than 10kW capacity, with the remaining installations between 10kW and 1MW.

**FITs for every occasion.** This new solar support mechanism complements the country's existing FIT, which was introduced in 2006 and differentiates between technology, type and capacity size. FITs are awarded for up to 10 years with additional payments allocated to projects in the three southernmost provinces and based on diesel replacement. Thailand was one of the first Asian countries with a comprehensive FIT program, and evidence suggests that the rates have been sufficiently attractive to generate private investment. The project pipeline totaled around 8GW at the end of 2011, with total installed capacity of 2,700MW at the end of last year.

**Doing more.** However, the country's FIT program could still benefit from a stronger regulatory framework. The creation of a new committee to oversee the scheme in 2010 introduced more stringent regulations, which have created a bottleneck for applications and introduced greater subjectivity into the process, making processing times harder to estimate.

The lack of integration of the country's renewable energy program with other energy planning processes has also been an impediment. The country has six separate long-term national energy plans, overseen by different Government departments, which has led to an ill-defined energy strategy and resulted in discontinuous support for the FIT program. A lack of public consultation on an acceptable level of pass-through costs to ratepayers has also been a fundamental problem.

**Attracting attention.** But there is still overwhelming evidence that foreign developers, investors and manufacturers are keen to secure a piece of Thailand's renewables sector. Germany's Juwi Group has started construction at five solar sites with total capacity of 48MW in two northern provinces, and in May this year, Japanese PV panel maker Sharp Corp. completed the final stage of an 84MW solar station. Thailand's renewed solar ambitions could be particularly good news for Chinese panel manufacturers facing new import tariffs in the US and Europe. LDK, one of China's leading solar module manufacturers, started doing business in the country earlier in the year.

Thailand's own companies also have ambitious plans. Wind Energy Holding commenced operations at its West Huay Bong 2 and 3 wind farms earlier this year, adding 207MW of installed capacity as part of its plans to generate 1GW of wind power in the country by 2020.

**Infrastructure boost.** The anticipated growth in the demand for power will continue to put strain on Thailand's grid infrastructure, but the Government has already committed to introduce smart-grid technology to help integrate renewable energy into the electricity mix. In 2011, the Government pledged to invest THB400b (US\$13b) in the initiative over the next 15 years. Further, a grid connection rate of around 82% based on a population of over 68 million people and low transmission losses relative to most of Asia indicate that infrastructure barriers are lower than elsewhere in the region.



# Turkey



## Highlights

- ▶ **Electricity demand growth of 6%-8% and increasing support is creating momentum for the sector.**
- ▶ **The Government's pledge will require 20GW of renewables capacity by 2023, while US\$10b per year is needed to double the country's total power-generating capacity.**
- ▶ **High electricity prices enable renewable power to be sold in the open market, with FITs often just a "safety net."**
- ▶ **Solar auction attracts 9GW of applications for only 600MW of capacity.**
- ▶ **Significant levels of funding from international institutions sends strong signals to the private sector, with at least 4GW of wind projects in search of funding.**

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**Keen to go green.** It seems that political unrest earlier in the year and challenging macroeconomic conditions have done little to dampen interest in Turkey's renewables sector, which is continuing to gain momentum as Government support grows and project activity picks up. Its ideal geographic position between a flailing Europe, a burgeoning Middle East and an aggressively expanding Asia is also helping to position Turkey as a serious contender in the renewables race.

**Electricity price challenges FITs.** The Government remains committed to its 2009 pledge to generate 30% of power from renewables by 2023, up from less than 10% currently, requiring around 20GW of renewable capacity over the next decade. The introduction of FITs in 2011 helped to create a large project pipeline, but the interesting dynamics of Turkey's power market means the tariffs are actually more of a "safety net." The FIT for wind and hydro of US\$0.073/kWh, for example, compares with a market power price of around US\$0.09/kWh, resulting in power often being sold through bilateral contracts or in the open market.

**Revisions signal efficiencies.** More recently, the Government also enacted a new energy law, which pledged to bolster competition by increasing the private sector share of investment in the electricity market to 75% from just one-third a decade ago. The legislative revisions in March 2013 also saw an increase in the threshold over which projects require licenses from 500kW to 1MW and a new 24-month time limit on pre-construction licenses in response to the hoarding of licenses by companies investing in renewables only to diversify without any strategic interest in the sector.

**Turning up the power.** One of the key drivers of the Government's ambitions to diversify the power mix is rapidly increasing electricity consumption, combined with an overreliance on the import of oil, natural gas and coal to meet this demand. Estimates of projected electricity demand of around 6%-8% per annum compare with an average of less than 1% across Europe, while fossil fuel imports account for 71.8% of Turkey's energy needs. In early 2013, the Deputy Energy Minister claimed the country would need to spend US\$10b per annum on new

Rankings snapshot	Issue 39	Issue 38
Total RECAI	24	24
Onshore wind	21	23
Offshore wind	23	26
Solar PV	30	27
Solar CSP	11	13
Biomass	31	30
Geothermal	4	6
Hydro and marine	12	12

## Solar auction offering 600MW of capacity attracted almost 9GW of applications in five days.

power generation until 2023 to double capacity from the current 55GW, with renewables to be one of the most important aspects of supporting economic growth.

### Gigawatts, gigawatts and more gigawatts.

This is not surprising given the abundant untapped resources. According to the country's Energy Market Regulatory Authority (EMRA), Turkey has 45GW of hydropower potential, 48GW of wind potential and 600MW of geothermal power potential (although geothermal direct use potential has been estimated at 31.5GW thermal). Meanwhile, the Turkish Solar Energy Industry Association puts total feasible PV power at 450MW-500MW peak. This is in the context of total installed renewables capacity of around 3GW at the end of 2012.

**Wind starts the race.** The Government has historically expected wind to be the main driver in meeting its 2023 target, after a 2007 wind tender resulted in 750 applications totaling 78GW of capacity, of which 350 were taken through to evaluation. Around 11GW of projects are already licensed according to the Government, with actual installed wind capacity of just over 2GW at the end of 2012.

**But will solar overtake?** But after a slow start, it seems solar is finally picking up the pace to challenge its turbine rival. With less than 30MW of solar capacity at the end of 2012, the Government initiated the first round of bidding for 600MW of solar licenses in June this year, receiving almost 9GW of applications within the five-day submission period. EMRA will grant licenses in the first half of 2014 based on specific sites defined in 2011, and further tenders are expected to follow given the Government's goal to install 3GW of solar by 2023. It is also expected that the market for self-generation by corporates with large rooftops will be opened up by the new 1MW threshold below which licenses are not required, with companies now looking for savings on energy bills rather than FITs.

**Geothermal coming up behind.** Turkey also has high hopes for its geothermal sector given the 600MW of electricity potential and the significant thermal potential. At the end of August, Zorlu Energy successfully commissioned the first 60MW phase of its Kizildere II project, while a tender for three-year exploration licenses for nine geothermal sites across the Kutahya region was announced in September 2013. Earlier this year it was revealed that Munich Re and the International Finance Corporation, will cooperate on developing and piloting geothermal exploration risk insurance in Turkey.

**Supply chain incentives.** This growing project pipeline has also created demand for local manufacturing capabilities, largely driven by the local content bonus payments attached to the FIT scheme. These additional premiums can increase overall payments by between 32% and 146% depending on the technology. Turkey's geographic position also makes it a potential supply hub for neighboring regions and therefore particularly attractive to foreign manufacturers. China Sunergy Co., for example, began output at its 300MW solar panel production line in May 2013, from where it hopes to better serve Europe and the domestic market.

**Funding favorite.** Turkey has continued to receive significant financial support for large-scale renewables projects from a range of international finance institutions (IFIs). Notably, both the EBRD and World Bank have €1b (US\$1.3b) loan programs in place for clean energy projects in Turkey. It also became the EBRD's second largest country of operations in 2012, and around half of the €3b (US\$4b) invested in Turkey since 2009 has been for sustainable energy and energy efficiency, including direct funding for the country's two largest wind farms.

**Private participation.** However, it is not sustainable – nor desirable – for the sector to rely on IFI funding indefinitely. More private sector investment, both domestic and foreign, will be required to help make the market more competitive and self-sufficient. According to BNEF, there are around 4GW of wind projects that have obtained their licenses but are still looking for providers of debt finance. There is plenty of funding available from local banks, typically offering 12-year tenors; however, heavy reliance on international credit has made rates relatively expensive. But this has the potential to change as economic conditions improve, and significant IFI investment to date signals the opportunities are there.

**Jewel in the crown.** Turkey is by no means a perfect market. The repercussions of political unrest earlier this year may yet be felt, and the devaluation of the Turkish lira could make project financing more expensive. More also needs to be done to address a heavily regulated energy sector, although March's pledge to increase private sector participation is encouraging. But there is little doubt that the country's renewables sector is a diamond in the rough that will continue to attract increasing attention from all corners of the globe in the months and years ahead.



# Poland



## Highlights

- ▶ **The Government is proposing to phase out the GC scheme by 2021 in favor of competitive bidding.**
- ▶ **The number of GCs per technology will remain unchanged in the interim, throwing the future offshore wind's 8GW pipeline into disarray.**
- ▶ **Some of the new proposals, including absolute fixed prices for 15 years, have triggered protests from the sector.**
- ▶ **Precedent for legislative delays has triggered concerns over further market exits and risks daily fine of more than US\$150,000.**
- ▶ **Potential 1,100MW power shortfalls in 2017 and 13GW of wind power potential should expedite legislative dialogue and implementation.**

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**All change.** After three years of trying to push through legislation that would see renewable technologies receive a differentiated number of GCs, the Polish Government appears to have changed its strategy. GCs are out; competitive bidding is in.

**Auctions win this round.** The Ministry for the Economy revealed its proposals for a revised Renewable Energy Sources (RES) law at a press conference on 17 September. It would see the GC system phased out by 2021 in favor of an auction system awarding guaranteed tariffs over 15 years. Price competition is likely to be fierce, with cost confirmed as the most important criterion. Separate auctions will be held for projects above and below 1MW, while biomass projects greater than 50MW and all biomass co-firing plants will be excluded altogether. Projects must start producing power within four years of successful bidders being announced.

### Existing projects on 2021 countdown.

Facilities operating before the law takes effect will still be entitled to support for 15 years but will only receive GCs until 2021, after which they may participate in separate auctions for existing projects to bid for electricity sale contracts. There will also be a two-year window from the day the law comes into force for operators to elect to switch to the auction system ahead of 2021.

**One size fits all.** Though GC support will continue, previous proposals to vary the number of GCs by technology have been scrapped under the new proposals, with existing projects continuing to receive one GC per MWh. This currently represents around €93/MWh (US\$125) based on a GC price of €48/MWh (US\$64) and an average electricity price of €45/MWh (US\$60) in 2013. However, September's proposals brought bad news for biomass co-firing projects, which will see support cut by 50%, and hydro plants over 1MW, where support is to be withdrawn completely.

**GC stabilization.** In a bid to increase the stability of the GC market given volatile price shifts in recent years, the Government is also proposing to freeze the "substitution fee" at PLN297.4/MWh (US\$94.5), being the payment energy suppliers may choose to pay instead

Rankings snapshot	Issue 39	Issue 38
Total RECAI	25	23
Onshore wind	18	17
Offshore wind	18	18
Solar PV	35	28
Solar CSP	35	35
Biomass	18	18
Geothermal	14	13
Hydro and marine	23	24

## A switch to an auction mechanism could throw the future of Polish offshore and solar into disarray.

of redeeming GCs. It will also restrict payment of this fee if GCs represent less than 75% of the substitution fee for a minimum period of one month. Energy producers staying in the GC scheme will also have to trade a portion of the GCs on the Polish Power Exchange, although specific details are yet to be discussed.

**Heading in the right direction?** So are these dramatic changes a good thing or a bad thing? Well, it certainly signals a very clear sense of direction from the Government after years of uncertainty. It also indicates a reaction to the lessons learned in other parts of Europe, where generous revenue-based support schemes have created unsustainable subsidy costs, triggering severe reductions or withdrawals of support. Therefore, switching now could save Poland heartache later on. The Government also estimates that the cost of support would more than halve to €1b (US\$1.3b) in 2020 under the proposed scheme compared with the current system.

**Drilling into the detail.** Notwithstanding the clear signals from Government, the sector appears less convinced. September's announcement set out only general proposals, with full details yet to be released yet even these general principles have triggered some hostile reactions. The Director of the Polish Wind Energy Association described need for existing projects to compete for support after 2021 as "absolutely unacceptable," while the President of the Society for Small Hydropower Plants Development complained that a 1MW support threshold for hydro is too low given 5MW is typically considered small across much of Europe.

**Fixed-price pressure.** The absolute fixing of prices through the auction process, without annual indexation, has also caused a stir. Investors will be required to calculate prices that will remain profitable for 15 years, regardless of what's happening in the electricity market or wider economy. This increased strain on project bankability could potentially threaten investor appetite.

**Technology tensions.** Another concern arising from the changes is the future of more expensive technologies. The auction system will inevitably favor large onshore wind projects with relatively low capital costs, which conflicts with the Government's previous ambitions to boost support for solar and offshore wind to 1.8 and 2.8 GCs per MWh respectively. Such announcements quickly led to the creation of an 8GW offshore wind pipeline according to the Polish Offshore Wind Energy Association, but a switch to an auction

mechanism could throw the future of Polish offshore and solar into disarray.

**Danger of delay.** Perhaps the most worrying aspect of the new proposal, though, is the likely timeframe to implement given the scale of the changes and the level of consultation required, particularly given the precedent for delays. The Government's continual amendments to the RES law since 2010 has resulted in a noticeable reduction in foreign participation in the wind market, illustrated by the exit of key players such as DONG, Iberdrola and Enertrag.

**Daily reminder.** But there are also factors that should encourage the Government to expedite the process. The country faces daily fines of around €133,000 (US\$178,000) for failing to transpose the 2009 EU RES Directive into its national energy laws. The Government had hoped to address this in legislative amendments passed in July, known colloquially as the "little energy three-pack," although legal opinion remains divided. Attention will therefore now turn to whether the more recent RES law proposals, part of the "big energy three-pack," could help Poland avoid these heavy fines.

**Shining light.** Perhaps the biggest impetus for fast-tracking a new RES law, though, should be Poland's own energy challenges. In July, the Ministry of Economy claimed that the power shortfall may reach 1,100MW during peak demand in 2017, forcing the Government to look at capacity mechanisms to guarantee supply. This energy imperative plus high carbon emissions, combined with impressive wind resource (13GW potential by 2020) and solar success of neighboring Germany, should easily galvanize a burgeoning renewables sector. The withdrawal of interest in many of its Central and Eastern European neighbors following severe subsidy cuts should also position Poland as a beacon of hope for opportunities in the region.

**The clock is ticking.** But the Government will need to work hard to convince the market it won't take another three years to reach an acceptable support regime if it is to avoid more exits from the market and heavy EU fines. Otherwise, there's a risk that even these new proposals could become redundant by the time they're actually enacted.



# Russia



## Highlights

- ▶ **The new Government target for 6.2GW of renewables capacity triggers competitive auctions and US\$2.7b of tariff support.**
- ▶ **Local content requirements of 50%, rising to 70% by 2020, are expected to drive domestic supply chain, particularly for solar projects.**
- ▶ **Solar attracted almost 1GW of applications for the 710MW on offer, while demand for wind was more subdued.**
- ▶ **More than 2.5GW of capacity is already lined up for the 2014 auction.**
- ▶ **Strong rationale exists for homegrown green energy, but policy transparency and a fossil fuel mindset present some challenges.**

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**Making an entrance.** From almost nowhere, a new competitor has entered the global renewables race. But this is no ordinary entrant – this is the largest country in the world, with a population of over 143 million and an energy strategy that, to date, could not have been further from the green agenda. Will Russia become the green giant of tomorrow, or is it just a passing phase?

**The goal.** The revelations began in May, when the Government announced a target of 6.2GW of renewables capacity by 2020 (excluding large hydro) as part of its Renewable Energy Source Development Measures package. This is equivalent to around 2.5% of total electricity generation, up from the current 0.8%. While this announcement represents reduced ambitions relative to a 2009 pledge to generate 4.5% of electricity from renewables by 2020, the latest targets are arguably more realistic given installed renewables capacity totaled only 1GW at the end of 2012, almost all of it small hydro. (It is noted the country also has more than 45GW of large hydro capacity.)

**The strategy.** To help achieve this target the Government will provide RUB85b (US\$2.7b) of support in the form of tariffs awarded via competitive auctions. Developers will be offered an investment return of up to 14%, with guaranteed payments for 15 years from the start of operations. However, successful projects will also be required to source 50% of equipment from local suppliers, rising to 65%-70% by 2020, in a bid to expand the domestic supply chain.

Under the support mechanism, projects greater than 25MW will bid competitively for capacity payments in exchange for making their plants available to meet demand during peak times. Projects less than 25MW will receive fixed tariffs determined by regional authorities, though those with capacity 5MW-25MW can also choose either system.

**The results.** It was with surprising speed that the Government not only approved the legislation announced in May, but also subsequently moved to hold its first tenders in September. Solar was undoubtedly the star of the show, attracting almost 1,000MW of bids for construction in 2014 to 2017 compared with the 710MW on offer, though only 32 projects totaling 399MW were actually awarded. Meanwhile, demand for wind was



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## Russia may be following in the footsteps of its Middle East neighbors, trying to free up fossil fuel for export.

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somewhat subdued, with only seven projects totaling 105MW selected compared with the 1,100MW on offer. No bids were received for large-scale hydro.

**Solar versus wind.** Many commentators are putting the high level of interest in solar down to greater confidence in the sector's ability to meet the stringent local content requirements. Meanwhile, lower production of wind equipment may have reduced interest in the technology, as well as the fact that 15-year capacity payments will be linked to generation during peak demand which could be problematic for intermittent wind generation. Outside of the tender, however, the Russian Association of Wind Power Industry estimated in October last year that approximately 3GW of wind projects were undergoing feasibility studies during 2012.

**Next steps.** September's tender was closed to non-Russian companies, apparently due to a short bidding timeframe and various stringent electricity market requirements, though it's not clear whether this will be the case for future auctions. The Government has already scheduled the second tender for June 2014, when it is planning to offer 1,645MW of wind capacity, 496MW of solar and 415MW of small hydro capacity, all for construction in the period 2015 to 2018.

**Scoping the opportunities.** Other announcements this year also support the existence of a burgeoning renewables sector. In August, the Government announced plans to create a renewable energy resource map that will help identify opportunities for development across different technologies. The sector is also planning to create an industry association covering all renewable technologies, as opposed to the current separate sector agencies, in order to create a stronger market presence and increase lobbying power.

**The rationale.** Despite this, some market commentators still claim that Russia has little economic incentive to diversify the power mix. So what's really driving this new clean energy agenda?

It may be that Russia is simply following in the footsteps of its Middle East neighbors in trying to free up fossil fuel for export, rather than consuming domestically. There is also potential to build new transmission lines to export renewable energy into Europe to assist Member States in achieving their 2020 targets and beyond.

**Homegrown energy.** Even within Russia, domestic green energy could generate savings in remote areas reliant on diesel-fueled generation relative to the high cost of transporting it thousands of kilometers from the country's oil refineries. It could also avoid the need to bring new, and often remotely located, oil and gas fields into production, as the traditional resource bases of the

Volga-Urals and West Siberian regions approach depletion. In the '90s, it was estimated that the renewable energy potential in Russia could provide a third of the country's vast energy needs.

And even if some parties do not find the energy argument itself sufficiently compelling, Russia's commitment for modernization and innovation that creates job opportunities, economic growth and new technologies should not be ignored and may be sufficient to influence policy-makers, corporations, investors and the public.

**Fighting the battle.** But challenges remain. Questions over transparency may hinder growth given the relative infancy of the renewables sector and its reliance on central support, while the slow pace of market liberalization will also need to be addressed to create a more competitive market. The modernization of the Soviet-era power network is also vital given long distances and low voltages. The 2011 World Energy Outlook estimated that Russia will require around US\$615b of infrastructure investment between 2011 and 2035, representing both opportunities and challenges for the sector.

**Vested interests.** Perhaps the biggest challenge, however, is the relative lack of competitiveness of renewables in the short term due to subsidized fossil fuel supplies creating artificially low-generating costs. This has enabled electricity prices to be maintained well below levels across the rest of Europe. The dominance of the country's fossil fuel industry and its historic economic importance has also created vested interests, making change difficult without clear central Government support and a change in cultural mind-set.

**From obscurity to opportunity.** So does that mean Russia's green agenda is unlikely to survive another winter? Broader political and structural concerns will not disappear overnight, but the Government does appear committed to creating a competitive and sustainable clean energy market. There is also a strong economic case based on exports, remote energy users and innovation. It remains to be seen whether the proposed targets and support mechanisms will be attractive enough to offset the perceived investment risks. But given the speed with which the Russian renewables market appears to have moved from obscurity to opportunity, anything is possible.

# Technology-specific indices

The technology indices reflect a weighted average across macro, energy market and technology-specific parameters.

Rank	Onshore wind		Offshore wind		Solar PV		Solar CSP		Biomass	
1	US	74.1	UK	74.9	US	75.0	US	73.1	Germany	66.6
2	China	71.3	Germany	71.6	China	74.1	Australia	64.6	Japan	65.4
3	Germany	67.9	China	68.5	Germany	71.8	Chile	63.2	US	62.4
4	UK	65.9	US	66.0	Japan	70.1	India	60.7	China	61.8
5	Canada	63.6	Belgium	61.2	Australia	64.8	China	59.3	Brazil	61.6
6	Australia	62.2	Denmark	61.0	India	62.1	Israel	59.1	UK	61.5
7	France	61.3	Sweden	58.5	UK	61.4	South Africa	58.9	Finland	59.5
8	Sweden	60.9	Netherlands	58.3	France	60.2	Spain	58.3	Sweden	58.5
9	India	60.5	France	57.8	Canada	58.5	Morocco	57.9	Denmark	57.9
10	Ireland	60.5	Finland	57.1	Thailand	58.4	Brazil	53.6	Netherlands	56.9
11	Denmark	60.5	Japan	57.0	South Korea	58.4	Turkey	52.0	France	56.8
12	Japan	60.1	South Korea	54.3	Italy	58.2	Italy	51.4	Belgium	56.5
13	Norway	59.0	Canada	52.1	Chile	56.5	Peru	51.3	South Korea	55.9
14	Brazil	58.9	Norway	47.5	South Africa	56.3	Greece	51.1	Italy	54.5
15	Netherlands	58.7	Australia	45.8	Israel	56.2	Saudi Arabia	50.2	Canada	54.5
16	Finland	58.6	Ireland	45.0	Belgium	56.0	Portugal	48.8	Austria	54.4
17	Portugal	57.5	Taiwan	44.0	Spain	55.8	France	48.8	Australia	52.6
18	Poland	57.4	Poland	37.9	Taiwan	54.9	Kenya	47.8	Poland	52.1
19	Austria	57.2	Portugal	37.5	Peru	54.3	Mexico	46.3	India	51.8
20	Belgium	57.1	Italy	36.3	Portugal	54.2	Thailand	46.2	Thailand	51.2
21	Turkey	56.5	India	35.0	Brazil	53.4	Taiwan	39.9	Portugal	51.0
22	Italy	56.1	Chile	34.2	Saudi Arabia	53.0	Canada	31.9	Ireland	50.4
23	South Korea	55.9	Turkey	31.8	Austria	52.4	South Korea	22.6	Peru	49.4
24	Spain	55.3	Spain	30.5	Netherlands	52.1	Belgium	-	Taiwan	49.3
25	Chile	55.2	Brazil	30.3	Greece	50.7	Bulgaria	-	Chile	49.3
26	South Africa	53.8	Peru	29.9	Denmark	50.7	Czech Republic	-	Norway	48.8
27	Mexico	53.6	Ukraine	29.8	Morocco	49.5	Denmark	-	Spain	47.1
28	Romania	52.7	South Africa	28.1	Romania	49.1	Finland	-	Czech	46.9
29	Morocco	51.8	Mexico	25.9	Mexico	48.3	Germany	-	Slovenia	45.6
30	Taiwan	51.3	Romania	25.6	Turkey	47.4	Ireland	-	Greece	43.3
31	Thailand	50.2	Bulgaria	24.8	Bulgaria	47.4	Japan	-	Turkey	43.0
32	Greece	49.1	Kenya	21.7	Ukraine	47.0	Netherlands	-	Mexico	42.4
33	Czech	48.4	Greece	21.3	Slovenia	46.8	New Zealand	-	Ukraine	42.0
34	Bulgaria	47.9	Morocco	21.2	Czech	46.3	Norway	-	Kenya	40.3
35	Ukraine	47.1	Israel	16.9	Poland	44.8	Poland	-	Romania	39.8
36	Peru	46.7	Slovenia	13.7	Kenya	44.0	Romania	-	Bulgaria	39.6
37	Kenya	46.4	Saudi Arabia	13.1	Sweden	44.0	Slovenia	-	South Africa	38.2
38	Israel	45.5	Austria	-	Ireland	35.2	Sweden	-	Israel	36.1
39	Slovenia	45.4	Czech Republic	-	Norway	34.3	UK	-	Morocco	20.9
40	Saudi Arabia	40.8	Thailand	-	Finland	31.7	Ukraine	-	Saudi Arabia	17.9

# Glossary

Rank	Geothermal		Hydro and marine	
1	US	69.5	US	54.6
2	Japan	57.0	China	54.6
3	Italy	52.3	Japan	53.0
4	Turkey	50.8	Canada	52.9
5	Germany	50.7	Brazil	52.3
6	Kenya	48.8	Peru	51.7
7	France	47.3	Germany	50.9
8	Mexico	46.4	Italy	50.1
9	Portugal	46.0	India	49.9
10	China	45.8	Norway	49.9
11	Australia	45.2	Sweden	49.7
12	Chile	44.8	Turkey	49.2
13	Peru	43.4	Austria	48.8
14	Poland	41.0	Chile	48.6
15	UK	40.2	Australia	47.6
16	Canada	39.0	France	47.3
17	Belgium	38.9	Portugal	46.7
18	India	38.2	South Korea	46.4
19	Austria	37.9	Slovenia	45.6
20	Slovenia	37.3	UK	44.9
21	Taiwan	34.7	Taiwan	44.2
22	Greece	34.6	South Africa	44.1
23	Sweden	32.6	Poland	44.1
24	Romania	32.1	Romania	43.2
25	Netherlands	31.9	Mexico	42.7
26	Norway	30.9	Kenya	42.4
27	South Korea	30.5	Belgium	41.9
28	Thailand	29.4	Bulgaria	41.8
29	Bulgaria	27.1	Netherlands	41.3
30	Saudi Arabia	26.8	Finland	41.0
31	Czech	26.6	Czech	40.8
32	Ireland	23.2	Denmark	40.2
33	Brazil	22.6	Thailand	40.1
34	Spain	22.3	Israel	40.1
35	Denmark	-	Ireland	39.8
36	Finland	-	Ukraine	39.4
37	Israel	-	Greece	38.6
38	Morocco	-	Morocco	37.7
39	South Africa	-	Spain	37.6
40	Ukraine	-	Saudi Arabia	-

Abbreviation	Definition
<b>b</b>	Billion
<b>BNEF</b>	Bloomberg New Energy Finance
<b>CfD</b>	Contracts for difference
<b>CFO</b>	Chief financial officer
<b>CHP</b>	Combined heat and power
<b>CREO</b>	Chief resources and energy officer
<b>EMR</b>	Electricity market reform
<b>EPE</b>	Brazil's Energy Research Agency
<b>ETS</b>	Emissions trading scheme
<b>EU</b>	European Union
<b>FIT</b>	Feed-in tariff
<b>FY</b>	Fiscal year
<b>GDP</b>	Gross domestic product
<b>GIB</b>	Green Investment Bank
<b>GW</b>	Gigawatt
<b>HMT</b>	Her Majesty's Treasury (UK)
<b>IFC</b>	International Finance Corporation
<b>IPO</b>	Initial public offering
<b>km</b>	Kilometer
<b>KOPIA</b>	Korea Photovoltaic Industry Association
<b>kW</b>	Kilowatt
<b>m</b>	Million
<b>M&amp;A</b>	Merger and acquisition
<b>MINEM</b>	Peru's Ministry of Energy and Mines
<b>MW</b>	Megawatt
<b>MWh</b>	Megawatt hour
<b>OPA</b>	Ontario Power Authority
<b>PPA</b>	Power purchase agreement
<b>PPP</b>	Public private partnership
<b>PV</b>	Photovoltaic
<b>R&amp;D</b>	Research and development
<b>REC</b>	Renewable energy certificate
<b>RO</b>	Renewable obligation
<b>WTO</b>	World Trade Organization

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# Our global cleantech services

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We offer assurance, tax, transaction and advisory services to all segments of the cleantech market, informed by our deep understanding of industry trends and business dynamics. Selected services include:

<b>Cleantech innovators</b>	<ul style="list-style-type: none"><li>▶ Capital raising: debt and equity</li><li>▶ Cleantech incentives, subsidies and grants</li><li>▶ Growth strategy formulation and implementation</li><li>▶ IPO readiness</li><li>▶ M&amp;A buy-side transaction support</li><li>▶ Valuation and business modeling</li></ul>	<ul style="list-style-type: none"><li>▶ Due diligence (financial/commercial)</li><li>▶ Operational transaction support</li><li>▶ JVs/partnerships/alliances</li><li>▶ Financial audit</li><li>▶ Global tax strategy and compliance</li><li>▶ Sustainability measurement, reporting and valuation</li></ul>
<b>Renewable energy project developers</b>	<ul style="list-style-type: none"><li>▶ Project finance: equity, debt, tax equity</li><li>▶ Cleantech incentives, subsidies and grants</li><li>▶ Capital and debt advisory: treasury, ratings advice, corporate finance</li><li>▶ Public-private partnership bid support</li><li>▶ M&amp;A advisory: refinancing, assets/ portfolio optimization, sell-side M&amp;A</li></ul>	<ul style="list-style-type: none"><li>▶ Buy-side M&amp;A advisory</li><li>▶ IPO readiness</li><li>▶ Economic modeling</li><li>▶ Site selection/economic incentives</li><li>▶ PMO/project risk management/contract compliance/construction cost audit</li><li>▶ Project assurance and reporting</li><li>▶ Parent company financial audit</li></ul>
<b>Corporations/investors/governments</b>	<ul style="list-style-type: none"><li>▶ Sustainability and cleantech strategy advisory and implementation</li><li>▶ Resource efficiency and low carbon strategies</li><li>▶ Energy mix optimization strategy and implementation (roadmap, capital, technologies)</li><li>▶ Energy, water and material resources efficiency and procurement programs</li><li>▶ Supply chain performance improvement</li></ul>	<ul style="list-style-type: none"><li>▶ Carbon tax, cleantech tax incentives and government programs</li><li>▶ Carbon markets and CDM advisory</li><li>▶ Energy and environmental policy advisory</li><li>▶ Market penetration and transaction support (investment, acquisition, JV, partnerships)</li><li>▶ Corporate venture capital formation and portfolio IPO readiness</li></ul>

# Recent EY publications

Available at [ey.com/cleantech](http://ey.com/cleantech)

## The Cleantech Growth Journey: CEO Retreat (2013)



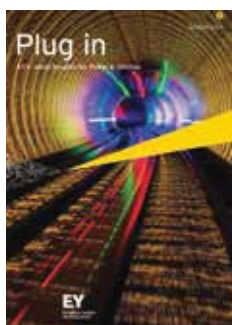
Summarized in this report are the insights and takeaways from the second-annual EY *Cleantech Growth Journey: CEO Retreat*, which focused on the critical issues of capital, transactions, corporate partnering and global expansion.

## From boiler room to boardroom: optimizing the corporate energy mix (2013)



Conventional renewable energy procurement instruments are rarely fit for purpose. Corporations are challenged with moving beyond conventional thinking to include renewable energy as part of a more diversified energy strategy. This report examines the range of innovative strategies at their disposal.

## Plug in (2013)



*Plug in* is our monthly update on the latest trends in power and utilities, including insights from our global network of professionals who are working with the world's biggest power companies. The October issue covers themes such as Germany's smart-meter rollout and the current trend for spin-off divestments.

## Rising tide: global trends in the emerging ocean energy market (2013)



We look at different forms of ocean energy technologies and the progress of some of the countries leading the way. We also present a variety of external insights from industry players and policy-makers.

## Do you need a chief resource and energy officer? (2013)



There is a compelling case for elevating corporate resource management to the highest levels of executive management through a *chief resource and energy officer* position. This report looks at the opportunities and the challenges for such a position.

## IFRS for solar (2012)



This report discusses the key IFRS issues faced by many solar companies, including scenarios and examples drawn from public filings.

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