

EI NEW ENERGY

Vol. 6, No. 1



January 5, 2017

Copyright © 2017 Energy Intelligence Group. All rights reserved. Unauthorized access or electronic forwarding, even for internal use, is prohibited.

- China: Home Stretch to National Carbon Market, p3
- Canada's Largest Province Unveils Cap-and-Trade, p4
- Transport Grows in Importance This Year, p5
- The Tricky Road to Finding Electricity's True Cost, p5
- In Brief: Ford Sheds Light On EV Pursuits, p7
- In Brief: China Cuts PV, Wind Rates, p7

In This Issue

OIL CLIMATE PV POLICY WIND
 CARS SOLAR COAL TRADE BATTERIES FUEL
 CELL **CARBON** ETS TRANSPORT
 TECHNOLOGY STORAGE GAS EMISSIONS NUCLEAR
 ELECTRICITY TAX HYDROGEN HYBRID BIOFUELS

Ten New Energy Advances — and Pitfalls — Likely in 2017

The year ahead could bring the new energy transition into some of its biggest struggles yet, but the movement toward a low-carbon economy may be strengthened in several important ways. Carbon policy, for example, may weaken in the US under the administration of Donald Trump, but it is set to strengthen in China and Canada. And, as 2016 proved, advances in technology — from solar photovoltaics to electric cars — are sprinting ahead despite economic and political hurdles. The Paris climate agreement will be an important test: the landmark accord was ratified at the end of 2016, and now, it's up to the world's polluters to prove they can uphold their end of the bargain.

Below, *EI New Energy* flags 10 milestones to watch in 2017, some that would speed up the low-carbon transition and others likely to slow it down.

1. China to launch world's biggest carbon market: China is set to launch its long-awaited national carbon market in 2017 — stirring hopes that if the world's largest greenhouse gas polluter is embracing carbon pricing, the day for widespread carbon trading, or even a globally linked carbon market, may be nearing. But it will be baby steps for China in the first few years, as senior Chinese officials have warned, before a mature and well-functioning market will emerge (p2). Jiang Zhaoli, deputy director of climate change under top policy planner the National Development and Reform Commission, predicts the Chinese carbon market will trade at around 30 yuan/ton (\$4.32/ton) in its early days. That's only a tenth of the 300 yuan level estimated as necessary to seriously promote carbon cuts. For advocates of a global carbon market, the crucial question will be: How long will it take for the world's largest market to start sending the right price signal to guide climate efforts not just domestically, but internationally? Another country where carbon pricing is likely to expand is Canada, with a federal price coming and the largest province, Ontario, beginning a cap-and-trade market (p4).

2. Trump's administration gets to work: US President-elect Donald Trump, who will be sworn in on Jan. 20, has said he would either “cancel” or “renegotiate” US participation in the Paris climate pact. Even though Paris has already been ratified, lack of action by the world's largest oil consumer and second-largest greenhouse gas emitter could weaken the enthusiasm of other countries to go the extra mile. Also watch to see what Trump's administration does on fuel economy standards, biofuel blending requirements, and financial

Renewable Energy Price Parity

	Gas (\$/MMBtu)	CO ₂ (\$/ton)
Europe		
Market Price	5.64	5.44
Wind Onshore	8.90	64.59
Solar PV	5.21	0.00
US		
Market Price	3.26	0.00
Wind Onshore	6.83	64.88
Solar PV	3.66	7.22
Japan		
Market Price	7.15	0.00
Wind Onshore	16.13	163.38
Solar PV	14.22	128.07

Market prices Jan 4. Table indicates either gas or CO₂ price needed for new renewable energy to match profitability of new gas-fired power, without subsidies. High US carbon prices reflect low gas prices. Japan at parity so no carbon price needed. Source: Energy Intelligence

incentives for clean energy. On a global scale, Trump's election has pushed oil market uncertainties to a "second order" concern, argues Olivier Appert, former boss of French energy institute Ifpen. Deborah Gordon of the US' Carnegie Endowment for International Peace says the US is "on target" to meet its Paris climate commitments since much of it is "economically aligned." She added: "California will rise to take a leadership role in the US, effectively making up for any national backsliding."

3. Next steps for UN climate talks: Trump's actions will be closely followed internationally, and a few important steps will be taken on a broader scale as work continues on ironing out the details of the Paris agreement. While 2015 saw momentum building ahead of the landmark deal reached at the end of that year, and 2016 witnessed a flurry of ratifications by countries, allowing the agreement to come into force much earlier than expected, UN climate talks in 2017 will cover carbon pricing and markets, which could be the most important implication for energy companies, and other aspects of the Paris "rule book."

4. EU may (finally) bring up carbon prices: Europe has repeatedly failed in attempts to strengthen its emissions trading system (ETS), with prices languishing far below levels considered effective to drive decarbonization. Hopes have been raised, though, by new policy reform measures winding their way through the European Parliament that may trim the massive oversupply of credits weighing down the market. Although the proposals could get watered down in negotiations between member states, it's also possible that ambition will be maintained, particularly if European leaders wish to be seen as remaining serious about global climate efforts and demonstrate European unity following the Brexit vote. And as others, like China, move toward carbon markets of their own, Europe may not want to be seen as lagging behind (p2).

5. Investor low-carbon pressures intensify: Large institutional investors and money managers are increasingly concerned about global warming's impact on the value of assets. Looking ahead, "their interest in climate change risk — and investment opportunities in solutions — will continue and grow in the next few years," said Meg Voorhes of the US Forum for Sustainable and Responsible Investment (SIF). In particular, the issue of "stranded" assets and their impact on financial markets will become more of a mainstream issue, especially in the light of the Paris agreement's aspirational 1.5°C target. Meanwhile, investors will be seeking more "green" projects but there is a "shocking gap" between the global abundance of capital and the scarcity of "good" projects and assets, including in the green energy space, said asset manager Amundi's Pascal Blanque.

6. Will oil companies branch out? In response to investor pressure, and the prospect of oil price recovery in 2017, constraints on oil company investment budgets may begin to loosen, so watch out for potential boosts in renewables investments. European majors Statoil, Eni and Total have led the way in preparing for a low-carbon future, but oil firms generally still seem to be trying to work out how to fit renewables into their businesses — or whether they should at all (NE Apr.23'15). Total has thus far invested in solar, batteries and biofuels. It is also looking at onshore wind, while Statoil has focused on offshore wind. Royal Dutch Shell has shown interest in hydrogen and biofuels, including advanced biofuels, where it may invest. This year could also see a greater emphasis on carbon capture and storage, a core area identified for research funding by the big oil companies involved in the Oil and Gas Climate Initiative.

7. Renewable costs falling, falling: Solar photovoltaic (PV) power costs have fallen dramatically in recent years, and that trend is expected to continue. The cost decline is now led by developing countries as they are buying large amounts of state-of-the-art panels for big projects and usually enjoy very good sunlight, said the World Bank's Pierre Audinet. Wind costs will also continue to decline significantly, while storage should "begin to make more of an appearance," according to consultancy EY's Gus Schellekens. This will help decentralized generation to gain market share, although adoption of residential batteries by households is still at an "extremely early stage" aside from a handful of niche markets such as Australia and Hawaii, said brokerage Raymond James' Pavel Molchanov. Residential batteries will become "truly mainstream" only around 2020 at the earliest, he believes.

8. Electric cars growing up fast: After major gains in 2016 for electric vehicles (EVs) — both in terms of automaker investments and sales — many expect similar progress to continue into 2017. Already, Ford has shed more light on its upcoming EV offerings and strategies (p7). The combination of air pollution challenges and falling battery costs should keep decarbonization of transport moving at a "rapid pace," said Melissa Lott with the UCL Institute for Sustainable Resources.

9. Fuel-cell vehicles — watch this space: “Automotive fuel cells are roughly at the stage of development that electric vehicles had in 2010 — that is to say, just barely getting to commercialization,” Pavel Molchanov of Raymond James tells *EI New Energy*. “The Toyota Mirai went on sale in 2016, and several other major automakers will be following in its footsteps. Japan is aiming to lead the world in fuel cell vehicles, having pledged to build a large network of hydrogen filling stations by the time of the Tokyo Olympics in 2020. Denmark already has such a network.” In most markets, however, fuel-cell vehicles will contend with competition from EVs. This is not exactly “a zero-sum game, in the sense that over 98% of the passenger car market uses neither electric batteries nor fuel cells, and the main target for both is the internal combustion engine,” Molchanov says. “But insofar as only a limited number of consumers are willing to be early adopters of new automotive powertrains, there will inevitably be competition among them.”

10. Paris drop-outs: Aside from the US, Australia is another possible Paris drop-out. At the end of 2016, the Australian government refused to consider or discuss any forms of carbon pricing as a greenhouse gas control tool, despite studies showing that the country is unlikely to deliver on its Paris climate pledge (NE Dec.15’16). While Canberra has promised to undertake a climate policy review in 2017, the ruling-out of carbon pricing has dampened hopes that the review would result in more effective carbon curbing measures. What’s more, Senator Cory Bernardi from the ruling Liberal-National coalition has argued that US President-elect Donald Trump’s intention to back out of the global climate deal “should be the catalyst for Australia to do the same” — despite Australia’s ratification of the pact in 2016. Bernardi and other conservatives could well press their advantage further this year for a complete Paris withdrawal.

Lauren Craft, Washington and Philippe Roos, Strasbourg; Ronan Kavanagh, London; Kimfeng Wong, Singapore

China: Home Stretch to National Carbon Market

China ushered in 2017 under smog-filled skies, which resulted in air pollution alerts and thousands of flight cancellations and forced citizens to don masks while merrymaking (NE Dec.22’16). With its environmental goals as strong as ever, the country is not letting up on preparations to launch the world’s largest national cap-and-trade carbon market within this year, with Beijing pledging an unwavering commitment to the Paris deal despite the growing uncertainty surrounding the global pact in the wake of Donald Trump’s US election victory. China sees carbon pricing as a “critical instrument” to unlock the public and private capital necessary for low-carbon technologies, said the country’s top climate change negotiator, Xie Zhenhua, in a Dec. 30 article he co-wrote for the official *China Daily*. In it, he also declared: “Our generation is pivotal — we have a moral duty to act on the science that is irrefutable.” Japan and South Korea are also keen to hook up with the Chinese scheme to form an East Asian regional market, which, if it materializes, would represent another step toward a global carbon marketplace (NE Dec.22’16).

But while China’s stance is reassuring, its climate officials have also warned that the high hopes placed on its carbon market plans must be tempered with patience and realistic expectations, arguing that it would take at least until after 2020 for it to evolve into an effective mechanism for curbing emissions. Judging from recent comments by various senior Chinese officials, the national emissions trading scheme (ETS) is likely to be up and running only in the second half of this year. Before it launches, China has a hefty to-do list: setting a national emission cap, allocating permits among affected emitters, and crafting ETS legislation. Preparations on all fronts are being “accelerated” and the central government will do its best to enact an ETS law in the first half of 2017, said Xie at a Shanghai conference last month. Xie, who is China’s special representative for climate change affairs, also warned that the process of dispensing carbon permits — most to be handed out for free — would be a real challenge likely involving “several rounds” of haggling back and forth. Regional governments and affected emitters are expected to bargain for more carbon permits, which will represent “real money” once an ETS is operational.

The methodology for setting the cap and handing out permits has already been finalized and approved by the cabinet-level State Council, which is likely to make an official announcement “soon,” Jiang Zhaoli, deputy head of climate change at China’s top policy planner, the National Development and Reform Commission (NDRC), told the local media last month. Jiang had indicated earlier that all emitters drafted into the ETS would likely receive their carbon allowances in the first or second quarter of this year. The stringency of the emissions cap will have a direct

China Carbon Prices

	Dec. 30 (yuan)	Dec. 23 (yuan)	Dec. 30 (\$)	Dec. 23 (\$)
Beijing*	55.40	52.30	7.98	7.53
Guangdong	14.27	12.49	2.06	1.80
Shenzhen	36.09	30.15	5.20	4.34
Tianjin*	15.05	15.05	2.17	2.17
Shanghai	27.21	26.38	3.92	3.80
Hubei	19.28	19.61	2.78	2.82
Chongqing*	14.22	10.38	2.05	1.49

*Average price, others are closing price. Source: Chinese exchanges

bearing on pricing, with Jiang signaling that the cap would be set “relatively loosely” in the initial years to allow emitters time to adjust. At first, the annual national cap is expected to fall in the range of 3 billion-5 billion tons of carbon dioxide equivalent, or roughly several times higher than the existing combined cap of 1.2 billion tons across the seven experimental regional Chinese carbon exchanges. By comparison, the annual EU cap currently stands at roughly 2 billion tons.

The Chinese carbon market would likely trade at around 30 yuan (\$4.30) per ton in the early years, or just a fraction of the 200 yuan-300 yuan that the NDRC has estimated as necessary to motivate serious carbon cutting efforts, according to Jiang (NE Aug.25’16). This begs the question: How long will it take for the world’s largest market to start sending the “right” price signal to guide not just domestic, but international climate efforts as well? Only after 2020, Jiang reportedly said. Meanwhile, more local carbon exchanges have sprung up in China. Fujian and Sichuan — with the blessings of the central government — both launched provincial-level carbon exchanges last month, joining the original seven pilot markets in Shenzhen, Guangzhou, Beijing, Shanghai, Tianjin, Hubei and Chongqing. That brings the total to nine and signals that regional exchanges are eyed to play vital roles in the upcoming national ETS.

Kimfeng Wong, Singapore

Canada’s Largest Province Unveils Cap-and-Trade

Ontario, Canada’s provincial economic juggernaut, has kicked off its joint cap-and-trade and carbon tax. The market adds considerable size and muscle to a carbon scheme already in place by California and Quebec, with whom Ontario plans to link in 2018 (NE Apr.30’15). However, the deeply unpopular Liberal government of Kathleen Wynne faces a provincial election that year and most bet she’ll lose the contest — putting Ontario’s cap-and-trade scheme in possible jeopardy. Where policy stands now, Ontario is aiming for a 15% reduction in GHG emissions by 2020 compared with 1990, and longer-term, Canada’s most populous province is pursuing an 80% cut by 2050.

Although the plan is expected to be effective in driving down carbon emissions, it has also come under fire from critics who fear it will drive up the cost of doing business in Ontario while giving the provincial government too much political influence in determining where the revenues — estimated to reach C\$2 billion (US\$1.48 billion) in 2017 — are allocated. The Ontario government says it plans to use the roughly C\$2 billion collected in 2017 to fund climate change action plans to encourage electric cars, improve the energy efficiency of buildings and enable factories to buy more energy-efficient technologies. But critics say it will be difficult to ensure these measures proceed, since details remain unavailable. The government says it will unveil detailed plans next year outlining more clearly how the revenues are spent.

Because Ontario is a late entry to the partnership finalized last year by Quebec and California, it’s likely the province will subsidize emissions cuts in the two other jurisdictions and enable them to achieve their low-carbon targets before Ontario does. The three partners will officially launch their three-way cap-and-trade system in 2018. Quebec launched its cap-and-trade system in mid-2013 and currently charges emitters C\$16.40 per ton. California’s carbon market launched in early 2013 and the latest auction this past November fetched prices of \$12.73/ton (NE May2’13).

In October, Ottawa unveiled the details of a national plan that will set a minimum price on carbon emissions next year at C\$10 per ton, then increase the tax by that amount each year until 2022, when the minimum price on carbon will peak at C\$50/ton. Most Canadians appear to support Ottawa’s carbon tax with Saskatchewan continuing to be the lone province voicing opposition on economic grounds (NE Oct.20’16). However, provincial and federal actions in Canada to fight climate change are up against a more laissez-faire approach in the US, where President-elect Donald Trump has promised to reverse many of President Barack Obama’s progressive environmental policies (p1).

James Irwin, Toronto

Transport Grows in Importance This Year

Efforts to fight climate change have mostly focused on shifting away from coal toward cleaner-burning natural gas and renewables. This has shaken up the power business, but been effective, helping to begin to turn the curve on climate-threatening emissions. Now, with emissions from the power sector falling behind transport emissions in places like Europe and the US, transport is emerging as the next great target in the clean energy transition. Transport is also closest to the oil industry's interests — although executives are skeptical about the threat (NE Oct.20'16). While action in the US is uncertain given the change in administration later this month, Europe is taking some major steps to address the transport task.

For Europe, a recent study by the respected Institute for Sustainable Development and International Relations (IDDRI) in Paris put the EU's challenge in context. In power, the carbon intensity of production dropped by 20.9% between 2000 and 2014, or a rate of 1.7% per year, and EU houses also consumed 21.2% less energy by size in 2013 than in 2000. By comparison, in transport, there was just an 8.7% fall in fuel per passenger kilometers by 2013 compared with 2000. The IDDRI concluded that the EU is currently "off-track" to achieve its long-term objectives, saying the rate of energy intensity improvement of passenger transport has been just 0.7%/year over 2000-2013, whereas "in scenarios reaching deep decarbonization by 2050 it needs to improve at more than 2% per year this decade and the next."

The European Commission has recognized this with its recent strategy for low-emission mobility (NE Dec.8'16). In it, Brussels points to transport as representing almost a quarter of Europe's greenhouse gas emissions and also being the main cause of air pollution in cities. Within this sector, road transport is by far the biggest emitter, accounting for more than 70% of GHG emissions from transport in 2014. By midcentury, greenhouse gas emissions from transport will need to be at least 60% lower than in 1990 and be firmly on the path toward zero, the Commission says.

In the coming year, European policymakers plan to start tackling the problem. Continent-wide, more details emerged in Brussels' recent massive "winter package" of policies. Also, Europe will inevitably set CO₂ emissions limits on cars and set a policy to drive a phase-out of fossil fuels, according to Greg Archer from climate campaign group Transport & Environment. "Even Germany, home of the big diesel engine makers, plans to cut transport emissions by 40% by 2030 and has announced a support programme for electric cars," Archer said. Calling the European Commission's Low-Emission Mobility Strategy "excellent," Archer said it confirmed the future will be electric and there will be a new car CO₂ target for the mid-2020s, which should be finalized in the third quarter of 2017. It's not just high-level efforts that count, either. Local action is increasingly important, with Paris joining Madrid, Athens, and Mexico City in pledging to remove diesel vehicles from their cities by 2025.

While automakers grabbed the EV headlines last year, Norwegian environmental group Bellona notes that the EU has also been tinkering away on its side by setting the scene for infrastructure to power electric cars (NE Dec.15'16). And given consumer anxiety around electric vehicle range and charging compatibility, Europe has much to do, Bellona said. The coming year looks "promising" for improving the interoperability of chargers, for example. "Right now member states are submitting their national plans for the implementation of the crucial alternative fuels directive, which could clear the way for more public and private charging stations based on an EU-wide standard," said Bellona's Teodora Serafimova. Bellona, however, criticized an earlier decision from Brussels to drop a measure that requiring 10% of parking spaces in all new EU buildings to be equipped with EV recharging facilities by 2023. Due to "enormous pushback" from EU member states, the commission proposal has been watered down for existing buildings. Instead, the provision will only apply to commercial ones with more than 10 parking spaces, and only from 2025.

Ronan Kavanagh, London

The Tricky Road to Finding Electricity's True Cost

How can the "full cost" of electricity be determined? It's quite tricky, but progress is being made. Levelized costs of electricity (LCOE), such as those published twice a year by *EI New Energy*, are a common and convenient tool to compare power generating technologies (NE Jun.30'16). However, as they usually capture costs at the power plant's gate, they disregard system costs such as connection

to the grid and backup generation. They also neglect the cost of pollution and climate change, which economists call “externalities” because they are incurred to society without being paid by the power generators who cause them. In an effort to “inform public policy discourse with comprehensive, rigorous and impartial analysis,” a team of researchers from the University of Texas at Austin (UT Austin) has released a set of data on the “full cost of electricity” in each county of the contiguous US.

LCOE measurements already cover a lot of bases — they include capital, operating and fuel costs over the lifetime of a project, calculated as a break-even price for electricity delivered to the high-voltage grid (NE Jun.30’16). But plants need to be connected to the grid, which can prove costly when using resources located in remote areas, a common situation for hydro, wind and solar. Critics also argue that backup costs make intermittent renewable sources more expensive than pure LCOEs suggest. However, while renewable generation can increase stress on grid stability, the cost of “ancillary services” such as voltage control, frequency response and synchronized reserve has not increased in recent years in Texas even as installed wind capacity in the state tripled from 4 gigawatts to 12 GW, UT Austin’s Carey King and Joshua Rhodes told *EI New Energy* (NE Mar.10’16). The main constraint on Texas’ grid is in fact the need to have enough reserve to cover the failure of its largest generating unit, a 2.3 GW nuclear station, King and Rhodes emphasized.

The Full Cost of Electricity: Regional US Examples

(\$/MWh)	Gas	Wind	Nuclear	Solar	Coal
County of Loving (Texas)					
Generation	61	94	138	108	109
Transmission	3	5	2	6	3
Direct CO ₂	33	0	1	0	46
Indirect CO ₂	2	11	4	35	3
Pollution	1	0	0	0	10
Total	99	109	144	148	171
Los Angeles County (California)					
Generation	57	162	168	121	148
Transmission	2	8	2	6	4
Direct CO ₂	33	0	1	0	46
Indirect CO ₂	1	17	5	35	4
Pollution	44	0	0	0	578
Total	137	186	176	162	779

Theoretical full cost of electricity including generation, transmission, direct and indirect CO₂ emissions and local pollution (but excluding system integration) in the contiguous US’ least and most populated counties, in \$ per megawatt hour. Technologies include combined cycle gas turbines, coal, nuclear, wind and utility-scale solar PV. Source: University of Texas at Austin, Energy Intelligence

Externalities mostly include environmental impacts and their consequences on human health and welfare. Direct carbon dioxide emissions related to the combustion of coal or gas, which worsen climate change, are increasingly “internalized” into plant-level cost accounting through carbon markets or taxes. However, experts believe current CO₂ prices — only at roughly \$4 per ton in the US Northeast, \$5/ton in Europe and \$13/ton in California — don’t reflect the true cost of climate change to society (NE Dec.22’16). Instead, UT Austin used the US government’s “social cost of carbon” published in 2015, ranging from \$38/ton in 2015 to \$71/ton in 2050, in today’s money. This translates into an additional \$33 per megawatt hour for combined cycle gas turbines and \$46/MWh for coal-fired plants partially fitted with carbon capture and storage.

UT Austin’s “LCOE calculator” also incorporates indirect emissions related to the extraction of fuels, manufacturing of equipment, and construction and decommissioning of plants. Those add just a few dollars to conventional technologies’ full social cost of generation, but over \$10/MWh to onshore wind’s and a considerable \$35/MWh to utility-scale solar photovoltaic’s (PV) because renewable energy is diffuse and involves much equipment and construction. In the case of PV cells, silicon manufacturing is an especially energy- and therefore carbon-intensive process.

Fossil fuels, mostly coal, also generate harmful pollutants such as sulfur dioxide, nitrogen oxides and particulate matter. Their impact, primarily on human health, is local and highly dependent on how polluted the air already is and how many people are exposed. If, for example, a coal-fired plant was built in Los Angeles County, the most populated in the US with over 10 million inhabitants, its pollution costs would add a huge \$578/MWh to \$152/MWh in generation and transmission costs and \$50/MWh in climate change costs. By contrast, in Loving County, Texas — the least populated in the US — a coal plant’s pollution would only cost \$10/MWh according to the model, which is based on a \$6 million “value of statistical life” used to determine the cost of increased mortality (NE May28’15).

UT Austin’s analysis shows that on a pure LCOE basis, excluding pollution and climate change impacts, combined-cycle gas turbines are the least-cost option for new power plants in roughly three-quarters of US counties and wind in most of the last quarter, mostly in Midwest states. When environmental externalities and feasibility of technologies are considered, gas drops to being the least-cost option in only 36% of counties. Wind becomes the cheapest technology in 43% of them — where wind resources are strong or barriers to gas plants too high, for example when cooling water is scarce or gas pipelines too far away. Beyond the extended Midwest, wind-friendly counties include significant parts of the Northeast. Nuclear is the least-cost technology in 13% of counties, UT Austin found, where wind resources are weak or gas too expensive or unavailable, largely in the southern US. Solar PV is the least-cost option in the remaining 7% of counties, mostly in remote locations where rooftop is best, and in the Southwest, where sunlight is very strong and water scarce.

Philippe Roos, Strasbourg

IN BRIEF

Ford Sheds Light on EV Pursuits

US automaker Ford has detailed seven of the 13 electrified models it will introduce in the next five years, including hybrid versions of the F-150 pickup and Mustang in the US, a plug-in hybrid Transit van to be launched later this year in Europe, and a full electric light SUV with an expected range of 300 miles (480 km) globally. “Our investments and expanding lineup reflect our view that global offerings of electrified vehicles will exceed gasoline-powered vehicles within the next 15 years,” said CEO Mark Fields. New models will also include a high-volume autonomous vehicle designed for commercial ride hailing or ride sharing, starting in North America in 2021. In order “to make EVs even easier to live with,” Ford is experimenting with wireless charging technology “that makes recharging as easy as pulling into a parking spot,” while also working in Europe with other automakers to create an ultra-fast charging network.

China Cuts PV, Wind Rates

China has cut feed-in tariffs for solar PV and wind projects, with the new rates being 5%-23% lower. The new PV rates are 0.65-0.85 yuan/kWh (9¢-12¢/kWh) for projects coming on line after Jan. 1, 2017, down from 0.80-0.98 yuan/kWh a year ago. Tariffs for onshore wind projects approved after Jan. 1, 2018 are subject to rates of 0.40-0.57 yuan/kWh, down from the 2016-17 rates of 0.47-0.60 yuan. China’s installed and grid-connected PV capacity stood at 70.75 GW as of end-September, while wind capacity reached 140 GW. By 2020, the government aims to bring PV and wind capacities to 110 GW and 210 GW, respectively (NE Dec.8’16).

Fuel Cell Industry Grows

The fuel cell industry continues to grow, according to a new report from consultancy E4tech. There are

signs that the supply chain is starting to solidify, though it is far from robust, and much of the policy environment positive, E4tech says. But the industry remains small, fragile, and almost entirely driven by government support. Japan seems to be maintaining its resolve, drawing in more big corporations, and Korea continues to aspire to something similar. “In Europe and North America things continue at their typical pace. Enough support is provided to keep most of the players alive, but not enough to drive real commercial growth — or to prove it can’t be done. Only China seems to wish to step up, with evidence emerging of a near-term dramatic increase in fuel cell deployment alongside ongoing support for science and technology,” the report said. Energy systems models suggest hydrogen and fuel cells can play an important role, but the economic doldrums felt by many countries, coupled with political turmoil, seem to be paralyzing many attempts to speed up deployment, it added.

Beijing Upgrades Transport Fuel

The Chinese capital city will adopt a stricter “Beijing-VI” standard this year for transport diesel and gasoline that is expected to cut particulate and other tailpipe emissions by 4.6% to 10%. State refiners have until March to ensure full supply of Beijing-VI compliant fuels throughout Beijing. The city’s new standard is more stringent than the national “China-V” specification — equivalent to Euro-V — that applies to the rest of the country from Jan. 1, as the capital city struggles to improve its air quality. Nationwide, the government is pushing oil refiners to reach the next China-VI standard by 2020. Last year, Beijing city experienced 12 more blue sky days compared with 2015 and saw a 9.9% drop in the average daily concentration of PM2.5, according to data released Tuesday. But the improvement was not significant

enough to produce a perceptible difference to the general public, which remain frustrated by ongoing seasonal winter smog attacks (NE Dec.22’16).

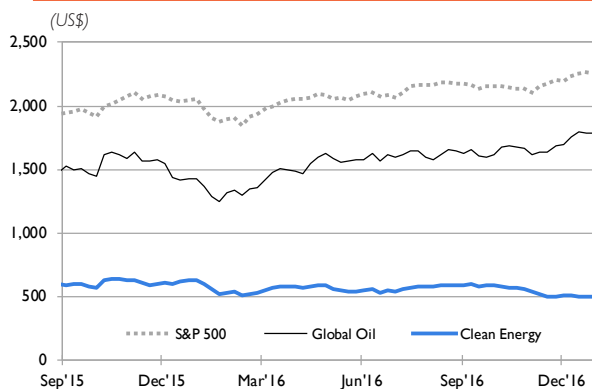
Algeria to Launch Renewable Tender
Energy Minister Nouredine Boutarfa told Algeria’s parliament last week he will soon launch a “national and international” tender for 4,000 megawatts of renewable electricity, as part of a long-awaited 22,000 MW renewable energy program to 2030. Boutarfa said the tender will require investors to locally produce part of the equipment, such as solar panels. To date, Algeria’s renewable electricity capacity amounts to a mere 380 MW, mostly including the 30 MW solar island of the Hassi R’mel hybrid gas-solar plant and about 340 MW of small solar photovoltaic plants already installed or about to be commissioned in remote areas of the country. Algeria’s total installed capacity, which is mostly gas-fired, amounts to around 17,000 GW.

Germany’s E.On Seeks Youth

German utility E.On is seeking out for talented young people to tackle what it sees as a “shortage of skilled labor” in the rapidly evolving power market. Some 1,000 apprenticeships are on offer in technical and administrative fields, with the majority of places, some 700, on offer in Turkey, 270 in Germany and 100 in the UK. E.On boasts an 87% post-apprenticeship employment rate. In Germany, E.On is offering not only the classic dual training scheme — for example as an electrician for operating technology, an electrician for devices and systems (IT) or as an industrial administrator — but also a combined study and work program where young people can pursue an apprenticeship in the company. In Germany, most new employees will start their apprenticeship at grid companies Bayernwerk, Avacon, HanseWerk and E.DIS.

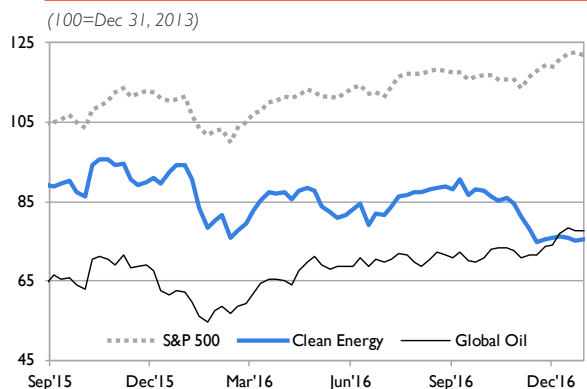
CLEAN ENERGY EQUITY MARKETS

Energy Equity Index Values



Source: Standard & Poor's

Energy Equity Class Performance



Source: Standard & Poor's

EI NEW ENERGY DATA

Energy Futures: Reference Prices

	Jan 3	Dec 27	Chg.
Carbon (€/ton)			
ECX EUA	5.41	6.32	-0.91
ECX CER	0.26	0.27	-0.01
Crude oil (\$/bbl)			
Nymex light, sweet	52.33	53.89	-1.56
ICE Brent	55.47	56.09	-0.62
Natural gas (\$/MMBtu)			
Nymex Henry Hub	3.33	3.73	-0.40
ICE UK NBP	6.05	5.97	+0.08
Coal (\$/ton)			
Nymex Eastern Rail CSX*	58.20	57.95	+0.25
ICE Rotterdam	82.50	90.05	-7.55

All prices are front month. EUA = EU Allowances; CER = Certified Emission Reductions under UN CDM. ICE UK gas converted from p/therm. *Short tons. Source: Exchanges

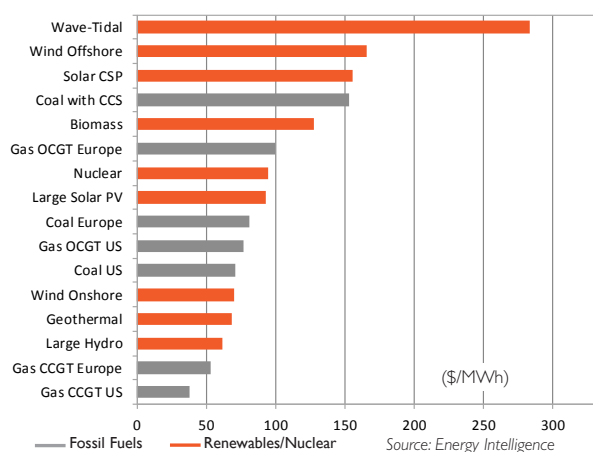
DATA: The complete set of *EI New Energy* data is available to web subscribers, including full levelized cost of energy (LCOE) calculations, fuel switching thresholds, electricity production by sector; ethanol and biodiesel fundamentals, carbon prices, methodologies and reader's guides. Historical data is available as a premium [Data Source product](#).

Global Carbon Prices

	Jan 3	Dec 27	Chg.
Europe (€/ton)			
EUA Dec '17	5.44	6.34	-0.90
US (\$/ton)			
CCA (Calif.) Dec '17	13.30	13.24	+0.06
RGGI (Northeast) Dec '17*	3.57	3.57	0.00
New Zealand (NZ\$/ton)			
NZU (spot)	17.10	17.00	+0.10
Asia (\$/ton)	Dec 30	Dec 23	Chg.
China-Guangdong	2.06	1.80	+0.26
South Korea	16.00	16.09	-0.09

Benchmark months. *Short tons; all others metric tons. Source: ICE, OMF

Newbuild Power Generation Costs



EU Carbon Futures Prices



Global Electricity Prices

	Jan 3	Dec 27	Chg.
Europe (\$/MWh)			
Germany (EEX)	52.25	48.56	+3.69
France (Powernext)	69.98	55.03	+14.95
Scandinavia (Nordpool)	31.93	32.04	-0.11
UK (APX)	56.22	55.88	+0.34
Italy (GME)	63.70	50.95	+12.76
Spain (Omel)	69.33	61.59	+7.73
North America			
New England	45.13	49.50	-4.38
Texas (Ercot)	20.11	35.73	-15.62
US Mid-Atlantic (PJM West)	31.28	28.10	+3.18
US Southwest (Palo Verde)	27.50	25.88	+1.63
Canada (Ontario)	11.36	8.41	+2.96
Other			
Australia (NSW)	110.88	62.47	+48.41
Brazil (SE-CW)	45.41	34.85	+10.55
India (IEX)	38.15	35.31	+2.84
Japan (JPEX)	81.47	77.50	+3.98
Russia (ATS)	21.70	19.54	+2.16
Singapore (USEP)	54.98	44.15	+10.83

Wholesale prices. Source: Exchanges

Key Biofuel Prices

	Jan 3	Dec 27	Chg.
US (\$/gallon)			
Futures			
CBOT Ethanol	1.5480	1.5550	-0.0070
RBOB Gasoline	1.6218	1.6535	-0.0317
Spot market			
Ethanol Midcont.	1.62	1.82	-0.20
Ethanol NY Harbor	1.74	1.78	-0.04
Ethanol US Gulf	1.73	1.81	-0.08
Europe (\$/ton)			
Futures			
ICE Gasoil	493.75	499.25	-5.50
Spot market			
Gasoline	563.50	540.00	+23.50
Diesel	488.50	483.00	+5.50
Biodiesel			
Fame 0	940.00	940.00	0.00
RME	915.00	915.00	0.00
SME	950.00	950.00	0.00
PME	955.00	940.00	+15.00

Source: Thomson Reuters, Exchanges

EDITOR: Lauren Craft (lcraft@energyintel.com), DEPUTY EDITOR: Ronan Kavanagh, EDITORIAL: CANADA: James Irwin, DUBAI: Amena Bakr, Oliver Klaus, Iain Packham, INDIA: Rakesh Sharma, LONDON: Jason Eden, SINGAPORE: Kimfeng Wong, STRASBOURG: Philippe Roos, US: Jason Fargo, Emily Meredith, Paul Merolli, Barbara Shook, Anthony Venezia, PRODUCTION: Michael Win. Published weekly. Copyright © 2017 by Energy Intelligence Group, Inc. ISSN 2168-5185. *EI New Energy* is a trademark of Energy Intelligence. All rights reserved. Access, distribution and reproduction are subject to the terms and conditions of the subscription agreement and/or license with Energy Intelligence. Access, distribution, reproduction or electronic forwarding not specifically defined and authorized in a valid subscription agreement or license with Energy Intelligence is willful copyright infringement. Additional copies of individual articles may be obtained using the pay-per-article feature offered at www.energyintel.com