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Q1 2012 CLEAN ENERGY POLICY & MARKET BRIEFING

Contents

Prepared by Bloomberg New Energy Finance for the Clean Energy Solutions Center, an initiative of the Clean Energy Ministerial

Policy pullbacks, weak economies, market oversupply slow Q1 investment

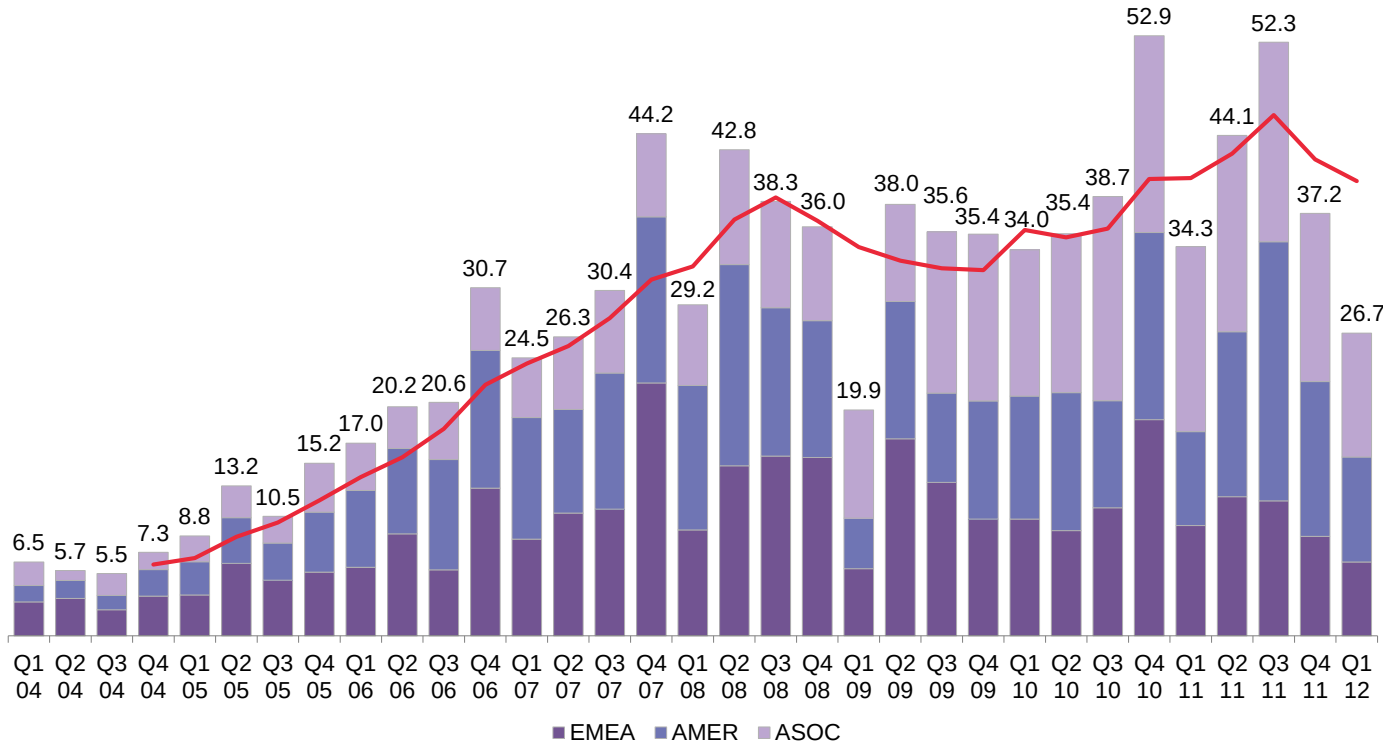
New investment in clean energy projects, companies and technologies fell in the first quarter of 2012 amid weak economic conditions in Europe, narrowing profit margins for manufacturers, scaled back subsidy support from policy-makers and fierce competition from low-priced natural gas. Total new funds into the sector slipped to $26.7bn in the quarter, down 28% from Q4 2011 and 22% from Q1 2011. In this inaugural edition of the Quarterly Policy & Market Briefing for the Clean Energy Solutions Center, Bloomberg New Energy Finance outlines clean energy trends worldwide in Q1 2012.

- Several factors contributed to the investment fall. Certain nations where clean energy has historically thrived posted little or no economic growth in Q1. Oversupply plagues the industry with excess wind turbine, photovoltaic (PV) module and advanced battery manufacturing capacity available and equipment makers' profit margins are getting squeezed. Budget belt tightening has prompted policy makers in developed markets to scale back support, in some cases quite dramatically. And record low natural gas prices in the US are crowding out opportunities.
- Financing for large-scale power generating projects fell to $24.2bn in the quarter from $34.7bn in Q4 2011 and from $27.9bn in Q1 2011. Long-term project financing has become harder to secure, with banks in the EU, in particular, extending project credit on a shorter term basis.
- Fundraising for companies via the stock exchanges totalled $0.6bn, down only slightly from $0.68bn in the prior quarter but off by a substantial 94% from the $4.6bn raised in Q1 2011. However, clean energy companies already trading on the world's stock exchanges saw their values grow, on average. The WilderHill New Energy Global Innovation Index tracking 98 clean energy stocks rose 7.1% in Q1. Still, that trailed the performance of other major indices.
- Major policies backing clean energy were scaled back in the US and in key EU nations, including Spain, the UK and Germany. Meanwhile, governments in countries with less clean capacity such as India, China and Brazil appear to be stepping up their support.
- Prices for solar PV modules at the factory gate 17 April were $0.90-0.99/Watt, depending on type (monocrystalline vs. multicrystalline) and manufacturer location (China vs. anywhere else). That's down from roughly $2/Watt at the start of 2011. Solar-grade silicon prices continued to slide during Q1 and were at $25.04/kg as of 17 April.
- The average price for utility-scale wind equipment hit a new low in the second half of 2011, dipping 4% from six months earlier, according to March data.
- The average price for an electric vehicle lithium-ion battery pack was $689/kWh in Q1, down from approximately $800/kWh a year earlier and from $1,000-plus levels in 2009.
- Falling wind and PV equipment costs have pushed down the levelised cost of electricity. As costs continue to decline, market demand for clean energy will rise, driven by basic economics. The industry's short-term pain will ultimately lead to long-term gains after all excess costs are eliminated.

1. INVESTMENT

Funding for clean energy fell sharply in Q1 2012 to just $27bn – down 28% from Q4 2011 and 22% lower than the equivalent figure in the first quarter of last year. All three segments of financial investment counted by Bloomberg New Energy Finance – asset finance for large-scale power-generation or biofuel-producing projects, public market capital raised over the world's stock exchanges for companies, and venture capital and private equity (VC/PE) financings for new start-ups and other privately held companies – were down on a quarter-to-quarter basis. One of the relative bright spots of Q1 2012 involved the valuation of publicly traded companies. Those rose on average, but the industry's stock performance still trailed that of the broader markets.

Figure 1: New financial investment in clean energy, Q1 2004-Q1 2012 ($bn)



Source: Bloomberg New Energy Finance. Note: Red line represents the four quarter trailing average investment. Figures include asset finance (financing of large-scale power-generating projects), public markets (funds raised over the stock markets), and venture capital and private equity (financing for primarily private companies from private investors). Excludes corporate and government R&D, and small distributed capacity. Not adjusted for re-invested equity

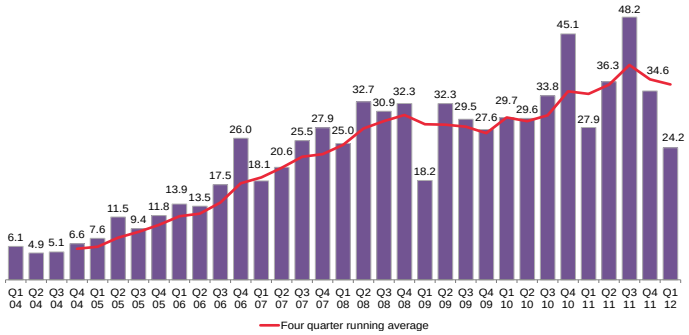
1.1. Asset finance and venture capital/private equity

Financing for utility-scale power-generating projects slumped last quarter due to a confluence of factors. Asset finance of $24.2bn was 30% down from the fourth quarter and 13% below Q1 2011. Still, there were major renewable energy projects financed, most notably the 396MW Marena Wind Portfolio in Mexico for $961m, the 100MW KVK Chinnu solar thermal plant in India for an estimated $400m, and the 201MW Post Rock Wind farm in Kansas, US, for approximately $376m.

Reasons behind the lower project financing levels varied regionally. In the EU, risk-averse banks are offering shorter duration loans to project developers. In the US, competition from natural gas is making it difficult for developers to sign power-purchase agreements to provide power above what is required by the approximately 30 state-level renewable portfolio standards. In China, the rush to build new wind capacity is slowing as officials grapple with transmission congestion and curtailment of existing projects. Across all three regions, policy uncertainty is creating significant further headaches for investors. Meanwhile, other nations, particularly in the developing world,

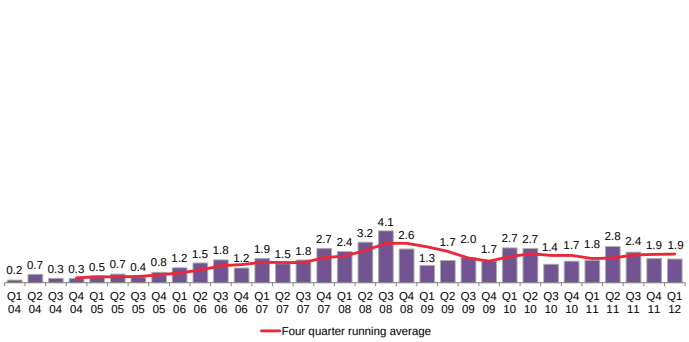
are poised to add substantial new capacity but are just beginning to get their clean energy sectors off the ground. Major investment is expected in these nations in coming quarters.

Figure 2: Global asset finance for new-build clean energy projects, Q1 2004–Q1 2012 ($bn)



Source: Bloomberg New Energy Finance. Note: Total values include estimates for undisclosed deals. Small distributed capacity excluded.

Figure 3: Global venture capital and private equity investment in clean energy, Q1 2004-Q1 2012 ($bn)



Source: Bloomberg New Energy Finance. Note: Total values include estimates for undisclosed deals.

Financing for early-stage, primarily private companies in the form of VC/PE also declined during Q1 but only slightly, to $1.85bn from $1.89bn in the prior quarter. The Q1 2012 VC/PE total was actually up 5.5% from the same quarter a year earlier. Still, the results were a far cry from Q3 2008, when investors ploughed a record $4.1bn into the sector. In all of 2008, clean energy attracted $12.3bn in new VC/PE funding, driven largely by enthusiasm for US biofuels and solar PV.

That year marked the high water mark for early-stage private investing in clean energy and backers of private companies have suffered substantial losses since. To a large degree, this was to be expected: venture capital investors recognise that the vast majority of the firms they back will not succeed. Just one or two breakthroughs can mean a massive windfall for their portfolio overall.

Still, venture investors have learnt some hard lessons in recent years about the fundamental challenges of investing in energy technologies compared with software or the other areas Silicon Valley knows well. The 'capital intensity' of energy – the amount of capital needed to prove a new energy technology at scale – was unfamiliar to a number of venture investors. Not surprisingly, venture investment has shifted in the last two years from technologies such as biofuels and photovoltaics into what Bloomberg New Energy Finance defines as 'energy smart technologies', such as smart meters, home energy management systems, and related software. These technologies focus on ways to improve energy efficiency; few require hundreds of millions of dollars to prove themselves at scale.

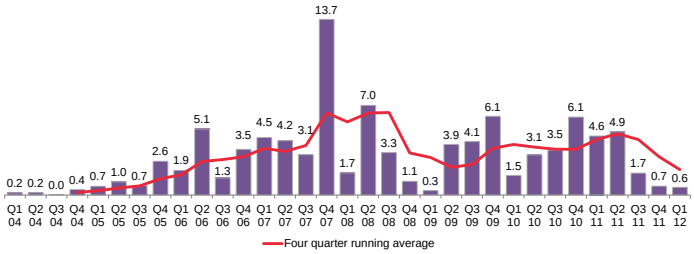
1.2. Public markets

Raising funds over the public stock exchanges has been particularly challenging for clean energy over the past nine months. In Q1 2012, the industry raised just $0.6bn via initial public offerings (IPOs) and secondary offerings by companies already trading. This represented a 12% fall from the prior quarter, an 87% drop from Q1 2011, and the worst quarter for new funds raised since Q1 2009. In a sign of the difficult conditions facing the industry, on 12 April, Israel- and California-based solar thermal technology and project developer BrightSource Energy pulled its planned IPO.

Still, there were successful offerings during the period. In January, Iowa-based designer of biodiesel plants Renewable Energy Group raised $72m via an IPO. In February, Brookfield Renewable Energy Partners LP/CA, an Ontario-based publicly traded investment vehicle with a primary focus on hydroelectric and wind resources, raised CAD 345.0m ($346m) via a secondary

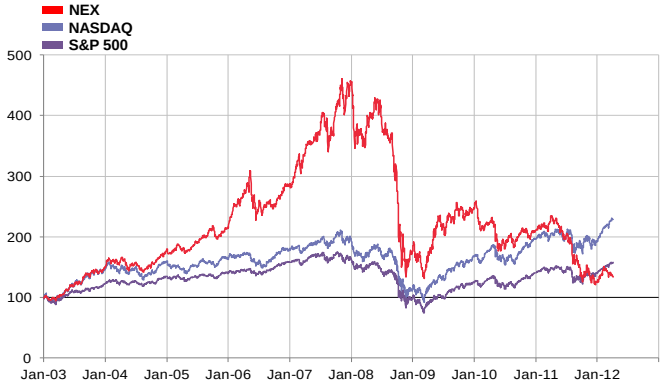
share placement. That same month, California-based energy crop producer Ceres raised $74.8m via an IPO.

Figure 4: Global public market new investment in clean energy, Q1 2004-Q1 2012 ($bn)



Source: Bloomberg New Energy Finance

Figure 5: Wilderhill Global New Energy Innovation Index (NEX) performance, 2003-12 YTD



Source: Bloomberg New Energy Finance. Note: Values as of 2 April 2012; NASDAQ and S&P 500 rebased to 100 on 01 Jan 2003.

Today, the outlook for public market fundraising looks uncertain. Companies that have filed to go public include next-generation biofuels technology developers Coskata (US), Enerkem (Canada), and Mascoma (US), as well as Silver Spring Networks (US), a developer of utility networking technologies.

Part of what has given investors pause has been the massive volatility seen in clean energy shares over the past five years. Bloomberg New Energy Finance tracks the performance of 98 international clean energy stocks via the WilderHill New Energy Global Innovation Index (NEX). The index is up overall since January 2003 but has seen its share of sharp spikes and declines. Through three months of trading ending 30 March, the NEX was up 7.3% year to date. By comparison, the MSCI World index was up 11.3% for the period and the S&P 500 rose 12%.

2. POLICY

Budget belt-tightening has heavily influenced clean energy policy-making in many developed world nations in recent months, prompting scale-backs of various subsidies and supports. The outlook has been considerably more positive in developing countries, with a number making important progress on their renewables and biofuels policy frameworks.

The eurozone debt crisis, austerity measures and falling technology costs have contributed to a turbulent time for clean energy policy in Europe. Germany and the UK led with high-profile subsidy cuts, with others planned in Italy, and Spain eliminating its feed-in tariffs completely for new, yet-to-be-approved projects. In the US, it was a similar story with key subsidies lapsing at the end of 2011 and an uncertain outlook for the wind sector's Production Tax Credit. Bloomberg New Energy Finance forecasts a drop in PV installations in the EU due to policy changes and barely any demand for new wind capacity in the US in 2013 if the PTC is not extended.

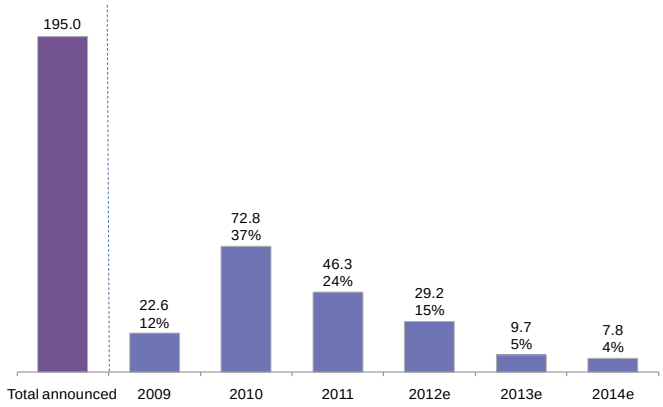
Concurrently, China, India, Brazil and other developing nations continued to make progress on new policies intended to support clean energy. New five-year plans for China and India pushed renewables to the forefront in Asia. Both countries have also launched support schemes through tariff-based auctions. Brazil could soon finalise a law that would make net metering a reality for PV and create a new market for residential solar system installers.

In 2008 and early 2009, governments around the globe pledged no less than $195bn in support for clean energy companies, projects and technologies via various stimulus programmes. Roughly three-quarters of this had been spent by the end of February 2012, leaving $53.2bn remaining.

The stimulus by no means represents the entirety of government support for clean energy. Bloomberg New Energy Finance estimates that clean energy public sector support totalled $43-46bn in 2009 alone.

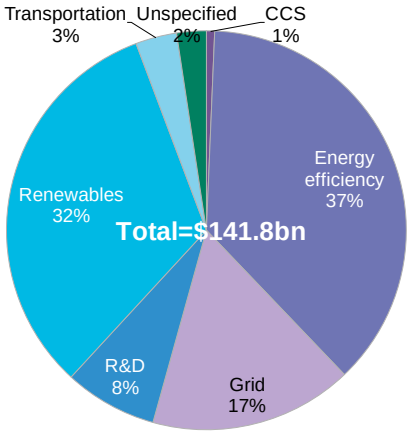
Still, with economic growth remaining relatively anaemic in the US and negative in some parts of the EU, governments are not feeling nearly as generous towards the sector as they did three years ago. Rapidly declining costs for clean energy equipment (see section 3) have also raised questions about how to set support at appropriate rates that do not over-subsidise the sector.

Figure 6: Annual global stimulus spend ($bn)



Source: Bloomberg New Energy Finance, governments. Note: Some $6bn is likely not to be disbursed from the announced programmes, hence the spending profile only adds up to $189bn.

Figure 7: Stimulus spend through 2011, by sector



Source: Bloomberg New Energy Finance, governments

2.1. AMER

In the **US**, the end of 2011 saw the expiration of several key programmes: the Treasury Department grants that supported renewable capacity development; a Department of Energy loan guarantee programme supporting project development; and the $0.54/gallon ethanol import tariff that shielded US producers from overseas competition. In March, the US for the first time imposed modest duties on solar goods from China and more tariffs could come this quarter. Meanwhile, it proposed CO2 emission standards for domestic new-build coal plants. New rules for existing coal-burning plants could come later this year.

Brazil held three reverse auctions for power contracts between August and December 2011, contracting 2.9GW of onshore wind and 595MW of biomass. The country plans to conduct its 14th energy auction in mid-June to contract power from wind, biomass and small hydro projects willing to deliver electricity by 1 January 2015. The government is considering launching a solar-specific auction, but not this year. In the meantime, Brazil is expected to support the growth of PV capacity through a new tax break for utilities, import duty exemptions for equipment imports, and a net metering regulation for end-users.

In **Mexico**, the state-owned public utility has committed to contract a total of 4GW from renewable sources. Mexico aims to meet its 7.5% target for clean energy installed capacity by 2012. The target requires the country to get 4.34% of its energy from wind, 0.77% from small hydro, 1.65% from geothermal and 0.85% from biomass. This could require approximately 16GW of new capacity.

In **Chile**, regulation to up the national renewable portfolio standard to 20% by 2020 is now making its way through parliament. **Panama** held its first wind auction in November, contracting four projects of 158MW installed capacity from applications totalling 450MW. The results were initially contested but power-purchase agreements for all four wind farms were signed in March at an average contract price of $102/MWh.

2.2. ASOC

With the approval of its 12th Five Year Plan in March, **China** adopted targets to reduce its carbon intensity by 17% from 2010 levels by 2015, and energy consumption (or intensity) by 16%. Under the plan, China would install at least 70GW of new wind capacity, start construction of 120GW of new hydro plants and add 40GW new nuclear capacity while bringing PV capacity up to 5GW, all by 2015. Seven cities, including Beijing and Shanghai, unveiled plans to pilot carbon trading. In a big push for power from waste-to-energy projects, the guaranteed tariff will be double that paid to coal-fired plants.

Summer is right around the corner in **Japan** and post-Fukushima the country is looking to meet its power needs with little or no nuclear capacity. Officials have announced plans for a new feed-in tariff and specific rates are expected to be unveiled in July. If set high enough, the tariffs could offer investors generous returns, according to Bloomberg New Energy Finance research. In addition, in February utility Tepco launched a mass rollout of smart meters and full penetration in its market is expected by 2023. Near the end of March, Japanese officials announced that the country would allow geothermal project development on certain parts of national parklands for the first time since 1974.

In **South Korea**, a February vote that would have established an emissions trading scheme by 2015 was postponed. That vote is now expected in Q2. The current legislative effort will fail if not passed before a new National Assembly is formed in June. The country has a voluntary emissions reduction target of 30% on business-as-usual levels by 2020.

India allocated PV subsidies at world record low levels under its Solar Mission competitive auctions held in December 2011. Auctions under state-level policies subsequently have attracted even lower price bids though it remains to be seen if all these projects will actually get built. India's 12th Five Year Plan may set a goal of as much as 30GW of new installed renewable capacity by March 2017. A Perform-Achieve-Trade scheme to promote energy efficiency in 478 energy-intensive industrial units has been rolled out to create a market for tradable energy saving certificates. On the flip side, however, the country's popular accelerated depreciation tax incentive – which is credited with helping India achieve the third-highest installed wind capacity globally – has been substantially pruned.

In **Australia**, a new federal Carbon Farming Initiative got underway in January to enable landowners to earn carbon credits for reducing emissions or storing carbon. In March, the Renewable Energy Venture Capital fund program commenced, with $200m available to develop Australian renewable energy companies, half of which was provided by the Australian Government. A new Clean Energy Regulator is set for operation in April with Australia's carbon pricing mechanism, emissions reporting and renewable energy targets all to be under its remit. In February, New South Wales, the nation's most populous state, released draft wind farm planning guidelines that impose significant new restrictions on developments in the state. This follows Victoria implementing some of the world's toughest wind farm regulations in August 2011. Australia's first large-scale solar feed-in tariff was legislated in the Australia Capital Territory in December, with bidding for 40MW due to close in April.

2.3. EMEA

Germany has introduced a one-time cut of 20-29% to its feed-in tariff for PV from the beginning of April. This will be followed by monthly cuts through 2012 then annual adjustments thereafter. Seeking to add 10GW of offshore wind power as part of its post-Fukushima 'turnaround' from nuclear energy, the country will seek to craft legislation that addresses liability issues and will look to new financing mechanisms to accelerate offshore wind grid connections.

Headlines in **UK** clean energy policy were made by a legal case over cuts to the feed-in tariff for PV, ultimately lost by the government. Nonetheless, lower rates took effect from March and a new

mechanism for further reducing the tariff was proposed to keep costs in check. A new renewable heat incentive was delayed in March so that the government could look at similar cost controls. The UK also re-launched its GBP 1bn CCS Commercialisation Programme in April.

Denmark's political parties finalised a new Energy Agreement in March that seeks to make the country entirely supplied by renewable power and heat by 2050. The new policy includes interim targets such as 50% wind energy consumption by 2020. New measures to achieve this include higher efficiency obligations on energy companies, the banning of fossil fuel boilers, incentives for onshore wind, biogas and biomass CHP, and new tenders for offshore wind.

In **France**, a 3GW tender for offshore wind closed in January, with the first results in early April handing tenders to EDF, Alstom and Dong. A second 3GW offshore wind tender will follow later this year. France launched a new energy efficiency action plan, including a third phase of its white certificate scheme for energy efficiency. The fate of France's aging nuclear reactors is being debated ahead of May's presidential election. A phase-out would require a near tripling of renewables investment.

Ireland launched two new feed-in premium schemes in February and March, designed to achieve the country's target of 16% renewable energy in 2020, by adding over 4GW of onshore wind and biomass. Facing difficulties over grid connections for wind, the regulator is reviewing liability and curtailment issues that are currently borne by project developers.

Spain's renewable energy sector was set to keep its boom-and-bust cycle going after the new government – seeking to curb its budget deficit – suspended feed-in tariffs in January for new, yet-to-be-approved installations. A new net metering law proposed for PV and biomass, which gives households retail credit for their own generation, would not be subject to the moratorium as it is subsidy-free.

3. TECHNOLOGY

Clean energy equipment has never been cheaper. While this is good news for project developers, small systems installers and ultimately consumers, it poses a serious threat to equipment manufacturers whose profit margins are getting squeezed. General oversupply in the wind and solar markets continued to keep equipment prices down through the first quarter of 2012. This, in turn, has helped to keep in check the final dollar per kilowatt hour price (the 'levelised cost of electricity') at which power generators can sell their power and earn an adequate return.

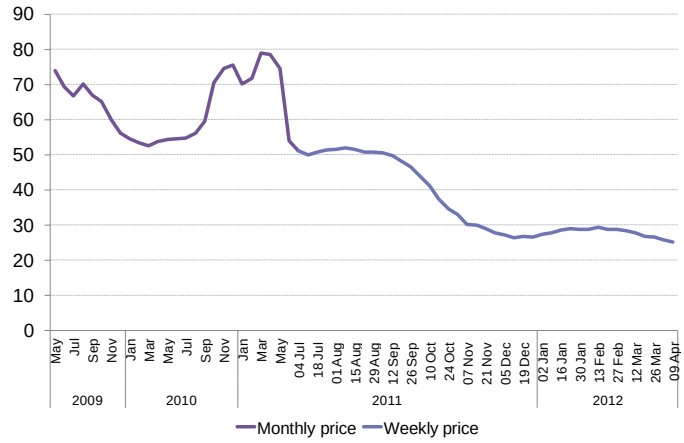
3.1. Photovoltaic equipment prices – low and holding

Prices for PV equipment deflated dramatically in 2011 with the final price at the factory gate falling by about half over the year. General PV equipment oversupply was largely to blame though manufacturers are also making important process improvements in production efficiency. Economies of scale are playing a major part in pushing down costs as well.

After falling through much of 2011, the 'spot' price for the base ingredient used in PV – PV-grade silicon –appeared to level off at approximately $28/kg as of 5 March 2012 but then slid further to stand at $25.04/kg on 17 April. Bloomberg New Energy Finance estimates that this essentially represents the underlying cost of production for major silicon producers. This suggests that prices are unlikely to fall much further in the short run – unless manufacturers are willing to produce at a loss.

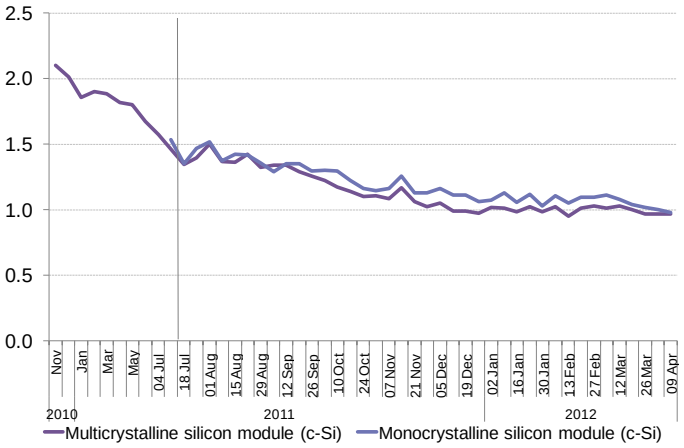
Similarly, the final price of solar modules appeared to level off in Q1 2012 at approximately $1/Watt, though there were significant variations in price across producers and regions. Chinese manufacturers have often underpriced their Western competitors. As of 17 April, Chinese modules were selling at approximately $0.91 – about 9% cheaper than those produced elsewhere. There are signs that Chinese players may even be selling their equipment at below cost out of concern that demand is only going to get weaker later this year.

Figure 8: Spot price of solar-grade silicon, May 2009-April 2012 ($/kilogram)



Source: Bloomberg New Energy Finance. Note: Average of all prices submitted to Bloomberg New Energy Finance survey. From 11 July 2011 the Index was conducted weekly. Dates in chart represent first day of the week over which the price has been averaged – i.e., 8 August represents average for the week 8-14 August.

Figure 9: Price for immediate delivery of crystalline silicon modules, Nov 2010-April 2012 ($/Watt)

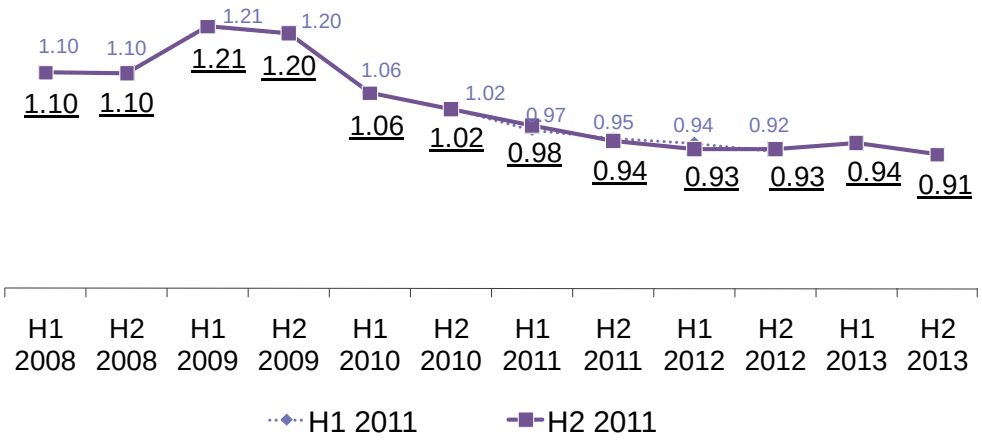


Source: Bloomberg New Energy Finance. Note: From 11 July 2011 the Index has been conducted on a weekly basis and the dates in chart represent first day of the week over which the price has been averaged. Prior to the weekly updates, the Index collected price of c-Si modules without differentiating between mono and multi crystalline silicon technology.

3.2. Wind turbine prices – still in the doldrums

A similar story of oversupply has plagued wind turbine manufacturers over the past year with the current situation unlikely to abate quickly in 2012. The average price for a utility-scale turbine hit another new low in the second half of 2011, dipping 4% from six months earlier because of excess capacity and entry into the market of new low-cost competitors, according to the latest Bloomberg New Energy Finance Wind Turbine Price Index (WTPI) released in March. And these figures do not include data from Asian wind turbine contracts, which tend to be even lower than those elsewhere due to the low price of Chinese-made equipment.

Figure 10: Wind Turbine Price Index mean price by date of delivery H1 2008-H2 2012 (EUR/MW)



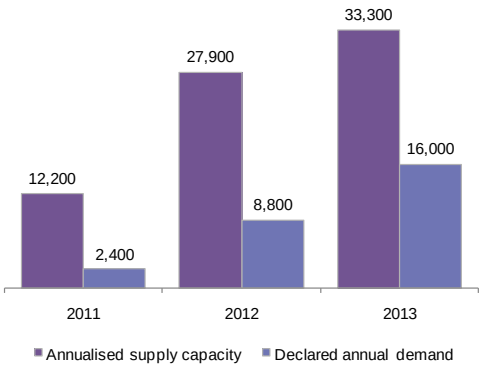
Source: Bloomberg New Energy Finance. Note: "H1 2011" indicates where prices were estimated to be the last time Bloomberg New Energy Finance conducted its survey of buyers and sellers of turbines in the first half of 2011. Contract prices include turbine plus towers and transport to site, and they exclude VAT. Asian turbine contracts have been excluded from the analysis as they have much lower pricing.

3.3. Electric vehicle batteries

The battery is a critical component in electric vehicles (EVs) and continued reduction of its cost is vital to EVs becoming more economical and acceptable to consumers. This month, Bloomberg New Energy Finance launched an Electric Vehicle Battery Price Index to monitor prices of lithium-ion batteries used in EVs worldwide. The index also looks at how prices have changed in the last couple of years and might move in the near term.

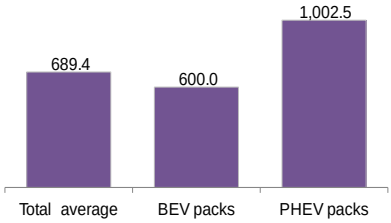
Today, there is roughly three times the manufacturing capacity for EV lithium-ion batteries available as there is demand for such batteries. Partly as a result of this, the price of lithium-ion battery packs used in plug-in electric vehicles has fallen significantly from the $1,000+ levels in 2009 to $689/kWh in Q1 2012. There is substantial discrepancy in cost based on where a battery is produced, with those from China on average much cheaper at $500/kWh. However, these products do not have the technical performance required in highway-capable passenger EVs. Instead, they tend to be used in low-speed EVs or buses.

Figure 11: EV lithium-ion battery manufacturing capacity and demand from automakers (MWh)



Source: Bloomberg New Energy Finance. Note: Demand only includes BEVs and PHEVs.

Figure 12: Battery pack prices by the type of vehicle the pack is used in ($/kWh)



Source: Bloomberg New Energy Finance. Note: the data used to calculate the figures above and all other charts do not include those on batteries produced by Chinese manufacturers unless clearly stated.

3.4. Levelised cost of electricity

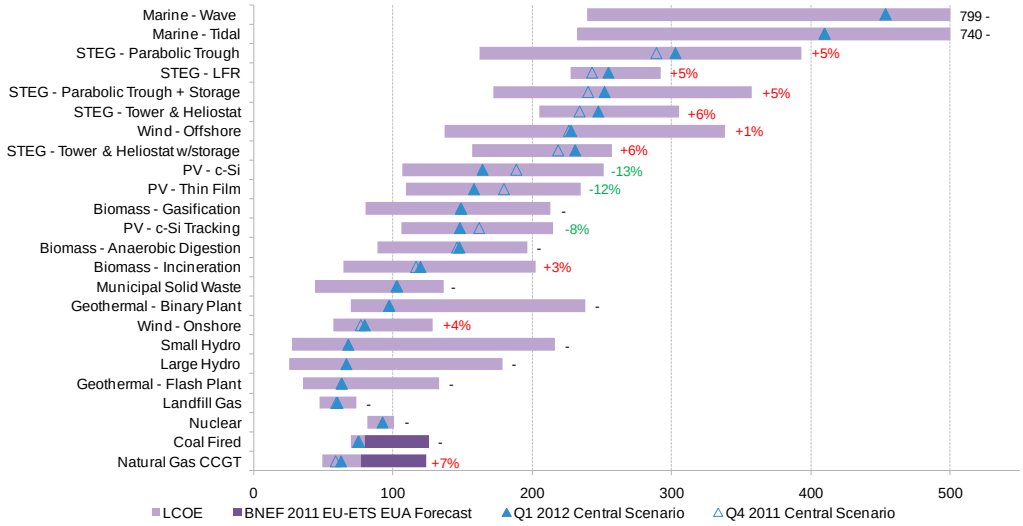
The levelised cost of electricity (LCOE) of a given technology represents the price at which a project owner can sell power and earn an acceptable return on his original investment. Each quarter, Bloomberg New Energy Finance examines the LCOEs of all the major clean energy technologies to understand how competitive each is with its fossil fuel rivals on something close to an apples-to-apples basis.

The LCOE is determined almost entirely by two factors: the cost of the equipment needed for a clean energy project and the cost of the capital needed to finance that project. (Marginal costs are minor since the fuel – the wind, sun, sub-surface heat for geothermal, etc. – is essentially free.) As discussed above, a highly competitive environment in the PV and onshore wind manufacturing industries has helped push down capital costs for clean technologies. But the cost of financing has not fallen in tandem. In fact, borrowing spreads are creeping up and term loan tenors slipping down, threatening to erode the advantages of a buyer's market.

The figure below illustrates the theoretical range of long-term power contracts project owners can sign to earn acceptable returns on their investments in their projects, given today's costs of equipment and capital. For the sake of its quarterly analysis, Bloomberg New Energy Finance considers a 10% return on investment to be the key hurdle rate for an average developer. Price

ranges reflect the differences in equipment that can be used by developers and the range of available natural resources at different sites.

Figure 13: Q1 2012 clean energy levelised costs of energy ($/MWh)



Source: Bloomberg New Energy Finance. Note: Carbon forecasts from the Bloomberg New Energy Finance European Carbon Model with an average price to 2020 of $33/mtCO2. Coal and natural gas prices from the US Department of Energy EIA Annual Energy Outlook 2011 and internal forecasts. Percentage change represents change from Q4 2011. For more on the complete assumptions behind this analysis, contact Bloomberg New Energy Finance.

For clean energy investment and deployment to accelerate rapidly, the industry's technologies must become cost-competitive with their fossil fuel rivals on a truly *unsubsidised* basis. For some technologies, that day is not far off. For others, it has actually already arrived. The massive price drop for solar PV has allowed the technology to become price-competitive today in residential markets with high retail electricity prices, exceptional insolation or some combination of both. Bloomberg New Energy Finance anticipates other major residential markets will reach 'grid parity' as well in the next few years. Meanwhile, small hydro, geothermal, and other clean energy projects that provide baseload power today already offer costs below those of fossil-generated power. And onshore wind costs, though highly variable by region and wind regime, are also competitive.

As costs continue to decline, market demand for clean energy will inevitably rise, driven by basic economics. To some extent, this is cold comfort for the manufacturing segment of the clean energy industry which today is being squeezed by small or even non-existent profit margins. But the industry's short-term pain will ultimately lead to long-term gains as all excess costs are eliminated, allowing consumers to access clean energy at the lowest possible costs.