



Editorial Letter

2011: The Good, the Bad, and the Ugly

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Twenty eleven has been a year of remarkable political and economic volatility. Political and civil unrest in much of the Middle East (the “Arab Spring”), Japan’s earthquake and tsunami and subsequent nuclear crisis, the European sovereign debt crises, and vast current and projected growth in demand for energy (and other commodities) from emerging economies have all combined to impact markets, including energy, in fundamental ways. Oil prices have reached levels not witnessed since 2008, and there has been significant volatility in these prices, and countries such as Germany and potentially Japan are looking at abandoning nuclear power.

When combined with considerable volatility – and in many cases negative returns – in nearly all commodity and equity markets, and dual concerns over a global economic slowdown and growing resource scarcity, this has brought energy security to the fore in many countries. This is particularly the case in countries which lack domestic fossil energy resources, have stringent environmental regulations or targets, and/or are reliant on nuclear energy for a significant portion of their electricity supply. As a result, countries like Germany and Japan have taken positive steps toward ensuring a more sustainable and secure energy future by focusing even more on renewable energy sources, while China continues to push ahead on all low carbon fuel sources.

As an opposing trend though, fiscal constraints imposed by the ongoing economic slowdown have also caused a slow-down – or stabilization – in political support for cleaner energy technology incentives in many countries, notably the Federal level in the US, and Italy and Spain in Europe. This raises the importance of falling renewable energy technology costs, which still continue. It also points to the importance of sustainable deployment of natural gas as a “bridge fuel” away from coal and towards renewables, particularly in countries such as the US, which have an abundance of natural gas reserves – and indeed this is a trend we are already seeing. Importantly, the US Environmental Protection Agency (EPA) has recently moved to tighten pollution restrictions on coal, which affects the relative economics and recognizes the impacts of hazardous air pollutants – EPA carbon regulations are still pending in the US.

This medium to longer-term view of a global energy transition was also represented in the outcome of the UN Climate Change Conference in Durban in December 2011, with some positive steps made toward laying the foundations for an all-encompassing, binding 2020 agreement and developing country funding through the Green Climate Fund. Just one month prior, Australia also passed legislation that sets a fixed carbon tax starting in July 2012, then moves to an



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emissions trading scheme from July 2015. Even so, there is a growing recognition that limiting global climate change to just 2 degrees Celsius may be increasingly difficult to achieve – this latter points to a growing need for adaptation, which will affect water and agriculture.

Overall, 2011 has seen both progress and constraint with regard to continuing the global transition toward cleaner sources of energy, but the megatrend ultimately continues. This has been reflected in the performance of the different asset classes in the clean energy space. Whereas cleantech public equities have fared poorly over the past 12 months, as have many equity sectors, private equity/venture capital and infrastructure markets have continued to grow, most important in terms of mitigation outcomes. Total investment in clean energy and energy efficiency markets (public, private and infrastructure) was nearly \$140 billion Q1 through Q3 2011, compared to \$103 billion over the same period a year ago¹. While there may be some moderation of growth in infrastructure markets in 2012, we expect the long-term growth in cleaner energy markets to continue.

¹ Source: Bloomberg New Energy Finance. Note: this does not include any investment in small distributed capacity or government/corporate R&D – as such, any total investment statistics for the period may differ



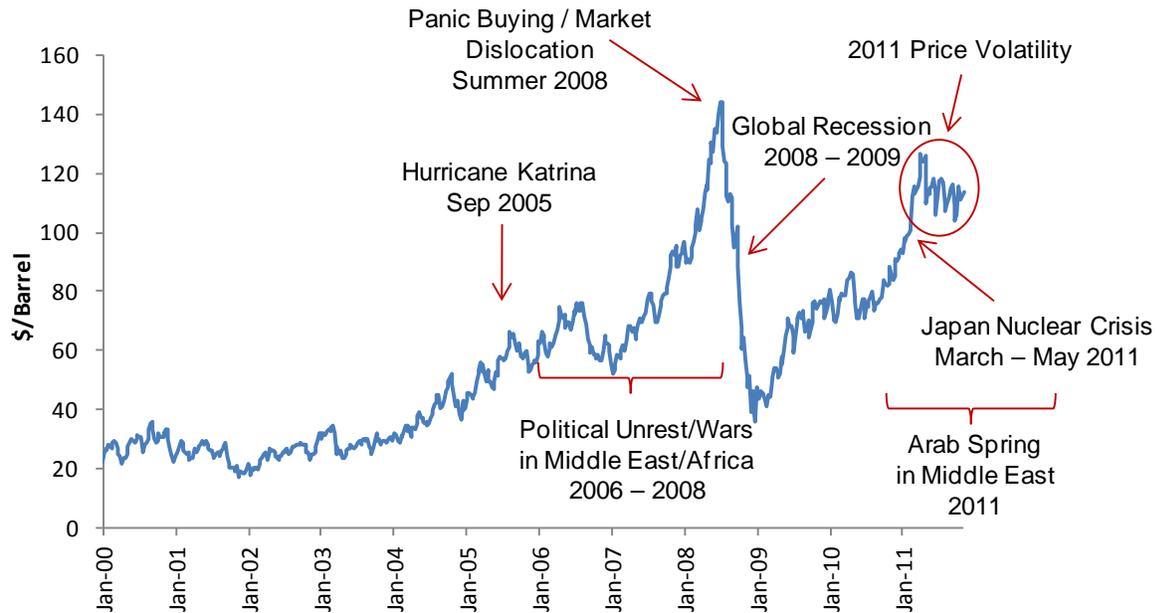
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Introduction

In this research note we evaluate the key energy policy and market themes of 2011 through a review of DBCCA's research papers from the past year.² We also reflect on how we see these themes evolving as we enter 2012, in particular that we continue to believe that the global energy matrix is in a "transition" phase right now – at the start of a long-term mega shift toward an "end-state" scenario of cleaner, domestic sources of electricity supply; presenting a huge range of investment opportunities. However, we also recognize that in many countries, budget deficits mean that financial support via government incentives may no longer be the key driver of this shift – but rather resource scarcity and associated commodity price spikes, and government regulations (for example, pollution controls) will become increasingly important drivers. The path toward achieving the ultimate goal of secure and sustainable energy supplies will also continue to vary by country and region, depending on local politics, commodity prices, domestic resources (both fossil and natural), level of socio-economic development, and many other factors. However, we continue to believe this energy shift can and will occur – even within the current constrained economic environment.

Oil Price Spike and the Japan Nuclear Crisis

Exhibit 1: Oil Shocks of 2008 and 2011



Source: Bloomberg Brent Crude Spot

There has been substantial market volatility since the start of 2011. This has been particularly evident in oil prices, which started a steep incline in early 2011 due to political and civil unrest in the Middle East and concerns over reductions in oil supply. These concerns were exacerbated by the tragic earthquake and tsunami in Japan on March 11th, 2011 and the subsequent Fukushima Daiichi nuclear plant crisis, which caused havoc with Japan's power

² To access these papers via the DBCCA website, see Appendix



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supply and had global market impacts, pushing oil prices even higher – Brent oil prices peaked for the year in April 2011 at \$128/barrel³. Since May, oil prices have declined somewhat but there has been considerable volatility due to the ongoing crisis in Japan, expanding political unrest in the Middle East, growing demand from emerging economies (in particular, China), and increasing concerns over European sovereign debt and the potential for a global “double-dip” recession.

In Q4 2011 oil prices were hovering at around \$105 to \$115/barrel⁴, and the Fukushima Daiichi nuclear plant was finally brought into a “cold shutdown condition in mid-December, although there still exists substantial and unmeasured radiation risk at the plant and surrounding area. These two events continue to have a significant impact on many nations’ energy policies, with certain countries – in particular, Germany and Japan⁵ (see subsequent discussion) – abandoning their nuclear ambitions. However, countries that have taken this route remain cognizant of their carbon reduction commitments and desire for greater energy independence – particularly with oil prices remaining north of \$100/barrel. In order to meet all these goals then, over the medium-to-longer term both these countries have committed to boosting their dependence on renewable forms of energy, and are making strides in efficiency – many countries are recognizing the importance of vehicle efficiency and have passenger vehicle fuel economy standards in place, with the most stringent being in the European Union, Japan and South Korea.

Not all countries, however, have turned away from nuclear – determining that the benefits of this carbon-free baseload source of power outweigh the risks. France currently sources 75% of its power from nuclear and has remained committed to this energy source. The government has so far refused to alter its nuclear build-out plans or reduce reliance on this energy technology – in fact, the country continues to build the much-delayed €6 billion Flamanville nuclear reactor led by state-controlled power company Électricité de France (EDF). China has an even more ambitious nuclear energy plan, with intentions to rapidly scale up capacity in order to meet growing energy demand. In response to Fukushima the country did announce a nuclear freeze until the beginning of 2012 while new safety codes and a new Atomic Energy Law are completed, but we do not expect China to materially alter its nuclear build program; rather we expect a shift to more advanced nuclear technologies. As we stated in September in our research note *China’s 12th FYP Update – The Work Plan. Focus on Energy Conservation and Emission Reduction*⁶, we continue to expect China to have approximately 50 GW of nuclear installed generation capacity in place by 2014 and we estimate 70 – 75 GW in place by 2020.

Global Economic Slowdown and a Year of Policy Slow-down for Cleaner Energy

As previously mentioned, there has been both progress and regression with regard to national policy support for cleaner energy in 2011. In our *Global Climate Change Policy Tracker*⁷, we continue to track momentum of legally binding and accountable climate policy for the Clean Energy Ministerial countries⁸, key US states and the EU bloc. Commitments to tackle climate change and reduce emissions continue to vary by region and country. Throughout 2011, Asia (in particular China) and Europe continue to experience the greatest momentum, while the US lags behind with no federal emission reduction targets and standards.

³ Brent crude oil spot price index. Source: Bloomberg

⁴ Brent crude oil spot price index. Source: Bloomberg

⁵ Several other countries have also committed to abandoning nuclear, including Switzerland and Italy

⁶ Access the report at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2386.jsp

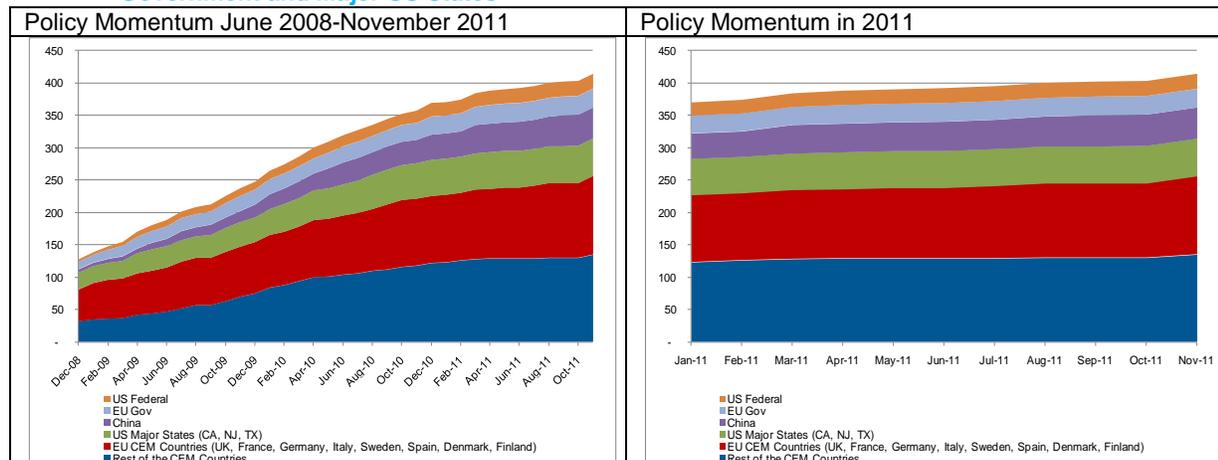
⁷ Access the report at: http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2375.jsp

⁸ The 23 governments participating in CEM initiatives are Australia, Brazil, Canada, China, Denmark, the European Commission, Finland, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Norway, Russia, South Africa, Spain, Sweden, the United Arab Emirates, the United Kingdom, and the United States. These countries account for 80% of global greenhouse gas emissions and 90% of global clean energy investment. Source: Clean Energy Ministerial



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Exhibit 2: Cumulative Net Binding & Accountable Climate Policies for CEM countries, EU Government and Major US States



Source: DBCCA Analysis, November 2011

We have tracked a net total of 414 binding and accountable climate policies in our policy database. During 2011 we tracked an overall total of 55 policies: 2 emission targets, 10 mandates and 43 supporting policies (such as feed-in tariffs, direct public funding and tax incentives). Included in this count were 49 positive, 2 neutral and 4 negative policy announcements in 2011.

Commitments to reduce emissions were largely introduced towards the end of 2009 and into the beginning of 2010, driven by the international negotiations and the resulting Copenhagen Accord. Since then the number of announced mandate and emission targets has stabilized. As seen in the chart above, there is still positive momentum of policy worldwide in 2011, however the pace and extent of growth has slowed down.

Throughout 2011 we have seen some key positive, neutral and negative developments in climate and energy policy. Below we highlight some of these key policy developments:

Germany

On May 30, the German Parliament voted to completely phase out the country's 12 nuclear plants by 2022, and on July 8 passed the latest revisions to its Renewable Energy Sources Act (the Erneuerbare-Energien-Gesetz or EEG). The revised EEG, which took effect on January 1, 2012, raises the renewable energy feed in tariffs (FiTs) for several technologies⁹ and sets a new target of 35% to 40% renewable energy in the electricity supply by 2020 – 35% already existed as the minimum required by law by 2020. Germany had already previously mandated that renewable energy supply 50% of the country's electricity by 2030 and 80% by 2050. In response to the nuclear phase-out Germany also announced a 75% increase in clean energy investment research in August, 2011.

Japan

Unsurprisingly, the Fukushima Daiichi incident has had considerable implications for public acceptance of nuclear power in Japan¹⁰, forcing a complete re-evaluation of the country's future energy strategy – in 2010 Japan had published its "2010 Electricity Supply Plan", through which it sought energy independence via the development of a substantial amount of nuclear power¹¹. However, as we outline in our September paper *Japan - The People's Greener Choice*¹², Japanese society is now seeking ways to dramatically reduce or eliminate nuclear generation

⁹ Tariffs have been raised for geothermal, offshore wind and biomass. Solar FiT digression remained the same.

¹⁰ In a July 2011 poll, 70% of Japanese stated they want to phase out atomic energy

¹¹ It is worth noting that Japan has virtually no domestic fossil fuel resources

¹² Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2377.jsp



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while maintaining carbon budgets and improving energy security. Logically, this can only be achieved using conservation and efficiency measures and natural gas as a transition fuel as renewable energy capacity is aggressively built.

Prior to the events of March 11th, Japan had 54 operating nuclear reactors and a total installed capacity of 49 GW (ranking third globally, behind the US and France), with nuclear accounting for 27% of the country's power supply. Recent statements from the government indicate Japan will completely phase out nuclear by 2035 to 2050, and no new nuclear plants will now be built¹³. In line with these policy statements, under the DBCCA Scenario 1, "Practical Nuclear Reduction," Japan would reduce nuclear power in 2030 by 72%, convert all coal generation to natural gas and reach 228 GW of renewable capacity including nearly 60 GW of new wind capacity, nearly 100 GW of new solar capacity and 15 GW of new hydro capacity. Electricity from intermittent resources would account for 25% of estimated 2030 electricity production, so we expect Japan to simultaneously undertake a substantial "smart grid" program to increase transmission capacity and facilitate intermittent generation management. As an additional demonstration of support for renewable energy, in late August the Japanese Diet passed a law requiring Japanese electric utility operators to purchase solar, wind, hydro, geothermal and biomass generated electricity for contractual terms and at prices to be fixed by the Government (i.e. a Feed-in Tariff) – we view this legislation (to be implemented in July 2012) as "the first step toward the repowering of Japan."

US

In contrast to Germany and Japan, US Federal support for incentives for renewable forms of energy has suffered severe setbacks in 2011, with the expiry of the Loan Guarantee Program (in September 2011) and the highly successful Treasury Grant Program (at the end of 2011), and the pending expiry of the Production Tax Credit (PTC) for wind (at the end of 2012). Given the current political gridlock and need to reduce the nation's debt, retroactive or proactive extension of these programs is at best uncertain and at worst highly unlikely, leaving the US renewable energy industry in a state of considerable uncertainty:

- The Loan Guarantee Program has been weighed down by the highly politicized controversy over failed US solar panel manufacturer Solyndra, which received a \$535 million loan guarantee in September 2009 and in August 2011 filed for bankruptcy. The failure of Solyndra has been the subject of an extended Congressional inquiry and has raised suspicion among skeptics over the entire US clean energy industry and its federal policy support mechanisms.
- The 1603 Treasury Grant Program (TGP), which reimburses renewable energy project developers in cash for 30% of a project's costs, has in some ways been a victim of its own success. Congress was wary about extending the program due to the associated estimated costs of an extension (scored at \$2 billion for a 1 year extension through 2012), as so many renewables projects (mostly wind) were expected to move forward and receive project funding under this program. As a result the program was not extended at the end of 2011 – and retroactive extension also seems unlikely – despite a recent letter of support for extension of the program, signed by 34 senators: "Over the last two and a half years, the TGP has leveraged nearly \$23 billion in private sector investment for 22,000 projects in every state and across a dozen clean energy industries, including solar, wind, biomass, fuel cell, combined heat-and-power, and hydropower projects... [and the program] has supported roughly 290,000 U.S. jobs. Allowing the TGP to expire would shrink financing available for renewable energy projects by 52 percent"¹⁴.

¹³ Japan's incoming Prime Minister Yoshihiko Noda stated at the end of August that Japan will continue to use nuclear power for the next 40 years in the wake of the Fukushima disaster. The previous Prime Minister, Naoto Kan's had promised a non-nuclear future in half that time. Source: Bellona Foundation

¹⁴ US Senate letter, December 7 2011



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- Extension of the Production Tax Credit (PTC) for wind is also highly uncertain at this stage – given that it does not expire until the end of 2012, it is not likely to be extended until the end of the year, or even retroactively in 2013, if at all. Without this incentive, the US wind industry would receive no federal support in 2013, and as a result future growth prospects for the industry (supply chain through project development) rely on the state RPS' and competitive pricing.

Importantly, despite the above Federal US policy setbacks, the Administration, through the EPA, has moved to restrict Hazardous Air Pollutants (HAPs) from coal via the Cross-State Air Pollution Rule (CAPR) and the Maximum Achievable Control Technology (MACT) regulations. These two very important – and controversial – regulations were issued by the EPA in 2011, and regulations of carbon emissions by the EPA are still pending.

- On July 6, 2011, the EPA issued its final Cross-State Air Pollution Rule, which requires certain states to improve air quality by significantly reducing power plant emissions (of sulfur dioxide and nitrogen oxide) that cross state lines and contribute to ozone and/or fine particle pollution in other states. Emission reductions were set to take effect quickly, starting in January or May, 2012, depending on the type of emissions. However, on December 31, 2011 the US Appeals Court in Washington granted a stay on the EPA rule, with a hearing expected in April 2012, and a decision later in the year. It therefore remains to be seen to what degree this Court decision will impact timing and enforcement of the EPA's CAPR.
- Despite this setback, the EPA Mercury and Air Toxics Standards – issued on December 21, 2011 – continue the pressure to close older coal fired generation in the US. The final MACT Standards are the first national standards to reduce power plant emissions of mercury and toxic air pollution (e.g. arsenic, acid gas, nickel, selenium, and cyanide) from 600 coal and oil-fired power plants in the US, by relying on available, proven pollution controls. The caps, which take effect in 2015, will require all coal plants to meet the emissions levels that the top 12% of coal plants now achieve, creating a high hurdle for many older, emissions-intensive coal plants, particularly in the Midwest and Mid-Atlantic.

These EPA regulations significantly change the economics of natural gas and renewables relative to coal, and as we outlined in our recent research note *Natural Gas and Renewables: The Coal to Gas and Renewables Switch is on!*¹⁵, over the next 20 years there will be a scale up in natural gas and renewable energy as a growing number of coal plants (particularly older coal plants) are retired (see full discussion of this trend later in paper). This is despite the US natural gas industry being subject to considerable controversy in 2011, with concerns raised over the chemicals utilized in hydraulic fracturing for shale gas extraction, and whether the industry and its waste (particularly its waste water) are sufficiently regulated. This topic has received a lot of public attention, although the industry has responded with greater transparency with regard to the processes and chemicals involved in shale gas extraction. In our view, within an environmentally acceptable framework, gas will remain a growing part of the US energy mix due to the large domestic resources, favorable economics and lower emissions of carbon and other pollutants.

Snapshot of Feed-in Tariffs in Europe

Feed-in tariffs continue to be the driving force behind many renewable energy developments globally, and are an effective tool for catalyzing the large investment flows needed to achieve 2020 emission and clean energy targets. The EU continues to dominate the FiT market, although momentum is spreading to China, Asia, Canadian provinces and some US localities. Over the course of 2011 there have been few new FiT initiatives in the EU, which is to be expected given 80% of member states already have FiT systems in place. Instead many European countries have adjusted their FiTs to reflect degression schedules, driven by declining costs and increasing capacity. Whilst on the whole such revisions can be viewed as neutral or even positive in terms of extending the life of the program such as

¹⁵ Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2395.jsp



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the rate reviews in Germany in 2011, a few stand out as being particularly damaging to their respective markets and thus we classify them as negative policy announcements:

- At the end of 2010 we witnessed Spain's Government ratify a decree that reduced the revenues existing solar PV plants can earn. These retroactive cuts have severely damaged investor confidence in 2011. In addition to this, in October, 2011, Spain announced that it is preparing to reduce the power price utilities must pay to new wind parks. The regulation is being prepared by the Industry Ministry to take effect in January, 2013, but will do little for the country's wind sector in 2012 ahead of the expected changes.
- Italy's Council of Ministers signed a bill (the Fourth Conto Energia) in May, 2011 that progressively reduces FiT rates for solar PV from June, 2011. There will be monthly reductions from June to December 2011, and then bi-annual reductions in 2012 and 2013, after which a new FiT mechanism will be introduced. The decree included rate cuts ranging from 4-14% for projects installed between June and August 2011.
- The UK's feed-in tariff for projects below 5 MW came into effect in April, 2010. However in early 2011 the Government announced an early review of the PV feed-in tariffs. In June the proposed new FiT levels for the solar sector for technologies of 50 kW and above were confirmed to take effect in August, 2011. The government's consultation proposed a reduction in tariffs of up to 55.5% for smaller projects depending on the installation size from December 12, 2011. Installations up to 4 kW were meant to reduce to £0.21/kWh from £0.43/kWh. However a December 23, 2011, High Court ruling granted in favor of Friends of the Earth, Solar Century and Homesun, finding that the premature cuts were illegal resulting in anyone registering for FiTs between now and March 31, 2012 being eligible for the higher £0.43/kWh tariff for 25 years. However, the UK Department of Energy and Climate Change (DECC) has pledged to appeal this decision as soon as possible, and if they are successful the initial December 12 deadline for the higher tariff will be reinstated. The Government also plans to revise subsidies for solar PV installations 4-250 kW in size, some of which already saw cuts in August, 2011 as discussed above. Overall, this lack of policy certainty and longevity could damage investor confidence in the country's solar market going into 2012.

In terms of new feed-in tariff policy, the UK Government finalized its choice of support for large-scale renewable projects (>5 MW), essentially aimed at the offshore wind market, including a FiT with Contract for Difference, which will be available in a transition from 2014. There are still some uncertainties about the detailed structure of the FiT CfD, however upcoming technical papers are expected to provide more transparency. The FiT CfD should provide greater certainty over revenue and as it is considered more efficient in terms of costs should help to encourage longevity. Overall it should provide more transparency, longevity (TLC) and we see it as being a positive regulatory step for the UK, especially for offshore wind¹⁶.

Lastly, we saw France's Government publish an order in March, 2011 setting out a new solar PV FiT scheme further to the suspension of the power purchase obligation. The new scheme limits installed capacity to 500 MW per annum. Key features of the new scheme are a solar PV FiT that is limited to plants installed on buildings with capacity <100kW. There were also FiT reductions for residential building integrated plants, commercial building integrated plants, and ground plants. The tariffs will be adjusted quarterly on the basis of grid applications volume made during the previous quarter. The revision can be seen as neutral in terms of the French solar market as it still allows for the additional installation of capacity that had received construction permits in 2010, which industry analysts estimate could result in 2011-2012 capacity additions in the region of 1.5 GW.

¹⁶ See DBCCA research note *UK Offshore Wind: Opportunity, Costs and Financing* http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2400.jsp



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Natural Gas and Renewables in the US

As previously outlined, 2011 was a year of inaction on climate and energy policy by US Congress, and with many key clean energy policy initiatives having expired in 2011 – combined with recent EPA regulations – we maintain that natural gas will play an increasingly critical role in the US power mix. As we stated in our updated US power forecast analysis *Natural Gas and Renewables: The Coal to Gas and Renewables Switch is on!*¹⁷, over the next 20 years there will be a scale up in natural gas and renewable energy as coal plants are retired and energy efficiency reduces the rate of growth in electricity demand. As stated in our initial 2010 report *Natural Gas and Renewables: A Secure Low Carbon Future Energy Plan for the United States*¹⁸, we believe natural gas and renewable energy can play complementary roles in displacing coal-fired generation and lowering greenhouse gases (GHGs) emissions from the US electricity sector through 2030, and at present a gas and renewables combination represents the most logical, politically acceptable, and economically feasible low-carbon energy pathway for the United States. This 2011 research update also provides evidence that this thesis is occurring – for example, an increase of 2 percentage points in the share of the US electricity mix coming from renewables (chiefly wind) from 2009 to mid-2011.

We believe 2011 is likely to be the last year of meaningful coal capacity additions in the US as: (i) new coal generation is increasingly unpopular among the general public; (ii) recently issued EPA regulations (as previously outlined) focused on non-carbon pollutants will, we believe, lead to as much as 60 GW of coal generation retirements in the US by 2020; and (iii) assuming a \$6/MMBtu gas price, it will be more economic to build new gas-fired generation than new coal plants. Based on these and other conclusions, our updated US power forecast is displayed below.

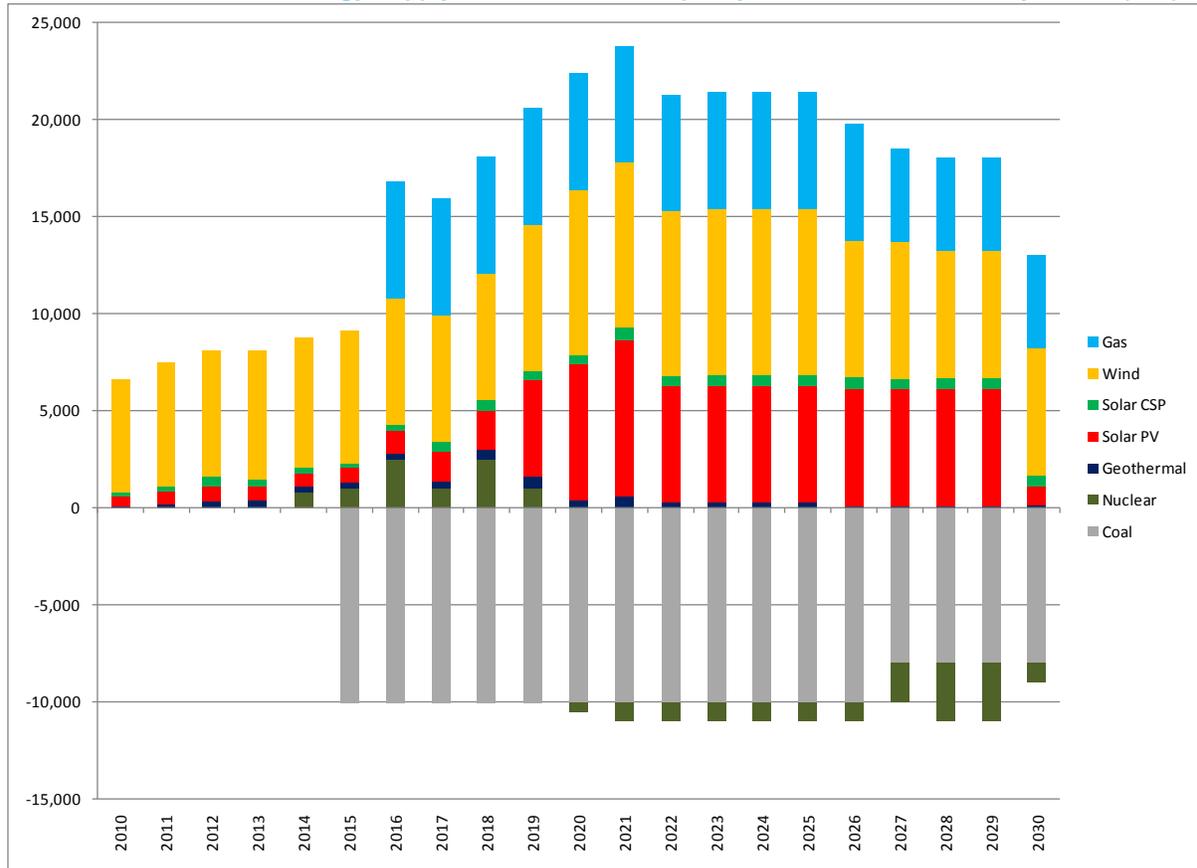
¹⁷ Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2395.jsp

¹⁸ Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2358.jsp



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Exhibit 3: DBCCA Energy Supply Forecasts - New Capacity Additions / Removals by Sector (MW)



Source: WPK Model, DBCCA analysis

Simultaneous to this research update, we published a companion paper *Repowering America: Creating Jobs*¹⁹, which looks at the job implications of our power market forecasts. Over the period 2010 to 2030, we expect around 7.9 million cumulative net job years²⁰ of direct and indirect employment to be created as a result of this electricity supply forecast outlook. By 2020 and extending out to 2030, there will be around 500,000 net new jobs in place compared with the start of 2010. As can be deduced from Exhibits 3 and 4, gas and renewables account for the net capacity and associated job growth while there will be some losses in the coal sector, although the latter will be more than offset by job gains.

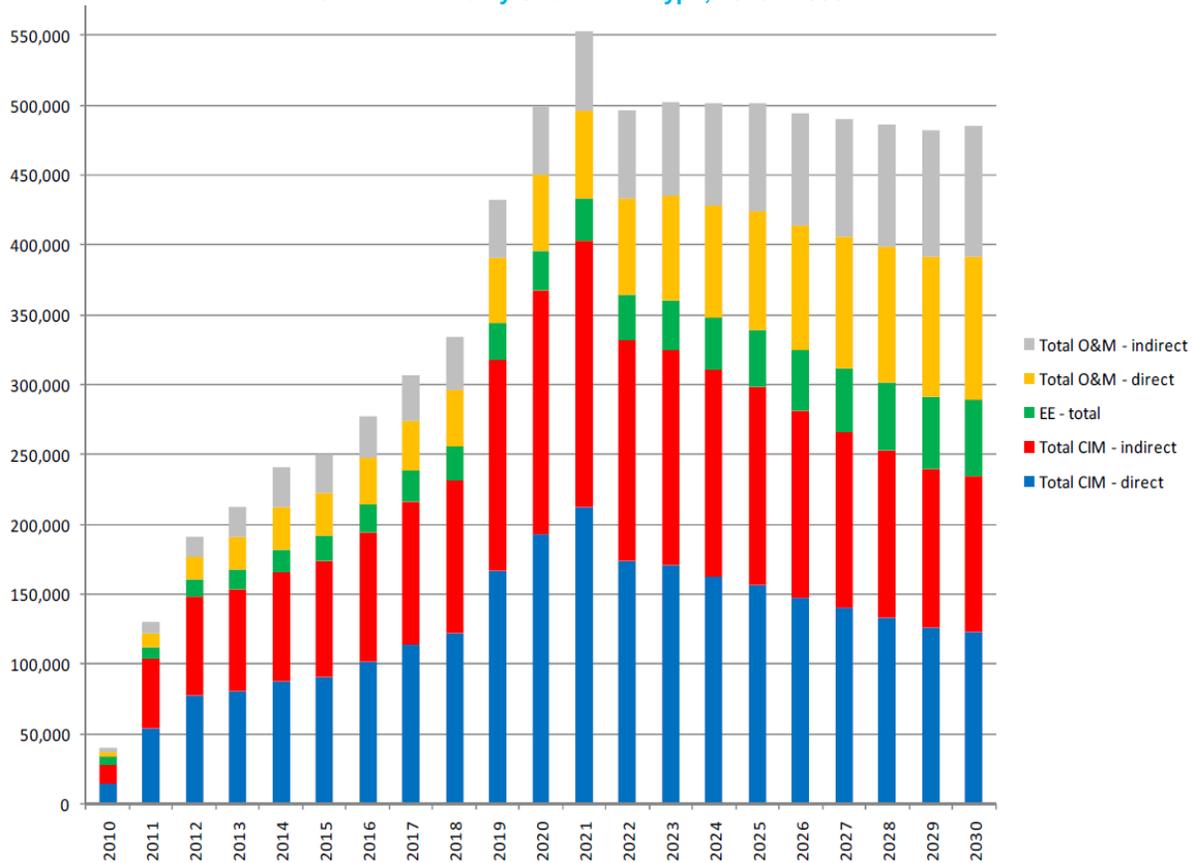
¹⁹ Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2396.jsp

²⁰ A job-year of employment is defined as full-time employment for one person during one year (measured by a standard 2,080 hrs of employment/year). In terms of the model, this is the number of job-years in that particular year



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Exhibit 4: Annual Net Job Additions by Sector and Type, 2010 - 2030



Source: WPK Model, DBCCA analysis

Clearly there is a strong economic and political case for the US to switch from coal to natural gas and renewables, and improve energy efficiency. Another clear benefit of this shift is with regard to reductions in greenhouse gas (GHG) and other emissions. Our August research note *Comparing Life-Cycle Greenhouse Gas Emissions from Natural Gas and Coal*²¹ incorporates a full lifecycle analysis of natural gas and coal-fired electricity generation from source to use, and concludes that GHGs from natural gas – even when produced from shales – to be 47% below (on a MWh basis) the source-to-use GHG emissions from coal. As a result of these lower emissions during the lifecycle, under the DBCCA electricity supply forecast we see a 23% and 31% reduction in GHGs by 2020 and 2030 compared to a 2005 baseline. There are also substantial reductions in other emissions harmful to human health (e.g. sulfur dioxide, particulate matter, and nitrogen oxide), and these reductions are even more significant with regard to renewables, which are near zero emission energy technologies.

China Continues Global Leadership towards a Low Carbon Economy

Despite a clean energy policy slow-down in the US and several other countries in 2011, China has continued to demonstrate leadership in the climate and renewable energy world. This comes in the form of the policy momentum and ambition of China's efforts to create a low carbon economy and improve its energy security through ambitious

²¹ Report available at www.dbcca.com/dbcca/EN/investment-research/investment_research_2376.jsp



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goals in terms of energy intensity targets and renewable energy deployment, backed up by strong incentives encouraging the development of green industries and jobs. As outlined in our DBCCA research note *12th Five Year Plan – Chinese Leadership Towards a Low Carbon Economy*²², China's 12th Five Year Plan (12th FYP)²³ provides clear evidence that China's low-carbon policies remain global best-in-class. According to Hu Angang of the Chinese Academy of Sciences, 33.3% of the targets in the 12th FYP address resource or environmental objectives compared to 27.2% in the prior 11th FYP. Indeed the Plan contains an entirely new section on "...energy conservation and environmental protection in responding to climate change" and lays out significant progress in key areas, describing the high-level objectives of China's National Climate Change Program. It is also stated that pilot cap-and-trade systems for carbon and other criteria pollutants will be undertaken. This global leadership in particular contrasts to the stalled efforts at the US Federal level. China also took somewhat of a leadership role at the international climate talks in Durban around a 2020 binding emissions deal that includes the developing world.

The 12th FYP, as subsequently amended, establishes energy goals for 2015, in addition to many of the 2020 targets already announced. China has targeted that energy intensity by 2015 will improve by 18% from 2010 and non fossil fuel energy will increase to 11.4% of total generation. With regard to wind and solar, installed capacity goals for 2015 have also been announced in 2011, including 15 GW of solar PV²⁴ (relative to less than 1 GW at the end of 2010), and 100 GW of wind by 2015²⁵ (from 42 GW at the end of 2010). However, in August the central authorities moved to take control of permissioning wind projects as the "overhang" of unconnected renewable energy projects builds up. Importantly, transmission lines for renewables are also targeted for expansion as part of State Grid of China's announced plans to invest RMB 500 billion (US\$76.7 billion) over the next five years. Further, forest cover is targeted to increase by 12.5m hectares and high-speed rail is targeted to expand by 47,000 km between now and 2015.

Another key component to the 12th Five Year Plan is the identification of seven "Strategic Emerging Industries" (SEI's). Under the 11th Five Year Plan the SEI's exceeded targeted growth, and importantly, five of these seven new SEI's are either directly related, or highly related, to climate change themes. These include clean energy, clean energy vehicles, energy conservation, new materials and environmental protection. This offers further evidence that the Chinese government is placing heavy strategic importance on decarbonizing the nation's economy, whilst also achieving sustained growth.

Clean Energy Market Struggling? – Strong Deployment, Weak Equities

Public Markets Investment in Clean Energy

Following a surge of activity in H2 2010, public markets investment in the clean energy sector slowed considerably in 2011. As of the start of December 2011, clean energy public investment was down by nearly a quarter (-\$6.5 billion) relative to the same period a year ago²⁶. Moreover, in 2011 publicly-traded clean energy stocks have underperformed significantly compared with the broader market. Exhibit 5 below shows the performance of two leading clean energy indices – the DB Nasdaq OMX Cleantech Index (DBCC) and the WilderHill New Energy Global Innovation Index (NEX) – against the performance of the MSCI World Index (MXWO); while the MSCI has declined by roughly 11.5%, the two cleantech indices have both declined by 36%.

²² Report available at http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2366.jsp

²³ The Draft 12th Five Year Plan was released on March 5, 2011

²⁴ This target was officially increased from 10 GW in mid-December 2011. Source: State Media, as cited by DB Market Research, December 16 2011

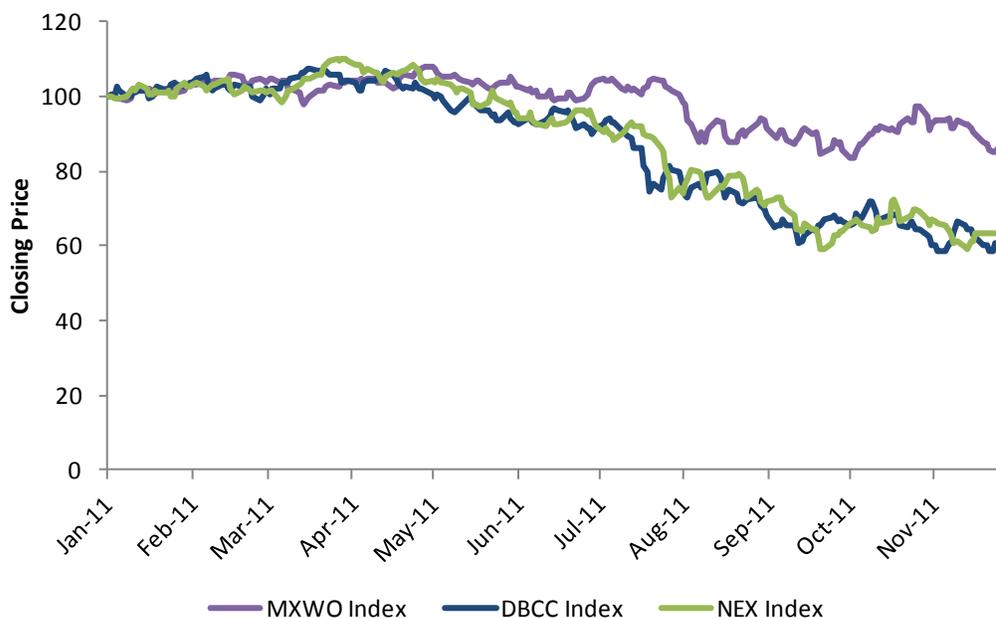
²⁵ Source: State Media, as cited by DB Market Research, December 16 2011

²⁶ Source: Bloomberg New Energy Finance database



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Exhibit 5: Indexed Returns of MSCI World, DBCC and NEX Indices, YTD 2011



Note: Data as of December 1 2011; indexes rebased to each equal 100 as of Jan 1 2011.
Source: Bloomberg LP

Share-price declines have been particularly severe for upstream players in the clean energy value chain; amid a glut of production capacity and razor-thin margins, with a result being that wind turbine and solar module manufacturers are down nearly 50% compared with their peak valuations in 2008. Lackluster returns for clean energy public equities have also chilled the market for clean energy IPOs in 2011. Whereas the first eleven months of 2010 saw \$12.1 billion in clean energy IPOs, in the same period of 2011 there has been clean energy IPO activity worth only \$4.8 billion – a decline of more than 60%. Again, the drop-off in activity has been most severe for the wind and solar PV manufacturing sub-sectors.

Given this 2011 context, the outlook for clean energy public equities in 2012 hinges chiefly on: (i) how the policy retrenchment currently underway in the US and certain European countries affects demand for clean energy technologies; and (ii) when solar PV and wind turbine manufacturers commence a (seemingly inevitable) process of “rationalization” and industry consolidation.

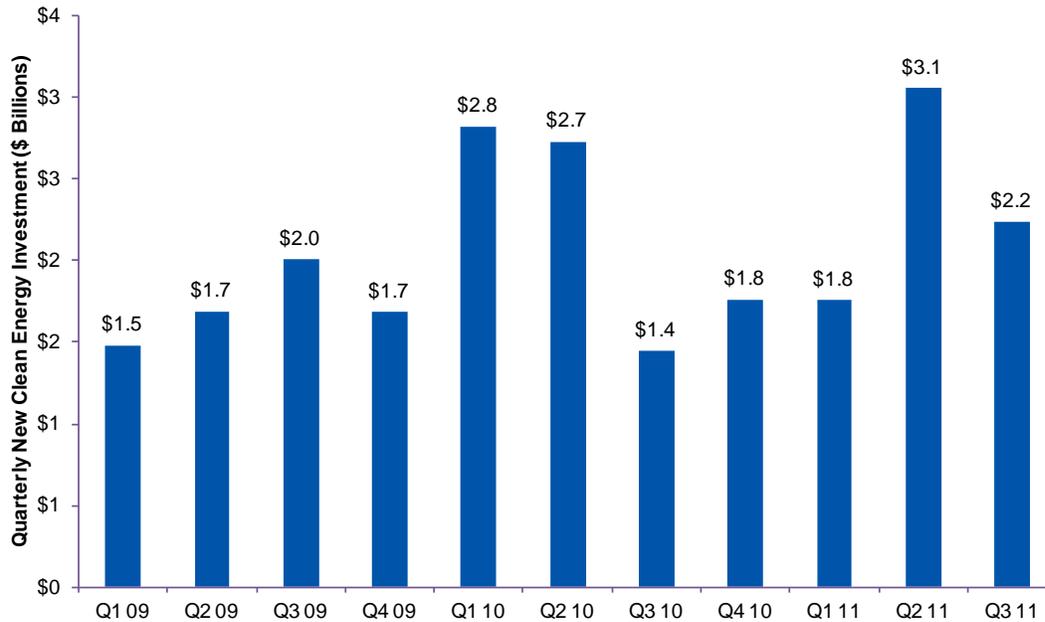
VC/PE Investment Remains Steady

Despite investor uncertainty and associated volatility in clean energy public markets, private investment in the sector has remained relatively consistent throughout the economic downturn and through 2011 (see Exhibit 6 below). This bodes well for continued technological innovation and is particularly prevalent in the US, which accounts for the vast majority of private clean energy investment.



Review of 2011 as seen by DBCCA Research

Exhibit 6: Quarterly New Clean Energy VC/PE Investment, Q1 2009 – Q3 2011



Source: Bloomberg New Energy Finance, 2011

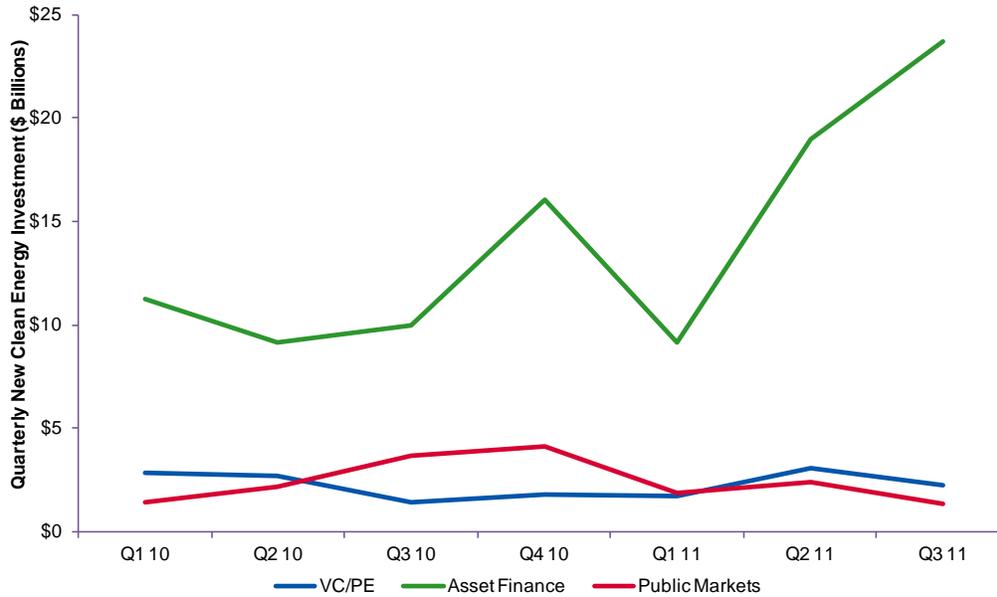
Robust Year for Clean Energy Project Finance Market

On an even more positive note, clean energy project financing has seen a huge boom in 2011, reaching a record quarterly investment figure of \$23.7 billion in Q3 2011. Asset finance now consistently dwarfs public market and VC/PE investment (see Exhibit 7 below), demonstrating that clean energy projects continue to be financed and built, despite uncertainty in the public markets.



Review of 2011 as seen by DBCCA Research

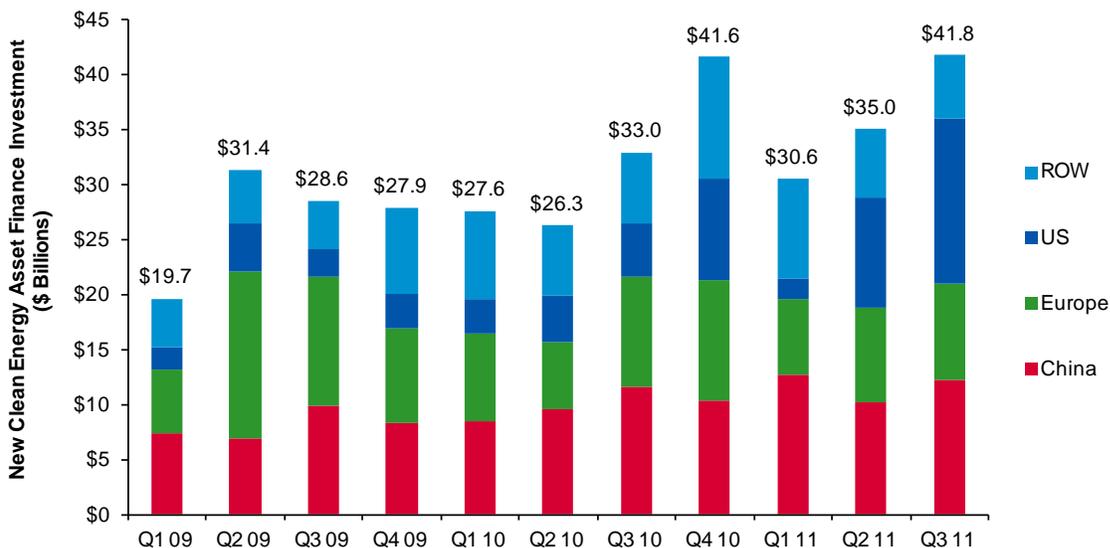
Exhibit 7: Quarterly New Clean Energy Investment by Asset Class, Q1 2010 – Q3 2011



Source: Bloomberg New Energy Finance

In terms of a regional breakdown, there has been a consistent growth trend in asset finance investment in China over the past several years, while the US and Europe have seen more fluctuations (see Exhibit 8 below). For the US, 2011 has been a particularly robust year for clean energy infrastructure investments, with nearly \$27 billion of investment in Q1 through Q3 2011 – relative to only \$12 billion over the same period in 2010. There was a particular boom in Q3 2011, with the US representing the majority of new clean energy infrastructure investment in this quarter – 36% of global investment, relative to 29% in China and 21% in Europe. This is the first time the US has exceeded China’s asset finance investment in the sector since 2007, and is largely the result of a boom in investment in wind and solar to meet the Treasury Grant Program deadline (the program expired at the end of 2011).

Exhibit 8: Quarterly New Clean Energy Asset Finance Investment by Region, Q1 2009 – Q3 2011



Source: Bloomberg New Energy Finance

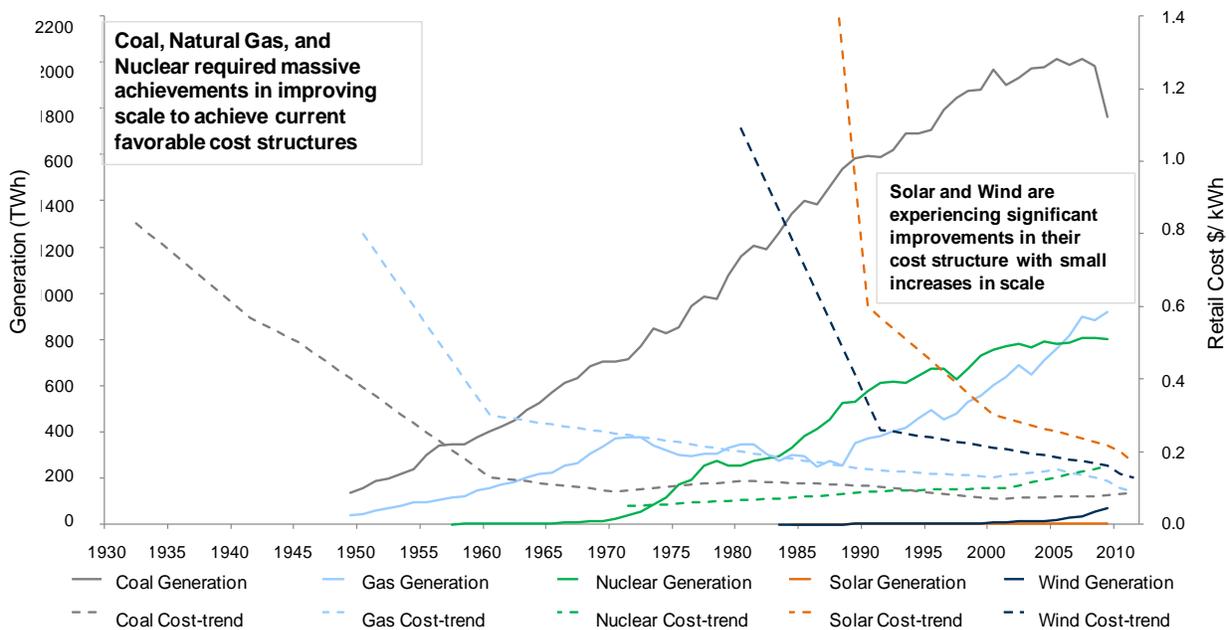


Review of 2011 as seen by DBCCA Research

Meanwhile Clean Energy Costs Continue to Decline

Another long-term positive market signal for the clean energy industry is the continued and rapid technology cost declines. We believe that renewable energy sources will reach grid parity in the next 5-10 years, and as a result investment in this sector will continue to grow – even though public market investment in clean energy has had a troubled couple of years. In effect, incentives are working to reduce costs due to “learning by doing” as industry scales up and so have a finite time frame in sight. Exhibit 9 below shows the effect of scale on energy technology costs historically in the US, and just how dramatically wind and solar costs have declined over the last 2 to 3 decades.

Exhibit 9: Renewables are Trending towards Grid Parity - US Electricity Generation and Retail Cost by Technology, 1930-2010



Source: Hudson Clean Energy Partners analysis 2011

Durban Outcome

The December 2011 UN Climate Change Conference in Durban (Conference of the Parties, or COP-17), once again brought together representatives of the world’s governments, international organizations and civil society. The discussions sought to advance the implementation of the Kyoto Protocol and the Bali Action Plan and Cancun Agreements. On December 11, the conference reached an agreement and program to set a new course of action for the global fight against climate change. We believe that there were three key positive outcomes:

- **A longer-term deal is now more likely:** The Durban Platform for Enhanced Action set a schedule for negotiating a new ‘protocol’ covering all countries, developed and developing, by 2015 – with binding targets to occur from 2020. This very significant element can be viewed as a historic breakthrough in international



Review of 2011 as seen by DBCCA Research

climate negotiations: the acceptance of developing nations to the principle of limiting their emissions in a new agreement from 2020. This marks a significant advance along the path of climate negotiations, and the commitment by developing nations at Durban is a big “win” for the US and other countries that argued emerging economies should play an equal role in any climate mitigation action – as such, this decision is positive with regard to full participation by major economies in any future agreement, and makes US participation much more likely. However, the new agreement is expected to come into force from 2020, yet scientific consensus is that global greenhouse gas emissions need to reach a peak ahead of 2020 if there is to be any chance of stabilizing climate change to below 2 degrees Celsius. Therefore, it is most likely the case that the 2 degree figure may well be at risk now given the delays and changes to the international agreement schedule. Importantly though this does not mean that the world cannot still control further increases in temperature. To this end, although it does now seem clear that there will be a need for some climate adaptation, in our view the Durban outcome does not mean that the world has moved to prioritize adaptation over mitigation. Rather it means that the goal posts are potentially moving beyond 2 degrees Celsius change, and global action is still possible if the assumption that a 2015 agreement can be reached with all economies on board comes to fruition. We acknowledge, however, that this does continue to point to the increasing importance of adaptation.

- **Extension of the Kyoto Protocol:** The Kyoto Protocol has been extended into a second commitment period (2013 to either 2017 or 2020), with countries submitting targets by May, 2012. The European Union and 12 other nations accepted limits under a second commitment period from 2013 – a step that is critically important to the Clean Development Mechanism and renewable energy projects in developing countries. On the negative side, Japan, Russia and Canada will not participate in the second commitment period, and Canada has even left the Protocol entirely. However, we believe these countries would have struggled to meet their emissions targets as a result of the Fukushima nuclear incident in Japan and need to develop a new long-term electricity supply plan, and domestic, fossil-intensive energy strategies in Russia and Canada.
- **The formal adoption of the Green Climate Fund:** The Green Climate Fund, originally put forward at the Copenhagen summit in December, 2009, has now been approved and is designated as an operating entity of the Financial Mechanism of the Convention with clearance for countries to begin contributing to the fund in 2012. The GCF will funnel some of the \$100 billion that developed nations have pledged to developing nations by 2020 with an initial offer from the Republic of Korea to contribute to the start-up cost of the facility. A key outcome at Durban was the resolution of a dispute over where the fund should be “housed”. The GCF will be overseen by the United Nations, something that developing nations had called for rather than it being overseen by the Global Environment Facility. There are of course still issues to be addressed including the crucial point of how the facility will be funded and by whom. But it is known that the fund may receive financial inputs from a variety of other sources, public and private and will provide simplified and improved access to funding, including direct access, basing its activities on a country-driven approach. The GCF will have thematic funding windows for adaptation and mitigation projects.



Concluding Remarks

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As outlined in this paper, 2011 has been an unusual and transformative year:

- Severe political and economic volatility has occurred throughout much of the world, and this is reflected in oil prices and public equity markets – in particular, clean energy equities.
- The Japan nuclear crisis, combined with market volatility and growing demand from emerging economies, has led to energy security concerns and both progress and regression on the clean energy and climate policy front. China has continued to demonstrate clear low carbon leadership and Japan and Germany have initiated plans to shift away from their reliance on nuclear and towards renewables, whilst several countries have either cut back or failed to extend existing policies (for example, the US).
- Meanwhile clean energy as a sector has had a mixed year, with poor public market performance and investment, but growth in project finance and consistent private investment.
- And December 2011 saw international climate negotiations continue in Durban, with agreement reached on future directions and some key concepts – namely who will be part of a 2020 agreement, who will participate in the second commitment period of the Kyoto Protocol, and who will operate the GCF and which sectors can participate –, but the process has still thus far failed to come with a follow-up binding treaty to Kyoto.

Taking these trends together, as we begin 2012 we continue to believe that the global energy matrix is in a “transition” phase right now – at the start of a long-term mega shift toward an “end-state” scenario of cleaner, domestic sources of electricity supply; presenting a huge range of investment opportunities. The strategy toward achieving this goal varies by country and region, depending on local politics, commodity prices, domestic resources (both fossil and natural), level of socio-economic development, and many other factors. However, we also recognize that there remain key short-term challenges to be overcome, including policy uncertainty caused by the complex economic and political situations in the EU and US, the relatively high (but rapidly declining) costs of clean energy, and the necessary infrastructure expenditure – all within a constrained economic environment – to achieve this energy shift.



Appendix: DBCCA Investment Research, 2011

Access all DBCCA investment research at http://www.dbcca.com/dbcca/EN/investment_research.jsp

Access *Durban Platform: Laying New foundations* at
http://www.dbcca.com/dbcca/EN/media/Durban_2011-Laying_new_Foundations.pdf

Access *Durban must clear the path for more low carbon investment* at:
http://www.dbcca.com/dbcca/EN/media/Durban_must_clear_the_path_for_more_low_carbon_investment.pdf

Access *UK Offshore Wind: Opportunity, Costs and Financing* at:
http://www.dbcca.com/dbcca/EN/media/UK_Offshore_Wind_Opportunity-112111.pdf

Access *Hydropower in China: Opportunities and Risks* at:
http://www.dbcca.com/dbcca/EN/media/Hydropower_in_China-Opportunities_and-Risks.pdf

Access *Repowering America: Creating Jobs* at:
http://www.dbcca.com/dbcca/EN/media/DB_Repowering_America_Creating_Jobs.pdf

Access *Natural Gas and Renewables: The Coal to Gas and Renewables Switch is on!* at:
http://www.dbcca.com/dbcca/EN/media/NaturalGasAndRenewables-Oct_2011_Update.pdf

Access *Mitigating Climate Change Through Agriculture: An Untapped Potential* at:
http://www.dbcca.com/dbcca/EN/media/Mitigating_Climate_Change_Through_Agriculture-An_Untapped_Potential.pdf

Access *China's 12th FYP Update – The Work Plan. Focus on Energy Conservation and Emission Reduction* at:
http://www.dbcca.com/dbcca/EN/media/China_EE_WorkPlan.pdf

Access *Japan – The People's Greener Choice* at:
http://www.dbcca.com/dbcca/EN/media/Japan-The_Peoples_Greener_Choice.pdf

Access *Comparing Lifecycle Greenhouse Gas Emissions from Natural Gas and Coal* at:
http://www.dbcca.com/dbcca/EN/media/Natural_Gas_LCA_Update_082511.pdf

Access *Global Climate Change Policy Tracker: Winners and Losers* at:
<http://www.dbcca.com/dbcca/EN/media/Tracker-2011.pdf>

Access *Climate Change Litigation After Supreme Court Ruling in American Electric Power v. Connecticut* at:
http://www.dbcca.com/dbcca/EN/media/US_Connecticut-v-American_Electric_Power.pdf

Access *The German Feed-in Tariff for PV: Managing Volume Success with Price Response* at:
http://www.dbcca.com/dbcca/EN/media/German_FIT_for_PV.pdf

Access *The 2011 Inflection Point for Energy Markets: Health, Safety, Security and the Environment* at:
http://www.dbcca.com/dbcca/EN/media/Inflection_Point_Research_Note.pdf

Access *GET FIT Plus: De-risking Clean Energy Business Models in a Developing Country Context* at:
http://www.dbcca.com/dbcca/EN/media/GET_FIT_Plus.pdf

Access *12th Five Year Plan – Chinese Leadership Towards A Low Carbon Economy* at:
http://www.dbcca.com/dbcca/EN/media/China_12th_Five_Year_Plan.pdf

Access *Investing in Climate Change 2011: The Mega-Trend Continues - Exploring Risk & Return* at:
http://www.dbcca.com/dbcca/EN/media/Inv_in_CC_2011_Final.pdf



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