A greener shade of grey

A special report on renewable energy in China

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Editor's note

How green will China become? Beijing is taking aggressive measures to steer the country towards lower-carbon energy use, with some notable successes. Yet China's energy use is both vast—it is the world's largest consumer of energy—and dirty. It relies on coal for two-thirds of its energy needs and ranks as the world's biggest carbon polluter.

The articles collected in this report examine China's progress across a number of alternative-energy forms, presenting the Economist Intelligence Unit's view of what the future holds for each. China's use of solar power, wind energy and hydropower is destined to grow rapidly—though, as we explain in this report, not so fast that ascendant Chinese renewables firms can feel secure. We project that the combined share of renewable energy and nuclear power (a formula reflecting the way China tracks its own alternative-energy use) will rise from 13% in 2010 to over 16% at decade's end. Although this may sound like modest growth, in nominal terms the increase in China's use of renewables will be roughly equivalent to Canada's total annual energy consumption.

As a result of this and a growing appetite for natural gas, climate-warming coal will satisfy a lower proportion of China's energy needs. Yet in 2020 we expect coal to provide well over half of China's energy consumption—which by then will have swollen greatly. As a result, 35% more coal will be burnt in 2020 than in 2010. Together with strong demand for other fossil fuels, this means that carbon emitted from burning fuel will rise by over 40% by 2020. Although China will grow greener in relative terms, judged purely on how much carbon it emits, the opposite will be true. Grey will remain the dominant colour.

Martin Adams
Energy Editor
Hong Kong, May 2012

Energy policy: A greener shade of grey

Fossil fuels will continue to dominate China's energy mix, although renewable energy will carve out a bigger role. The large market for clean technology that this provides will give succour to firms in the sector—those, that is, that are able to survive their present difficulties.

Most car owners want a vehicle that is responsive, reliable and environmentally efficient. In many ways, China's aims for its energy supply are similar.

Between 2001 and 2011, Chinese energy consumption grew by 136%. This rapid pace breeds concern in Beijing about the security of supplies, particularly oil imports from the Middle East. On top of energy-security worries are the human health and environmental problems that arise from China's craving for fossil fuels. This is especially true for coal, which provided 66% of China's gross domestic energy consumption in 2011, according to estimates by the Economist Intelligence Unit. Pollution is now a contentious issue in China's major cities as the health costs of coal dependence become increasingly obvious. A desire to steal a march on rivals in the emerging clean-technology industry is another spur for China to build markets for locally-produced clean-tech equipment.

With a mixture of incentives and penalties China is opening up a continent-sized economy for renewable-energy equipment.

Thus, China has ample incentives to "green" its predominantly grey energy mix. To this end, it is promulgating laws that climate experts consider progressive and setting a range of supporting targets. Policies are taking new and sometimes surprising directions, even as they bump up against ever bigger obstacles.

Green with hints of red

China's efforts to cut pollution and energy intensity are normally traced to the renewable-energy law of 2005, which came into force the following year. The legislation decreed that 15% of total energy should come from renewable energy by 2020. This was quietly recast in 2009 to 15% from all non-fossil energy sources, including nuclear.

Target-setting has borne fruit. Goals for renewable-energy generating capacity were often exceeded and subsequently revised upwards. Such targets blew life into China's wind industry in the second half of the decade; it is now the biggest manufacturer and installer of turbines in the world. According to an April report by Pew Charitable Trusts that uses data from Bloomberg New Energy Finance, of 565 gigawatts (GW) of global renewable-power capacity, roughly a quarter (133GW) is installed in China.

Another key objective during the eleventh five year plan period (2006-10) was cutting energy intensity (units of energy per unit of GDP) by 20%. This featured the kind of efforts that harked back to an earlier era of command and control: measures included the forced shuttering of plants. Uncharacteristically, it ended in failure (by a single percentage point, according to official figures that some suspect are inflated).

This green push is being carried over into the current five-year plan, 2011-15, which is replete with new targets (see table). There is a carbon intensity reduction target, for the first time, seeking to cut carbon emissions per unit of GDP by 17% during the five-year period. China is also committed to a carbon-intensity reduction of 40-45% from 2005 levels by 2020.

Target setting
China's official energy targets

	12th five year plan 2011-15		13th five year plan 2016-20	
	Official target	EIU forecast	Official target	EIU forecast
Energy intensity, % change over five-year period	-16.0	-15.1	Pending	-10.2
Non-fossils' share of total energy at end-period, %*	11.3	14.4	15	16.4
Wind power generating capacity at end-period, GW	100	106	200	180
Solar power generating capacity at end-period, GW	15	15	50	40
Hydropower generating capacity at end-period, GW	325	297	380	332

Sources: National Development and Reform Commission, Economist Intelligence Unit

* Official targets are thought to refer to final energy use; EIU forecasts are for gross domestic energy consumption of nuclear, renewables and waste

In what would be a remarkable turnaround, reports in the official press continue to speak of a possible cap on energy use by 2015—this coming from a country that, until the most recent round of international climate talks in Durban last year, staunchly resisted any efforts to cap its carbon emissions as a bar on its economic development. A recent article in the official English-language newspaper, China Daily, reported plans to impose a cap of 4.2bn tonnes of coal equivalent (tce) by 2015, citing Han Wenke, the head of the Energy Research Institute under the National Development and Reform Commission, which co-ordinates economic planning in China. This compares to consumption of 3.5bn tce in 2011, by official reckoning. The plan proposes breaking down the overall objective into provincial and city-level targets—although Mr Han described the national target as "relatively flexible", in contrast to those for energy efficiency and carbon-emissions intensity

Let a thousand carbon-trading platforms bloom

The very notion of a cap, however flexible, illustrates the fact that China's clean-energy policies are a work in progress. China's rumoured cap (absolute or not) on energy use reflects the strictures of a command-and-control economy. It leaves it open to familiar abuses: only one of China's provinces admitted to missing its 2006-10 energy-intensity aims, though in aggregate the country failed to reach

its overall target. This points to a disconnect between objectives at the centre and in the provinces, which tend to prioritise economic growth.

Still, the policy hierarchy in Beijing is currently devising more sophisticated tools to make a cap work. Provisions for both a national emissions-trading scheme and carbon tax feature in China's draft Climate Change Law, although this may not be approved for as long as three years. Trials of carbon-trading regimes will begin next year in seven provinces and provincial-level cities chosen to reflect various stages of development within China. This remains highly experimental. Beijing's scheme, for instance, will reputedly take in direct emitters next year and cover those indirectly responsible for pollution from 2014. Even before this initiative, local exchanges were competing to establish themselves as models for a national carbon-trading scheme (though few carbon credits have actually changed hands).

A nationwide scheme does not look likely within this five-year period. However, a carbon tax—likely to be set initially at a low rate of perhaps Rmb20-30/tonne (roughly US$3-4/t)—may see the light of day during this planning period. Unlike carbon-trading arrangements, the design of the tax and procedures for implementing it are said to be fully-drawn. Precisely when it will actually be unveiled may depend to some degree on developments in international climate-change talks, where it could be used as a bargaining chip. Whatever the case, at the initial levels that seem likely, the tax will have little impact on emissions.

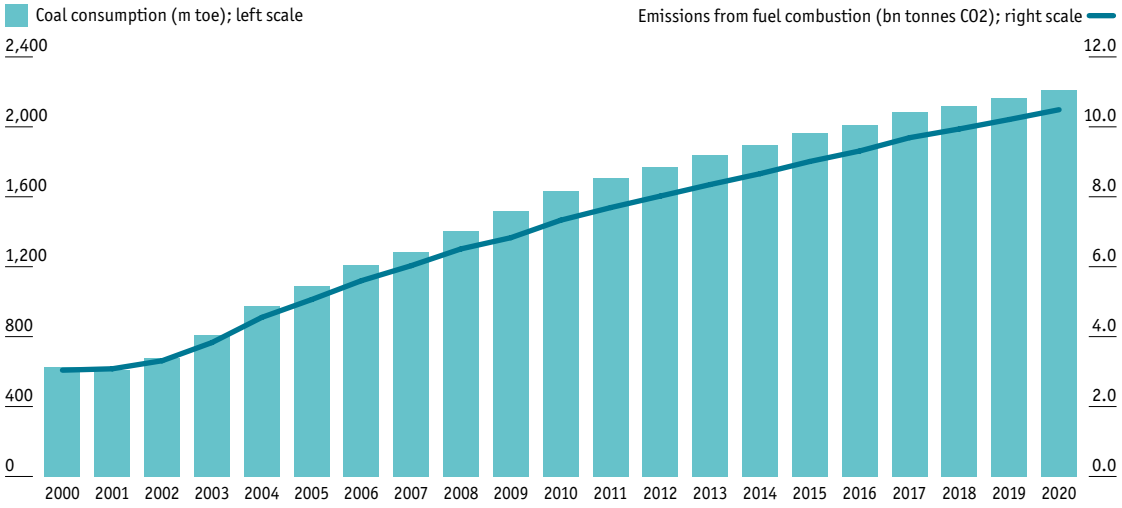
Intense problems and a coal conundrum

Needless to say, refitting a large, swiftly developing economy like China with clean-energy technology is no easy task. Absorbing so much new wind-power capacity is proving immensely difficult for China's grid, to cite one important example. Just under a third of China's wind farms are stranded without a grid connection, while power generated at others often goes to waste because the utility is unable or unwilling to buy it. A reported renewable energy quota system could address the problem by setting local renewable-energy targets, though much will depend on the enforcement mechanisms. So far, efforts to encourage the grid to buy more green power lack teeth.

The structure of China's economy will also make it difficult to clean up its energy mix. The country has pumped investment into a state-dominated heavy-industrial sector that consumes vast amounts of electricity and resists government attempts to slim it down. In the current five-year period, the aim is to raise energy-efficiency by 16%. As this is four percentage points lower than the previous target, even some at the heart of policymaking felt it was not rigorous enough. Yet the early signs are that hitting even this modest target will not be easy. In 2011, China aimed to slash energy intensity by 3.5%, but managed just a 2% cut. The state responded by raising the efficiency goals it imposed on energy-guzzling sectors. However, we expect that although energy efficiency will continue to improve, the government's scaled-down aims are unlikely to be met.

Heavy industry is of concern for another reason: it is a large source of demand for coal. An abundance of this cheap, dirty source of energy in China, which has the world's third-largest coal reserves, is probably the biggest barrier to the pursuit of greener growth. The coal sector is hampered by bottlenecks in the railway system connecting mines in the north and west of the country to power

Chart 1: Dirty relationship
(China's coal demand and carbon emissions from burning fuel)



Source: Economist Intelligence Unit.

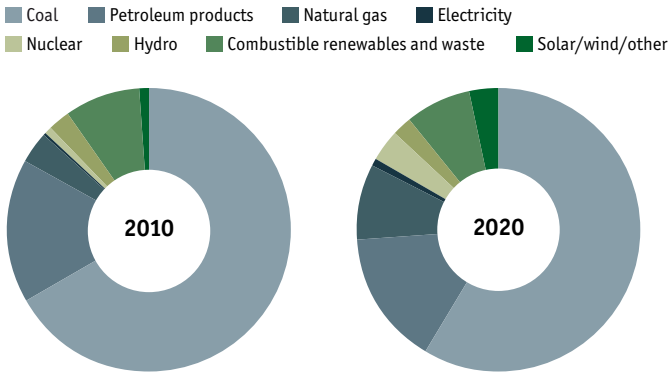
stations and factories closer to the eastern seaboard, which exacerbates power shortages. This is being addressed in several ways, however. The most significant move is to encourage construction of 14 big coal-industry bases. Coal will be converted into electricity at these hubs, avoiding altogether the country's already-strained railway network. A sweeping scheme to construct a network of ultra-high voltage cables over the course of this decade, though presented in a green rinse as a means of bringing renewable power from the interior to the coast, will also provide a way to transmit this new wave of coal-fired power. (China's coal-industry centres could be doubly harmful for China's energy-efficiency and carbon-intensity plans, as local governments in the west covet the opportunity to foster new heavy-industrial bases—coal-to-liquids plants, for instance—to capitalise on the anticipated coal-mining boom.)

Green-ish pioneer

What does all this mean for China's profile as an energy consumer? We forecast that by the end of the decade coal will have declined as a percentage of China's (far expanded) energy use. Cleaner-burning natural gas will become more important, as policymakers throw their weight behind its greater uptake. It will displace some coal used for baseload electricity generation, as China imports more and tries to develop indigenous shale-gas resources. Coal will nonetheless still provide well over half of China's energy. In absolute terms, the country will burn 35% more coal by 2020 than it did in 2010. We project that carbon emitted through burning fuel will rise by 43% between 2010 and 2020 (see chart 1).

As a percentage of gross domestic energy consumption, the share of renewable energy (including waste as well as hydropower, by far the largest form of renewable power) and nuclear power will grow from 13% in 2010 to 16.4% at decade's end (see chart 2). (Direct comparison with government targets is complicated, partly because official measures of total energy differ from our own.)

Chart 2: Split decisions
(China's gross domestic energy consumption, by fuel, percentage of total)



Source: Economist Intelligence Unit.

Many of China's critics—and perhaps some who hope that China will lead the way on climate action—will be disappointed by this performance. Apologists for China will argue that for a developing economy even such huge growth in carbon emissions represents commendable progress; things would be much worse if it failed to act. They might also point out that in Chinese policy circles the scientific basis of climate-change is not a matter of debate, unlike in Washington DC.

This debate will continue to generate hot air of its own. What seems indisputable, though, is that with a mixture of incentives and penalties China is opening up a continent-sized economy for renewable-energy equipment. China is not only spurring the use of wind turbines, solar panels and dams. Its low-cost production, economies of scale and the mobilisation of large pools of financial resources—such as tens of billions of dollars in controversial low-interest loans from state banks—is forcing down the cost of deploying renewables, to the alarm of competitors. Last year, global solar-panel prices fell by half.

China has fuelled the rise of some of the world's biggest renewables-equipment makers. Prosperity in these firms' large home market is not assured, however. International solar manufacturers are refocusing on China to make up for less bright prospects overseas. A slowdown in wind installations at home means China's wind manufacturers must look abroad ever more urgently. As a result, consolidation will gather pace in both sectors. In the long run, though, drawing on significant domestic demand will sustain the companies that survive the shake-out. For Chinese firms' overseas competitors, this is ominous; politicians in the US and elsewhere will continue to complain about lost jobs and unfair trade practices as competition for global market share in green technology intensifies. Yet, as the world's governments struggle to address climate change, the growth of renewable power in China, and the related ascent of Chinese clean-tech manufacturing firms, will serve as the primary engine driving the green economy for years to come.

Wind power: Weather warning

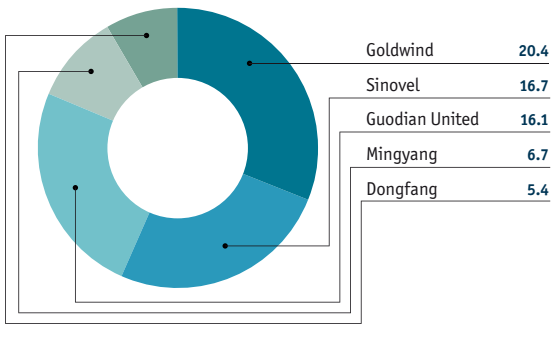
Over-exuberance in China's wind-power sector is beginning to hurt its turbine makers. This will put many lesser firms out of business and spur the bigger ones to push harder into overseas markets.

Throughout swathes of China's inhospitable north, not much grows. But one thing has been springing up from the land thanks to the region's blustery climes: wind turbines. China had just 1-gigawatt worth of wind towers in 2005 but in 2010 it surpassed the US to claim the largest installed wind-power capability. By the end of last year, the country had built over 60GW of wind farms.

This rapid ascent has fuelled a parallel rise—that of Chinese wind-turbine producers. China's most prominent turbine makers, Sinovel Wind Group and Xinjiang Goldwind Science & Technology, are now among the top five global turbine manufacturers. Bubbling below the surface of this tale of Chinese industrial advance, however, has been an equally familiar storyline: one of too-hasty progress at the expense of quality, burgeoning overcapacity and damaging price competition. Of late, this subplot has started to bog down the upbeat main story, and China's turbine makers are suffering.

Structural cracks under Chinese turbine-makers' home market are widening.

Chart 3: Wind from the East
(Top five Chinese firms' share of domestic turbine sales in 2011, %)



Source: China Wind Energy Association

Profits at the traditional Chinese market-leader, Sinovel, fell by nearly 73% in 2011, the company recently announced. Goldwind, which edged past Sinovel to sell more turbines last year (see chart 3) warns that profit could fall by up to 100% in the first three months of 2012. One cyclical reason is tighter monetary policy, which strangles off credit to wind-farm developers. But deeper, structural cracks under Chinese makers' home market are widening.

Problems and solutions

Leading manufacturers also blame "decreases in the average selling price of wind turbines caused by the increasing market competition", in the words of Goldwind. Bruising price warfare between Chinese makers, many of whom cannot compete

with the likes of Sinovel and Goldwind on technology alone, is a franker way of putting it. While cheaper turbines bring closer the day when unsubsidised wind power can compete with fossil fuels, for many turbine manufacturers such aggressive pricing could eventually prove disastrous.

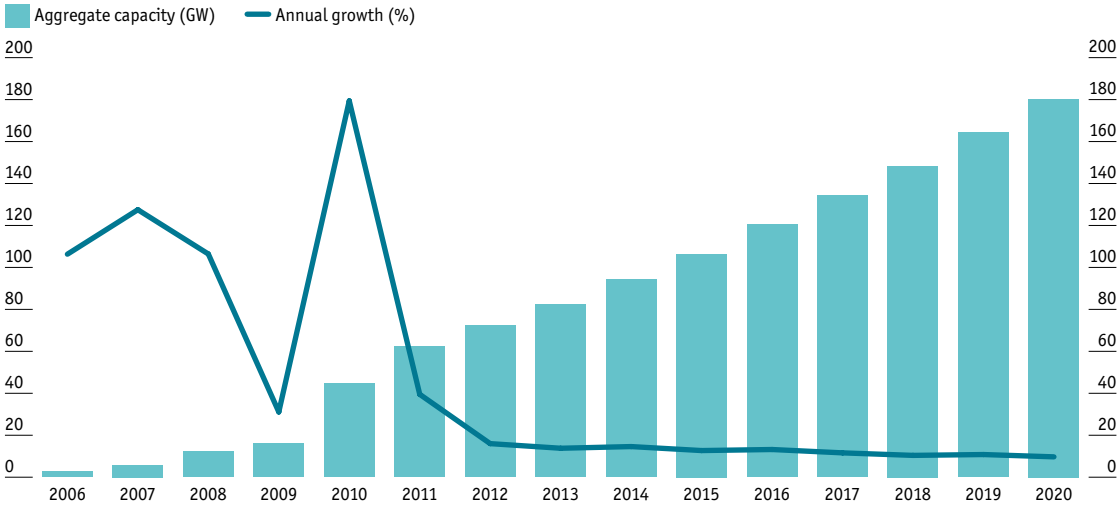
Less rampant demand growth also deserves a big portion of the blame. The march of turbines across China has slackened in pace. At its peak, installed capacity more than doubled each year and demand for turbines consequently rocketed (see chart 4). But this could not continue indefinitely. By 2011 the slowdown in installations was such that demand for new turbines actually dipped below levels in the previous year for the first time in memory (although China was nonetheless the world's biggest market, putting up nearly half of all wind towers erected last year).

This turnaround partly reflects the grid's difficulty keeping up with the pace at which new wind farms are spawned. Often State Grid, China's dominant electricity utility, lacks the capabilities and, critics complain, the inclination to accept power that is generated at grid-connected wind plants. Worse, based on official figures, 28% of turbines did not even have a connection to the grid at the end of 2011.

State Grid dislikes wind energy because the power it produces is not only expensive but also variable, which can pose a threat to the stability of the electricity network. In addition, many developers go ahead with projects in the nether reaches of northern China even when the utility has warned them it has no intention of laying down the costly cables needed to hook them up to the grid. Government compensation to State Grid for the costs of building such links has reportedly been slow coming, in many cases, and incomplete.

Until recently, grid companies have also contended with poor quality technology within the farms that undermines their ability to maintain a steady connection. This is changing, however. Probably the biggest disturbance in the status quo in China's wind sector in recent years came from outages at three wind farms in the first half of 2011, affecting nearly 2,000 turbines. These high-profile accidents

Chart 4: Gusty at first
(China's installed wind power capacity)



Source: Economist Intelligence Unit.

jolted the central government into action. Beijing last year bombarded the industry with a raft of new technical standards. Most importantly, regulations now require state-of-the-art connections for all installed turbines: developers must make sure they are equipped with low-voltage ride-through (LVRT) technology, which enables turbines to carry on operating even when voltage dips precipitously, but which has been generally lacking in China. (Developers cannily shifted this responsibility to turbine manufacturers, who have scrambled to obtain the necessary approvals.)

This is one plank of a broader effort, which picked up momentum in 2011. The central government wants to bring the industry more tightly under its own control, rein in the rate of expansion and shift the focus from quantity to quality. One important way it is doing so is by granting itself more say over project approvals. Wind farms smaller than 50 megawatts (MW) previously only needed local approvals; now, they must also receive the nod from the National Energy Administration (NEA). Weeding out less economic projects and closing the grid connectivity gap are the aims—though, if effective, this initiative will also further dampen demand for turbines.

Other measures are being taken to try to patch up the sector's problems. From December 2011, the renewable surcharge on power sales, which is used to reimburse grid companies for buying expensive renewable power, was raised from Rmb0.004/kWh to Rmb0.008/kWh. And China is seeking to overcome the geographical mismatch between supply of and demand for renewable energy—wind farms cluster in the north, while China's citizens live mainly along the eastern seaboard—in innovative ways. Chinese engineers have invented a new variety of ultra-high voltage (UHV) cables that are being laid across the country in a "strong smart grid" to bring power from China's relatively empty extremities to its urban east.

Another approach is to bring the wind farms to the people. The government's latest plans lay a heavier emphasis on "distributed" projects (which plug directly into local distribution grids and/or customers' systems but do not feed into the transmission network). Provinces including Anhui, Jiangxi and Hubei, which are far to the south of the traditional wind bases and where the wind typically blows less hard, will receive priority in future approvals assessments.

Unresolved difficulties

As of yet, these assorted fixes will make little difference to the problems with the grid that hamper turbine makers. Laying down a UHV network will occupy Chinese engineers for the rest of the decade. Developers are indeed looking further south, which could help avoid adding to the strain on the grid; some hitherto neglected provinces further south raised installations growth dramatically last year. But they are starting from a very low base, and turbines are still overwhelmingly sprouting where the wind blows hardest, in the north (most numerously in Inner Mongolia, where the grid is already hard pressed). Lower wind speeds elsewhere mean that less electricity can be generated, and thus there is less revenue potential to attract developers to invest. A national power market that matches supply and demand across provinces appears a distant prospect

Against this backdrop, the Economist Intelligence Unit expects a continued slowdown and levelling off in wind-power installation growth in China. Capacity will reach a still impressive 106GW by 2015,

exceeding the official target of 100GW, and hit a mighty 180GW by 2020 (albeit falling short of the official goal of 200GW). But the headlong dash of the late 2000s will seem a distant memory.

Looking overseas

This is one reason why Chinese turbine makers could face an even harsher environment at home this year than they did in 2011. As the pie on offer shrinks, firms will try to cut out a larger slice; companies accustomed to competing on price will be tempted to simply engage in more of the same. Profit margins will probably come under greater strain, and a shake-out among China's dozens of turbine firms beckons. For those at the top of the pile, in particular, pressure will build to strike out beyond China.

Recently, China's wind players have made some progress in reaching customers overseas, especially in the US, thanks mostly to Goldwind. Admittedly, turbine exports from China last year were equal to a tiny fraction (1%) of new capacity installed in the domestic market, judging from figures from the China Wind Energy Association, an industry body (which in China means that it has close ties with the government). Yet in important ways, some among China's market leaders are better placed to succeed abroad than they were a few years ago.

Quality has been a big barrier. By consensus, however, top Chinese makers have pulled their socks up: Goldwind now reports "availability" (a measure of how reliably turbines work) of 98.9% in its 1.5MW turbine, up from 94.3% in 2008. (By contrast, there is room for improvement on its newer 2.5MW model, the availability rate for which languishes at 95%).

Goldwind has so far been a savvier player on the international stage than Sinovel: it has hatched plans to manufacture equipment in the US, for instance, which may in future help it to avoid Sino-US trade frictions. Sinovel, on the other hand, is embroiled in an intellectual-property dispute with American Superconductor (AMSC). The US firm accuses Sinovel of stealing code from turbine control systems that it provided and is taking the case to China's supreme court. The fracas has threatened to deter some Western firms from doing business with Sinovel: Mainstream Renewable Power in Ireland has put on hold a deal until the AMSC case is resolved. Other Chinese makers should fear being tarred with the same brush.

Given the scale of the leading Chinese turbine manufacturers, though, the risks are overstated. Sinovel recently announced an agreement with a Danish firm, Mita-Teknik, securing the supply of a turbine control system. Sinovel's ambition, like Goldwind's, is undeterred: reports on April 16th said that China's top two are both mulling takeover bids for the world's biggest wind-equipment manufacturer, Vestas, which could be a shortcut to overseas expansion. As their home market falters, China's turbine makers know very well that their fortunes will rely increasingly on catching foreign gusts.

A version of this article originally appeared on April 23rd 2012.

Solar power: An array of difficulties

China will increasingly harness the sun's rays to generate electricity, but the Chinese solar industry is nonetheless ripe for consolidation.

A continent-sized economy is a useful attribute, particularly for a country whose government is fond of exercising a robust industrial policy. China's firms benefit from access to a large home market in which to test new technologies and create economies of scale. Some of them, like Huawei and ZTE in telecoms, have used this as a springboard to overseas success. Yet, in the arena of solar photovoltaic manufacturing, China has followed a different course.

Conditions appear ripe for consolidation throughout the industry, from suppliers of basic materials such as polysilicon, to makers of cells and modules.

Competitors complain that China has supported local solar firms with tax breaks, cheap land and easy credit. Until recently, though, it has not done much to ignite a potentially large local market. Instead, it has let Europe's green-minded governments foot much of the bill for subsidising a still expensive technology. Chinese firms now supply around half the world's solar cells, but they face rising uncertainty in overseas markets. This is prompting their government to prod the local market into life in order to bolster demand for China-made solar products.

In the latest complication for China's solar manufacturers, on March 20th an initial ruling by the US Commerce Department imposed import duties to punish China for subsidising its solar firms. China's plethora of solar manufacturers hopes that orders from the US will provide succour as European demand suffers. Due to the continent's debt travails, EU governments—including Germany, most alarmingly for solar makers, which has bought more of their gear than anywhere else—are cutting installation targets and the feed-in tariffs that reward solar plants for the power they produce.

Widespread overcapacity and a sharp fall in solar-equipment prices further cloud the outlook for Chinese makers. Solar modules became 47% cheaper last year, according to Bloomberg New Energy Finance. This is both a blessing and a curse for the industry. Cheaper equipment means solar power will rely less on hand-outs, which is good for the prospects of installing more solar panels in the long run. But subsidy cuts hurt solar makers now. Conditions therefore appear ripe for consolidation throughout the industry, from suppliers of basic materials such as polysilicon, to makers of cells and modules.

Waking the dragon

To shore up Chinese firms, Beijing began last year to try to stimulate home-grown demand. It at last introduced a feed-in-tariff, under which plants approved before July 2011 and completed before

the end of last year qualify for a rate of Rmb1.15/kWh; later projects will earn Rmb1/kWh. Then, in December, the government lifted its solar power capacity targets: by 2015, the new plan is to install 15GW, versus the previous aim of 10GW; the 2020 target was more than doubled to 50GW.

As a result, installed capacity last year jumped from under 1GW at the end of 2010 to an estimated 3.2GW in 2011 (although reliable data is difficult to come by and estimates vary considerably). Solar sector CEOs talked up the possibility that China will add up to 5GW this year, which helpfully boosted their firms' share prices. Andrew Beebe, the chief commercial officer of Suntech, the world's largest solar manufacturer, told the Economist Intelligence Unit that the company's sales in China could climb above 300MW this year, pushing them up to "safely above 10%" of revenues.

In addition to supporting China's push to carve out a big share of the global market for new-energy technology, stimulating demand at home coincides with other government priorities, such as job protection and pursuing greener economic growth. Yet China must balance competing policy priorities: there will be limits to how much it intervenes.

Beijing often seeks (with varying degrees of success) to replicate the workings of a market economy by encouraging consolidation. China's 12th five-year plan industrial template for developing the solar industry, released in February, envisions just this. The government wants to see continued reductions in the cost of solar panels and stronger industry leaders—that is, one company with annual sales over Rmb100bn and between three to five firms with sales of at least Rmb50bn by 2015. Currently, China has hundreds of solar manufacturers; all but 15 could fall by the wayside within five years, Li Junfeng of the Energy Research Institute under China's top economic planning body, the National Development and Reform Commission, said late last year.

Wind behind it

In regulating the industry, Beijing will bear in mind the problems facing China's wind sector. An over-enthusiastic build-out of wind equipment-making capacity has narrowed profit margins. Despite impressive installations growth in China, moreover, many turbines lack connections to the grid. Beijing will not want to see a repeat performance with solar plants. (Anecdotally, smaller solar plants are already having trouble securing grid connections.)

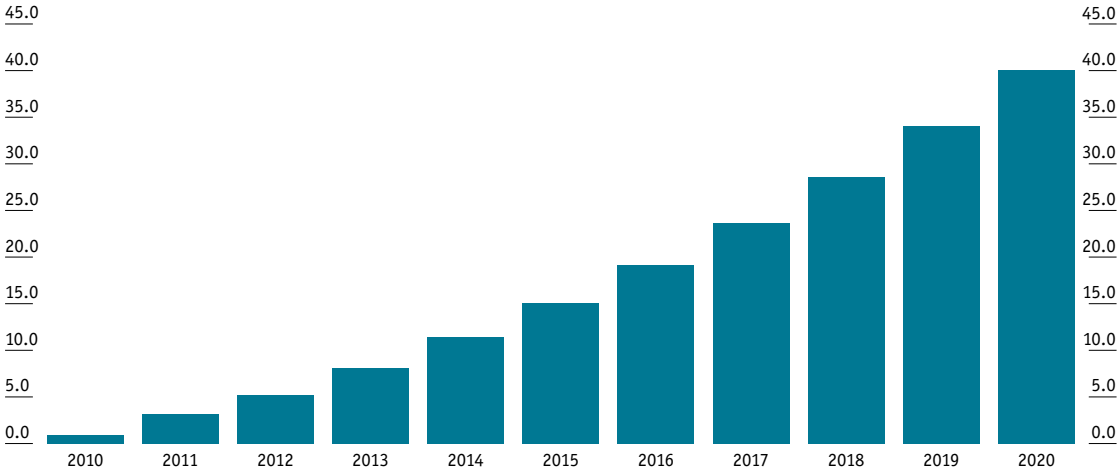
Doubts also pertain to the commercial allure of the new feed-in-tariffs, according to analysts and industry insiders alike. Last year's buoyant installation growth may have been artificially inflated: some attribute a sharp spike at the end of last year to a rush to build projects approved before July 1st, in order to qualify for a higher feed-in-tariff rate. Many companies installing solar plants now are trying to gain an early foothold in a promising market, a ploy more suited to bigger, state-owned developers. Smaller players, by contrast, are said to be waiting until better returns are on offer, although investors do not yet know for how long the new tariffs will be valid.

Another reason why China's government may be cautious in its regulation of the solar market is that the prospects for overseas demand for Chinese makers' products, though less rosy, are not yet dire. In fact, the US's new import levies are something of a damp squib. Some analysts had expected duties of up to 30%, whereas in the event the tariffs ranged from 2.9% (on Suntech Power) to 4.73% (on Trina Solar); all other Chinese makers were hit with a rate of 3.61%. China's solar firms should barely blink, while many of their indebted competitors are in trouble.

The EIU view

On balance, although China will continue to install many more solar panels than it had been until last year, a boom of the type seen in wind power, where at the peak installed capacity doubled each year, will not occur. We expect developers to build 2GW of new solar capacity this year. China will just manage to reach its 2015 goal of rolling out 15GW of solar capacity, reaching 40GW in total by 2020, 10GW short of target (see chart 5).

Chart 5: Sunny outlook
(China's installed solar power capacity, GW)



Source: Economist Intelligence Unit.

Smaller Chinese solar manufacturers will therefore struggle. Already, there have been reports that banks in Jiangsu province, a heartland of solar manufacturing, are reluctant to lend to local solar firms. But the likes of Suntech and Yingli look a much less threatened species. Vertical integration, market dominance and backing from policy lenders like the China Development Bank will cushion them greatly.

What are the risks to our view? One sign that installations growth could take off more quickly in later years would come if State Grid exceeds expectations and makes quick progress in connecting new solar plants to its power network. A flowering of local incentives for solar plants in China's sunny west and northwest could also prompt a rethink. The biggest possible upset may lurk in the US. A final judgement on the subsidies case will be made in June, but the greater threat for Chinese makers could come from a preliminary decision, due in mid-May, in a second case. Chinese makers are charged with "dumping" their products in world markets below cost; anti-dumping duties are normally higher than those meted out in subsidy cases. Stiffer tariffs could cause Beijing to more energetically help Chinese firms by further spurring home demand.

Eventually, the controversy in the US could make large Chinese renewables firms stronger, and not just by speeding consolidation of the Chinese solar sector. It may also serve to underline a lesson to which some of them are already aware: probably the best way to sidestep the risk posed by trade

disputes is to build factories—thus create jobs—in target markets. Suntech, for instance, claims to be relaxed about US import tariffs because it makes solar products in Arizona. Following such a path may whittle away some of Chinese makers' cost advantage. But with such large market shares, that may not matter much.

A version of this article originally appeared on March 29th 2012.

Hydropower: Dammed fast

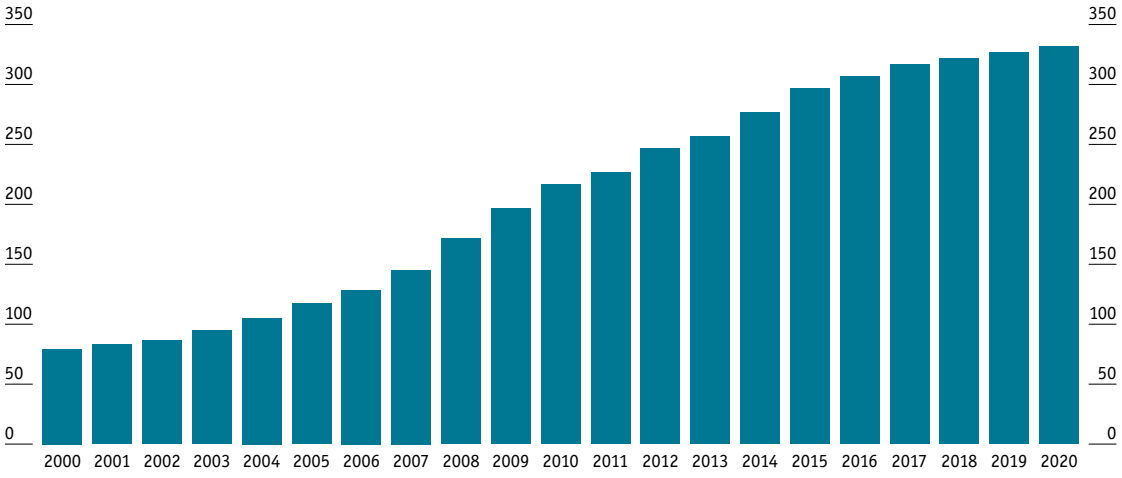
China's best-laid hydro plans are likely to go awry due to the difficulty of harnessing ever more inaccessible water resources.

Hydropower is not as "cool" as its green cousins wind and solar, but in China produces more power than both combined.

Attention is paid whenever China's turbine makers catch new gusts or the star of its solar manufacturers brightens or dims. By contrast, the old-fashioned business of damming rivers to produce power generates curiously little press (the Three Gorges Dam aside). Yet in China, as globally, dull old hydro still leaves solar and wind in its wake. It makes up about a fifth of China's generating capacity, compared with less than 5% for solar and wind combined.

Dam-building is an area where environmentalists can claim a rare degree of success; the need to relocate people slowed hydropower's progress during the previous five-year plan (2006-10). China's hydro capacity nonetheless grew by over 80%, from 117GW in 2005 to over 210GW in 2010. Officials are reportedly targeting 284GW of conventional hydropower and 41GW of pumped storage, or 325GW in total, by 2015; the Economist Intelligence Unit thinks a flurry of dam-building will take

Chart 6: Dam burst
(China's installed hydropower capacity, GW)



Source: Economist Intelligence Unit.

total hydro capacity to just under 300GW by then. By 2020, however, we expect slower installations growth, to 332GW (see chart 6). This will fall short of the government's reported target of 380GW (which it is rumoured may be raised to 430GW), including 330GW of conventional hydro and 50GW of pumped storage.

China's best-laid hydro plans are likely to go awry due to the difficulty of harnessing ever more inaccessible water resources. Growing concerns about the environmental costs of dam-building, and local-level opposition to human relocation caused by hydro projects, will also have an impact. Such factors, together with stiff domestic competition, will push Chinese hydro companies on overseas adventures. They are already proceeding with vigour: International Rivers, a non-governmental organisation, has traced the involvement of Sinohydro, the world's biggest hydropower firm, in 195 (sometimes controversial) dam projects in 60 countries.

Chinese dam-builders bring with them some of the advantages of China's wind and solar makers. Cost, for instance: some recent bids have undercut rival hydro companies by a quarter. Mostly, though, state-owned Sinohydro and its ilk resemble China's other natural-resources champions like PetroChina or Sinopec. They are not shy about wading into high-risk countries like Sudan and Myanmar. Diplomats bring them business: civil-engineering schemes like dams often feature in China's "resources-for-infrastructure" deals in Asia and Africa. Meanwhile, dam projects can dwarf anything Suntech or Goldwind can do. China Three Gorges Corporation last year proposed investing US$15bn in Pakistan, where it wants to dam the Indus river valley. Suntech's total revenues in 2011 were only around US$3bn. From this angle, too, hydro has the power.

A version of this article originally appeared on May 11 2012.

Waste-to-energy: Rubbish plans?

Efforts to burn more waste will yield China valuable electricity but threaten to further pollute its cities. That is causing a backlash.

Faced with a seemingly intractable problem, Chinese are prone to sigh futilely that "there are just too many people in China". That is of little consolation when it comes to the country's mounting rubbish problem: 1.3bn people throw away a lot of stuff. A determined push to burn more of it promises profits for developers and much-needed electricity for China's citizens. But it also generates new difficulties, not least harmful pollution in cities.

China produces over one-quarter of the world's rubbish, piling up at least 250m tonnes of household waste each year, according to conservative estimates by the Economist Intelligence Unit. In urban areas, this giant heap grows at around 8-10% annually. What to do with it? One approach that China is adopting is to incinerate more waste to produce energy. Currently, little Chinese waste is burnt: most is buried in landfills. Under China's current five year plan (2011-2015), landfills will continue to dominate the policy landscape. But the central government is nonetheless showing strong support for incineration: it wants 30% of China's municipal solid waste to be burnt by 2030.

China's incinerators, though presented in a shimmering green light, have a dirty underbelly.

Kindling the market

China has already climbed a steep learning curve in waste-to-energy. At first, it deployed grate incinerators like those commonly used in developed economies. But plant operators soon discovered that the composition of municipal waste in China made for poor feedstock: comprised largely of organic material, it is too wet to burn in grate incinerators without costly pre-treatment. In any case, the costliness of the equipment put it out of reach for China's second- and third-tier cities. Combined with a drive by Beijing to localise environmental technologies, these practical obstacles helped to spur the (state-funded) development of indigenous waste-to-energy technology. Newer facilities increasingly deploy China-made equipment: grate incinerators feature among these, as do "circular fluidized-bed" models (which, for more efficient combustion, turn China's soggy solid waste into something resembling a fluid). Though small, the latter generate relatively large amounts of electricity and can use different sorts of feedstock, meaning coal can be added for easier ignition. This type of incinerator now accounts for almost half of China's waste-to-energy capacity.

Juicy incentives have attracted investors. Incineration is treated as a renewable energy form in China, so plant owners receive a feed-in tariff. It is hard to overstate the importance of this. Elsewhere, other revenue streams play a bigger role: incineration plants in Europe charge rubbish haulers "tipping fees" that may reach above €100/t (US$132/t) of waste; in China, tipping fees rarely top Rmb100/t (US$16/t) and usually hover around Rmb50/t. Only about one-fifth of revenue comes from tipping fees in many cases; the rest flows from selling electricity.

A refreshing openness to private-sector investment has also encouraged growth in waste-to-energy installations. China's energy sector remains state-dominated, but early legislation on waste, passed almost a decade ago, allowed private-sector investment. Lured by the potential of the China market, foreign and local players alike have rushed to stake claims—in some cases submitting loss-making tender offers just to get a foothold. A 2009 study by Standard Chartered found that over one-half of orders for new waste-incineration facilities came from China.

Something smells fishy

A new rush of investment looks likely in pursuit of government targets. This appears doubly useful. We expect China's electricity demand to grow by 78% between 2012 and 2020, while rubbish will keep piling up; converting waste to energy addresses both problems. That sounds too good to be true, which may well be the case.

China's incinerators, though presented in a shimmering green light, have a dirty underbelly. Emission regulations for waste-treatment plants are far looser than for power plants, although burning rubbish produces harmful pollution sometimes worse than that from burning coal (the dominant fuel in China). Legally, they may emit nitrous oxide and sulphur dioxide at, respectively, four and five times the levels permitted in power plants. Newer facilities have air pollution control systems, but these are costly to run and maintain. Thus, many plants operate without the required flue-gas filtering equipment.

It does not help that China's incinerators often lace waste with coal. Waste-to-energy plant operators concede in interviews that they often use equal weights of coal and rubbish in the feedstock mix, versus an official limit of 20%. Coal's share is sometimes as high as 70%. Such plants operate practically as small coal-fired power stations—exactly the kind of facility that Beijing wants to eliminate on public health grounds. On top of this, treatment of other highly toxic byproducts (wastewater removed before incineration and fly ash created during burning) tends to be either poor or non-existent.

Public resistance

Lax enforcement is partly to blame for these pollution problems, but the fragmented nature of the sector exacerbates matters. Consolidation would create stronger firms able to invest in cleaner technologies. Yet an industry shake-up, anticipated by industry experts and policymakers, appears to be years off. Over 40 firms will commission the next 100 planned incineration plants, by some accounts.

Public opposition may stand a greater chance of forcing change. Pollution is an ever more sensitive subject in China and people living nearby existing plants, offended by odourous emissions and worried

about possible health risks, have protested against new projects. Information on protests is patchy, but according to Chinese media reports by mid-2010 construction of at least six new incineration plants had been postponed due to public opposition. City officials say in interviews that many Chinese mayors are blocking new projects, concerned that they will trigger unrest and spoil their chances of promotion. As more incinerators are built, opposition is likely to mount.

Citizens' demands for more transparency and better monitoring have already begun to change practice on the ground. Beijing last year spoke of introducing a minimum tipping fee that reflects the costs of environmentally safe rubbish-combustion within the next four years. This could translate into waste plants burning less coal—or, more likely, into plants being able to afford to take simple measures like turning on their flue scrubbers. Ultimately, though, higher tipping fees must be funded by China's citizens. It will be a brave government official who explains that better health, like cleaner energy, comes at a price.

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