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Deutsche Bank

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China Industrial Primer

Energy saving & environment protection: an investor guide

Special Report

An investor roadmap
China's energy saving and environmental protection industry is well positioned to blossom in the near future. In October, the government announced a plan to accelerate the development of seven strategic emerging industries, with the energy saving and environmental protection industry flagged as the first priority. This report is meant to help investors understand technology basics, fundamental drivers, market dynamics, and potential investment opportunities in 10 kinds of energy saving and environmental protection methods.

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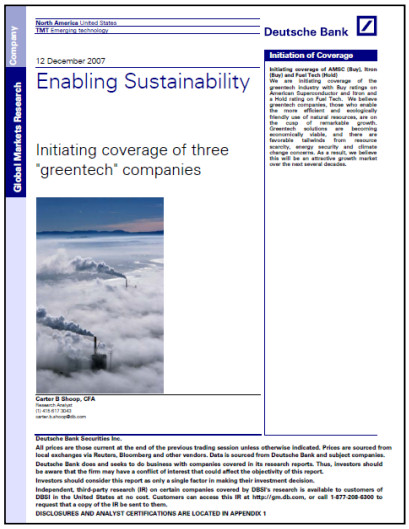
Deutsche Bank energy savings and environmental protection reports



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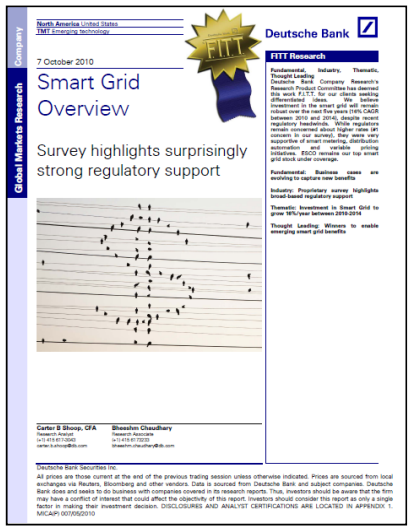

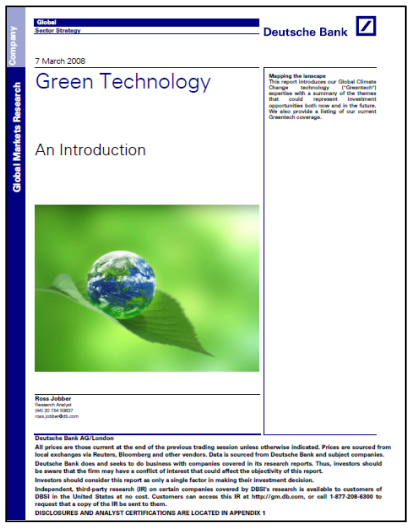

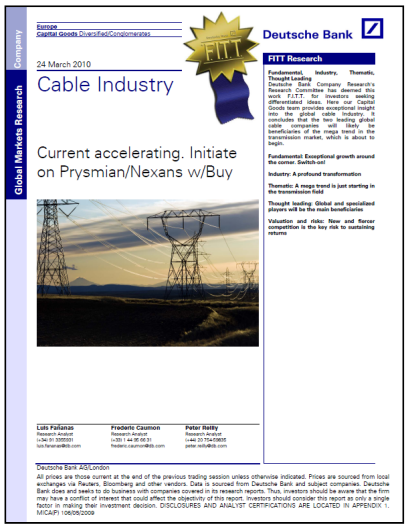

Source: Deutsche Bank

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An investor roadmap

China's energy saving and environmental protection industry is well positioned to blossom in the near future. In October, the government announced a plan to accelerate the development of seven strategic emerging industries, with the energy saving and environmental protection industry flagged as the first priority. This report is meant to help investors understand technology basics, fundamental drivers, market dynamics, and potential investment opportunities in 10 kinds of energy saving and environmental protection methods.

Energy savings investment opportunities and key beneficiaries

China's energy intensity is among the highest in the world. Alongside fast economic growth, China has become increasingly dependent on imported energy supply. After the 20% reduction target set in the 11th Five-Year Plan, the government plans to reduce its energy intensity in the 12th and 13th Five-Year periods by approximately 15%. Another reason for China to promote energy savings is to ensure that the country meets its 40-45% carbon intensity reduction target by 2020. In this report, we discuss five key energy saving methods – waste heat recovery, LED, ground source heat pumps, frequency inverter, and energy efficient building materials – and have identified 40+ listed players with significant business exposures.

Environmental investment opportunities and key beneficiaries

Despite achieving a remarkable double-digit GDP growth rate, China's pollution has been increasing rapidly, and the social loss for China that is associated with pollution is estimated to be 4-6% of GDP, according to the World Bank. The Chinese government has undertaken a variety of methods to achieve its energy intensity and environmental targets. In the 12th Five-Year Plan, China may more than double its investments in the pollution treatment industry to Rmb3,100bn. In this report, we cover three key environmental protection areas – waste water treatment, solid waste treatment, and exhaust gas treatment – and have identified 20+ listed players with significant business exposures.

Smart grid and waste recycling serve both needs; EMC accelerates energy saving products

China's smart grid plan aims to accommodate renewable energy in a more seamless manner and transmit electricity more efficiently, which play a role in both energy savings and environmental protection. Similarly, waste recycling preserves the environment and conserves energy. We have identified 10+ listed players in these two areas. We also examine Energy Management Contract (EMC), the new business model to promote energy saving product sales.

What else is included in this report?

We compare the 10 sub-segments in terms of addressable market size, growth outlook, entry barrier, market concentration, and competition. We have included detailed comparison tables for the total 80+ stocks, with metrics of historical financials, share price performance, and consensus valuation multiples. For each listed company highlighted in our individual section, we provide a snapshot of the company background, business exposure, and key financials. A glossary of common terms has also been included.

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Table of Contents

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Figure 1: Summary table of various energy-efficient and environmental protection technologies

	Energy efficiency							Environmental protection		
	Waste Heat Recovery	LED	Group Source Heat Pumps	Frequency Inverter	Energy Efficient Building Materials	Smart Grid	Waste Recycling	Wastewater Treatment	Solid Waste Treatment	Exhaust Gas Treatment
Sector fundamentals										
Addressable market size	++	++++	+	++	+++	++++	+++	++++	+++	++
Growth outlook	ΔΔΔ	ΔΔΔΔ	ΔΔΔΔ	ΔΔΔΔ	ΔΔΔΔ	ΔΔΔΔ	ΔΔ	ΔΔΔ	ΔΔΔ	ΔΔ
Entry barrier	OO	OOO	OO	OOOO	OOO	OOOO	OO	OO	OOO	OO
Market concentration	√√√	√√	√√	√√√	√√√	√√√	√√	√√√	√√√	√√
Technology	xxxx	xx	xxx	xxx	xx	xx	xxxx	xxxx	xxx	xxxx
Competiton	ϕϕϕ	ϕϕϕ	ϕϕϕ	ϕϕ	ϕϕϕ	ϕϕ	ϕϕϕ	ϕϕϕ	ϕϕ	ϕϕϕ
Listed players financials										
ROE (FY09)	16.0%	13.4%	N.A	24.1%	7.2%	17.8%	22.5%	15.1%	13.8%	11.7%
Revenue growth (2007-09)	58.8%	21.0%	N.A	36.9%	12.9%	27.2%	46.1%	25.9%	22.2%	16.7%
EPS growth (2007-09)	22.8%	16.0%	N.A	71.8%	41.3%	32.6%	46.8%	13.3%	7.4%	18.5%
EBITDA margin (2009)	15.5%	19.3%	N.A	16.7%	14.6%	16.8%	20.4%	35.6%	26.1%	14.5%
Net margin (2009)	9.9%	14.6%	N.A	15.1%	5.0%	15.2%	12.8%	21.3%	1.3%	8.4%
Consensus valuation										
PE (FY10E)	38.9	40.4	N.A	49.9	61.4	44.5	29.1	36.1	37.0	48.6
PE (FY11E)	28.9	26.5	N.A	34.3	28.8	30.8	20.8	28.1	29.1	30.2
PE (FY12E)	22.8	18.9	N.A	25.3	20.6	24.5	20.7	23.2	22.8	29.4
PB (FY10E)	4.3	4.4	N.A	6.0	5.3	7.1	4.2	3.6	4.1	4.6
Absolute Share price performance										
3 months	18%	20%	N.A	18%	23%	21%	31%	18%	21%	31%
6 months	-2%	22%	N.A	15%	25%	9%	17%	4%	6%	11%
1 year	23%	85%	N.A	56%	61%	41%	54%	33%	56%	54%
3 years	85%	322%	N.A	95%	76%	90%	16%	4%	39%	73%

Source: Deutsche Bank; Note: ++++ Very Large, +++ Large, ++ Medium and + Small; ΔΔΔΔ Very Strong, ΔΔΔ Strong, ΔΔ Neutral and Δ Weak ; OOOO Very High, OOO High, OO Neutral and O Low; √√√√ Very High, √√√ High, √√ Neutral and √ Low; xxxx Very mature, xxx mature, xx Neutral and x new; φφφφ Very High, φφφ High, φφ Neutral and φ Low

Note: Sector listed financials, consensus valuation and absolute share price comps are based on the comps table provided in the book. To make the comparison more meaningful, we remove some outliers in the calculation (For RoE, Revenue Growth and EPS Growth, we remove Sanan Optometrics for LED, Beijing Water Doctor for Wastewater treatment and Hembly for Solid Waste Treatment)

Source: Deutsche Bank, Bloomberg Finance LP

Executive summary

Strategic importance of the energy saving and environment protection industry

In the past decade, China has experienced a remarkable double-digit GDP growth rate that was driven mainly by rapid industrialization. While general living standards as measured by GDP per capita have improved dramatically, China's economic growth was accompanied by two growing problems.

For one, China's pollution has been increasing rapidly such that it is one of the largest emitters of SO_2 (sulphur dioxide) in the world, and the social loss for China that is associated with pollution is estimated to be 4-6% GDP, according to the World Bank.

At the same time, China's natural resources are quickly depleting and have become increasingly dependent on imported energy supply, which may become a threat to the national security in the near future. Another reason for China to promote energy savings is to ensure that the country meets its 40-45% carbon intensity reduction target by 2020. Apart from an increase from low-carbon energy sources, raising energy efficiency also helps achieve this target.

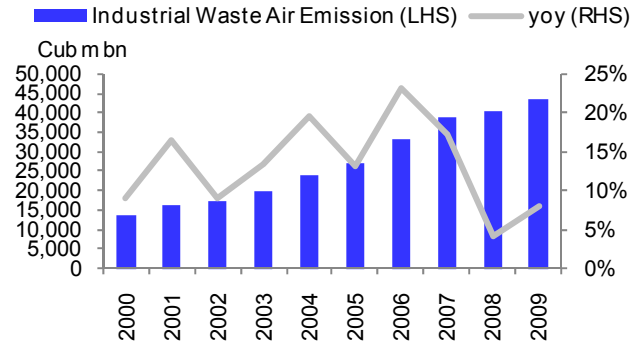
In light of these concerns, in October 2010, the Chinese government announced its plans to accelerate the development of seven strategic emerging industries, with energy saving and environmental protection flagged as the first priority industry, among others. In the next decade, these industries should account for 8% of China's total GDP by 2015 and 15% by 2020 versus the current level of 3%, which implies a CAGR of 25% in 2010-20 assuming GDP growth of 7% per annum. The government believes the development of these industries will propel the country's growth and at the same time promote a sustainable economic growth structure.

With a clear directive policy from the government, China's energy saving and environmental protection industry is well positioned to blossom in the near future, bringing about abundant investment opportunities in the sector. This report discusses China's overall energy saving and environmental market and the potential investment opportunities in various kinds of energy efficiency and environmental protection methods.

The need for pollution abatement and energy saving

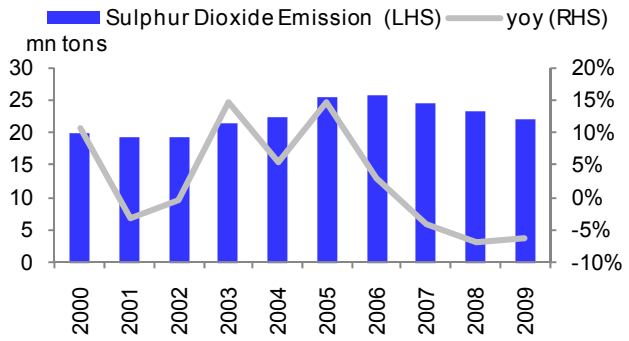
China's urgent need for pollution abatement is driven by the increasing social loss associated with pollution. Figure 2, Figure 3, Figure 4 and Figure 5 depict the country's pollution rate in terms of air, water pollution and municipal solid waste from 2000 to 2009.

Figure 2: Industrial waste air emission



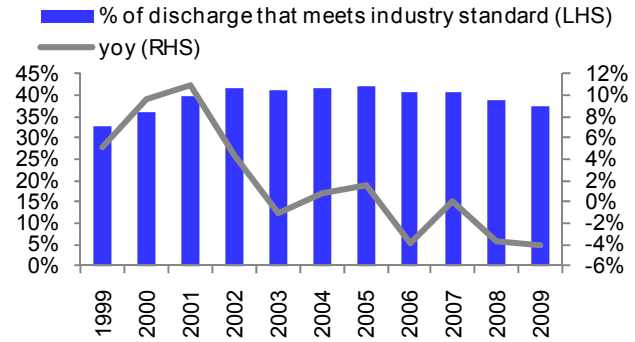
Source: Deutsche Bank, CEIC

Figure 3: China's SO_2 emission rate



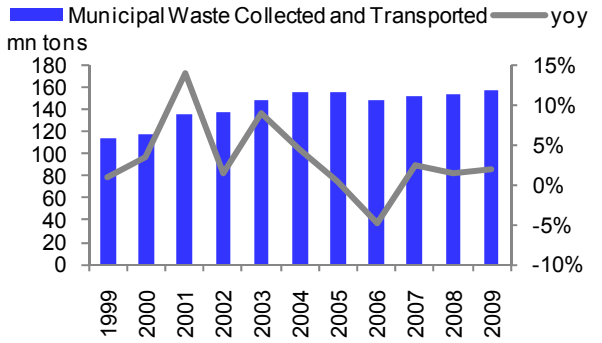
Source: Deutsche Bank, CEIC

Figure 4: % of wastewater discharge that meets industry std



Source: Deutsche Bank, CEIC

Figure 5: Municipal solid waste volume in China



Source: Deutsche Bank, CEIC

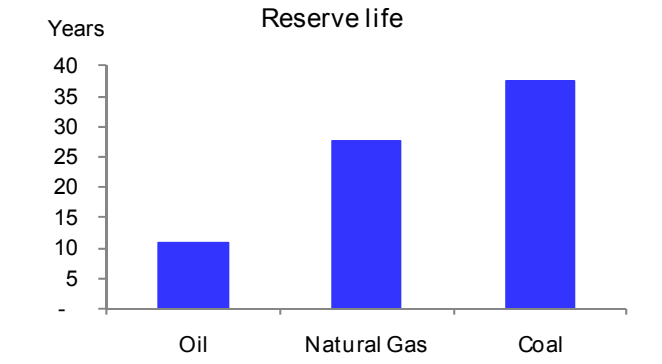
China's pollution condition is getting worse

China has been the world's largest emitter of SO_2 since 2005, and its air pollution has been getting worse. Figure 2, Figure 3, and Figure 4 show that although its sulphur emission fell marginally over the years, its industrial waste gas emission has been increasing and the percentage of wastewater discharge that meets industry standards remains very low at less than 40% in 2009. In addition, according to a recent survey conducted by the Ministry of Environmental Protection on China's pollution situation in over 338 cities in the country, more than 70% of its cities are classified as polluted after they all failed the Chinese air cleanliness assessment, of which 40% of them were classified as heavily polluted.

Pollution cost at 4-6% of GDP: Over the last decade, China's direct economic loss from pollution looks insignificant compared with the country's GDP. However, when we consider the indirect cost associated with pollution, the economic cost is likely to be magnified by a million times. The World Bank's report, *Cost of Pollution in China: Economic Estimates of Physical Damages, 2007*, estimates that the health care costs of air and water pollution in China amount to about 4.3% of its GDP; and including the non-health impacts of pollution, the total cost of air and water pollution in China is about 5.8% of GDP. Although results on the economic cost of pollution vary, according to the assumptions and methodology deployed, the figure published by the World Bank does signal that China's pollution cost is material.

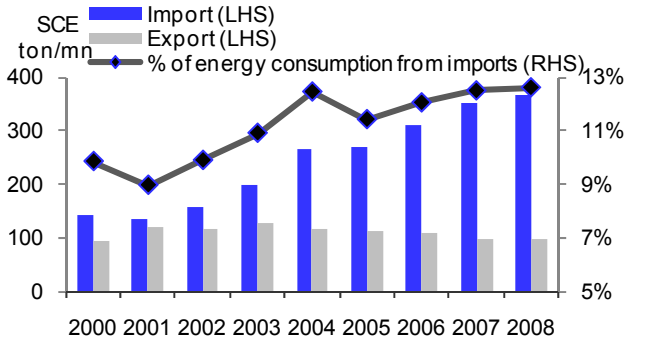
China's need for energy savings is driven by energy security concerns and carbon emission target. From 2000 to 2008, China's energy imports have been increasing at a CAGR of 12% per year, while its energy exports have been declining steadily. As a result, China's energy trade balance has been in a deficit since 1997, and the country is increasingly dependent on foreign energy supply. In Figure 8, we note that China's import mix of total energy consumption has been increasing steadily over the years. Going forward, China expects its demand for energy supply to increase significantly based on its GDP growth forecast and high energy intensity level. According to Zhou Dadi, director of the National Energy Research Institute, China's total energy consumption will increase by fivefold by 2030. Thus, to meet the country's growing energy demand, China is likely to be increasingly dependent on foreign energy supply, and this will be a growing concern for the country in the near future.

Figure 6: China's energy reserve life (2009)



Source: Deutsche Bank, BP Statistical Review; Note: Reserve life is calculated as proven reserves/actual production volume in the year

Figure 7: Energy trade balance



Source: Deutsche Bank, CEIC; Note: SCE=Standard tons of coal equivalent

Another reason for China to promote energy savings is to ensure that the country meets its 40-45% carbon intensity reduction target by 2020. There are three ways for China to achieve its carbon reduction goals, namely:

- Increase its primary energy fuel mix from low-carbon sources such as hydro, wind, nuclear, solar, and geothermal energy
- Change the economic structure of the economy to one that is more service-oriented rather than manufacturing
- Promote energy savings

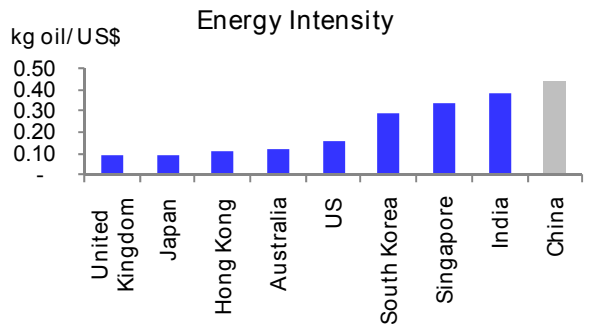
Although China has also stated that 15% of primary energy will come from non-fossil fuels by 2020, a 40-45% carbon emission intensity reduction target is hard to meet without a decrease in energy intensity.

Comparison with other countries

China has the highest energy and carbon intensity level in 2009

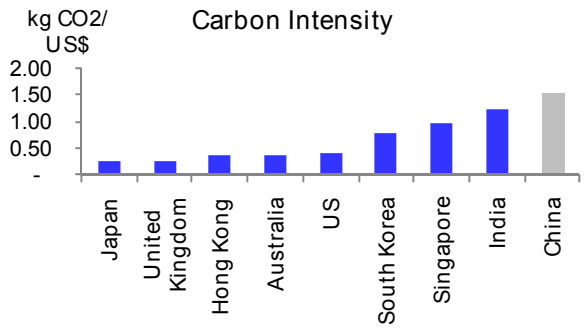
In 2009, China consumed the highest amount of energy per unit of GDP output (energy intensity) and emits the largest amount of carbon per unit of GDP output (carbon intensity), respectively. As compared with the more developed countries such as the UK and the US, China's energy intensity is three to six times higher (Figure 8) and its carbon intensity is at two to four times higher (Figure 9). This difference in the level of intensity can be largely attributable to the difference in the market structure and energy efficiency of a country. China, as a developing country, is primarily involved in the industrial production sector, which consumes the most energy and emits the most carbon. As a result, developed countries that have an established and significant service sector should have a lower intensity level than developing countries. Nonetheless, China's energy and carbon intensity level is still higher than its developing peers.

Figure 8: 2009 energy intensity by country



Source: Deutsche Bank, IMF, BP Statistical Review

Figure 9: 2009 carbon intensity by country



Source: Deutsche Bank, IMF, BP Statistical Review

China's higher energy intensity level can be attributed to its less efficient production

While China's higher energy intensity level can be partly attributable to the difference in its market structure, we also note that its less efficient production process also accounts for the difference in its energy intensity level. Figure 10 illustrates energy intensity for the production of China's main industrial products. For example, China consumes 480kg of oil equivalent (kgoe) for one ton of steel production, versus a typical developed country of 450kgoe/ton. As compared with developed countries, even at 2000-03 levels, China's efficiency is still lagging behind. Although China's energy efficiency has improved significantly over the years, there is still a lot of room for improvement in the industrial sector's energy efficiency based on current technology.

Figure 10: China vs. developed countries on energy intensity by product

Product	Unit	China (2005)	China (2010E)	Developed country
Steel	kgoe/ton	491	480	450 (2000)
Cement	kgoe/ton	127	129	128 (2003)
Ethylene	kgoe/ton	703	650	440 (2003)
Aluminum	kWh/ton	15,268	15,215	14,100 (2003)

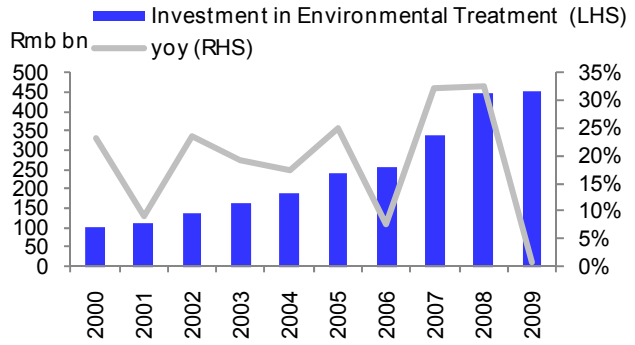
Source: Deutsche Bank, NDRC, China Steel Association

Investments in energy saving and environmental protection

Rapid increase in environmental treatment investments

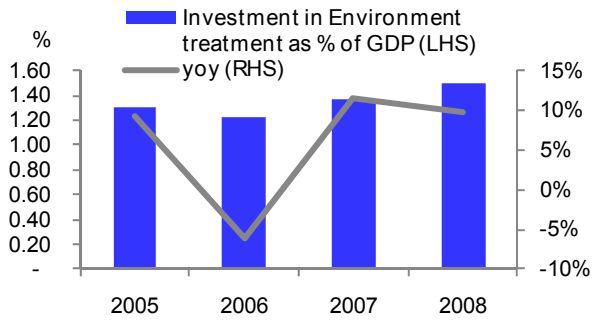
Given the concerns on pollution cost and energy security, China's investments in environmental treatment have increased steadily over the years. In the last decade, China's investment in environmental treatment (Figure 11) has increased by a CAGR (2000-09) of 18% to Rmb452.5bn in 2009, which was higher than the country's GDP growth. As a result, investment in environmental treatment as a percentage of GDP (Figure 12) has increased steadily in recent years. The strong growth in environmental investment in the past decade partly reflects China's determination to achieve its energy efficiency and environmental target that was set in 2005.

Figure 11: Investment in environmental treatment



Source: Deutsche Bank, CEIC

Figure 12: Environmental investment as % of GDP

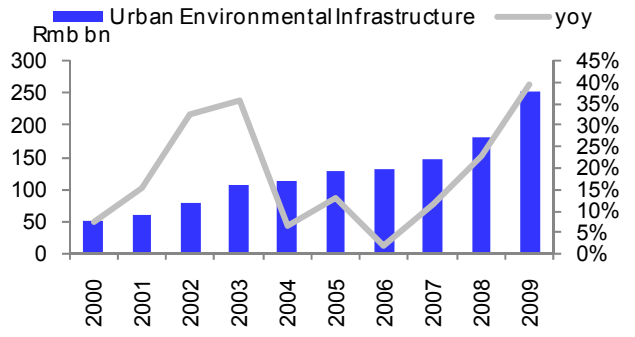


Source: Deutsche Bank, CEIC

Three main areas of environmental investments

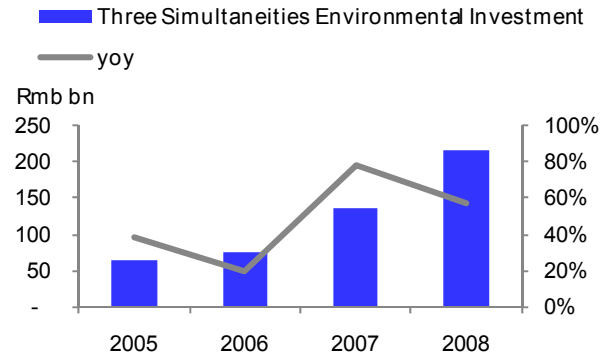
Environmental investments are channeled to three main areas, namely: 1) industrial pollution treatment, 2) urban environmental, and 3) "three simultaneities" environmental investment. Industrial pollution treatment investments refer to investments in waste water, waste gas, solid waste, and noise pollution, while urban environmental investment refers to investment in gas supply, centralized heating, drainage works, gardening and greening, and environmental sanitation. Three simultaneity investments refer to investments in the supplementary environmental facilities to the design, construction, and operation of the new industrial projects. This largely includes investment in energy efficiency, air pollution abatement, and waste water treatment for *new* projects. Note that waste water and waste gas investment categorized under industrial pollution treatment refer to investment in environmental facilities for "*old* or existing" projects and not to the new projects.

Figure 13: Urban environmental infra. Investment



Source: Deutsche Bank, CEIC

Figure 14: "Three simultaneities" environmental investment



Source: Deutsche Bank, China Statistical Yearbook

Environmental investment in 10th and 11th Five-Year period

Figure 15 shows China's 10th and 11th Five-Year investment plan in environmental treatment. According to the government's plan, China generally allocates most of its investments towards pollution control treatment such as wastewater treatment, solid waste treatment, and waste gas treatment (Figure 15).

Figure 15: Investment in environmental treatment by sector

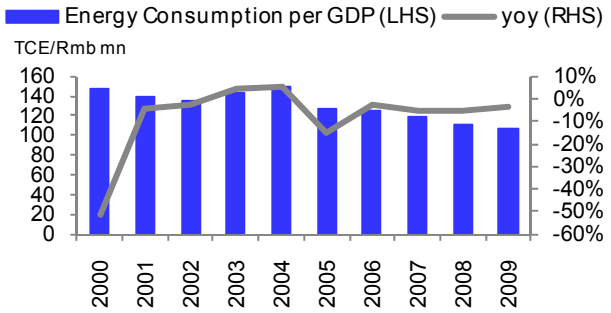
(Rmb bn)	2001-05	2006-10	% increase
Wastewater treatment	270	640	137%
Waste gas treatment	280	600	114%
Solid waste treatment	90	210	133%
Environmental protection in rural areas and natural ecosystems	50	30	-40%
Nuclear safety	NA	15	NA
Environmental management	10	35	250%
Total	**700**	**1,530**	**118%**

Source: Deutsche Bank, NDRC

Lower energy intensity, carbon intensity, and SO_2 emissions in recent years

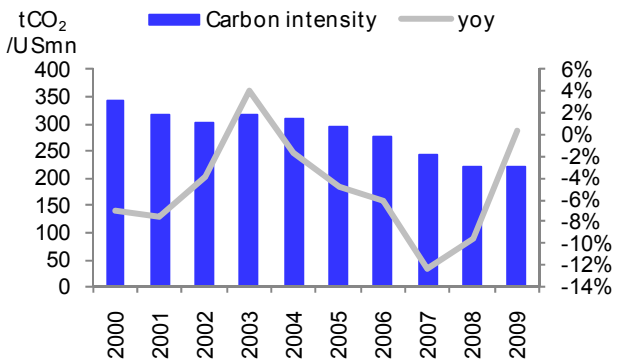
As a result of the government's rapid increase in environmental investments, coupled with favorable government policies, China's energy intensity (Figure 16), carbon intensity (Figure 17), and SO_2 emissions (Figure 3) have declined over the last decade.

Figure 16: Energy consumption intensity



Source: Deutsche Bank, CEIC; Note: TCE= tons of standard coal equivalent

Figure 17: Carbon emission intensity



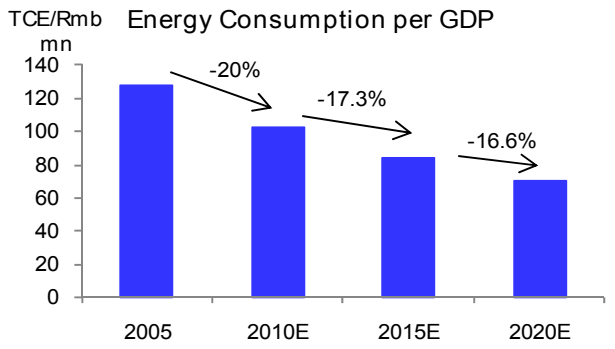
Source: Deutsche Bank, CEIC

Energy savings and environmental targets and investment plans

Aggressive energy intensity target by 2015 and 2020

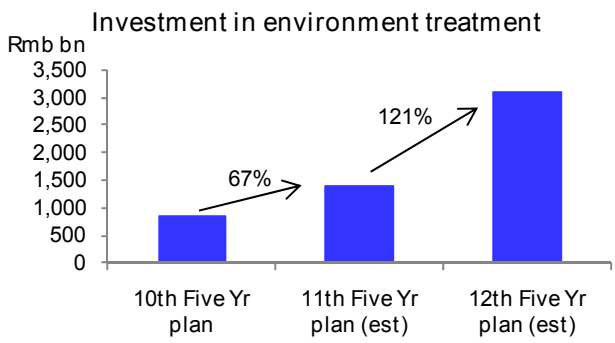
Although China has not finalized the energy intensity target, government officials such as Huang Li, deputy director of the National Energy Bureau's Department of Energy Conservation and Technology Equipment, said that China plans to reduce its energy intensity in the 12th and 13th Five-Year periods by 17.3% and 16.6%, respectively (Figure 18). These estimates tend to be rather accurate and suggest that by 2020, China should achieve an energy intensity level that is similar to Korea and less than Singapore in 2009. Nonetheless, compared with the 38TCE/Rmb m for the US in 2009, China's energy intensity level target of 70TCE/Rmb m will still be higher.

Figure 18: China's energy intensity target



Source: Deutsche Bank, CEIC, National Energy Bureau

Figure 19: Plan investment in environmental treatment



Source: Deutsche Bank, China Academy of Environmental Protection

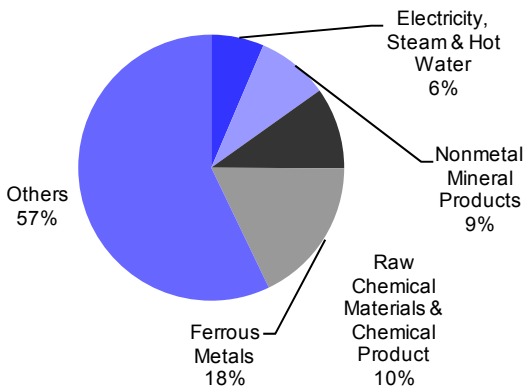
Two more pollutants to be included into the 12th Five-Year pollution control program

According to Zhou Shengxian, minister for Environment Protection, the government will include another two pollutants, namely nitrogen oxide, which cause acid rain and haze, and ammonia nitrogen, which leads to excessive food sources for bacteria in water bodies, to the pollution control program in the 12th five-year period. Hence, key targets will be set for sulphur dioxide (SO_2), chemical oxygen demand (COD), nitrogen oxide, and ammonia nitrogen for the 2011-15 periods. In the previous 11th Five-Year Plan, the government had set a 10% reduction target for SO_2 and COD. SO_2 is a major indicator of air pollution and COD is a measurement of water pollution.

Investment in environmental treatment to double in 12th Five-Year Plan

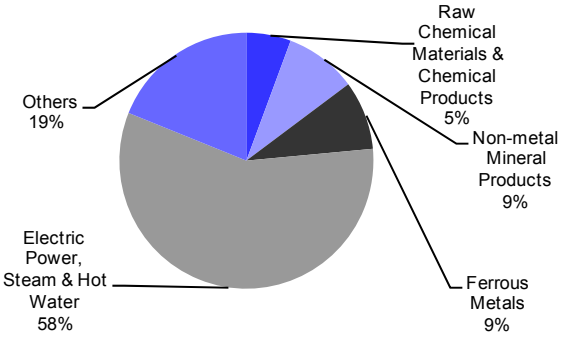
To achieve the planned target for energy intensity and pollution control set in the 12th Five-Year Plan, Chinese Academy for Environmental Protection Wang Jinnan said in 2009 that China may more than double its investment in the pollution treatment industry to Rmb3,100bn. We believe environmental investments will likely be targeted towards industries that are highly energy intensive and causes the most pollution. In Figure 20 and Figure 21 we identify the key sources of energy consumption and pollution.

Figure 20: Energy consumption by industry (2008)



Source: Deutsche Bank, CEIC

Figure 21: SO2 emission by source (2008)



Source: Deutsche Bank, CEIC

High correlation between energy consumption and environmental pollution industry

In 2008, China's energy consumption was mainly attributable to four sectors, namely: 1) power, 2) ferrous metals (mainly iron and steel), 3) non-metal minerals (mainly cement, ceramic and glass), and 4) the chemical industry, which accounted for 43% of total

consumption (Figure 20). This high production industry is also associated with high pollution as well. However, the pollution mix changes dramatically for the power sector, as it currently accounts for 58% of total SO_2 (Figure 21). Nonetheless, given that these industries are the main source of energy consumption and pollution emission, we believe environmental investments will be channeled towards improving the energy efficiency and reducing the pollution emissions from these industries.

Supporting policies

Policies for energy savings and environmental protection have been more specific and favorable over the years

In the past decade, China has designed and implemented several policies (Figure 22) to encourage and promote the development of energy efficiency throughout the economy. Although China's current energy intensity is still the highest in the world, it is clear that these policies will help pave the way for greater levels of energy efficiency in the future. Our belief stems from the fact that the institutional and structural requirements such as a clearer legal and regulatory frameworks are now in place to promote energy savings. In addition, government's favorable tax incentives and funding will further aid the growth of this industry.

Figure 22: Key government policies on energy efficiency in the last 10 years

Policy Type	Agency	Policy and directives	Date	Significance
Nationwide energy saving and environmental protection policies	NDRC	Opinion on accelerating the environmental protection industry	2001	1) Priortize the development of the environmental protection industry
	State Council	Energy conservation law	1998 (revised 2007)	1) Identifies the government bodies in charge of the 11th Five Year Energy Conservation plan, prohibits many high energy intensive products, and authorizes provinces to charge companies that are wasting energy 2) Provides a legal basis for enterprises to be held liable for selling/producing products that does not meet energy efficiency standard
	State Council	New Environmental Impact Assesment Law	2003	1) Strengthens the environmental impact assesment (EIA) 2) Requires higher technical standard of EIA and increase compliance by investors, business operators, construction companies, technical consultants and government departments
	NDRC	Medium and long term plan for energy conservation	2005	1) Sets out specific energy saving targets for industrial, transportation, and building sectors 2) Establish a system for the measurement and evaluation of energy intensity 3) Implement "Top 1,000 enterprises energy conservation project"
	State Council	State Council's decision on strengthening energy conservation	2006	1) Restricts new high energy consumption projects 2) Prioritize clean energy in the power generation sector 3) Promotes tax and fiscal policies to support energy conservation
	NDRC	11th Five Year Energy Conservation Plan	2007	1) Specify the efficiency targets for electricity generation, selected industrial process, appliances and transport 2) Targets to reduce energy intensity by 20% by 2010 3) Targets to reduce COD and SO2 by 10% by 2010
	State Council	Plan Environmental Impact Assessment Regulation	2009	1) The objective of the regulations is to strengthen the Plan Environmental Impact assesment and to improve the scientic rationality of planning
	State Council	National Energy Saving and Environment Protection (ESEP) conference	May-10	1) The province's ESEP industry will be part of the local government performance matrix 2) As such, local governments that do not meet the ESEP targets will be punished severely
	State Council	State Council's decision to accelerate the development of strategic emerging industries	Sep-10	1) Identified 7 key emerging industries to be established by 2020, including energy efficiency and environmental protection industries 2) Establish a fund to support R&D, major innovation projects, major demonstration projects, etc
Tax Policies	NDRC & MOF	Reduced Export Tax Rebates for several low value added but high energy intensity products	2006-2007	1) Export tax rebate was reduced from 11% to 8% for steel, 13% to 11% for glass, 13% to 8% for cement, & 13% to 5%, 8% to 11% for some non-ferrous metal products 2) Cancelled or cut 5% of export rebates on most steel products
	MOF	Interim measures for incentives to environmental conservation technology reforms and phase out program	2007	1) Government set aside Rmb23.5bn to improve energy efficiency & abate pollution in 2007 2) In 2008, allocated another Rmb27bn for energy conservation and carbon reduction
	SAT	Regulations on implementation of corporate income tax for energy conservation enterprises	2008	1) Grants preferential tax treatment for energy saving investment, technology and equipments 2) Qualified investments receive a tax exemption for 3 yrs followed by a 60% reduction in corporate tax

Source: Deutsche Bank, various government websites

Latest policy: emerging industries to account for 15% of GDP by 2020

On 18 October, the State Council published its plan to accelerate the development of seven strategic emerging industries. According to the development plan, these industries will account for 8% and 15% of China's total GDP by 2015 and 2020, respectively, versus the current level of 3%. There are seven strategic industries listed under the plan and these include energy efficiency and environmental protection, alternative energy, next-generation information technology, bio-engineering, high-end equipment manufacturing, alternative material, and alternative-energy vehicle industries. The plan has also set specific guidance for the energy efficiency industry and this includes measures to promote the development of energy saving technology and equipment such that China will be able to manufacture high-quality energy saving products and export them overseas.

Upcoming 12th Five-Year Plan

Although the upcoming 12th Five-Year Plan is still being finalized, several government officials have provided some guidance on the plan. According to Dai Yande, deputy director general, Energy Research Institute of the NDRC, China's 12th Five-Year Energy conservation plan will be published by the end of 2010, and Mr. Dai said that the country aims to reduce

its energy intensity by 15-20% by 2015. To achieve this target, China plans to: 1) change the composition mix of its exports from industrial goods, 2) promote the country's energy saving potential, and 3) promote economic growth. With respect to specific measures on energy saving, Zhou Zhang Yi from the Ministry of Industry and Information Technology said on 29 October that during the 12th Five-Year Period, the government may draw a list of companies that fail the energy saving standard and penalize them.

Roadmap to energy savings and environmental protection

Target achieved through various avenues

The Chinese government has set out a variety of ways to achieve its energy intensity and environmental targets. Below we summarize the various methods that the government will adopt to achieve its goals, and we provide a brief summary of the methods and its corresponding market growth potential. A detailed introduction of the individual methods will be further discussed in the individual subsection.

Energy savings

- Heat recovery device
  - Waste heat recovery allows the collection of this thermal energy and reapplies it to a useful purpose thus reducing the amount of fuel consumed overall. About 5-30% reduction in fuel consumption can be achieved in this fashion. The recovered heat can be recycled and applied to power generation, heating, and cooling.
  - MIIT plans to invest Rmb5bn on the installation of waste heat power generators in 37 iron and steel enterprises from 2010 to 2012. It also plans to invest another Rmb12.7bn for the installation of waste heat power generators to 95% of new dry cement production lines from 2010-13.
- Frequency inverter
  - Frequency inverters are used to control the real-time motor speed and torque of an alternating current (AC). It can be used to save energy and improve the industrial process control.
  - Industry experts forecast low-voltage frequency inverters will incur growth rates from 2009-12 at an annual growth rate of 16%, while medium and high voltage will experience 25% and 48%, respectively. In addition, the high-voltage inverter market reached a market value of Rmb3.4bn in 2008 and is expected to reach Rmb15.4bn by 2012.
- Ground source heat pump
  - A centralized heating or cooling system that utilizes the moderate temperature of the ground surface to extract and transfer heat during the winter and summer seasons. It is among the most energy efficient technologies to provide HVAC (Heating, Ventilating, and Air Conditioning) and water heating.
  - The industry experienced rapid growth of 70% CAGR (2005-09) and industry experts expect significant growth potential, given the increasingly favorable government policies, demand growth in the building market, and higher energy prices.
- Light-emitting diode (LED)
  - LED is a semiconductor device that converts electric power into luminous energy. It is more energy efficient, has a longer lifetime, smaller size, and greater reliability compared with a traditional lighting system.
  - NDRC forecasts the LED lighting industry should grow at a CAGR of 30% from 2009 to 2015. The market penetration of LED lighting products is projected to increase to

20% in functional lighting, 50% in backlighting, and 70% in landscape lighting by 2015.

- Energy Efficient building materials
  - Energy efficient building materials are construction materials/equipments that are used to construct a building that is environmentally friendly and resource-efficient.

Energy saving and environmental protection

- Waste recycling
  - Metals waste recycling is the process of transforming an obsolete metal into new usable products to save raw material and reduce energy consumption. Steel, aluminium, and copper are the largest metal waste recycling markets.
- Smart grid
  - China's strong and smart grid refers to an updated power network combined with advanced digital technologies in measurement, communications, and information control across the power system.
  - China's smart grid network is made up of ultra-high voltage (UHV, (±1,000kV AC or ±800kV DC)) power transmission lines, smart meters, upgraded existing grid lines, and other monitoring systems.
  - The government announced a total investment of Rmb4tr for the smart grid, which will be invested in three phases: 1) Rmb550bn in 2009-10, in which the UHV power grid is set for Rmb83bn; 2) Rmb2tr in 2011-15, in which the UHV power grid is set for Rmb300bn; and 3) Rmb1.7tr in 2016-20, in which the UHV power grid is set for Rmb250bn.

Environmental protection

- Solid waste treatment
  - Solid waste treatment is the process of disposing solid waste. There are three main processes to handle solid waste: 1) incineration, 2) landfill, and 3) composting.
  - CEPI expects total investment in the solid waste area is expected to be Rmb800bn in the 12th Five-Year period (2011-15), tripling the amount spent in the 11th Five-Year period.
- Wastewater treatment
  - Wastewater treatment is the process of removing contaminants from wastewater to produce an environmentally safe liquid and solid waste that is suitable for disposal or reuse.
  - Mr. Hao Chun, deputy secretary General of the China Association of Environmental Protection Industry, said on 8 August 2010 that China will invest more than Rmb1,000bn on industrial and urban sewage treatment.
- Exhaust gas treatment
  - Exhaust gas control technologies help to reduce harmful emissions and pollutants, which are mainly sulphur dioxide (SO_2) and nitrogen compound (NOx)
  - The Ministry of Environmental Protection states that coal-fired power plants and co-generation units that are 200MW or larger and are new, rebuilt, or under expansion, should install Low-NOx Combustion Technologies. If NOx emissions levels are still exceeding the emission standards, then flue gas de-NOx technology should be installed.

Overview of key listed beneficiaries

Figure 23: China listed energy saving and environmental protection players

Company Name	Ticker	Location	Description
Frequency Inverters			
Shenzhen INVT Electric	002334.CH	Guangdong (Shenzhen)	Shenzhen Invt Electric, established in 2000, primarily engages in the low-voltage frequency inverter category through R&D, manufacturing and sales. The company has developed the CHV, CHE, CHF, CHH and CHA series of low voltage inverters which represented 83.3% of revenue in 2009.
Hiconics Drive Technology	300048.CH	Beijing	Beijing Hiconics Technology, based in Beijing, manufactures and designs various high-voltage frequency inverters. Established in 2003 with registered capital of Rmb120m and net assets of more than Rmb1.2bn, the company is a top three domestic manufacturer of frequency inverters.
Harbin Jiuzhou Electric	300040.CH	Heilongjiang (Harbin)	Harbin Jiuzhou Electric, based in Harbin, was established in 2000 with a registered capital of Rmb69.5m and was listed on the Shenzhen GEM exchange in January 2010. The company's main products include high-voltage inverters, high-voltage soft starters, high-frequency direct current power supplies, high-low-voltage switch cabinets, and incoming power line cabinets.
Waste Heat Recovery			
Hailu Heavy Industry	002255.CH	Jiangsu (Zhangjiagang)	Suzhou Hailu Heavy Industry is primarily engaged in the design, manufacture and distribution of exhaust heat boilers (waste heat) and large-scale pressure vessels for the nuclear power industry. The company was listed in Shenzhen Stock Exchange on Jun 2008. Its major shareholder, Mr. Xu Yuan Sheng, is also the president of the company.
Greens Holdings	1318.HK	Shanghai, Jiangsu, Inner Mongolia	Greens Holdings (Greens) is a Cayman Islands incorporated company which is directly derived from the Greens UK Company founded by Edward Green, inventor of the Fuel Economizer in 1845. Greens' products include power station boilers, marine boilers, heat recovery steam generators, waste heat boilers, exhaust boilers and petrochemical boilers. Greens also produces wind turbine towers. Greens has a fully owned subsidiary that builds and operates waste heat recovery power generators, biomass power generation and waste to energy power plants.
Sichuan Chuanrun	002272.CH	Sichuan (Chengdu)	Sichuan Crun (Crun) is principally engaged in the research, development, production and sale of lubrication hydraulic equipment and related integrated systems, boiler components, as well as pressure vessels. The company provides thin oil lubrication system series (thin oil stations), drying oil centralized lubrication system series (drying oil stations), hydraulic control system series and related components, boiler components for large scale power stations, as well as vessels for energy and chemical industries. The company's products are mainly applied in building materials, metallurgical mining, electrical power, petrochemicals, construction machineries, light industry and other industries.
Dalian East New Energy Development	300125.CH	Liaoning (Dalian), Fujian (Longyan), Liaoning (Huludao)	Dalian East New Energy is principally engaged in the design, engineering, construction and operation of a wide range of new energy equipments such as industrial waste heat boiler. The company was founded in 2008 through the restructuring of Dalian East Development Company and was listed on the Shenzhen Stock exchange in Oct 2010. The company's major shareholder, DL Like Tech Engineer holds a 30.2% stake and is engaged in the design, manufacturing, and installation of automation equipment systems and pressure vessels.
Shuangliang Eco-Energy Systems	600481.CH	Jiangsu (Jiangyin)	Shuangliang Eco-energy Systems (Shuangliang), formerly known as Jiangsu Shuangliang Air Conditioning Equipment, is principally engaged in the manufacture and sale of air-conditioning products and parts. Products include flue gas lithium bromide absorption chillers, lithium bromide heat pump chillers, silica gel adsorption chillers, high efficiency exchangers, and direct air-cooled condensers.
Ground Source Heat Pumps			
Ground Source Energy	8128.HK	Guangdong (Shenzhen)	China Ground Source Energy is engaged in the environmental protection and geothermal energy business in China. Its core business is the shallow ground energy utilization system, which it designs, operates and manufactures. The company was formally known as IIN International Limited and was renamed in 2008 to China Ground Source Energy after its acquisition of two major acquisitions in environmental protection and shallow ground energy utilization. Its main shareholder, Mr. Xu Shengheng, is the company's Chief Executive Officer and owns a 20% stake.
Yantai Moon	000811.CH	Shandong	Yantai Moon manufactures and sells air-conditioning and refrigeration equipment in Mainland China. The company's products include industrial and commercial refrigeration systems, compressors, condensers, chillers, low-temperature brine chillers, food freezers, evaporative coolers, and parts. It also manufactures other equipment, such as pressure vessels, dry food processing equipments, and vacuum frying equipments. The company was founded in 1988 and is headquartered in Yantai, Shandong province. Yantai Moon Co., Ltd. is c.24%-owned by Yantai Moon Group Co., Ltd.
Light-Emitting Diode			

Figure 23: China listed energy saving and environmental protection players (Cont'd)

Neo-Neon	1868.HK	Guangdong (Heshan)	Neo-Neon is an investment holding company with operating segments of decorative lighting, general illumination lighting, entertainment lighting and all others. As a pioneer in LED application products, Neo-Neon is specialized in the design and manufacturing of LED applications and was listed in Hong Kong in 2006 and the company's president holds a majority stake of 36.74%.
Sanan Optoelectronics	600703.CH	Hubei (jingzhou)	Sanan Optoelectronics is primarily engaged in full-color high-brightness LED wafer and chip manufacturing. The company also manufactures solar cell and PIN photodetectors. Sanan Optoelectronics was listed in Shanghai in 2008 and is controlled by Xiamen Sanan Electronics, which holds a 41.39% stake of the company.
Jiangxi Lianchuang Optoelectronic Science & Technology	600363.CH	Jiangxi (Nanchang), Fujian (Xiamen)	Lianchuang Optoelectronic, found in 1999, is engaged in the research, design, manufacturing and sales of LED wafer, chip and LED lighting application. The company also produces optoelectronic cables. Lianchuang Optoelectronic was founded in 1999 and was listed in Shanghai in 2001. Jiangxi Electronics Group, as the major shareholder, holds 20.41% stake of the company.
Zhejiang Yankon Group	600261.CH	Zhejiang (Shangyu)	Zhejiang Yankon is primarily engaged in the development, manufacture and distribution of lighting appliances. The company's lighting products covers applications in office lighting, commercial lighting and household lighting. The company also provides electrical equipment, such as switches and sockets. Established in 1975 from the predecessor of the Shangyu Bulb Factory, Zhejiang Yankon is a leading lighting appliance manufacturer in China and distributes its products in overseas market through original equipment manufacturers (OEM). The company was listed in Shanghai in 2000.
Han's Laser Technology	002008.CH	Guangdong (Shenzhen)	Han's Laser is primarily engaged in laser processing equipment manufacturing for various industries, including consumer electronics, packaging industry, auto parts, jewelries, textile and solar power. Han's Laser was listed on the Shenzhen Stock Exchange in 2004.
Elec-Tech International	002005.CH	Guangdong (Zhuhai), Anhui (Wuhu)	Elec-Tech International, established in 1996, is principally engaged in the development, production and sale of small domestic appliances (SDA). The company is also involved in the businesses of LED chips, LED epitaxial wafers, packaging and LED application after a series of mergers in 2009. The company was listed on the Shenzhen Stock Exchange in 2004. Zhuhai Dehao Electric Appliance is the major shareholder, controlling a 20.63% stake.
NVC Lighting Technology	2222.HK	Guangdong (Huizhou)	NVC Lighting Technology is engaged in the design and manufacturing of a variety of lighting products, focusing on energy saving products. The company also provides electronic products, such as electronic transformers and electronic and inductive ballasts. The company was listed in Hong Kong in May 2010 and is controlled by SB Asia Investment Fund II L.P. with a 22.98% stake.
Energy efficient building material			
CSG	000012.CH	Guangdong (Shenzhen)	CSG Holding (CSG) was founded in 1984 and is principally engaged in the manufacture and sale of glass. It is one of the leading Low-E glass manufacturers in China. CSG also produces products for the solar energy industry. The company's flat glass segment primarily provides float glass, special glass, solar energy glass, quartz sands and others; the engineering glass segment mainly provides environmental protection and energy saving low-emissivity-coated glass. The company distributes its products in domestic markets and to overseas markets, including Hong Kong, the US and Australia. The company has a large institutional shareholder base and is controlled by Shenzhen International Holdings.
Wuhu Conch Profiles and Sci	000619.CH	Anhui	Wuhu Conch Profiles and Science (WCP) is principally engaged in the research, development, manufacture, and sale of building materials in China. WCP provides PVC profiles, sheets, boards, doors, windows, molds, plastic additives, white/colored/grain extruded profiled materials, plastic bars, window roller shutters, window blinds, and other ornament profiled materials. The company distributes its products within China's domestic markets, with eastern and northern China as its major markets. As of 31 December 2009, Wuhu had 10 major subsidiaries. The company, formerly known as Anhui Hongxing Xuanzhi Paper Co., Ltd., was founded in 1996 and is headquartered in Wuhu, China. It is controlled by the Anhui Conch Group.
Beijing New Building Materials	000786.CH	Beijing	With an annual production capacity of 1bnsqm Beijing New Building Materials (BNBM) is the largest gypsum board producer in Asia and ranks among the top three in the world. BNBM principally engaged, manufactures, and sells new building materials, new wall materials, pipe fittings, and decoration materials. The company also develops and applies environmental protection and energy saving products. The company operates its businesses through three segments: walling and suspension systems including plaster (gypsum) boards, keels, mineral wool boards and accessories; residential parts systems for energy saving including doors and windows, heating, heat preservation and paint; external walling systems, cement tile roofs; and siding systems. BNBM operates as a subsidiary of China National Building Material Group Corporation.
Avic Sanxin	002163.CH	Guangdong (Shenzhen)	AVIC Sanxin (AS) is principally engaged in the design and undertaking of energy saving curtain wall projects as well as the manufacture and distribution of engineering glass products, electronic glass products and curtain wall doors, and windows products. The company's special glass materials include offline Low-Emissivity (Low-E) glass, on line Low-E glass, electronic functional coated glass and solar glass, among others. AVIC distributes its products within domestic markets and to overseas markets.
Smart grid			
Wasion Group	3393.HK	Hunan	Wasion Group, located in Hunan province, is a leading supplier of advanced energy metering products and solutions. Wasion distributes its products to China and overseas markets including Southeast Asia and the Americas. Wasion Group was listed in Hong Kong in 2005, and is controlled by Mr. Ji Wei, president of the company, with a 50.5% stake.
Shenzhen Clou Electronics	002121.CH	Guangdong (Shenzhen)	Clou Electronics, founded in 1996, specializes in the design and manufacture of power automation products and electrical instruments. The company was listed on the Shenzhen Stock Exchange in 2007 and is controlled by Mr. Rao Luhua, president of the company, holding a 49% stake.

Figure 23: China listed energy saving and environmental protection players (Cont'd)

NARI Technology Development	600406.CH	Jiangsu (Nanjing)	NARI Technology, established in 2001, specializes in software and hardware products serving the power industry, as well as the provision of system integration services. NARI Technology has four branch companies, covering power network controls, system controls, industrial controls and rural electrification. NARI Technology was listed in Shanghai in 2003 and is controlled by Nanjing NARI Group, which has a 36.8% stake in the company. Nanjing NARI Group is 100% owned by China State Grid.
Guodian Nanjing Automation	600268.CH	Jiangsu (Nanjing)	Guodian Nanjing Automation is principally engaged in the manufacture and distribution of power automation equipment. Predecessor of Guodian Nanjing Automation is Nanjing Electric Power Automation Equipment General Factory founded in 1940. Guodian Nanjing Automation was listed in Shanghai Stock Exchange in 1999 as one of the earliest high-tech listing companies in electric power industry. Major shareholder is China Huadian Corporation, holding 58.2% stake of the company.
XJ Electric	000400.CH	Henan (Xuchang)	XJ Electric is primarily engaged in automation, protection and controlling products for electric power systems. XJ Electric was founded in 1993 and was listed on the Shenzhen Stock Exchange in 1997. The major shareholder is XJ Group, holding 29.9% stake.
Sieyuan Electric	002028.CH	Shanghai	Sieyuan Electric is primarily engaged in power transmission, distribution and monitoring equipment. Specializing in certain traditional electrical equipment including arc-suppressing coil and switchgears, the company further extended its business into the gas-insulated switchgear (GIS), SVG and active power filter (APF) businesses in recent years. Sieyuan Electric was listed in 2004. The largest shareholder is Dong Zengping, president of the company, holding an 18.12% stake.
Dongfang Electronics	000682.CH	Shandong (Yantai)	Dongfang Electronics, found in 1957, is principally engaged in the development, production and distribution of electrical and industrial automation control systems. The company was listed in 1997 and parent Yantai Dongfang Electronics Group holds a 19.7% stake.
China XD Electric	601179.CH	Shaanxi (Xi'an)	China XD Electric is mainly engaged in power transmission, distribution equipment and protection equipment and is an integrated provider of technology and service as well as engineering contracting. The predecessor of the company was Xi'an Electrical Machinery Manufacturing Company, which is established in 1959. China XD Electric was listed in Shanghai in January 2010 and is controlled by China XD Group, which holds a 58.1% stake.
TBEA	600089.CH	Xinjiang	Tebian Electric Apparatus engages in the manufacture and distribution of electric power transmission and transformation equipment. The company is also involved in contract construction of power transmission and transformation projects and photovoltaic projects, as well as manufacture of new materials such as aluminum foil. TBEA has nine manufacturing bases in China and distributes its products to overseas markets. TBEA was listed in Shanghai in 1997, and its parent, Xinjiang Tebian Electric Group, holds an 11.4% stake in the company.
Zhixin Electric	600517.CH	Shanghai	Zhixin Electric is principally engaged in the design and manufacturing of amorphous metal transformers. The company is the world's largest amorphous metal transformer producer in terms of production capacity and is a technology leader. Zhixin Electric provides a full spectrum of amorphous metal transformers. The company was listed in Shanghai in 2003, and is controlled by Shanghai Zhixin Group, which holds a 32.3% stake.
Rongxin Power Electronic	600517.CH	Liaoning	Rongxin Power Electronic, based in Anshan City, manufactures electrical equipment, primarily in China. The company is mainly engaged in energy saving high voltage electronic equipment through its design and manufacturing business. Its products include the power quality series (SVC, SVG), and Motor Drive Series (HVC, VFS, MABZ). The static var compensator (SVC) is the only SVC ISO9001 certified in China and is produced according to international standards.
Ligong Online Monitoring Technology	002322.CH	Zhejiang	Ligong Online Monitoring Technology (LGOM) is engaged in research, development, design, manufacture and distribution of high electric voltage online monitoring products. Originally engaged merely in electrical transformer online monitoring, the company diversified its business into wider applications in recent years, including GIS online monitoring systems, cable online monitoring systems and circuit breaker online monitoring systems. The company was listed in 2009 in Shenzhen, as the first online monitoring listing company in the electric power industry. The largest shareholder is Ningbo Tianyishiji Investment.
Boer Power Holdings	1685.HK	Jiangsu	Boer Power is primarily engaged in producing high-low-voltage electrical switchgear systems, switch components and electrical network management system. Its products are widely applied in residential, building, industry, energy and infrastructure. The company was developed from its predecessor, Wuxi City Power Instrumentation System Works, founded in 1985. Boer company is one of the largest licensed partners of Schneider Electric in China. Boer Power is also a partner with ABB. Boer Power was recently listed in HK, and is controlled by King Able Limited (69%), which is owned by Mr. Qian Yixiang, chairman of the board and CEO and Ms. Jia Lingxia, executive director and COO and also the wife of Mr. Qian Yixiang.
Tianwei Baobian Electric	600550.CH	Hebei	Tianwei Baobian Electric (TWBB) is engaged in the manufacture and distribution of transformers. The company is also involved in construction of energy projects. Its products are applied in the thermal power generation, hydropower generation and nuclear power fields. TWBB is the only supplier of main transformers for domestic nuclear power companies. TWBB is 51% owned by Baoding Tianwei Group and was listed in Shanghai in 2001.
Waste Recycling			
Chiho-Tiande Group	0976.HK	Zhejiang (Ningbo, Taizhou)	Chiho-Tiande is a mixed-metal scrap recycler that specializes in the recycling, reuse and processing of mixed-metal scrap. The company was ranked No.1 in China for total import volume of mixed copper scrap in 2009. In recent years, Chiho-Tiande has expanded into the manufacturing of aluminum-alloy ingots as well as copper rods and wires. The company was listed in Hong Kong in 2010. Fang Ankong, chairman and CEO of Chiho-Tiande, is the company's major shareholder, holding a 34.5% stake.
China Metal Recycling	0773.HK	Guangdong, Zhejiang, Tianjin, Hubei	China Metal Recycling is a leading scrap-metal recycling company in China. The company produces recycled scrap ferrous and non-ferrous products from scrap steel, scrap copper and other scrap metal. China Metal Recycling also resells unprocessed metal scrap. The company was listed in Hong Kong in 2009, and Chun Chi Wai, president of China Metal Recycling, holds a 61.6% of stake.

Figure 23: China listed energy saving and environmental protection players (Cont'd)

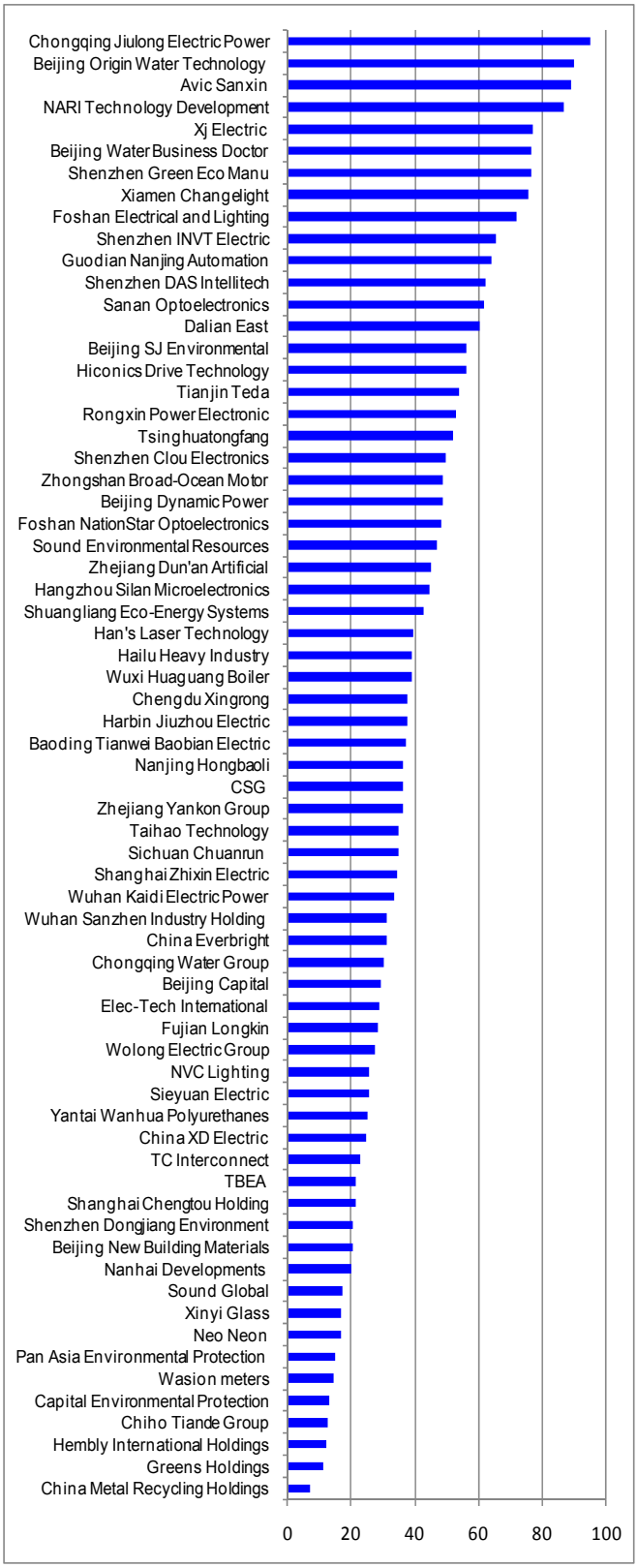
Shenzhen Green Eco-Manufacture Hi-Tech	002340.CH	Guangdong (Shenzhen)	GEM Hi-Tech, established in 2002, specializes in collecting and recycling cobalt/nickel scrap to produce high valued-added products of ultra-fine powder. It also provides wood-plastic composites. It is the only domestic company that utilizes waste cobalt and nickel products for powder manufacturing, while others rely on natural mines of cobalt or nickel. The company was listed in Shenzhen in early 2010. Shenzhen Huifengyuan Investment, the major shareholder, holds a 22.8% stake in the company.
Dongjiang Environment	8290.HK	Guangdong (Shenzhen)	Dongjiang Environment (DJE), established in 1999 in Shenzhen, is primarily engaged in waste management and environmental services. The company is also engaged in clear development mechanism (CDM) programs. It was listed on Hong Kong's Growth Enterprise Market (GEM) in 2003 with a stock code of 8230.HK, and transferred to the main board in September 2010 with a new code of 0895.HK
Wastewater treatment			
China Everbright	0257.HK	Shandong	China Everbright International is primarily engaged in environmental protection project investments such as sewage water treatment, waste-to-energy and solid waste disposal. The company also operates a toll bridge in Fuzhou, Fujian province. China Everbright International is controlled by China Everbright Group and has positioned itself as the environmental investment arm of its parent.
Tianjin Capital Environmental Protection	600874.CH	Tianjin	The company is primarily engaged in the wastewater treatment business in China, originally constructing/operating plants in Tianjin, and more recently has acquired sewage and water projects outside of Tianjin such as Hubei, Jiangsu, Zhejiang, Yunnan and Shandong. The company also operates water recycling plants as well as toll stations in Tianjin. Tianjin Capital is listed in Hong Kong and Shanghai and is controlled by Tianjin Municipal Investment Company (TMICL), the investment arm of the Tianjin municipal government.
Sound Global	0967.HK	Hubei	Sound Global is an integrated water and wastewater treatment solutions provider in China and offers services ranging from the design, construction, operation and maintenance of water and wastewater treatment facilities to the manufacturing of water and wastewater treatment equipment. The company is incorporated in Singapore and is listed both in Hong Kong and Singapore.
Beijing Capital	600008.CH	Beijing, Hunan, Anhui, Shenzhen	Beijing Capital is principally engaged in the operation, construction and management of water supply and water sewage business with operations in areas such as Beijing, Hunan, Anhui and Shenzhen. It is also involved in other non-utility businesses such as the management of toll roads and hotels. The company was listed on the Shanghai Stock Exchange in April 2000.
Chongqing Water Group	601158.CH	Chongqing	The company is principally engaged in the operation and management of water supply and water sewage treatment business in Chongqing municipality. It is also involved in the engineering, procurement and construction (EPC) of public utility and housing projects. Its parent company, Chongqing Waterworks Asset Management, is a state-owned enterprise and owns a 75% stake in Chongqing Water. The company was listed on the Shanghai Stock Exchange in March 2010.
Beijing Enterprises Water Group	027.HK	Beijing	Beijing Enterprise Water is a state-owned enterprise that specializes in water services and environmental protection in China. It is the flagship vehicle of Beijing Enterprises Holdings (0392.HK, Buy), a state-owned red chip utility conglomerate for expanding into the water service market. The company was listed in Hong Kong in 1992 and Beijing Enterprises Holdings became the controlling shareholder in March 2008.
Beijing Origin Water Technology	300070.CH	Beijing	Beijing Origin Water Technology Company is a non state-owned enterprise established in 2001 by a group of scientists and professionals from overseas and domestic universities. The company's business spans from sewage treatment and recycling to water and drinking water research to solid waste disposal, project design, and construction. The company was listed in April 2010.
Beijing Water Business Doctor	300055.CH	Beijing, Ningxia (Yinchuan)	Beijing Water Business Doctor is a non-state owned company that provides water treatment and management services for a range of industries including refining, petrochemical, coal chemical, metallurgy, electricity, and mining. The company was established in Beijing in 1998 and listed in Shenzhen Stock exchange in Feb 2010.
Rino International Corp	RINO.US	Liaoning (Dalian)	Rino International Corp is engaged in the design, development, manufacture and installation of industrial equipment that are mainly used for environmental protection equipment for the iron and steel industry in China. The company was originally incorporated in Minnesota in 1984 as Applied Biometrics but was restructured in 2007 into an environmental protection equipment manufacturer.
Duoyuan Global Water	DGW.US	Beijing	Duoyuan Global Water is a privately owned sewage equipment supplier in China, offering over 80 types of products and solutions for industrial and residential wastewater treatment. The company was incorporated in June 2007 and was listed on the New York Stock Exchange in June 2009.
Waste processing			
Sound Environmental Resources	000826.CH	Hubei, Beijing	Sound Environmental Resources is listed on the Shenzhen Exchange and is primarily engaged in the municipal/industrial solid waste treatment and water business. The company has operations in Hubei, Jiangsu, Zhejiang, Beijing, Inner Mongolia and other regions. The company is c.44.9%-owned by Beijing Sound Group. Beijing Sound Group has another listed vehicle, Sound International (0967.HK, NR), which focuses on wastewater treatment.
Dongjiang Environment	8290.HK	Guangdong (Shenzhen)	Shenzhen Dongjiang Environmental Company (DJE), listed on the Growth Enterprises Market in Hong Kong in 2003 and transferred to a Main Board listing in September 2010, is an environmental company specializing in waste management and environmental services. DJE is primarily engaged in three business segments: (1) waste collection, treatment, transportation and disposal; (2) the construction and provision of environmental systems and services; and (3) the production and sale of recycled products and renewable energy. The company was established in 1999 and is headquartered in Shenzhen.

Figure 23: China listed energy saving and environmental protection players (Cont'd)

New Environmental Energy	3989.HK	Shanghai	New Environmental Energy, formerly known as Hembly International Holdings, is a provider of waste treatment and environmental infrastructure services in China. Before diversifying into waste treatment and waste-to-energy business, the company was mainly engaged in the distribution and retailing of apparel and footwear. With the acquisition of Smartview Investment Holdings in December 2009, the company entered the waste treatment industry with operations in five provinces and has a target to treat over 6,000 tons of waste per day.
Wuxi Huaguang Boiler	600475.CH	Jiangsu (Wuxi)	Wuxi Huaguang Boiler, based in Wuxi in Jiangsu province, was listed on the Shanghai Stock Exchange in 2003. The company mainly specializes in the manufacturing of boilers for power plants, industry boilers, heat recovery steam generators, boilers for garbage, life-form fired boilers, and flue gas desulfurization and purification equipment. The company is 45%-owned by Wuxi Guolian Environmental and Energy Group, which is ultimately owned by the Wuxi municipal government.
Shanghai Chengtou Holding	600649.CH	Shanghai, Shandong (Qingdao, Weihai)	Shanghai Chengtou Holding, formerly Shanghai Municipal Raw Water Company, was founded in 1992 and is based in Shanghai. Shanghai Chengtou's main operations include the supply of fresh water and tap water, engineering design, pipeline construction and maintenance; mechanical and electrical equipment installation; sewage cleaning and solid waste disposal; and the sale of real estate.
Nanhai Development	600323.CH	Guangdong (Foshan)	Nanhai Development, based in Nanhai District, Foshan, Guangdong province, is primarily engaged in tap water products and supply, sewage treatment and waste-to-energy electricity generation. The company is listed on the Shanghai Stock Exchange and is 28%-owned by Foshan Nanhai Water Supply Group, a municipal state-owned enterprise. Currently, the company derives all of its revenue in Foshan city.
ZhongDe Waste Technology AG	ZEF.GR	Fujian (Fengquan)	Established in 1996, ZhongDe Group is a provider of small and medium-sized waste incineration equipment in China. The company designs, manufactures and installs pyrolytic, grate and rotary kiln waste incinerators for the disposal of solid medical, municipal and industrial waste. Furthermore, as an investor in BOT projects, ZhongDe also operates waste-to-energy plants. The company was listed on the Frankfurt Stock Exchange in 2007. Most of ZhongDe Group's operations are based in Fuzhou city, Fujian province.
Exhaust Gas Control			
Fujian Longkin	600388.CH	Fujian, Xinjiang	Fujian Longking is principally engaged in the production, distribution, and installation of electrofilter equipment. It is also involved in the operation of desulphurization projects; sale and leasing of real estate properties; management of properties; generation of hydropower electricity; and provision of technologies. The company is based in Longyan, China and distributes its products in China and internationally.
Chongqing Jiulong Electric Power	600292.CH	Chongqing	Chongqing Jiulong Electric Power is engaged in electric power production and electric power technology services. It also sells electric machines, electricity transmission equipment and electronic components, and is involved in environment protection technology research and development. The company has an installed capacity of 2,102MW, mainly located in Chongqing city. China Power Investment Corporation, which owns a 31% stake, has indicated its plan to transform the company into a pure environmental player in the future.
Pan Asia Environmental Protection	0556.HK	Jiangsu (Wuxi), Zhejiang, Anhui	Established in 1998, Pan Asia is an integrated environmental protection services provider, with capabilities in design and project execution. It is principally engaged in the sale of water and flue gas treatment products and equipment, and undertakes environmental protection construction engineering projects. It offers engineering design, ancillary product design, procurement, manufacturing and processing, assembly, installation, construction and after-sale services to customers in industries such as textile and dyeing, iron and steel, and power.
Rino International Corp	RINO.US	Liaoning (Dalian)	Rino International Corp is engaged in the design, development, manufacture and installation of industrial equipment that are mainly used for environmental protection equipment for the iron and steel industry in China. The company was originally incorporated in Minnesota in 1984 as Applied Biometrics but was restructured in 2007 into an environmental protection equipment manufacturer
Zhejiang Feida Environmental Science & Technology	600526.CH	Zhejiang	Zhejiang Feida Environmental is based in Zhuji City, Zhejiang, and was listed on the Shanghai Stock Exchange in July 2002. The company mainly focuses on designing and manufacturing equipment for air quality control. As of end-1H10, the company was c.36%-owned by Feida Group, which is wholly owned by the Zhuji State-owned Assets Supervision and Administration Commission.

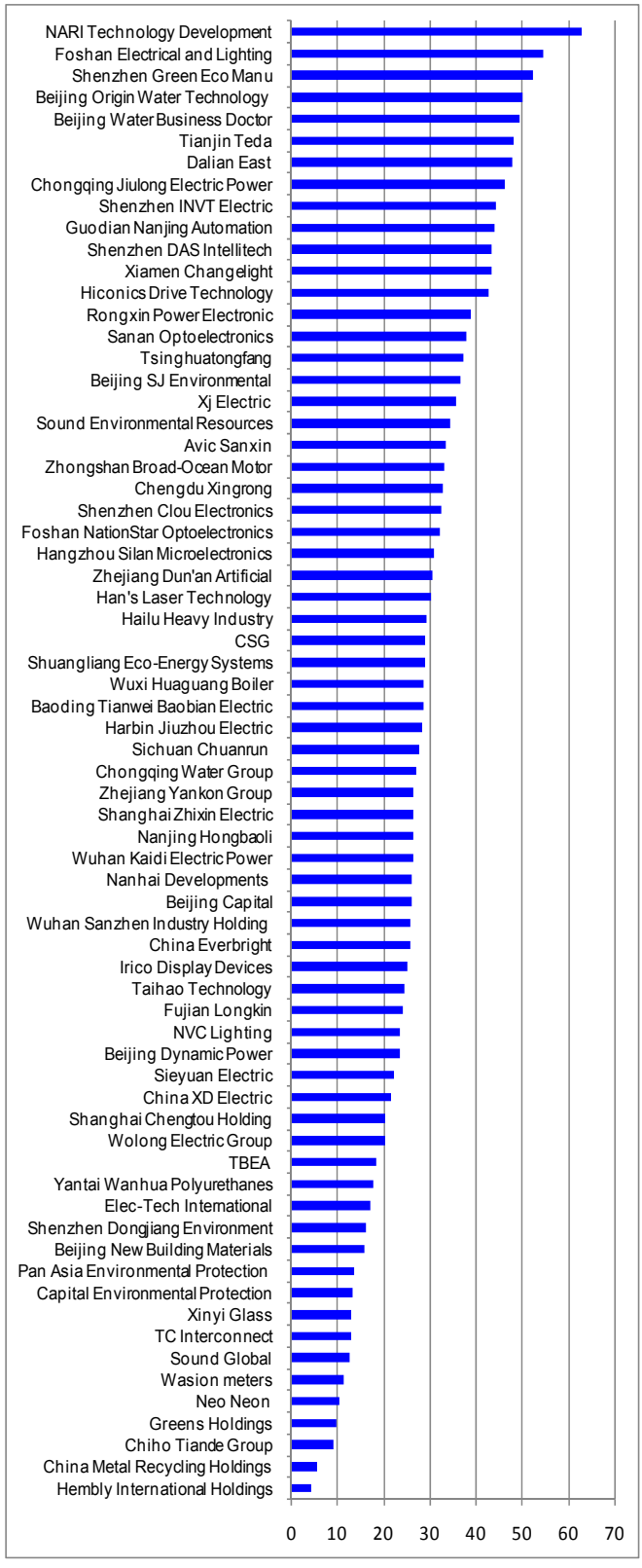
Source: Deutsche Bank, company data

Figure 24: 2010E price–to-earnings ratio



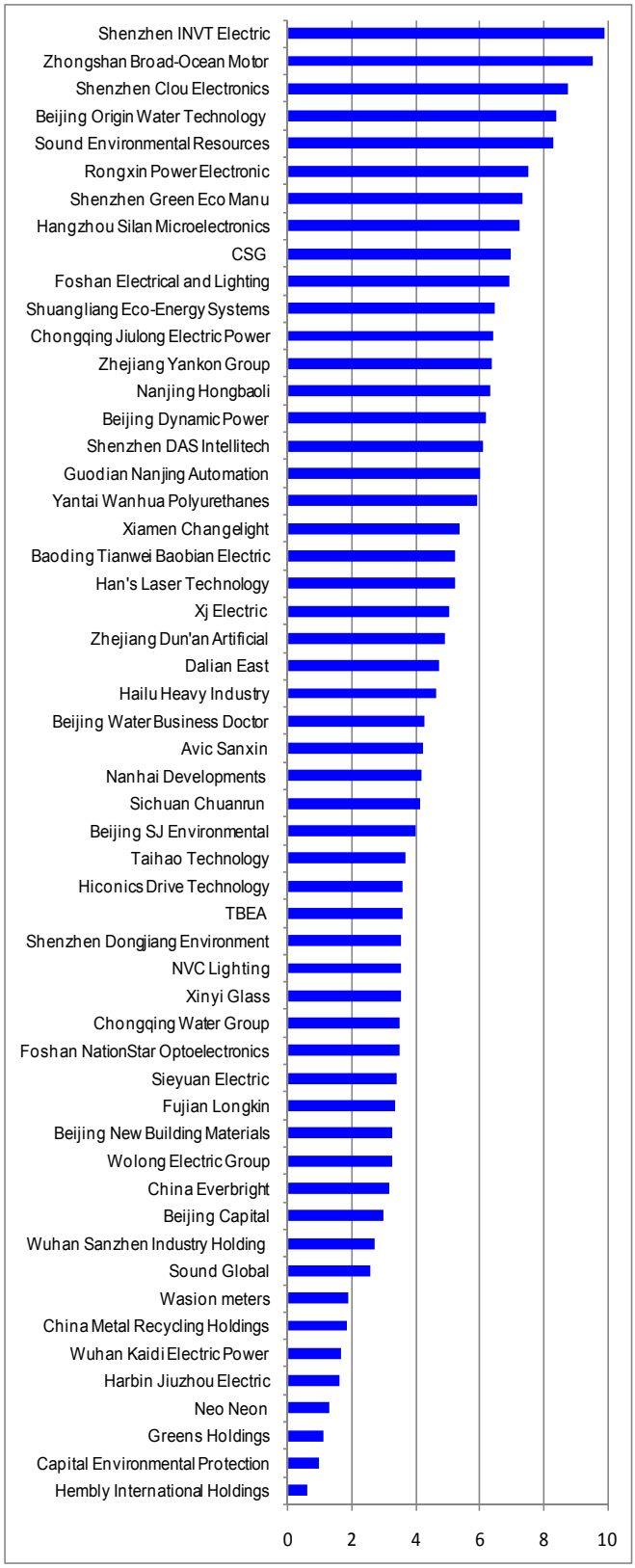
Source: Deutsche Bank estimates for China Everbright, Bloomberg Finance LP estimates for others

Figure 25: 2011E price–to-earnings ratio



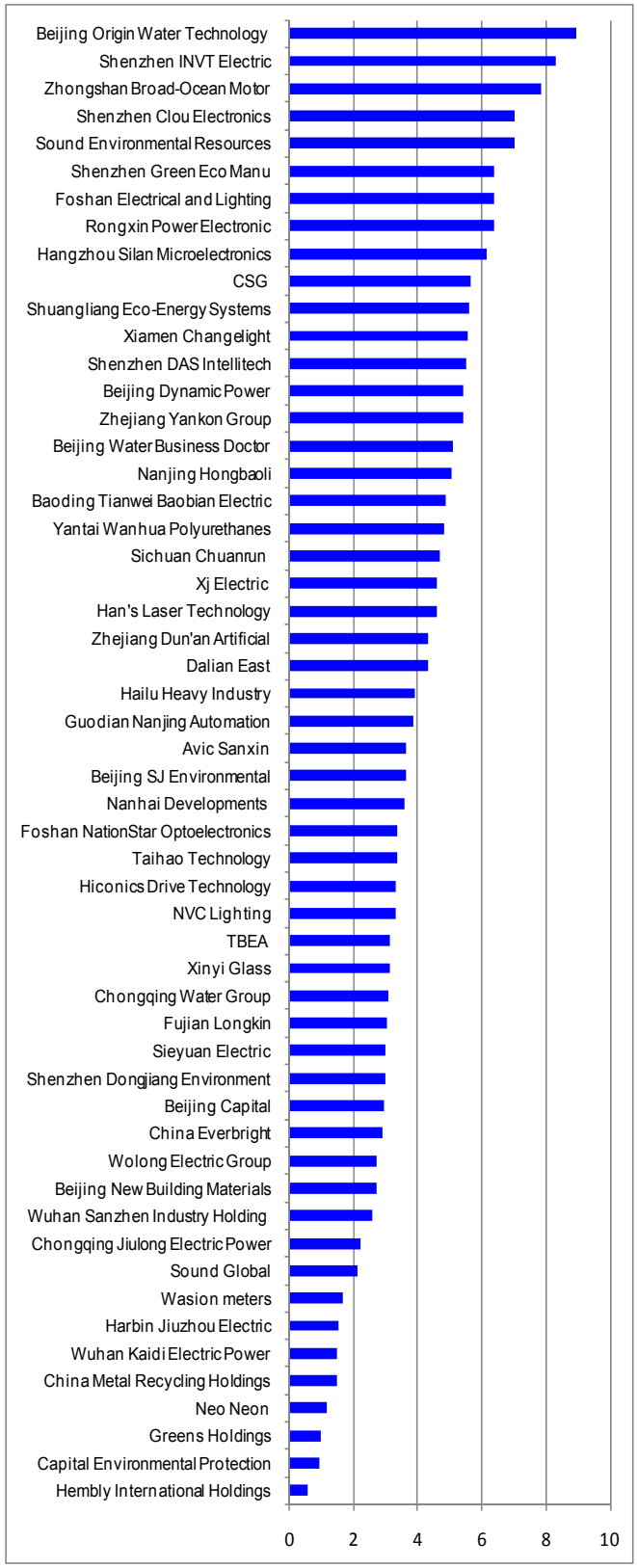
Source: Deutsche Bank estimates for China Everbright, Bloomberg Finance LP estimates for others

Figure 26: 2010E price-to-book ratio



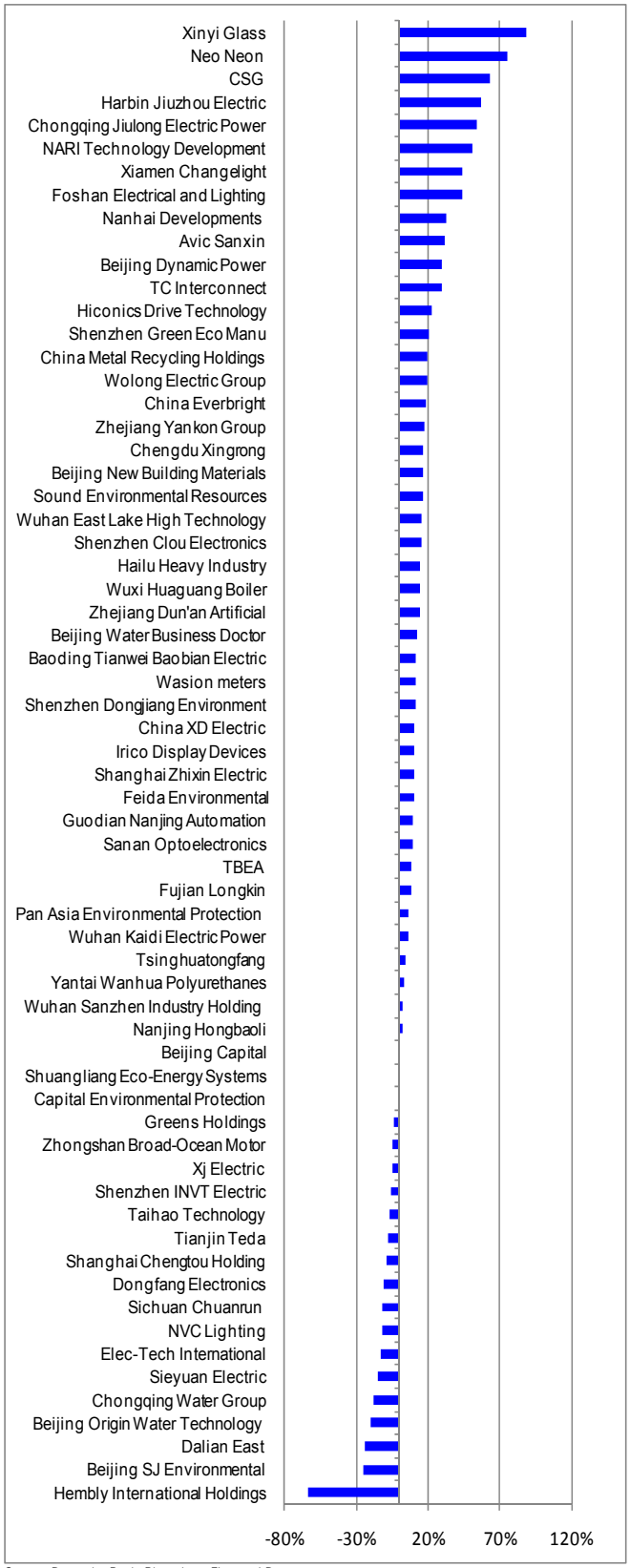
Source: Deutsche Bank estimates for China Everbright, Bloomberg Finance LP estimates for others

Figure 27: 2011E price-to-book ratio



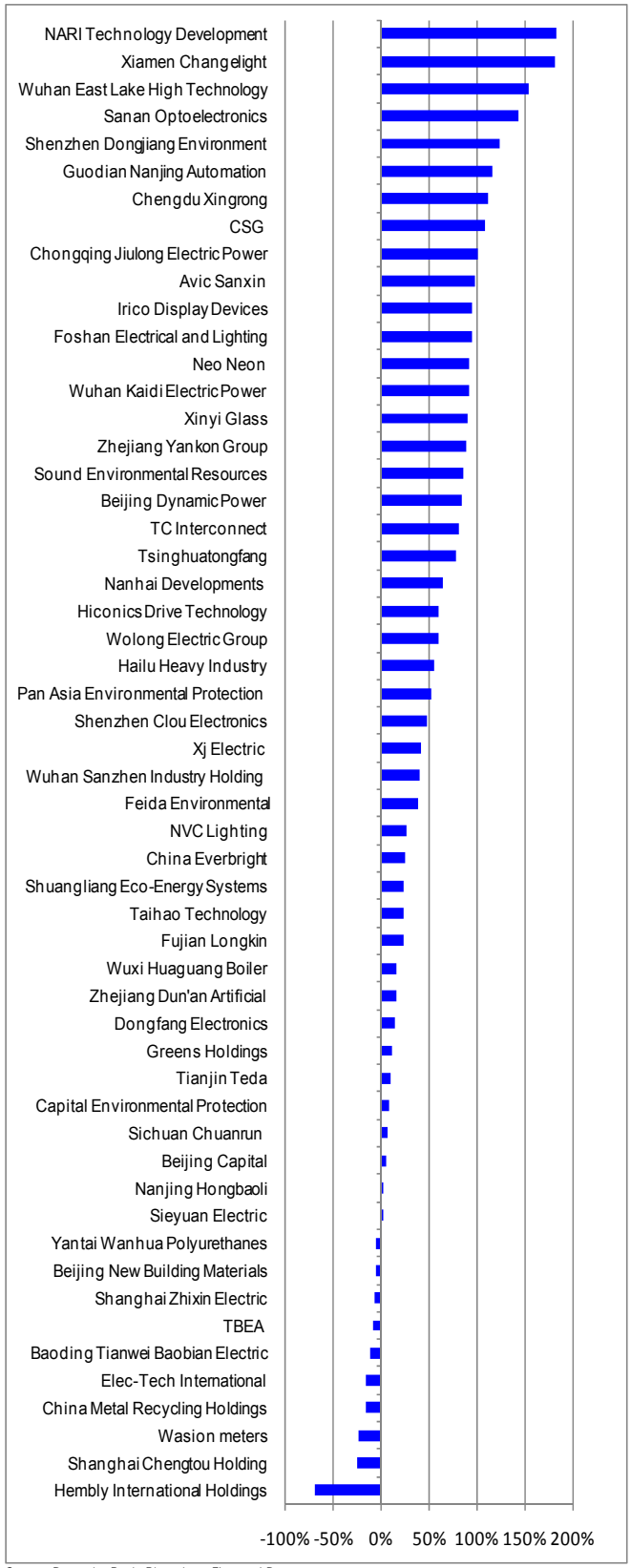
Source: Deutsche Bank estimates for China Everbright, Bloomberg Finance LP estimates for others

Figure 28: 6M absolute share price performance



Source: Deutsche Bank, Bloomberg Finance LP

Figure 29: 12M absolute share price performance



Source: Deutsche Bank, Bloomberg Finance LP

Figure 30: China energy efficiency stock universe comps table

Share Price as of 08 November 2010

Company	Ticker	Price	Rating	Mkt. Cap. US$m	Performance Absolute 3m	Performance Relative 3m	Valuations P/E 10F	P/E 11F	P/E 12F	EV/EBITDA 10F	EV/EBITDA 11F	EV/EBITDA 12F	P/BV 10F	P/BV 11F	Returns and Gearing (%) RoE 10F	RoE 11F	RoA 10F	RoA 11F	Gearing 09A	Yield 10F
Wastewater Treatment																				
Chongqing Water Group	601158 CH	Rmb8.59	NA	6,194	12%	-6%	30.0	27.2	24.3	NA	NA	NA	3.5	3.1	14.1	13.3	NA	NA	21.6	NA
Shanghai Chengtou Holding	600649 CH	Rmb9.78	NA	3,376	8%	-10%	21.3	20.4	21.3	19.7	18.8	19.6	NA	NA	NA	NA	NA	NA	20.9	1.0
Beijing Origin Water Technology	300070 CH	Rmb113.80	NA	2,513	16%	-3%	90.0	50.1	32.8	NA	NA	NA	8.4	8.9	20.3	28.4	NA	NA	(78.4)	0.2
Beijing Capital	600008 CH	Rmb6.91	NA	2,284	15%	-4%	29.2	26.0	24.4	15.2	14.0	13.7	3.0	3.0	11.9	12.6	NA	NA	27.2	2.3
China Everbright	257 HK	HK$4.36	Hold	2,049	20%	3%	31.1	25.7	25.1	20.9	18.5	17.8	3.2	2.9	10.8	11.9	5.8	6.6	21.8	0.7
Beijing Water Business Doctor	300055 CH	Rmb108.20	NA	1,860	50%	26%	76.5	49.2	31.8	NA	NA	NA	4.3	5.1	9.2	14.5	NA	NA	(53.1)	NA
Chengdu Xingrong	000598 CH	Rmb21.80	NA	1,513	7%	-10%	37.6	32.9	27.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	45.0	NA
Capital Environmental Protection	1065 HK	HK$2.82	NA	1,316	14%	-2%	13.1	13.3	12.6	17.4	17.3	16.6	1.0	0.9	8.1	7.6	4.1	3.5	75.6	2.9
Sound Global	967 HK	HK$5.15	NA	857	NA	NA	17.5	12.6	11.5	11.9	8.3	7.2	2.6	2.1	17.2	19.7	14.5	17.8	(65.5)	1.2
Nanhai Developments	600323 CH	Rmb17.50	NA	713	23%	3%	19.8	26.0	23.0	NA	NA	NA	4.2	3.6	11.2	14.2	NA	NA	63.6	NA
Wuhan Sanzhen Industry Holding	600168 CH	Rmb9.81	NA	650	10%	-7%	31.1	25.8	21.6	30.2	29.6	27.7	2.7	2.6	6.4	6.9	NA	NA	54.7	NA
Average							***36.1***	***28.1***	***23.2***	***19.2***	***17.7***	***17.1***	***3.6***	***3.6***	***12.1***	***14.3***	***8.1***	***9.3***	***12.1***	***1.4***
Exhuast Gas Treatment																				
Fujian Longkin	600388 CH	Rmb35.00	NA	1,093	21%	2%	28.3	24.3	21.2	NA	NA	NA	3.3	3.0	11.3	10.6	NA	NA	(50.2)	NA
Chongqing Jiulong Electric Power	600292 CH	Rmb17.72	NA	890	87%	57%	94.8	46.3	40.3	NA	NA	NA	6.4	2.2	5.7	6.1	1.1	2.3	114.2	NA
Beijing SJ Environmental	300072 CH	Rmb43.43	NA	635	13%	-5%	56.2	36.6	26.7	35.1	23.9	16.7	4.0	3.6	12.9	15.8	NA	NA	47.5	1.1
Zhejiang Feida Environmental Science &	600526 CH	Rmb17.71	NA	372	14%	-5%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	58.5	NA
Pan Asia Environmental Protection	556 HK	HK$1.76	NA	182	17%	1%	15.1	13.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(62.3)	2.3
Average							***48.6***	***30.2***	***29.4***	***35.1***	***23.9***	***16.7***	***4.6***	***3.0***	***9.9***	***10.9***	***1.1***	***2.3***	***21.5***	***1.7***
Solid Waste Treatment																				
China Everbright	257 HK	HK$4.36	Hold	2,049	20%	1%	31.1	25.7	25.1	20.9	18.5	17.8	3.2	2.9	10.8	11.9	5.8	6.6	21.8	0.7
Tianjin Teda	000652 CH	Rmb8.90	NA	1,973	16%	-3%	53.9	48.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	73.2	NA
Sound Environmental Resources	000826 CH	Rmb25.10	NA	1,559	15%	-3%	47.1	34.4	26.1	31.1	23.6	17.6	8.3	7.0	15.5	17.7	7.5	7.4	68.9	0.2
Wuhan Kaidi Electric Power	000939 CH	Rmb16.30	NA	1,444	13%	-5%	33.6	26.3	20.0	NA	NA	NA	1.7	1.5	6.9	7.3	NA	NA	91.3	NA
Shenzhen Green Eco-manufacture	002340 CH	Rmb68.66	NA	1,251	21%	2%	76.4	52.3	40.9	NA	NA	NA	7.3	6.4	16.3	18.4	NA	NA	124.8	NA
Wuxi Huaguang Boiler	600475 CH	Rmb22.99	NA	884	46%	22%	39.0	28.6	23.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	(18.4)	NA
Wuhan East Lake High Technology	600133 CH	Rmb11.43	NA	852	13%	-5%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90.9	NA
Nanhai Developments	600323 CH	Rmb17.50	NA	713	23%	3%	19.8	26.0	23.0	NA	NA	NA	4.2	3.6	11.2	14.2	NA	NA	63.6	NA
Shenzhen Dongjiang Environment	895 HK	HK$3.09	NA	321	25%	7%	20.4	16.1	14.0	9.4	7.3	6.1	3.5	3.0	21.0	21.0	7.0	8.0	53.2	1.3
Hembly International Holdings	3989 HK	HK$0.66	NA	86	14%	-5%	12.0	4.4	9.4	12.3	4.0	7.0	0.6	0.6	(0.7)	17.6	4.9	6.7	113.3	1.1
Average							***37.0***	***29.1***	***22.8***	***18.4***	***13.3***	***12.1***	***4.1***	***3.6***	***11.6***	***15.4***	***6.3***	***7.2***	***68.2***	***0.8***

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Definitions: 1) Gearing is net debt / shareholders equity; 2) EV is after deducting estimated value of associates

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 31: China energy efficiency stock universe comps table (continued)

Share Price as of 08 November 2010

Company	Ticker	Price	Rating	Mkt. Cap. US$m	Performance Absolute 3m	Performance Relative 3m	Valuations P/E 10F	P/E 11F	P/E 12F	EV/EBITDA 10F	EV/EBITDA 11F	EV/EBITDA 12F	P/BV 10F	P/BV 11F	Returns and Gearing (%) RoE 10F	RoE 11F	RoA 10F	RoA 11F	Gearing 09A	Yield 10F
Light Emitting Diode																				
Sanan Optoelectronics	600703 CH	Rmb43.37	NA	4,276	-12%	-26%	61.6	37.9	20.4	NA	NA	NA	NA	NA	20.4	27.7	NA	NA	(35.7)	NA
Han's Laser Technology	002008 CH	Rmb16.88	NA	1,766	35%	13%	39.3	30.3	23.7	22.9	16.4	12.6	5.2	4.6	14.2	15.4	NA	NA	31.3	NA
NVC Lighting	2222 HK	HK$4.38	NA	1,732	38%	18%	25.7	23.5	19.5	17.0	14.6	12.2	3.5	3.3	17.7	13.9	10.9	9.3	12.1	0.7
Hangzhou Silan Microelectronics	600460 CH	Rmb23.72	NA	1,547	18%	-1%	44.4	30.8	22.1	22.7	16.7	13.8	7.2	6.2	23.2	32.0	11.6	13.4	60.1	0.7
Xiamen Changelight	300102 CH	Rmb84.13	NA	1,491	NA	NA	75.3	43.2	29.5	NA	NA	NA	5.4	5.6	7.8	12.0	7.6	13.1	(10.2)	0.4
Elec-Tech International	002005 CH	Rmb18.74	NA	1,360	-5%	-20%	28.7	17.2	12.9	NA	NA	NA	NA	NA	19.8	27.5	NA	NA	42.8	NA
Foshan NationStar Optoelectronics	002449 CH	Rmb35.20	NA	1,137	17%	-2%	48.4	32.1	23.5	32.3	22.6	16.9	3.5	3.4	10.1	12.6	7.0	8.4	(21.6)	0.2
Neo Neon	1868 HK	HK$4.77	NA	564	7%	-8%	16.9	10.4	8.2	10.7	6.6	5.5	1.3	1.2	7.3	11.2	5.8	8.3	(23.0)	1.1
TC Interconnect	515 HK	HK$2.75	NA	113	59%	37%	22.9	12.9	10.3	8.4	5.3	4.4	NA	NA	11.5	17.2	3.9	5.6	93.0	0.4
Average							***40.4***	***26.5***	***18.9***	***19.0***	***13.7***	***10.9***	***4.4***	***4.0***	***14.7***	***18.8***	***7.8***	***9.7***	***16.5***	***0.6***
Frequency Inverter																				
Zhongshan Broad-Ocean Motor	002249 CH	Rmb32.34	NA	2,081	14%	-4%	48.8	33.2	20.5	42.1	27.7	18.7	9.5	7.8	19.5	24.6	14.1	18.3	(52.1)	1.1
Rongxin Power Electronic	002123 CH	Rmb40.98	NA	2,069	20%	0%	52.9	38.9	29.3	43.3	36.0	26.4	7.5	6.4	16.9	18.9	NA	NA	(17.5)	0.5
Shenzhen INVT Electric	002334 CH	Rmb66.11	NA	1,208	58%	32%	65.5	44.3	29.6	62.0	41.1	25.6	9.9	8.3	24.7	22.8	13.9	12.3	(55.6)	0.2
Wolong Electric Group	600580 CH	Rmb17.40	NA	1,121	2%	-15%	27.5	20.2	15.5	20.5	14.0	10.6	3.2	2.7	11.9	13.3	8.4	9.5	(1.8)	2.2
Hiconics Drive Technology	300048 CH	Rmb46.88	NA	845	17%	-2%	56.0	42.6	33.5	NA	NA	NA	3.6	3.3	7.1	8.0	NA	NA	1.3	NA
Harbin Jiuzhou Electric	300040 CH	Rmb20.72	NA	432	6%	-11%	37.5	28.2	26.0	NA	NA	NA	1.6	1.5	7.7	9.2	NA	NA	(63.2)	1.4
Beijing Dynamic Power	600405 CH	Rmb13.15	NA	431	21%	1%	48.7	23.5	16.2	NA	NA	NA	6.2	5.4	12.8	23.4	5.0	6.6	2.5	2.1
Shenzhen Das Intellitech	002421 CH	Rmb34.69	NA	406	5%	-12%	62.3	43.3	31.9	49.8	35.7	26.3	6.1	5.5	11.7	14.3	9.9	11.8	(19.6)	2.3
Average							***49.9***	***34.3***	***25.3***	***43.5***	***30.9***	***21.5***	***6.0***	***5.1***	***14.0***	***16.8***	***10.3***	***11.7***	***(25.7)***	***1.4***
Waste Heat Recovery																				
Shuangliang Eco-Energy Systems	600481 CH	Rmb17.92	NA	2,181	18%	-1%	42.9	28.9	21.0	27.5	20.1	15.1	6.5	5.6	13.9	18.1	NA	NA	7.1	NA
Zhejiang Dun'an Artificial	002011 CH	Rmb26.45	NA	1,480	40%	18%	44.9	30.6	23.4	26.3	19.5	15.5	4.9	4.3	11.2	14.2	9.6	10.7	(7.8)	0.3
Hailu Heavy Industry	002255 CH	Rmb46.18	NA	896	11%	-7%	39.1	29.4	20.9	NA	NA	NA	4.6	3.9	12.7	14.4	NA	NA	(60.2)	NA
Wuxi Huaguang Boiler	600475 CH	Rmb22.99	NA	884	46%	22%	39.0	28.6	23.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	(18.4)	NA
Dalian East	300125 CH	Rmb74.38	NA	659	NA	NA	60.5	47.8	39.9	39.5	28.6	22.0	4.7	4.3	8.1	9.3	NA	NA	(39.8)	0.1
Sichuan Chuanrun	002272 CH	Rmb24.16	NA	413	11%	-5%	34.9	27.6	22.1	25.2	21.3	18.0	4.1	4.7	12.9	15.7	NA	NA	25.4	0.5
Greens Holdings	1318 HK	HK$0.90	NA	145	-20%	-31%	11.0	9.7	8.6	5.0	4.3	3.9	1.1	1.0	9.8	10.5	NA	NA	(13.5)	2.6
Average							***38.9***	***28.9***	***22.8***	***24.7***	***18.7***	***14.9***	***4.3***	***4.0***	***11.4***	***13.7***	***9.6***	***10.7***	***(15.3)***	***0.9***

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 32: China energy efficiency stock universe comps table (continued)

Share Price as of 08 November 2010					Performance		Valuations								Returns and Gearing (%)					
				Mkt. Cap.	Absolute	Relative	P/E			EV/EBITDA			P/BV		RoE		RoA		Gearing	Yield
Company	Ticker	Price	Rating	US$m	3m	3m	10F	11F	12F	10F	11F	12F	10F	11F	10F	11F	10F	11F	09A	10F
Energy Efficient Building Materials																				
CSG	000012 CH	Rmb21.34	NA	5,341	78%	49%	36.3	29.0	21.7	17.0	13.2	10.2	7.0	5.7	18.7	19.5	NA	NA	55.2	0.8
Yantai Wanhua Polyurethanes	600309 CH	Rmb20.33	NA	5,080	23%	3%	25.3	17.7	14.3	21.1	13.1	11.0	5.9	4.8	22.2	26.2	10.8	15.9	30.5	1.5
Tsinghuatongfang	600100 CH	Rmb28.82	NA	4,303	26%	5%	52.1	37.2	28.9	NA	NA	NA	NA	NA	5.9	7.2	NA	NA	10.1	NA
Xinyi Glass	868 HK	HK$5.99	NA	2,723	65%	41%	17.0	13.0	11.0	13.7	9.4	8.2	3.5	3.1	20.6	25.8	14.7	15.6	18.7	2.8
Foshan Electrical and Lighting	000541 CH	Rmb19.72	NA	2,551	41%	18%	72.0	54.5	35.7	NA	NA	NA	6.9	6.4	9.4	12.0	8.1	9.2	(38.3)	0.6
Irico Display Devices	600707 CH	Rmb17.35	NA	1,920	-6%	-21%	255.1	25.0	14.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	36.4	NA
Beijing New Building Materials	000786 CH	Rmb14.89	NA	1,287	1%	-15%	20.3	15.7	12.7	11.9	9.6	7.8	3.3	2.7	14.1	15.2	NA	NA	49.6	NA
Zhejiang Yankon Group	600261 CH	Rmb28.73	NA	1,078	16%	-3%	36.2	26.5	19.0	24.8	17.1	13.4	6.4	5.4	17.4	21.0	8.2	9.2	(14.7)	0.8
Avic Sanxin	002163 CH	Rmb17.60	NA	1,062	16%	0%	88.9	33.3	16.9	NA	NA	NA	4.2	3.6	5.8	13.4	NA	NA	153.6	NA
Taihao Technology	600590 CH	Rmb14.38	NA	984	9%	-9%	35.1	24.5	18.7	24.7	18.7	14.2	3.7	3.4	9.3	12.3	4.8	5.9	13.2	0.8
Nanjing Hongbaoli	002165 CH	Rmb17.18	NA	650	3%	-14%	36.3	26.3	21.9	26.8	20.9	15.9	6.3	5.1	17.4	19.9	NA	NA	(0.6)	NA
Shenzhen DAS Intellitech	002421 CH	Rmb34.69	NA	406	5%	-12%	62.3	43.3	31.9	49.8	35.7	26.3	6.1	5.5	11.7	14.3	9.9	11.8	(19.6)	2.3
Average							***56.7***	***26.6***	***19.0***	***21.1***	***15.3***	***11.9***	***4.8***	***4.2***	***12.7***	***15.6***	***8.1***	***9.7***	***22.6***	***1.2***
Smart grid																				
TBEA	600089 CH	Rmb20.94	NA	6,378	24%	4%	21.5	18.3	17.8	14.9	13.1	11.6	3.6	3.1	17.8	18.1	10.3	10.9	(6.8)	0.7
China XD Electric	601179 CH	Rmb7.88	NA	5,158	17%	-2%	24.8	21.6	19.0	NA	NA	NA	NA	NA	20.0	19.0	NA	NA	53.7	0.6
Baoding Tianwei Baobian Electric	600550 CH	Rmb29.08	NA	5,103	27%	6%	37.4	28.6	25.7	31.4	22.7	18.2	5.2	4.9	15.7	17.1	7.7	9.0	132.6	0.3
NARI Technology Development	600406 CH	Rmb61.04	NA	4,816	40%	17%	86.6	62.8	46.2	66.2	51.5	40.0	22.8	17.0	25.7	25.6	NA	NA	(18.9)	0.2
Xj Electric	000400 CH	Rmb33.82	NA	1,922	19%	0%	76.9	35.7	29.1	28.2	20.7	17.2	5.0	4.6	6.7	8.2	NA	NA	13.8	0.3
Shanghai Zhixin Electric	600517 CH	Rmb19.39	NA	1,802	9%	-9%	34.6	26.4	20.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	(30.8)	NA
Sieyuan Electric	002028 CH	Rmb26.50	NA	1,750	8%	-10%	25.6	22.2	20.3	23.1	27.3	22.9	3.4	3.0	16.0	15.0	9.3	6.9	(49.2)	0.2
Guodian Nanjing Automation	600268 CH	Rmb25.07	NA	1,069	33%	11%	63.8	44.0	28.2	43.3	30.7	21.4	6.0	3.9	10.6	13.7	NA	NA	90.9	NA
Shenzhen Clou Electronics	002121 CH	Rmb27.84	NA	1,004	44%	20%	49.4	32.4	24.8	NA	NA	NA	8.7	7.0	19.4	22.0	NA	NA	5.1	0.7
Dongfang Electronics	000682 CH	Rmb5.78	NA	849	9%	-9%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(25.0)	NA
Wasion meters	3393 HK	HK$5.42	NA	650	-11%	-24%	14.4	11.3	9.4	11.7	9.4	7.8	1.9	1.7	13.7	16.0	9.2	10.6	(10.5)	2.2
Average							***44.5***	***30.8***	***24.5***	***31.3***	***25.1***	***19.9***	***7.1***	***5.6***	***16.2***	***17.2***	***9.1***	***9.4***	***18.6***	***0.7***
Waste Recycling																				
Shenzhen Green Eco Manu	002340 CH	HK$68.66	NA	1,251	21%	-9%	76.4	52.3	40.9	NA	NA	NA	7.3	6.4	16.3	18.4	NA	NA	124.8	NA
China Metal Recycling Holdings	773 HK	HK$9.09	NA	1,227	19%	3%	6.9	5.7	NA	6.5	5.2	NA	1.9	1.5	31.8	29.9	16.4	18.6	1.2	3.4
Chiho Tiande Group	976 HK	HK$4.34	NA	560	60%	38%	12.8	9.0	7.2	11.1	8.1	6.6	NA	NA	40.3	33.0	19.6	20.8	234.9	NA
Shenzhen Dongjiang Environment	895 HK	HK$3.09	NA	321	25%	7%	20.4	16.1	14.0	9.4	7.3	6.1	3.5	3.0	21.0	21.0	7.0	8.0	53.2	1.3
Average							***29.1***	***20.8***	***20.7***	***9.0***	***6.9***	***6.4***	***4.2***	***3.6***	***27.3***	***25.6***	***14.3***	***15.8***	***103.5***	***2.3***

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 33: China energy efficiency stock universe comps table (continued)

Share Price as of 08 November 2010			Share price performance local currency					avg. daily trade	Relative performance local currency & local country index****						avg. daily trade	Share price statistics current / current/						avg. daily trade
Company	Price	Rating	1m	3m	6m	12m	3yr	US$, 1mn**	1wk	1m	3m	6m	12m	3yr	US$, 6mth**	52w H	52w L	52W H	52W L	10yr H	10yr L	US$, 1yr**
Wastewater Treatment																						
Chongqing Water Group	Rmb8.59	NA	17%	12%	-18%	NA	NA	47.0	2%	-1%	-6%	-25%	NA	NA	32.1	13.11	6.50	66%	132%	13.11	6.50	43.9
Shanghai Chengtou Holding	Rmb9.78	NA	21%	8%	-9%	-25%	-49%	41.0	6%	3%	-10%	-17%	-25%	-9%	19.7	14.39	7.77	68%	126%	21.04	4.17	23.9
Beijing Origin Water Technology	Rmb113.80	NA	29%	16%	-20%	NA	NA	18.7	-2%	9%	-3%	-27%	NA	NA	24.1	168.80	78.83	67%	144%	168.80	78.83	35.1
Beijing Capital	Rmb6.91	NA	14%	15%	0%	5%	-59%	19.9	2%	-3%	-4%	-9%	6%	-26%	12.0	8.36	5.45	83%	127%	23.45	3.73	22.4
China Everbright	HK$4.36	Hold	14%	20%	19%	26%	9%	10.0	-1%	3%	3%	-3%	14%	41%	4.1	4.45	2.80	98%	156%	4.45	0.16	4.2
Beijing Water Business Doctor	Rmb108.20	NA	20%	50%	12%	NA	NA	10.3	-1%	2%	26%	2%	NA	NA	9.6	111.93	62.18	97%	174%	111.93	62.18	14.7
Chengdu Xingrong	Rmb21.80	NA	8%	7%	17%	112%	65%	26.4	-3%	-8%	-10%	7%	114%	197%	19.2	23.82	10.62	92%	205%	23.82	2.02	17.9
Capital Environmental Protection	HK$2.82	NA	13%	14%	-1%	9%	-10%	18.2	-3%	1%	-2%	-19%	-1%	17%	10.5	8.83	5.61	32%	50%	13.85	2.87	15.2
Sound Global	HK$5.15	NA	1%	NA	NA	NA	NA	0.3	-8%	-10%	NA	NA	NA	NA	0.4	5.27	4.81	98%	107%	5.27	4.81	0.4
Nanhai Developments	Rmb17.50	NA	3%	23%	33%	65%	61%	22.5	-3%	-12%	3%	21%	66%	191%	15.3	17.99	10.54	97%	166%	17.99	5.18	14.9
Wuhan Sanzhen Industry Holding	Rmb9.81	NA	7%	10%	3%	41%	13%	11.0	1%	-9%	-7%	-6%	42%	103%	9.1	11.56	6.80	85%	144%	14.46	2.62	11.9
Average			**13%**	**18%**	**4%**	**33%**	**4%**		**-1%**	**-2%**	**-1%**	**-8%**	**31%**	**73%**								
Exhuast Gas Treatment																						
Fujian Longkin	Rmb35.00	NA	18%	21%	8%	24%	121%	37.6	2%	0%	2%	-1%	25%	298%	25.1	39.07	24.82	90%	141%	39.07	4.50	25.9
Chongqing Jiulong Electric Power	Rmb17.72	NA	37%	87%	54%	102%	75%	37.4	-6%	16%	57%	41%	103%	216%	16.1	18.36	8.36	97%	212%	18.36	2.54	14.2
Beijing SJ Environmental	Rmb43.43	NA	9%	13%	-25%	NA	NA	7.7	-6%	-8%	-5%	-32%	NA	NA	9.1	58.19	34.80	75%	125%	58.19	34.80	11.8
Zhejiang Feida Environmental Science	Rmb17.71	NA	8%	14%	10%	38%	24%	17.1	-4%	-9%	-5%	0%	39%	122%	11.1	20.29	12.98	87%	136%	24.14	4.45	13.8
Pan Asia Environmental Protection	HK$1.76	NA	21%	17%	7%	53%	NA	0.2	-2%	8%	1%	-13%	39%	NA	0.1	2.00	1.14	88%	154%	3.08	0.58	0.2
Average			**18%**	**31%**	**11%**	**54%**	**73%**		**-3%**	**2%**	**10%**	**-1%**	**52%**	**212%**								
Solid Waste Treatment																						
China Everbright	HK$4.36	Hold	14%	20%	19%	26%	9%	10.0	1%	-3%	1%	8%	27%	96%	4.1	4.45	2.80	98%	156%	4.45	0.16	4.2
Tianjin Teda	Rmb8.90	NA	13%	16%	-8%	9%	-45%	51.9	-4%	-4%	-3%	-16%	10%	-1%	26.7	10.50	6.69	85%	133%	24.21	1.58	30.7
Sound Environmental Resources	Rmb25.10	NA	0%	15%	16%	86%	198%	30.6	-1%	-16%	-3%	6%	88%	437%	19.9	25.90	13.21	97%	190%	25.90	1.36	20.8
Wuhan Kaidi Electric Power	Rmb16.30	NA	15%	13%	6%	92%	29%	30.8	1%	-3%	-5%	-3%	93%	133%	24.1	17.14	8.54	95%	191%	17.14	2.38	24.4
Shenzhen Green Eco-manufacture	Rmb68.66	NA	28%	21%	21%	NA	NA	17.8	3%	8%	2%	10%	NA	NA	11.0	71.08	41.77	97%	164%	71.08	41.77	14.0
Wuxi Huaguang Boiler	Rmb22.99	NA	31%	46%	14%	17%	42%	26.3	4%	11%	22%	4%	18%	156%	14.7	22.99	13.18	100%	174%	23.22	4.44	15.9
Wuhan East Lake High Technology	Rmb11.43	NA	7%	13%	16%	154%	124%	46.5	-5%	-9%	-5%	6%	156%	303%	26.4	12.48	4.55	92%	251%	12.48	1.64	32.2
Nanhai Developments	Rmb17.50	NA	3%	23%	33%	65%	61%	22.5	-3%	-12%	3%	21%	66%	191%	15.3	17.99	10.54	97%	166%	17.99	5.18	14.9
Shenzhen Dongjiang Environment	HK$3.09	NA	-5%	25%	11%	124%	16%	0.4	-4%	-15%	7%	-9%	103%	51%	0.3	3.76	1.43	82%	217%	3.76	0.17	0.3
Hembly International Holdings	HK$0.66	NA	36%	14%	-64%	-69%	-83%	1.2	-12%	15%	-5%	-67%	-69%	-70%	0.9	2.61	0.48	25%	138%	6.76	0.19	1.8
Average			**14%**	**21%**	**6%**	**56%**	**39%**		**-2%**	**-3%**	**1%**	**-4%**	**55%**	**144%**								

Note: Relative performance is made with reference to the key stock index of the exchange that the securities is traded (ie. HSCEI for HK listed stocks, Shanghai Composite for China listed stocks)

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 34: China energy efficiency universe comps table (continued)

Share Price as of 08 November 2010			Share price performance local currency					avg. daily trade	Relative performance local currency & local country index****						avg. daily trade	Share price statistics current / current/						avg. daily trade
Company	Price	Rating	1m	3m	6m	12m	3yr	US$, 1mth*'	1wk	1m	3m	6m	12m	3yr	US$, 6mth*'	52w H	52w L	52W H	52W L	10yr H	10yr L	US$, 1yr**
Light Emitting Diode																						
Sanan Optoelectronics	Rmb43.37	NA	-3%	-12%	9%	143%	1580%	50.5	-3%	-18%	-26%	0%	145%	2925%	47.9	51.64	16.66	84%	260%	51.64	0.79	39.4
Han's Laser Technology	Rmb16.88	NA	26%	35%	29%	82%	12%	79.0	-4%	7%	13%	18%	83%	102%	54.4	16.89	8.44	100%	200%	20.01	2.20	47.8
NVC Lighting	HK$4.38	NA	13%	38%	NA	NA	NA	6.3	3%	2%	18%	NA	NA	NA	9.1	4.38	1.86	100%	235%	4.38	1.86	9.1
Hangzhou Silan Microelectronics	Rmb23.72	NA	-1%	18%	44%	182%	133%	36.9	-5%	-16%	-1%	31%	185%	320%	29.7	25.53	8.14	93%	291%	25.53	2.64	27.2
Xiamen Changelight	Rmb84.13	NA	11%	NA	NA	NA	NA	13.9	-8%	-6%	NA	NA	NA	NA	28.1	89.95	69.76	94%	121%	89.95	69.76	28.1
Elec-Tech International	Rmb18.74	NA	-4%	-5%	-12%	27%	197%	31.6	-8%	-18%	-20%	-20%	28%	436%	27.7	23.79	13.17	79%	142%	23.79	1.84	26.4
Foshan NationStar Optoelectronics	Rmb35.20	NA	7%	17%	NA	NA	NA	15.5	-4%	-9%	-2%	NA	NA	NA	22.6	38.08	28.36	92%	124%	38.08	28.36	22.6
Neo Neon	HK$4.77	NA	-5%	7%	-13%	-15%	-49%	2.1	-6%	-15%	-8%	-29%	-23%	-34%	2.2	6.75	3.80	71%	126%	18.34	0.90	3.1
TC Interconnect	HK$2.75	NA	2%	59%	75%	92%	56%	1.7	-8%	-8%	37%	43%	75%	103%	0.7	3.03	1.06	91%	259%	3.03	0.24	0.7
Average			**5%**	**20%**	**22%**	**85%**	**322%**		**-5%**	**-9%**	**1%**	**7%**	**82%**	**642%**								
Frequency Inverter																						
Zhongshan Broad-Ocean Motor	Rmb32.34	NA	5%	14%	30%	84%	NA	28.9	5%	-11%	-4%	19%	85%	NA	22.1	33.91	18.15	95%	178%	33.91	3.41	18.6
Rongxin Power Electronic	Rmb40.98	NA	1%	20%	23%	60%	139%	23.0	0%	-14%	0%	12%	62%	331%	18.7	42.60	23.27	96%	176%	42.60	9.87	15.2
Shenzhen INVT Electric	Rmb66.11	NA	22%	58%	57%	NA	NA	18.0	4%	4%	32%	44%	NA	NA	15.0	66.11	31.79	100%	208%	66.11	31.79	15.5
Wolong Electric Group	Rmb17.40	NA	2%	2%	-14%	18%	94%	41.4	-10%	-14%	-15%	-21%	19%	250%	33.3	20.14	13.12	86%	133%	20.14	2.56	28.7
Hiconics Drive Technology	Rmb46.88	NA	27%	17%	-5%	NA	NA	9.3	-4%	8%	-2%	-14%	NA	NA	9.0	59.72	35.26	78%	133%	59.72	35.26	12.1
Harbin Jiuzhou Electric	Rmb20.72	NA	10%	6%	-5%	NA	NA	8.6	-8%	-6%	-11%	-13%	NA	NA	7.0	29.86	16.93	69%	122%	29.86	16.93	8.5
Beijing Dynamic Power	Rmb13.15	NA	3%	21%	19%	60%	51%	18.4	0%	-12%	1%	9%	62%	172%	16.0	13.98	7.33	94%	179%	17.11	2.03	15.3
Shenzhen Das Intellitech	Rmb34.69	NA	3%	5%	NA	NA	NA	8.3	-3%	-13%	-12%	NA	NA	NA	11.5	39.00	29.42	89%	118%	39.00	29.42	11.5
Average			**9%**	**18%**	**15%**	**56%**	**95%**		**-2%**	**-7%**	**-1%**	**5%**	**57%**	**251%**								
Waste Heat Recovery																						
Shuangliang Eco-Energy Systems	Rmb17.92	NA	16%	18%	-12%	7%	71%	49.3	-5%	-1%	-1%	-19%	8%	207%	36.8	22.24	12.83	81%	140%	22.24	1.35	34.3
Zhejiang Dun'an Artificial	Rmb26.45	NA	31%	40%	14%	55%	143%	31.5	1%	11%	18%	4%	57%	338%	14.3	26.59	15.28	99%	173%	26.59	2.86	14.9
Hailu Heavy Industry	Rmb46.18	NA	12%	11%	-1%	24%	NA	14.9	4%	-5%	-7%	-10%	25%	NA	8.4	57.10	37.60	81%	123%	57.10	10.35	10.1
Wuxi Huaguang Boiler	Rmb22.99	NA	31%	46%	14%	17%	42%	26.3	4%	11%	22%	4%	18%	156%	14.7	22.99	13.18	100%	174%	23.22	4.44	15.9
Dalian East	Rmb74.38	NA	NA	NA	NA	NA	NA	24.5	-4%	NA	NA	NA	NA	NA	24.5	78.06	62.96	95%	118%	78.06	62.96	24.5
Sichuan Chuanrun	Rmb24.16	NA	5%	11%	-4%	12%	NA	5.1	-6%	-6%	-5%	-21%	2%	NA	3.8	29.23	19.21	83%	126%	33.64	7.30	5.0
Greens Holdings	HK$0.90	NA	-3%	-20%	-24%	NA	NA	0.3	-7%	-13%	-31%	-38%	NA	NA	0.3	2.15	0.89	42%	101%	2.15	0.89	1.2
Average			**15%**	**18%**	**-2%**	**23%**	**85%**		**-2%**	**-1%**	**-1%**	**-13%**	**22%**	**234%**								

Note: Relative performance is made with reference to the key stock index of the exchange that the securities is traded (ie. HSCEI for HK listed stocks, Shanghai Composite for China listed stocks)

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 35: China energy efficiency stock universe comps table (continued)

Share Price as of 08 November 2010			Share price performance local currency					avg. daily trade	Relative performance local currency & local country index****						avg. daily trade	Share price statistics current / current/						avg. daily trade
Company	Price	Rating	1m	3m	6m	12m	3yr	US$, 1mth**	1wk	1m	3m	6m	12m	3yr	US$, 6mth**	52w H	52w L	52W H	52W L	10yr H	10yr L	US$, 1yr**
Energy Efficient Building Materials																						
CSG	Rmb21.34	NA	35%	78%	63%	109%	89%	184.3	8%	15%	49%	49%	111%	241%	85.3	21.34	8.87	100%	241%	21.34	1.86	65.0
Yantai Wanhua Polyurethanes	Rmb20.33	NA	20%	23%	4%	-6%	-45%	92.6	-5%	2%	3%	-5%	-5%	0%	46.0	25.71	13.37	79%	152%	42.96	2.03	41.9
Tsinghuatongfang	Rmb28.82	NA	29%	26%	5%	78%	15%	178.7	3%	9%	5%	-4%	80%	106%	97.3	28.92	15.20	100%	190%	37.26	5.44	98.0
Xinyi Glass	HK$5.99	NA	22%	65%	88%	90%	22%	12.0	-9%	10%	41%	54%	73%	58%	7.8	6.33	2.80	95%	214%	6.33	0.84	7.9
Foshan Electrical and Lighting	Rmb19.72	NA	15%	41%	43%	94%	83%	140.0	-5%	-3%	18%	31%	96%	230%	84.6	20.68	9.50	95%	208%	20.68	3.11	59.4
Irico Display Devices	Rmb17.35	NA	-3%	-6%	10%	96%	201%	27.7	-5%	-17%	-21%	1%	97%	442%	18.0	20.20	9.08	86%	191%	20.20	2.24	18.6
Beijing New Building Materials	Rmb14.89	NA	12%	1%	17%	-6%	45%	26.2	0%	-5%	-15%	7%	-5%	161%	18.3	18.68	11.48	80%	130%	18.68	2.56	19.5
Zhejiang Yankon Group	Rmb28.73	NA	8%	16%	17%	89%	142%	15.5	-2%	-8%	-3%	7%	91%	335%	10.7	29.26	15.61	98%	184%	29.26	3.83	10.8
Avic Sanxin	Rmb17.60	NA	12%	16%	31%	98%	148%	21.9	0%	0%	0%	0%	0%	0%	14.0	17.60	9.04	100%	195%	17.60	2.25	14.1
Taihao Technology	Rmb14.38	NA	4%	9%	-7%	24%	117%	41.7	0%	-12%	-9%	-15%	25%	291%	29.2	16.90	11.07	85%	130%	16.90	2.35	27.4
Nanjing Hongbaoli	Rmb17.18	NA	4%	3%	2%	2%	21%	18.1	3%	-12%	-14%	-7%	3%	117%	11.3	22.99	12.90	75%	133%	22.99	3.13	9.9
Shenzhen DAS Intellitech	Rmb34.69	NA	3%	5%	NA	NA	NA	8.3	-3%	-13%	-12%	NA	NA	NA	11.5	39.00	29.42	89%	118%	39.00	29.42	11.5
Average			**14%**	**24%**	**26%**	**59%**	**68%**		**-1%**	**-2%**	**4%**	**12%**	**50%**	**169%**								
Smart Grid																						
TBEA	Rmb20.94	NA	20%	24%	9%	-8%	74%	190.4	-1%	2%	4%	-1%	-7%	213%	90.4	25.72	13.84	81%	151%	25.72	1.11	91.8
China XD Electric	Rmb7.88	NA	10%	17%	10%	NA	NA	60.3	1%	-6%	-2%	1%	NA	NA	33.8	8.32	6.15	95%	128%	8.32	6.15	39.7
Baoding Tianwei Baobian Electric	Rmb29.08	NA	10%	27%	12%	-11%	-5%	101.8	-7%	-7%	6%	2%	-10%	72%	58.4	35.51	18.63	82%	156%	43.10	1.54	60.3
NARI Technology Development	Rmb61.04	NA	-3%	40%	50%	183%	373%	46.5	1%	-17%	17%	37%	186%	751%	30.5	63.99	21.74	95%	281%	63.99	2.82	25.1
Xj Electric	Rmb33.82	NA	12%	19%	-5%	41%	79%	63.6	5%	-5%	0%	-13%	43%	222%	54.8	38.80	22.17	87%	153%	38.80	3.69	43.4
Shanghai Zhixin Electric	Rmb19.39	NA	3%	9%	10%	-7%	36%	35.7	-5%	-13%	-9%	1%	-6%	146%	22.5	21.04	15.61	92%	124%	21.04	0.80	21.0
Sieyuan Electric	Rmb26.50	NA	13%	8%	-15%	2%	62%	53.0	-5%	-5%	-10%	-23%	3%	191%	34.6	34.00	21.80	78%	122%	34.00	1.98	32.5
Guodian Nanjing Automation	Rmb25.07	NA	8%	33%	10%	117%	128%	21.6	0%	-8%	11%	0%	119%	310%	13.5	25.76	11.51	97%	218%	25.76	2.44	13.0
Shenzhen Clou Electronics	Rmb27.84	NA	16%	44%	15%	48%	88%	20.8	0%	-2%	20%	5%	50%	239%	14.9	27.84	17.00	100%	164%	27.84	3.84	16.6
Dongfang Electronics	Rmb5.78	NA	10%	9%	-10%	15%	9%	23.1	-4%	-7%	-9%	-18%	16%	96%	14.8	7.12	4.49	81%	129%	23.70	1.70	22.2
Wasion meters	HK$5.42	NA	-7%	-11%	12%	-24%	1%	2.4	-10%	-16%	-24%	-9%	-31%	31%	1.9	8.20	4.49	66%	121%	8.20	0.81	3.1
Average			**9%**	**21%**	**9%**	**41%**	**90%**		**-2%**	**-7%**	**1%**	**-2%**	**41%**	**236%**								
Waste Recycling																						
Shenzhen Green Eco Manu	Rmb68.66	NA	28%	21%	21%	NA	NA	17.8	-5%	-13%	-9%	1%	-6%	146%	11.0	71.08	41.77	97%	164%	71.08	41.77	14.0
China Metal Recycling Holdings	HK$9.09	NA	12%	19%	20%	-16%	NA	5.0	-2%	1%	3%	-2%	-23%	NA	2.2	11.30	6.25	80%	145%	11.84	6.04	5.3
Chiho Tiande Group	HK$4.34	NA	23%	60%	NA	NA	NA	2.4	-3%	10%	38%	NA	NA	NA	2.2	4.34	2.36	100%	184%	4.34	2.36	2.2
Shenzhen Dongjiang Environment	HK$3.09	NA	-5%	25%	11%	124%	16%	0.4	-4%	-15%	7%	-9%	103%	51%	0.3	3.76	1.43	82%	217%	3.76	0.17	0.3
Average			**14%**	**31%**	**17%**	**54%**	**16%**		**-3%**	**-4%**	**10%**	**-3%**	**25%**	**98%**								

Note: Relative performance is made with reference to the key stock index of the exchange that the securities is traded (ie. HSCEI for HK listed stocks, Shanghai Composite for China listed stocks)

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 36: China energy efficiency: detailed financial metrics

Share Price as of 08 November 2010			Revenue (US$mn)					EBITDA (US$mn)					Net Profit (US$mn)				
Company	Price	Rating	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F
Wastewater Treatment																	
Chongqing Water Group	Rmb8.59	NA	339	397	465	511	569	204	220	NA	NA	NA	106	148	208	228	251
Shanghai Chengtou Holding	Rmb9.78	NA	447	478	652	689	658	150	161	220	230	221	183	111	160	166	158
Beijing Origin Water Technology	Rmb113.80	NA	31	45	78	133	204	11	19	NA	NA	NA	11	16	27	48	73
Beijing Capital	Rmb6.91	NA	247	379	526	594	622	95	137	192	210	214	38	65	79	85	83
China Everbright	HK$4.36	Hold	273	259	340	406	285	78	94	125	148	151	50	54	76	92	94
Beijing Water Business Doctor	Rmb108.20	NA	53	68	93	153	243	7	15	NA	NA	NA	6	12	21	36	55
Chengdu Xingrong	Rmb21.80	NA	339	324	89	102	NA	21	14	NA	NA	NA	(1)	(17)	NA	NA	NA
Capital Environmental Protection	HK$2.82	NA	157	173	178	186	202	102	108	101	102	106	33	36	40	39	41
Sound Global	HK$5.15	NA	148	189	264	353	403	41	45	58	83	95	29	41	49	70	77
Nanhai Developments	Rmb17.50	NA	61	68	84	105	119	32	33	NA	NA	NA	14	15	19	27	31
Wuhan Sanzhen Industry Holding	Rmb9.81	NA	33	45	55	59	68	11	12	26	27	29	8	11	15	17	20
Exhuast Gas Treatment																	
Fujian Longkin	Rmb35.00	NA	417	492	513	582	672	36	49	NA	NA	NA	25	38	37	43	51
Chongqing Jiulong Electric Power	Rmb17.72	NA	314	405	489	554	565	28	47	NA	NA	NA	(19)	8	8	27	30
Beijing SJ Environmental	Rmb43.43	NA	42	44	63	90	118	8	12	16	23	33	4	7	11	17	22
Zhejiang Feida Environmental Science & Technology	Rmb17.71	NA	231	210	NA	NA	NA	11	11	NA	NA	NA	1	2	NA	NA	NA
Pan Asia Environmental Protection	HK$1.76	NA	85	89	NA	NA	NA	21	16	NA	NA	NA	11	13	12	13	NA
Solid Waste Treatment																	
China Everbright	HK$4.36	Hold	273	259	340	406	285	78	94	125	148	151	50	54	76	92	94
Tianjin Teda	Rmb8.90	NA	405	659	NA	NA	NA	25	62	NA	NA	NA	20	43	NA	NA	NA
Sound Environmental Resources	Rmb25.10	NA	74	99	145	199	261	29	39	55	72	97	16	21	30	41	54
Wuhan Kaidi Electric Power	Rmb16.30	NA	261	287	441	630	526	70	97	NA	NA	NA	6	28	52	60	82
Shenzhen Green Eco-manufacture	Rmb68.66	NA	44	54	99	134	162	9	15	NA	NA	NA	6	8	15	21	31
Wuxi Huaguang Boiler	Rmb22.99	NA	399	376	445	523	569	34	36	NA	NA	NA	15	17	22	32	38
Wuhan East Lake High Technology	Rmb11.43	NA	38	46	NA	NA	NA	8	18	NA	NA	NA	4	10	NA	NA	NA
Nanhai Developments	Rmb17.50	NA	61	68	84	105	119	32	33	NA	NA	NA	14	15	19	27	31
Dongjiang Environment	HK$1.65	NA	31	47	NA	NA	NA	14	15	NA	NA	NA	9	10	NA	NA	NA
Hembly International Holdings	HK$0.66	NA	141	95	179	193	108	13	(14)	14	42	24	1	(126)	9	30	13

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 37: China energy efficiency: detailed financial metrics

Share Price as of 08 November 2010			Revenue (US$mn)					EBITDA (US$mn)					Net Profit (US$mn)				
Company	Price	Rating	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F
Light Emitting Diode																	
Sanan Optoelectronics	Rmb43.37	NA	30	68	152	302	602	15	34	NA	NA	NA	7	26	70	111	173
Han's Laser Technology	Rmb16.88	NA	246	284	423	564	710	28	21	87	121	157	19	0	45	57	73
NVC Lighting	HK$4.38	NA	256	306	447	562	691	42	55	89	104	124	18	13	58	71	86
Hangzhou Silan Microelectronics	Rmb23.72	NA	133	139	227	315	417	20	24	67	92	111	2	11	38	56	72
Xiamen Changelight	Rmb84.13	NA	22	28	46	76	115	NA	NA	NA	NA	NA	9	12	19	32	45
Elec-Tech International	Rmb18.74	NA	362	280	482	690	NA	11	31	NA	NA	NA	(9)	7	39	70	NA
Foshan NationStar Optoelectronics	Rmb35.20	NA	81	91	126	192	274	NA	NA	28	40	54	15	17	24	35	47
Neo Neon	HK$4.77	NA	208	143	230	342	442	30	28	50	82	97	18	20	33	54	68
TC Interconnect	HK$2.75	NA	108	95	123	154	178	11	11	19	30	35	4	1	6	10	12
Frequency Inverter																	
Zhongshan Broad-Ocean Motor	Rmb32.34	NA	225	211	277	400	589	25	36	47	71	105	20	29	38	57	90
Rongxin Power Electronic	Rmb40.98	NA	83	134	206	285	374	15	25	49	59	80	19	27	39	52	68
Shenzhen INVT Electric	Rmb66.11	NA	35	47	80	124	190	7	10	18	26	42	6	12	20	29	44
Wolong Electric Group	Rmb17.40	NA	306	325	448	548	692	27	40	50	74	98	19	29	37	49	66
Hiconics Drive Technology	Rmb46.88	NA	24	43	63	87	126	6	11	NA	NA	NA	6	10	14	17	24
Harbin Jiuzhou Electric	Rmb20.72	NA	43	55	77	105	125	7	9	NA	NA	NA	5	7	10	13	16
Beijing Dynamic Power	Rmb13.15	NA	83	88	138	231	341	3	9	NA	NA	NA	1	6	8	17	25
Shenzhen Das Intellitech	Rmb34.69	NA	37	45	62	82	108	4	5	7	10	13	3	4	6	9	13
Waste Heat Recovery																	
Shuangliang Eco-Energy Systems	Rmb17.92	NA	563	543	669	840	1,024	40	92	81	109	144	15	52	47	71	100
Zhejiang Dun'an Artificial	Rmb26.45	NA	372	333	499	624	748	39	41	60	80	101	22	23	33	49	63
Hailu Heavy Industry	Rmb46.18	NA	108	143	196	272	384	18	25	NA	NA	NA	11	16	23	30	43
Wuxi Huaguang Boiler	Rmb22.99	NA	399	376	445	523	569	34	36	NA	NA	NA	15	17	22	32	38
Dalian East	Rmb74.38	NA	36	57	93	116	138	5	7	13	18	24	4	6	11	14	16
Sichuan Chuanrun	Rmb24.16	NA	46	60	85	108	135	10	12	16	19	23	7	9	11	12	15
Greens Holdings	HK$0.90	NA	62	81	107	127	148	12	17	28	32	36	9	10	13	15	16

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Figure 38: China energy efficiency: detailed financial metrics

Share Price as of 08 November 2010			Revenue (US$mn)					EBITDA (US$mn)					Net Profit (US$mn)				
Company	Price	Rating	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F	2008A	2009A	2010F	2011F	2012F
Energy Efficient Building Materials																	
Shenzhen DAS Intellitech	Rmb34.69	NA	37	45	62	82	108	4	5	7	10	13	3	4	6	9	13
Taihao Technology	Rmb14.38	NA	324	345	454	580	732	31	33	46	60	79	13	14	24	34	46
Zhejiang Yankon Group	Rmb28.73	NA	271	254	334	446	604	27	23	45	65	83	15	18	30	42	57
Foshan Electrical and Lighting	Rmb19.72	NA	246	248	325	443	645	43	57	NA	NA	NA	32	31	37	52	81
Tsinghuatongfang	Rmb28.82	NA	1,984	2,231	2,722	3,142	3,695	124	82	NA	NA	NA	35	51	77	106	146
CSG	Rmb21.34	NA	614	772	1,115	1,406	1,801	152	237	343	441	573	60	122	188	235	309
Beijing New Building Materials	Rmb14.89	NA	358	478	666	847	1,047	48	111	140	174	214	35	47	63	81	101
Yantai Wanhua Polyurethanes	Rmb20.33	NA	1,102	946	1,420	1,868	2,189	289	213	270	436	520	223	156	193	279	352
Irico Display Devices	Rmb17.35	NA	434	191	209	401	587	21	(20)	NA	NA	NA	4	(105)	7	69	118
Xinyi Glass	HK$5.99	NA	500	511	730	1,005	1,282	121	137	215	313	360	91	100	162	211	251
Nanjing Hongbaoli	Rmb17.18	NA	128	135	204	261	320	16	23	26	33	44	10	15	17	24	31
Avic Sanxin	Rmb17.60	NA	196	241	353	570	883	12	14	NA	NA	NA	6	6	12	34	72
Smart grid																	
Wasion meters	HK$5.42	NA	152	158	217	285	343	52	52	59	74	89	38	38	46	58	70
Dongfang Electronics	Rmb5.78	NA	123	137	NA	NA	NA	5	5	NA	NA	NA	3	3	NA	NA	NA
NARI Technology Development	Rmb61.04	NA	196	258	365	484	746	21	32	71	91	117	25	37	51	66	89
Shenzhen Clou Electronics	Rmb27.84	NA	57	63	114	180	268	9	14	27	43	59	8	12	21	31	39
Guodian Nanjing Automation	Rmb25.07	NA	240	276	332	427	592	19	20	31	43	62	12	13	17	26	42
Xj Electric	Rmb33.82	NA	373	441	545	651	759	48	57	71	96	116	5	19	25	34	40
Sieyuan Electric	Rmb26.50	NA	219	274	315	377	419	48	61	70	59	71	50	139	71	74	76
China XD Electric	Rmb7.88	NA	1,854	2,037	2,336	2,700	3,062	241	259	NA	NA	NA	145	169	189	217	260
TBEA	Rmb20.94	NA	1,794	2,150	2,661	3,093	3,411	203	302	390	443	503	139	224	274	315	359
Baoding Tianwei Baobian Electric	Rmb29.08	NA	627	876	1,082	1,380	1,641	105	131	200	276	345	136	86	119	155	201
Shanghai Zhixin Electric	Rmb19.39	NA	229	189	250	325	514	38	55	NA	NA	NA	30	37	50	61	NA
Waste Recycling																	
China Metal Recycling Holdings	Rmb9.09	NA	838	1,169	3,216	3,899	NA	58	91	221	278	NA	38	62	177	216	NA
Chiho Tiande Group	Rmb4.34	NA	322	302	717	899	1,130	(34)	67	66	90	111	(26)	54	44	62	78
Shenzhen Green Eco Manu	Rmb68.66	NA	44	54	99	134	162	9	15	NA	NA	NA	6	8	15	21	31
Shenzhen Dongjiang Environment	Rmb3.09	NA	119	136	181	227	273	30	33	45	57	68	15	17	24	30	36

For DB covered stocks, all estimates are based on DB estimates and stock performance data are from Datastream.
For non-covered stocks, all estimates are based on bloomberg consensus estimates.

Source: Deutsche Bank, Bloomberg Finance LP, Datastream

Energy Management Contract

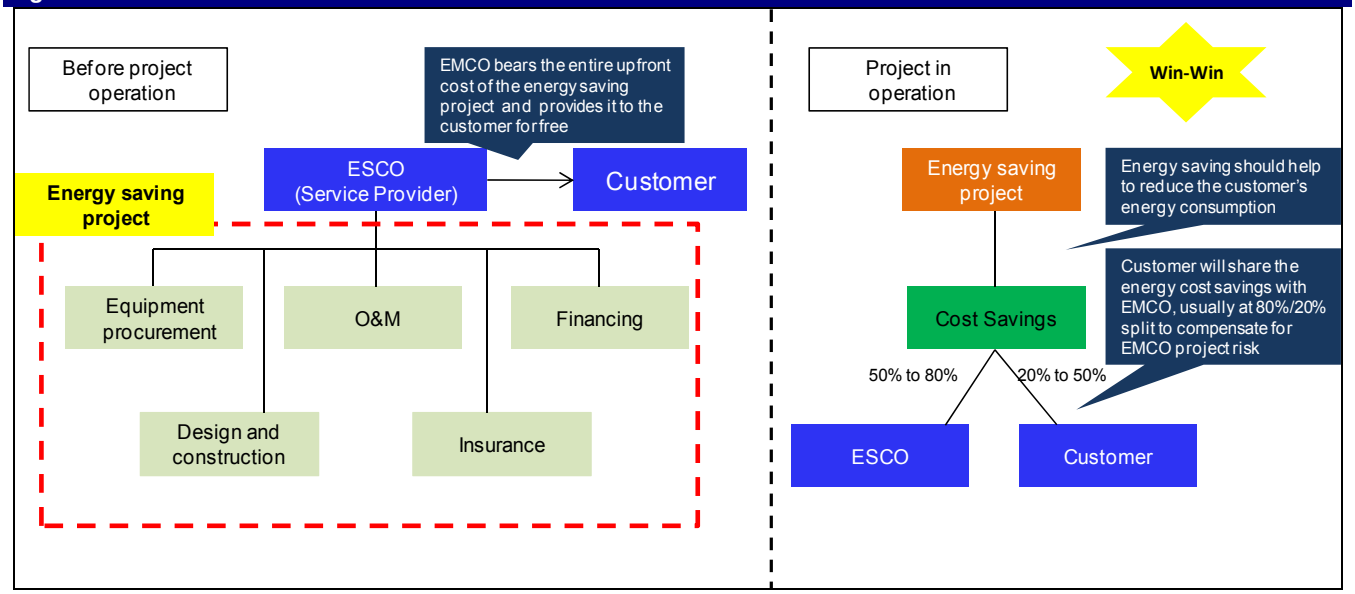
This section discusses the EMC business model, which is a new concept of selling the entire energy saving project to potential customers. Under this framework, the Energy Service Company (ESCO) will bear the entire up-front investment cost and will receive a return from the energy cost savings of the project. EMC is very relevant to our later discussions of LED, ground source heat pumps, waste heat recovery and inverter, as energy saving equipment manufacturers are often engaged in the EMC business and use it as a channel to sell their products and gain market share.

Energy Management Contract basics

What is it?

Energy Management Contract is a business model which allows enterprises to achieve energy savings without an up-front capital cost. It is basically a partnership between the customer and the Energy Service Company (ESCO) (provider) who is responsible for carrying out the energy conservation project. The ESCO will design and construct a project that meets the customer's needs and will guarantee the energy savings cost achieved. Upon completion of the project, the ESCO will share with the customer the profit made by the additional cost savings achieved until the end of the contracting period. Figure 39 illustrates the business model of the Energy Management Contract.

Figure 39: EMC business model



Source: Deutsche Bank

ESCO operational process

There are three key stages to the Energy Management Contract Process. In the first stage, normally referred to as the energy auditing or feasibility study phase, the EMC will evaluate all the various energy conservation measures that are appropriate for its customers and make recommendations on how to improve energy efficiency and cut energy cost with advanced technology. In the second stage, the customer will then choose the type of energy conservation project that best suits its needs and it will negotiate the terms of the energy management contract including the contract period, guaranteed energy-saving level and profit-sharing ratio with the ESCO.

In the final stage, the ESCO will commence construction of the project and it involves

- **Engineering, Procurement and Contracting (EPC)**: ESCO will design and purchase the materials and equipment required as well as carry out the construction of the project
- **Financing:** ESCO will source for the funding of the project from either its own capital, loans from commercial bank or funds from an international development bank
- **Operations and Management (O&M):** Upon complete construction of the energy conservation project, the ESCO will operate and maintain the project for a specific period of time as well as train its customers in the project's operations. During this period, ESCO will share with its customers the profit made by the additional cost savings achieved. However, if the projected cost savings are not realized, ESCO will have to compensate its customers with the difference between the guaranteed energy cost savings and the actual energy cost savings. Upon expiration of the contract, the customer will continue to reap all the benefits from the energy cost saved.

Win-Win business model for both customers and providers

The EMC business model produces a Win-Win scenario for both the customers and the providers. For the customer, they enjoy the benefit of the energy cost savings without having to incur any cost, while the providers can make a profit through the additional energy cost savings. In addition, EMC promotes energy conservation, which helps to reduce the amount of pollution emitted from power generation.

Types of EMC service providers

There are three types of EMC service providers in the market, namely: 1) equipment-affiliated, 2) utility-affiliated, and 3) independent/traditional. Equipment-affiliated ESCOs as the name suggests, are usually part of a company that manufactures the energy saving equipment, and the equipment-affiliated ESCOs use EMC as a channel to sell their products. Utility-affiliated ESCOs offer EMC projects as a value-added service to attract and retain large customers and generally focus on their utility business. Independent ESCOs are companies that are product neutral and derive most of their revenue from EMC contracting.

Energy Management Contract in China

Development history of EMC in China

The idea of the Energy Management Contract originated in the US in the early 1970s and was brought into China in the early 1990s. Over the past 20 years, China's EMC industry has developed very rapidly, such that by the end of 2009 there were over 502 EMC enterprises with a total asset value of Rmb58bn and the ability to reduce the country's energy consumption by 13.5m tons of standard coal equivalent annually. Nonetheless, compared to the US and Canada, China's EMC industry remains under-developed due to the lack of supporting policies, energy measurement standards, and financing. As of a result, most of China's EMC service enterprises are still very small, with only 20-plus companies having a registered capital of more than Rmb50m in 2009.

Market potential

Over the last few years, China's EMC market has developed very rapidly, producing output revenue of Rmb58bn in 2009. Several industry experts such as Mr. Li Gang, Deputy Director of China Energy Management Companies Association, and Mr. Shen Longhai, Chairman of the Energy Conservation Steering Committee, expect the energy service industry to achieve an output of Rmb80bn in 2010 and Rmb400bn in the next few years. The optimism in the industry growth is driven mainly by China's high energy consumption per capita and its commitment to reducing energy intensity. In addition, favorable government policy measures, including those that were implemented this year, will likely fuel the growth of the industry.

Favorable government policies to spur growth in the EMC market

Given China's aggressive carbon intensity reduction target of 40-45% by 2020, its government has implemented several measures this year to promote the development of the energy service industry. Two of the key measures include the notice on the "Opinion on Accelerating the Implementation of Energy Management Contract to Promote the Development of Energy Service Industry (2010.04)," and the notice "Interim measurements to manage financial incentive funding on Energy Management Contract (2010.06)". We highlight the key benefits from these measures below.

- **Increased financial assistance** – The Ministry of Finance has set aside Rmb2bn this year to reward energy conservation companies that engage in EMC projects that save 500 to 10,000 tons of standard coal annually. In addition, any other kinds of energy saving modification projects that can save over 100 tons of standard coal will enjoy other awards granted by the Chinese Central and provincial government. The reward is Rmb240/t of standard coal save, with not less than Rmb60/t shared by the local government.
- **Tax incentive –** EMC service enterprises are exempt from business tax. In addition, they enjoy an income tax holiday for the first three years of operations, followed by a 50% discount for the next three years. For EMC customers, the expenses incurred due to the EMC project are all tax deductible
- **Increased sources of funding –** Local government will encourage local and international banks to make loans to EMC projects. At the same time, the assets of the EMC projects can be used as a mortgage
- **Promote consolidation of small EPC service providers –** To develop a group of sizable EMC service providers, the government is encouraging smaller companies to grow through M&A.

Market structure of ESCOs

In China, the EMC market is characterized by a large number of equipment-affiliated ESCOs with a few small independent ESCOs. This market structure is driven by small independent ESCOs often facing difficulty with financing large EMC projects, and several of them have been acquired by the larger and more established domestic equipment manufacturers.

Difference between China and US EMC market

There are two main differences between EMC markets in China and the US. For one, China's EMC market is dominated mainly by equipment-affiliated ESCOs, which is in contrast with the US, where the market is mainly dominated by the utility-affiliated ESCOs. In addition, the largest customer sectors for China are the commercial and industrial sectors, while for the US it is the government sector.

Key listed players involved in EMC business

Although the market share by individual players is very small, the Chinese government has identified a group of established energy servicing companies. These companies include Harbin Jiu Zhou Electric (300040.CH), Shenzhen Das Intellitech (002421.CH), Shenzhen Batien Ecotype Engineering (002170.CH), Guangzhou Zhiguang Electric (002169.CH), Rongxin Power (002123.CH), Tell-house Sci-Tech (600590.CH), Dalian East (300125.CH), and Beijing Dynamic Power (600405.CH).

Major areas of application

The EMC business model is widely applied to energy conservation projects in China and it usually involves the installation of converters, LED (light-emitting diode), waste heat recovery equipments, and Ground Source Heat Pumps. For example, most green building projects require the installation of ground source heat pumps and LED to achieve energy savings.

Currently, there are several types of energy conservation projects in China and the government has identified 10 key projects which include 1) boiler renovation, 2) waste heat, gas and resource recovery, 3) district cogeneration projects, 4) energy efficient building, 5) optimization of energy management system, 6) green lighting, 7) conservation & alternative petroleum engineering, 8) government energy saving project, 9) energy saving monitoring and technical service system, and 10) energy efficient motor drive system.

Cost of energy saving

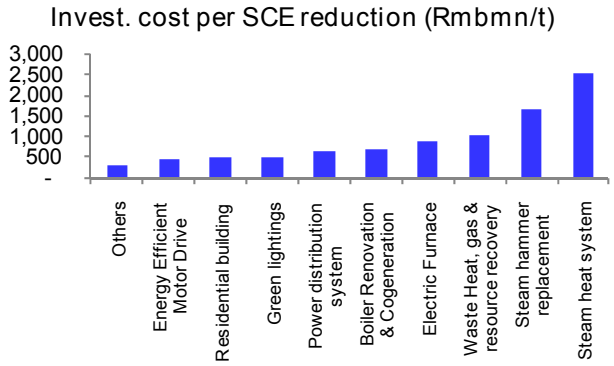
The cost of energy saving varies according to the type of energy conservation project; installation cost and energy saving potential differ across projects. Based on past energy conservation projects, the steam heat system renovation project is the most costly for energy savings.

Economics of EMC

The EMC service companies receive revenue made by the additional cost savings achieved, as well as the subsidy received from the government. Below we discuss the key revenue and cost drivers:

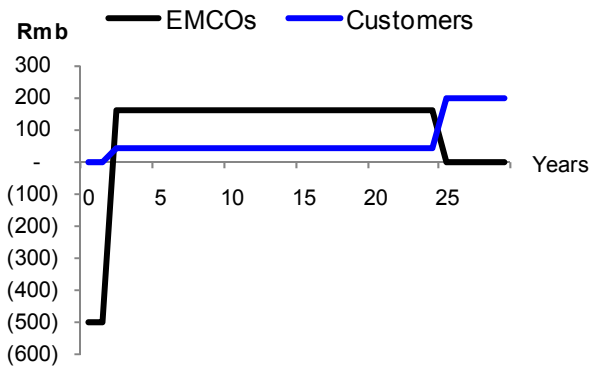
- **Amount of energy saved** – After installing the energy saving equipment, the ESCOs often determine the amount of energy saving resulting from the project and present it to their customers. After this, the customer will share the profit from the energy cost saved with the ESCO. Thus the higher the amount of energy saved, the greater the amount of profit the energy saving company receives.
- **Profit-sharing ratio –** The percentage of profit shared with the ESCOs is generally determined at the time the contract is signed. In general, the ESCO will receive 50% to 80% of the profit saved, as they bear the most risk in the operation of the project. However, EMC contracts vary across projects, with some offering the ESCO 100% for the first two years follow by 50% in the next three years
- **Government subsidy –** To encourage the development of the EMC industry, the government will grant a subsidy of Rmb240/t of energy saved.
- **Equipment and installation cost –** The highest cost for the operator is generally the up-front investment cost.
- **Financing –** Given that ESCOs are normally small-to-medium enterprises, the lending cost is normally higher to compensate for their higher credit risk. In addition, most of the EMC projects are highly debt financed, and this increases the portion of financing cost
- **Contracting period –** The ESCOs will only share the profit from the cost of energy savings during the contracting period. After this, the customer will reap the entire profit. The contracting period for EMC projects is normally around 15-20 years.

Figure 40: Average investment cost per SCE reduction



Source: Deutsche Bank, China Energy Efficiency Association; Note: SCE=Standard Coal Equivalent

Figure 41: Cash flow schedule of EMC project



Source: Deutsche Bank

Risks

Lack of financing

As most of the EMC service companies are relatively small in size and most EMC projects require a huge up-front cost, they normally face difficulty with financing the project. Thus, even if the ESCO were able to secure the EMC project, they may not be able to execute it without financing support from the bank or government.

Expected energy savings may be lower than expected

The ESCO usually guarantees its customer the amount of energy saving achieved. However, if the guaranteed cost saving is not realized, the ESCO will have to compensate its customer with the difference between the guaranteed energy cost saving and the actual energy cost saving.

Accounts receivable

Given that there is no standardized measurement for the energy saved, ESCOs and their customers often dispute the actual energy conserved. Thus, ESCOs may incur bad debts if the customers refuse to agree with them on the actual cost savings.

Frequently asked questions and glossary of terms

How much energy can be saved by engaging in an EMC project?

On average, an EMC project can reduce energy consumption by more than 20%, with some exceptional projects at 60%, depending on the technology and the customer's current energy efficient level.

Why is China's EMC industry underdeveloped?

The underdevelopment in the EMC industry can largely be attributed to 1) the lack of access to financing as most EMC companies are small enterprises with little track record, 2) huge up-front cost for EMC projects associated with obtaining and checking formation, planning and design, implementation scheduling and arranging financing, 3) lack of an independent party to calculate the actual energy saved, resulting in contractual disputes between the EMC service provider and customer and 4) the value made from energy cost savings being insignificant to the corporate, as it typically accounts for only a small percentage of enterprise operating costs.

What is the industry structure like?

The EMC industry is dominated by over 500 small enterprises, with only 20 companies having a registered capital of more than Rmb50m. In addition, most of these enterprises are affiliated to an equipment company.

Are there any foreign players in the sector in China?

The EMC market is mainly dominated by state-owned enterprises and is usually affiliated with equipment companies. However, foreign players such as Siemens have recently entered the market through joint ventures.

Figure 42: Glossary of terms

Term	Definition
Adjustable speed electric motor	An electric motor that is able to vary its speed. As compared to a traditional fixed-speed motor, the adjustable speed electric motor conserves more energy
Comprehensive Energy Management Plan (CEMP)	A detailed plan for the energy saving project which lists the potential energy saving measures, baseline for energy savings and energy performance guarantee
District heating system	A system where heat is generated in a centralized heating location and distributed to residential and commercial customers. The district heating plant has a better efficiency and emits lesser pollution than localized boiler.
Energy Audit	An inspection, survey and analysis of energy flows for energy conservation in a building, process, or system.
Energy Management Contract (EMC):	A market-based energy saving mechanism in which the ESCO carries out the energy conservation project for its customer and receives a profit from the cost savings of its energy conservation measures for the contractual period. After this, the customer will receive all the benefits from the energy conservation project.
Energy Service Company (ESCO)	A company that provides energy conservation services to customers without an up-front capital cost and receives a profit from the cost savings of its energy conservation measures.
Project guarantee	ESCOs normally provides a guarantee on the amount of energy cost savings or performance
Retrofitting	The addition of new technology to older systems to improve its efficiency

Source: Deutsche Bank

Frequency inverter

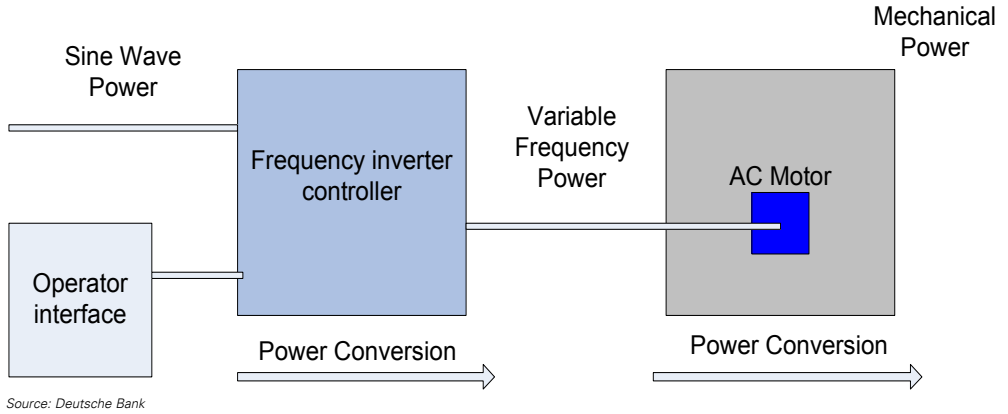
Frequency converter basics

Frequency inverters are used to control the motor speed and torque in real time of an alternating current (AC). A frequency inverter, an electrical variable speed drive, is attached to a motor-driven system, which can save energy and improve the industrial process control. As the motor-driven system is designed to handle peak loads and operates for an extended time period, energy is wasted when the load is reduced. By adding a frequency converter, the motor speed is adjusted to align with the motor output load, resulting in energy conservation.

Frequency inverters are often classified based on their voltage, namely: 1) low voltage (110V – 380V), 2) middle voltage (690V – 2,300V), and 3) high voltage (≥3kV). In addition to the voltage difference, the inverters differ in their circuit structure. A high-voltage inverter uses a multi-level series connection of IGBT, while the medium- and low-voltage inverters use a two- or three-level circuit structure.

There are two major controlling methods for frequency converters – voltage-to-frequency (V/F) control and vector control. Vector-controlled frequency converters usually have more advanced performance in the precision and range of speed and low-frequency torque. These superior properties enable vector-controlled frequency converters to be widely applied to elevators, cranes, digital machine tools, and other equipment whose needs are not satisfied by the V/F-controlling method.

Figure 43: Frequency variable drive system



Source: Deutsche Bank

Figure 44: Low-voltage frequency inverter

Source: Deutsche Bank, Shenzhen Invt Electric

Figure 45: High-voltage frequency inverter

Source: Deutsche Bank, Hiconics Technology

Market growth in China

In the 1970s, frequency inverter technology first appeared as the international oil crisis was driving energy prices up significantly resulting in an urgent need for energy efficient technology. In the 1990s, China began to use voltage frequency inverters in power supplies and metal production lines due to its energy saving nature. However, as the products and technology were monopolized by foreign companies, the prices for the inverters were very high, which hampered the development of the industry.

Growth in domestic frequency inverters manufacturers

After 2000, domestic manufacturers made significant breakthroughs in the technology and production of inverters, which resulted in a substantial increase in the reliability of the product and a decrease in its production costs. At the same time, the policy environment turned more favorable, with the NDRC, the State Intellectual Property Office, the Ministry of Science and Technology, and the Ministry of Commerce launching several guidance documents to promote the development of frequency inverters. Among these reports, the classification of the technology, equipment, and electronic devices regarding frequency inverters as key projects for high-technology equipment development in 2006-07 had a more significant effect.

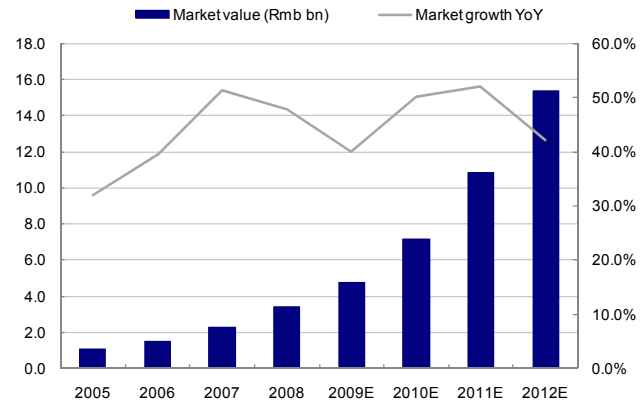
Market potential and growth forecast

The motor industry is the key demand market for frequency inverters and is well positioned to grow given the relatively low penetration rate in the market. In 2009, the overall motor capacity in China reached 580GW, 90% of which was accounted for by AC motors. Of the installed AC motors, only 10%, or 50GW motors, are equipped with frequency inverters, leaving a large potential market to be explored, given that 70-80% of AC motors are economically viable for the installation of frequency inverters in China. In addition, the motor industry accounts for 60-70% of China's total power consumption, suggesting significant potential for energy saving in China.

According to the 2009 High-Voltage Frequency Inverter Industry Yearbook and the 2008 Medium-Low Voltage Frequency Inverter Industry Survey, the market for high-, medium-, and low-voltage frequency inverters in China was approximately Rmb4.8bn, Rmb1.5bn, and Rmb10.3bn in 2009, respectively. The survey estimates that by the end of 2012, the market value of low-, medium-, and high-voltage inverters will likely reach Rmb16.0b, Rmb3.0bn, and Rmb15.4bn, at CAGRs of 16%, 25%, and 48% in 2009-12E, respectively.

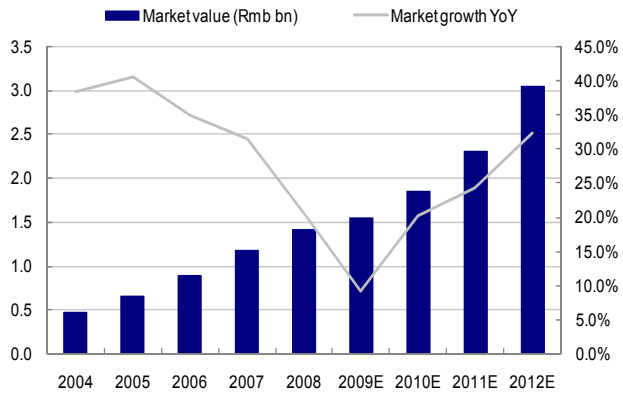
The main factors driving this growth are 1) favorable energy saving policies implemented by the government as it seeks to reduce energy consumption and emission reduction, and 2) a decline in domestic production cost of inverters due to technological breakthrough.

Figure 46: High-voltage frequency inverter market



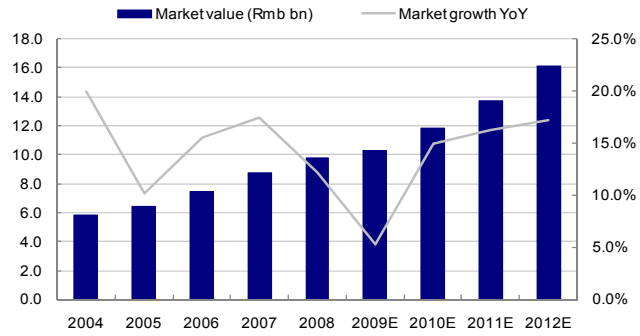
Source: Deutsche Bank, 2009 China High Voltage Frequency Converter Industry Yearbook

Figure 47: Medium-voltage frequency inverter market



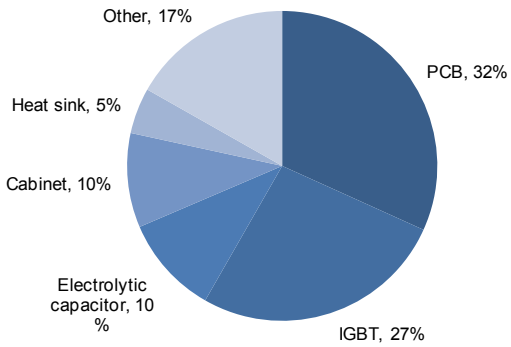
Source: Deutsche Bank, 2008 Medium-Low voltage frequency inverter industry survey report

Figure 48: Low-voltage frequency inverter market



Source: Deutsche Bank, 2008 Medium-Low voltage frequency inverter industry survey report

Figure 49: Frequency inverter material cost breakdown



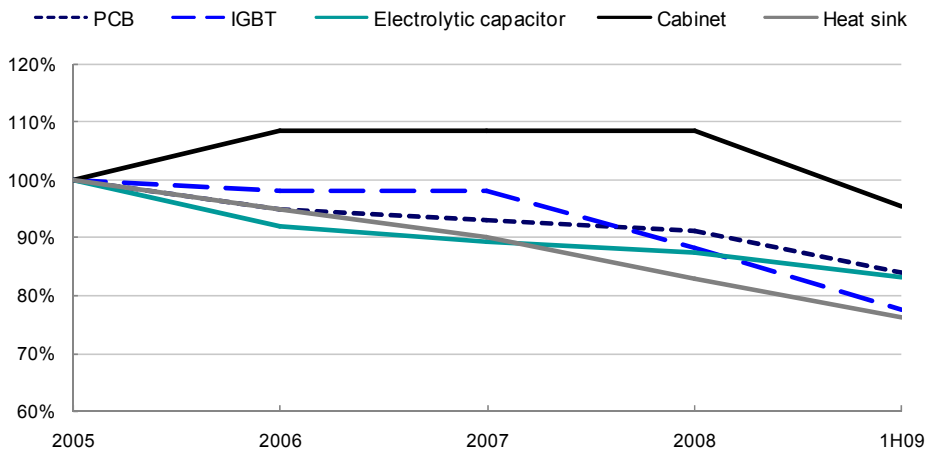
Source: Deutsche Bank, INVT Electric

Market dynamics

We can break the value chain of frequency inverters into upstream raw materials, design and production of frequency inverters, and downstream users.

Upstream raw materials: The upstream market consists of suppliers of transformers, IGBT, cooling fans, capacitors, heat sink, and transmitter cabinet. The insulated gate bipolar transistor (IGBT) is the main component in frequency inverters. An IGBT is a semiconductor device that switches electric power in electronic devices and is known for high efficiency and quick switching. Most of the IGBTs supplied to the market are from foreign manufacturers as domestic company technology is not very mature. The proportion of IGBT cost is not particularly high, accounting for 10-15% of total cost.

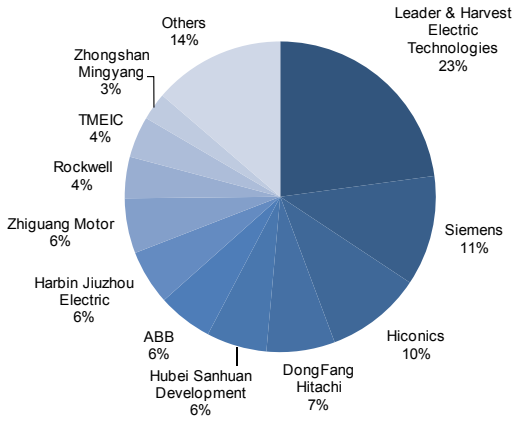
Figure 50: Cost trend of frequency inverter component



Source: Deutsche Bank, INVT Electric

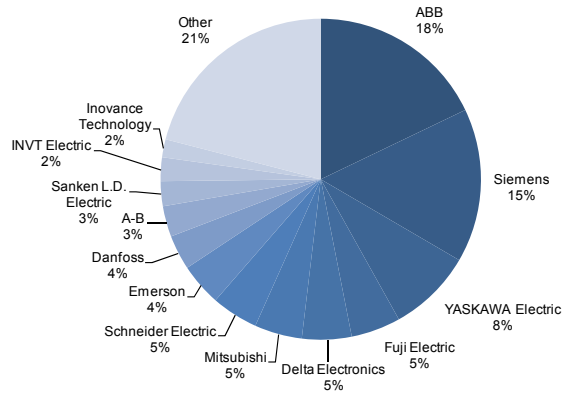
Frequency inverter producers: The market landscape for frequency inverters is mainly dominated by foreign companies. In the medium- and low-voltage inverter market, foreign players have a 76% market share in China with Japan, the EU and the US, and Taiwan and Korea at 18%, 50%, and 6%, respectively. Although domestic manufacturers only account for 24% of the Chinese market, its market share has increased significantly from less than 10% before 2003. Similar to the medium- and low-voltage market, the high-voltage frequency market is dominated by Leader & Harvest Electric, Siemens, and Toshiba Mitsubishi, which are foreign manufacturers.

Figure 51: High-voltage inverter market share 2008



Source: Deutsche Bank, HuiCong D&B Market Research

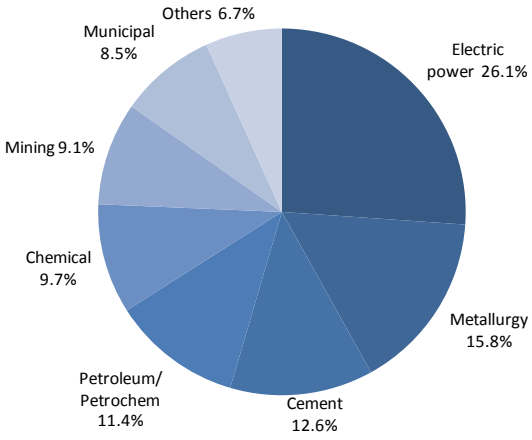
Figure 52: Low-voltage inverter market share 2008



Source: Deutsche Bank, 2009 China Low-voltage Inverter Market Report

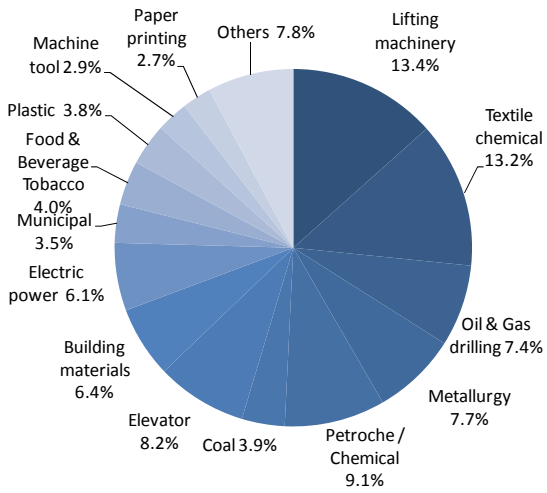
Downstream end users: With environmental energy saving awareness gaining traction, the application of frequency inverters will become the main motor speed control device. Application use for frequency inverters is quite broad and covers all sectors of the economy. For high-voltage frequency inverters, electric power is the main user, while lifting machinery and textile chemical fiber are the main users for low-voltage frequency inverters. In medium-voltage frequency inverter application use, coal represents the largest percentage with 36.9%, followed by oil and gas drilling and metallurgy at 19.9% and 14.9%, respectively.

Figure 53: High-voltage frequency inverter application



Source: Deutsche Bank, 2009 China High voltage inverter market research

Figure 54: Low-voltage frequency inverter application



Source: Deutsche Bank, 2008 China Low voltage inverter market research

Risk

Price pressure on frequency inverters due to market competition

Market competition in the frequency inverter industry is fierce given a large number of players, particularly in the middle- and low-voltage frequency inverters sub-sector. The average price of frequency inverters has declined from Rmb295/kW in 2006 to Rmb266/kW in 1H09.

High import reliance of raw materials may hamper industry growth

IGBT is a key component for frequency inverter manufacturing. Only a few players globally are engaged in IGBT manufacturing. Infineon and Mitsubishi account for up to 80% of the world market share in IGBT. Given that the majority of domestic players are still importing IGBT, the lack of domestic raw materials may serve as an impediment to the development of the domestic frequency inverter market.

Frequently asked questions and glossary of terms

How can a frequency inverter save energy?

When the output load and motor speed vary, a frequency inverter can adjust the motor speed, which will help to consume less energy.

What is the average price of frequency inverters?

The price varies for different types of inverters. In general, low-voltage inverters cost Rmb1,000-3,000 per unit, while middle-voltage inverters cost Rmb40,000-60,000 per unit and high-voltage inverters cost Rmb400,000-1,000,000 per unit. In terms of cost per unit of power, low-voltage inverters range from Rmb250/kW to Rmb350/kW, while high-voltage inverters range from Rmb600/kW to Rmb800/kW.

How much power can be saved from a frequency inverter?

As a general rule of thumb, a motor equipped with a frequency inverter can save 20-30% of power by controlling the motor speed, which helps to avoid unnecessary energy usage.

What are the key markets for frequency inverters?

Inverters are widely used in crane machinery, mining equipment, power generation, metallurgy, chemical industry, and textile.

What are the key components of an inverter?

The key components of an inverter are suppliers of transformers, IGBT, cooling fans, capacitors, heat sink, and transmitter cabinet.

Figure 55: Glossary of terms

Term	Definition
Alternating Current	The flow of electricity which changes direction on a regular continuous cycle reaching a maximum in one direction, decreasing to zero, and then reversing to reach a maximum in the opposite direction.
Capacitor	A device which can store electrical charge. In an AC circuit, a capacitor causes the voltage to lead the current. The unit of capacitance is the Farad.
Frequency	The rate at which alternating current reverses its direction of flow. The unit of frequency is either Hertz or cycles per second.
Full Load Speed	The speed of the motor at rated voltage, frequency and load.
Power Factor	A measurement of the difference in phase between voltage and current in an electric circuit.
Rotor	The rotating member of an electric motor.
Insulated gate bipolar transistor	A semiconductor device that is used for switching on/off the electric power
Three Phase motor	An electric power system that have at least three conductors that are carrying the voltage wavelength
Sine wave power	A measurement of the maximum power output of an audio amplifier
Single Phase Motor	An electric power system that have only one conductor that is carrying the voltage wavelength.

Source: Deutsche Bank

Frequency inverter players

Shenzhen Invt Electric (002334.CH, non-rated)

Company background

Shenzhen Invt Electric, established in 2000, primarily engages in the low-voltage frequency inverter category through R&D, manufacturing and sales. The company has developed the CHV, CHE, CHF, CHH and CHA series of low voltage inverters which represented 83.3% of revenue in 2009.

Business exposure

The company has annual production capacity of about 80,000 low-voltage frequency inverter units and approximately 275 units of medium voltage frequency inverters. The company's main products are used in lifting machinery, coal, plastics, building materials, textile and chemical fiber, oil and gas drilling, petrochemical and the chemical industry.

Key financials

As of 2009, the company's total revenue increased by 31% yoy to Rmb320m, while its net profit doubled to Rmb82m on increased inverters sales and better cost control. Its gross profit margin increases by 12% yoy to 42%, due to a higher mix of high margin products. In terms of revenue breakdown by product type, low-voltage frequency inverter totaled Rmb269.6m, while medium and low voltage frequency inverters were Rmb33.7m and Rmb17.1m, respectively. The gross profit margin was the highest for the medium frequency inverter at 58.06% followed by low voltage inverter at 40.96% and high voltage inverter at 27.73%. In 1H10, the company's net profit continues to increase by 71% yoy to Rmb43m on increased inverter sales.

Figure 56: SHENZHEN INVT ELECTRIC CO-A (Shenzhen: 002334, Currency: CNY)

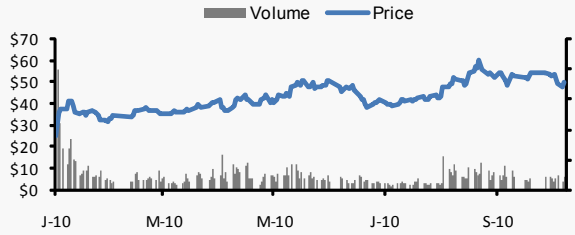
Description	
Address:	No 4 Gaofa Industrial Park Longjing,Nanshan District Shenzhen, 518055 China
Website:	www.invt.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	244	320	213
EBIT	47	66	40
Net Income	41	82	43
EPS (Diluted)	0.45	0.89	0.37
Book Value per Share	1.3	2.2	7.8
Total Assets	183	276	1,032
Cash Flow-Oper Activities	48	75	8
Capital Expenditures	(15)	(11)	(15)
Free Cash Flow	34	63	(7)
Return on Com Eqty (%)	41.5	51.3	18.5
Total Debt/Total Equity (%)	11.8	5.0	0.0

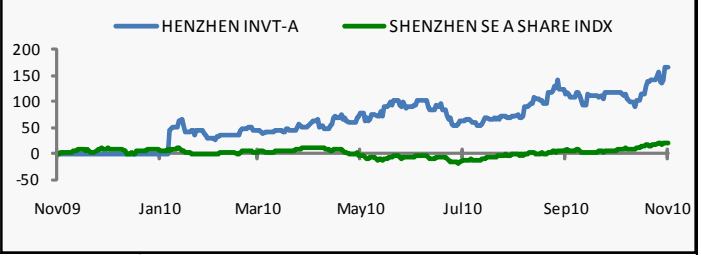
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Low Voltage Transformers	269.65
Medium Voltage Transformers	33.67
High Voltage Transformers	17.10
Other Revenue	0.79

Key Statistics	
Share price (CNY)	66.11
52-Week Range	25.263 - 66.11
YTD performance	-
Avg Daily traded Val (3 Months, USD)	18.5
Market Value (USD mn)	1,207.7
Float %	25.0%
Major shareholder	SHENLI HUANG
% stake	18.6%
No. of employee	520

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Hiconics Technology (300048.CH, non-rated)

Company background

Beijing Hiconics Technology, based in Beijing, manufactures and designs various high-voltage frequency inverters. Established in 2003 with registered capital of Rmb120m and net assets of more than Rmb1.2bn, the company is a top three domestic manufacturer of frequency inverters.

Business exposure

In 2009, the company invested in a R&D base for high-voltage converter system with expected annual output of 1,200 units. The company's products have applications in equipments, such as centrifugal fans, blowers, pump compressors, mine hoists used in power generation, metals, mining and minerals, petrochemical, water, cement, and the pulp and paper industries.

Key financials

As of 2009, the company's total revenue increased by 74% yoy to Rmb295m while its net profit increased by 84% yoy to Rmb70m. The increase in revenue and net profit was largely driven by the increase in high-voltage inverter orders. In 2009, the company bagged 542m of high-voltage inverter orders. In terms of revenue breakdown by product, revenue from universal high-voltage inverters increased by 63% yoy to Rmb249m, while high-performance high-voltage inverter increased by 182% to Rmb45.9m. The company's gross profit margin for its universal high-voltage inverter and high-performance high-voltage inverter was 40% and 48% respectively. In 1H10, the company's net profit increased by 9.79%. However, revenue from its high-performance high voltage inverter decreased by 73% yoy due to significant increase in the competition in the market from new entrants.

Figure 57: HICONICS DRIVE TECHNOLOGY -A (Shenzhen: 300048, Currency: CNY)

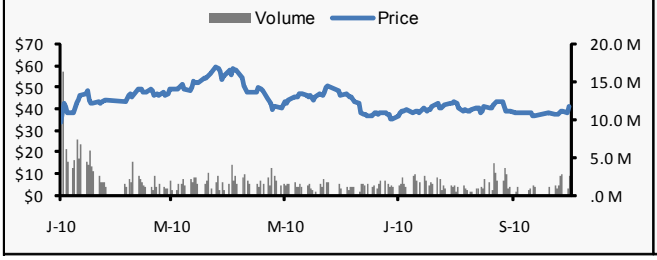
Description	
Address:	West Street 19 Shijingshan, Beijing, 100043 China
Website:	www.hiconics.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	169	295	145
EBIT	43	72	26
Net Income	38	70	38
EPS (Diluted)	0.43	0.79	0.33
Book Value per Share	2.7	2.5	10.1
Total Assets	240	409	1,398
Cash Flow-Oper Activities	(21)	(5)	(41)
Capital Expenditures	(1)	(31)	(15)
Free Cash Flow	(22)	(35)	(55)
Return on Com Eqty (%)	60.8	45.2	-
Total Debt/Total Equity (%)	15.8	11.1	0.0

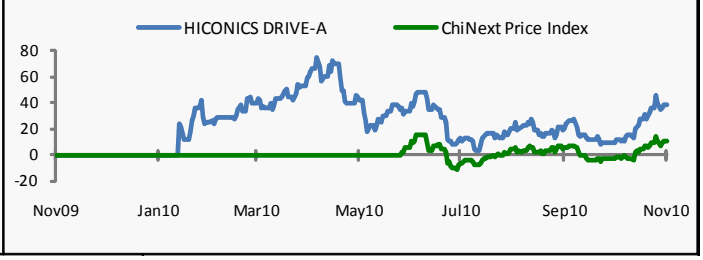
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
High Voltage Transformer	295.33
Other Operating Income	0.33

Key Statistics	
Share price (CNY)	46.88
52-Week Range	34.16 - 60.8
YTD performance	-
Avg Daily traded Val (3 Months, USD)	8.9
Market Value (USD mn)	845.1
Float %	25.0%
Major shareholder	SHANGHAI SHANGFENG G
% stake	29.3%
No. of employee	335

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Harbin Jiuzhou Electric (300040: CH, non-rated)

Company background

Harbin Jiuzhou Electric, based in Harbin, was established in 2000 with a registered capital of Rmb69.5m and was listed on the Shenzhen GEM exchange in January 2010. The company's main products include high-voltage inverters, high-voltage soft starters, high-frequency direct current power supplies, high-low-voltage switch cabinets, and incoming power line cabinets.

Business exposure

The company is one of the pioneers in high-voltage electric motor speed products in China. As of December 09, the accumulated total installed capacity of its high voltage electric motor product sold has reached 1.314GW and the electricity power saved by this product is 1.687GWh. To date, it has an annual production capacity of 250 sets of high-voltage electric motor timing products and 800 sets of high-frequency inverter switching DC power supply. The company is currently investing in two manufacturing bases, namely 1) a high-voltage electric motor expansion project which will add 500 sets of production capacity annually and 2) a wind converter expansion project that could add 200 sets of MW size converters.

Key financials

In 2009, the company's total revenue increased by 26% yoy to Rmb375m while its net profit increased by 29.7% yoy to Rmb46.8m. The increase in net profit was mainly driven by the increase in sales across all production. The sales of its main product, the high-voltage frequency inverter, increased by 26% to Rmb183m, accounting for 49% of the company's total revenue, while its gross margin stayed flat at 32%. In 1H10, the company's revenue increased by 20.8% yoy and net profit increased by 29% yoy to Rmb161m and Rmb14m respectively, due to increase in product sales.

Figure 58: HARBIN JIUZHOU ELECTRIC CO-A (Shenzhen: 300040, Currency: CNY)

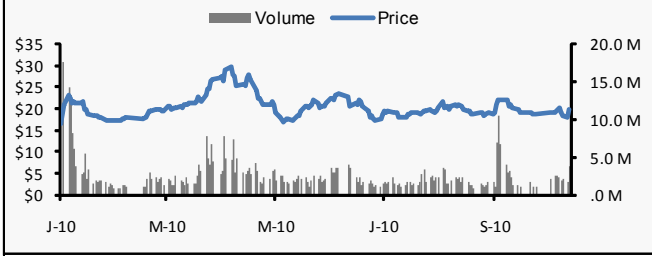
Description	
Address:	162 Haping Road Nangang District Harbin, Heilongjiang, 150081 China
Website:	www.jze.com.cn/

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	298	375	161
EBIT	41	52	14
Net Income	36	47	14
EPS (Diluted)	0.35	0.46	0.10
Book Value per Share	2.3	6.0	6.0
Total Assets	463	1,137	1,022
Cash Flow-Oper Activities	0	27	(64)
Capital Expenditures	(15)	(19)	(7)
Free Cash Flow	(15)	8	(71)
Return on Com Eqty (%)	16.8	8.8	-
Total Debt/Total Equity (%)	50.0	15.9	2.6

Business Segments (FY: Dec-09 ,CNYmn)	Revenue
High Voltage Electric Motor Timing Product	183.20
Direct Current Supply Product	105.73
Electrical Control and Automatic Product	81.48
High Voltage Starter	6.03
Wind Power Converter	0.43

Key Statistics	
Share price (CNY)	20.72
52-Week Range	16.5 - 30.84
YTD performance	-
Avg Daily traded Val (3 Months, USD)	7.6
Market Value (USD mn)	432.4
Float %	25.6%
Major shareholder	YIN LI
% stake	21.6%
No. of employee	911

Price and Volume (1 Year)



Comparative Returns

Source: Deutsche Bank, Bloomberg Finance LP

Waste heat recovery

Waste heat recovery basics

In industrial processes, air and fuel are burned to generate heat, and a portion of this heat is transferred, via the combustion gas products, to the heating device and its load. This results in a significant amount of combustion gases and produces a large amount of waste heat if these gases are emitted to the atmosphere. Waste heat recovery allows us to utilize such waste heat more efficiently.

Waste heat recovery allows the collection of this thermal energy and reapplies it to a useful purpose, thus reducing the amount of fuel consumed overall by 5-30%. The recovered heat can be recycled and applied to several uses. The most commonly used methods are:

- **Pre-heat combustion air:** This method recovers waste heat by transferring the heat energy from the exhaust gas to the combustion air. A recuperator or a regenerator is used in this process.
- **Steam generation and water heating**: This method recovers heat through a waste heat boiler which utilizes the hot exhaust gases to heat up water and generate steam that in turn drives a steam turbine to generate power. This process is similar to power generation using a conventional boiler except that waste heat boiler is larger because the exhaust gas temperature is lower than the heat used in conventional systems.
- **Direct heat recovery:** The waste heat is directly applied to the load in this method. When exhaust gases leaves the high temperature portion of the industrial process, it is brought into contact with the load. As such, heat energy of the exhaust gas is transferred to the load, thus reducing the energy required to heat the load originally.

Devices for waste heat recovery

Recuperator: A recuperator is a gas-to-gas heat exchanger placed on the stack or chimney of a furnace. It relies on tubes or plates to allow heat transfer between the outgoing exhaust gases and the incoming combustion air. The recuperator prevents the two air streams from mixing and is the most widely used heat recover device.

Economizer: Working along similar principles, an economizer is a type of recuperator used in boilers. It reduces boiler energy consumption by exchanging heat in the warm exhaust gases with the cooler incoming boiler fluid or combustion air. This preheats the incoming fluid and reduces the amount of energy consumption by raising the temperature of the incoming fluid. For example, modern economizers are usually fitted in coal-fired power stations and as part of a heat recovery steam generator in a combined cycle power plant.

Types of waste heat boiler

Waste heat boilers are similar to conventional boilers except that the heating source is the exhaust gas stream from a furnace instead of the boiler's own burner. The boiler generates steam only when the process (exhaust gas source) is running. There are generally two main types of waste heat boiler in the market

- **Power station waste heat boiler:** The steam produced during the power generation process can be recycled and use to drive a steam turbine and generate electricity. This device is commonly seen in power stations and combined heat and power plants (CHP) where the hot exhaust from the gas turbine is used to generate steam to drive the steam turbine.

- **Industrial waste heat boiler:** This is the most common waste heat boiler, and it is applied in various industrial processes including steel, non-ferrous metal, coke, building material, chemicals, textiles and paper. As compared to the technology of power station waste heat boiler, the technology of industrial waste heat boiler is more complicated and less economical to recover as industrial waste heat is generally of a lower temperature. Figure 59and Figure 60 are examples of industrial waste heat boiler.

Figure 59: Non-ferrous waste heat boiler

Source: Deutsche Bank, Suzhou Hailu Heavy Industry

Figure 60: CDQ (Code Dry Quenching) waste heat boiler

Source: Deutsche Bank, Suzhou Hailu Heavy Industry

Sources of downstream demand

The ways/devices above can be applied to almost any industrial manufacturing process that generates waste heat. The following is a limited selection of the potential end users:

Cement production

China's cement industry accounts for c.50% of the world's annual production and is also a major consumer of energy, accounting for over 57% of the energy consumed in the building materials industry. Cement production generates a lot of waste heat, particularly in the clinker stage and is an industry ideally suited to benefit from waste heat recovery.

- According to China Cement Association data, of the 769 large (over 2,000 tons per day) new dry process cement production lines that were set up in 2009, 498 or 65% of them had installed waste heat recovery power generation systems, totaling 3,316 MW in capacity.
- This is below the 95% target and suggests additional spending is necessary to meet the 2013 target of 95%. Up to Rmb12.7bn may be required to be spent by the government on this program alone.

Iron and steel

In December 2009, China's Ministry of Industry and Information Technology released a plan to promote waste heat cogeneration in China's iron and steel industry. Over the course of three years, the Chinese authorities plan to invest Rmb5bn in 37 key Chinese iron and steel enterprises in order to reduce energy consumption during the sintering process.

- According to Chinese authorities, the iron and steel industry consumes about 15% of total industrial energy consumption.
- Of this, about 9-12% is consumed during the sintering stage. Currently about 10% of the sintering flue gas undergoes heat recovery in recuperators.

- There is a lot of potential to improve waste heat recovery. The plan involves installing waste heat cogenerators at sintering plants nationwide.
- The program intends to boost total numbers to 82 cogenerators nationwide by 2012, at a total cost of Rmb5bn (from 10 waste heat co-generators).

Glass production

There are currently about 204 float glass production lines in China, each with exhaust gas of around 400 to 500 degrees Celsius. The estimated thermal energy trapped in the exhaust gas is about 35 to 50% of the fuel consumed.

- Currently about 40 lines have some form of waste heat power generating system installed; typically waste heat is consolidated from two or more production lines to one waste heat recovery power plant.
- The cost of installation for a single waste heat power generating plant is about Rmb50m. Thus assuming a two-to-one ratio of glass production line to waste heat recovery system, the potential market for existing lines stands at around Rmb4bn.

Buildings

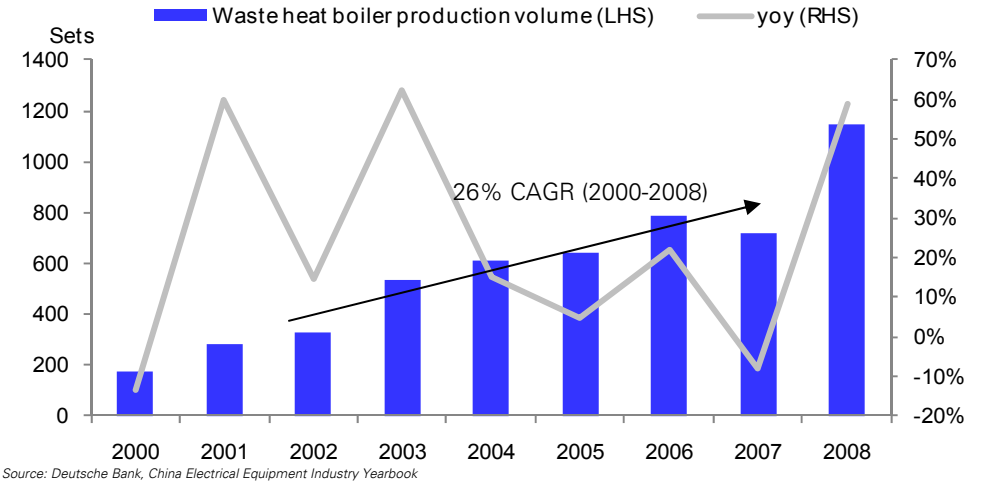
Air source heat pumps (which use the ambient heat in the atmosphere as a heat source) are a useful application. They can provide refrigeration, floor heating and hot water supply in one integrated system. Compared to conventional air conditioning systems, they can lead to energy savings of up to 30%.

Market potential in China

China waste heat boiler market has been increasing rapidly since 2000 at a CAGR of 26%. Going forward, the market for waste heat boiler is likely to grow given 1) strong replacement demand 2) technological improvement and 3) higher energy. We discuss the key drivers below:

- **Replacement demand:** To date, about 25% of the waste heat boiler installed have been utilized for over 10 years. Given that the average useful life of a waste heat boiler is about 15-20 years, this suggests strong replacement demand in the coming years.
- **Technological improvement:** With technological improvement, industrial waste heat boiler can be applied to a wider range of industrial processes, thereby increasing the market for industrial waste heat boiler.
- **High energy prices:** With rising energy prices, the economics for a waste heat boiler turns more favorable given the increase in energy cost savings from recovering heat.

Figure 61: Waste heat boiler production volume



Source: Deutsche Bank, China Electrical Equipment Industry Yearbook

National policies encouraging waste heat recovery development

Waste heat recovery reduces the energy intensity of industry and the overall demand for fuel. In recent years, the State Council and the National Development and Reform Commission have promulgated a two-pronged strategy of managing China's growing energy needs. On the supply side, there has been a noticeable push towards renewable energy sources. On the demand side, various plans and incentives have been put in place to reduce energy demand such as through boosting energy efficiency.

- In 2004's Medium and Long Term Energy Conservation Plan, the State Council pointedly highlighted waste heat recovery as a strategy for energy conservation.
  - This included specific annual plans to install 30 sets of waste heat power generation units per cement medium-to-large-sized (2,000 tons per day) production plant.
- In 2006, the Tenth National People's Congress adopted the 11th Five-Year Plan for Economic and Social Development (11-5). The 11th Five-Year Plan specifically mentioned waste heat recycling as an urgent priority in energy conservation.
  - In the same year, the National Development and Reform Commission set an objective of installing waste heat power generators to 40% of the cement production lines.
- In 2009 and 2010, the State Council and various bodies issued a number of notices promoting lean energy use in industries and the recycling of waste heat.
  - In January 2010, the Ministry of Industry and Information Technology also announced a Rmb5bn plan to install waste heat power generators in 37 iron and steel enterprises over a three-year period.
  - In February 2010, the Ministry of Industry and Information Technology further proposed that the authorities intend to promote the installation of waste heat power generators to 95% of new dry cement production lines. The total required investment is Rmb12.7bn over four years from 2010 to 2013.

Frequently asked questions and glossary of terms

How much energy can be recovered using waste heat recovery?
About 50% or more of the energy consumed in an industrial heating process escapes with the exhaust gases. The higher the industrial process, the more heat is wasted. Modern heat recovery techniques allow recovery of this thermal energy and total energy savings of 5-30% can be achieved.

What are the key markets for the use of waste heat recovery?
Key markets are any industrial process that involves heating, such as petroleum refining, cement manufacturing, iron and steel, lumber drying, food processing, glass manufacturing and other metallurgical processing industries. Where low temperature heat recovery or cooling is concerned, there is a large potential market in upgrading heating, power and water systems in large commercial and public buildings or in industries which require cooling, such as dairy products, beer breweries, and sugar refining.

How big is the market for waste heat recovery?
The government is putting a lot of emphasis into developing energy efficiency in Chinese industry. For example, the government intends to invest Rmb12.7bn in improving the energy efficiency of cement kilns through the addition of waste heat recovery power generation plants over four years from 2010 to 2013. Another industry that is seeing huge investment by the government is the iron and steel industry.

Why would companies convert old plants to be more efficient?
With the country's increasing focus on energy efficiency, there is public policy pressure to do so. In addition, the installation of waste heat recovery systems usually pays for itself over a three-to-five-year period from fuel savings. However, waste heat recovery systems are expensive and smaller-scale industrial processes with lower temperature or volume of exhaust may find the devices uneconomical.

Risks

A fragmented market
Most companies in this sector do not focus only on waste heat recovery devices and typically have multiple business lines providing industrial machinery. As such, the exposure of these companies to the waste heat recovery industry is diluted; in addition, there are also a lot of companies offering similar competing products.

Increasing competition
Margins will face pressure as more firms enter the industry and the products become increasingly commoditized.

Government subsidies may run out
Most of the current activities are boosted by a series of government subsidies that may run out in 2013. The future of the industry is unclear without continued support from the government. Also, the fast growth of the industry will eventually slow, once a critical mass of industrial plants has been retrofitted with waste heat recovery devices.

Waste heat recovery players

Suzhou Hailu Heavy Industry (002255.CH, non-rated)

Company background

Suzhou Hailu Heavy Industry Co., Ltd is primarily engaged in the design, manufacture and distribution of exhaust heat boilers (waste heat) and large-scale pressure vessels for the nuclear power industry. The company was listed in Shenzhen Stock Exchange on Jun 2008. Its major shareholder, Mr. Xu Yuan Sheng, is also the president of the company.

Business exposure

The company's key product is the manufacturing of waste heat boilers. Their products ranges from catalyzing and cracking heat recovery boilers, incinerator heat recovery boilers, dry quenching exhaust heat boilers, sulfur-burning sulfuric acid exhaust heat boilers, fluid bed boilers, pyrite acid-making heat recovery boilers and alkali recovery boilers. Of the various waste heat boilers, the company's CDQ (Coke Dry Quenching) boiler was honored with the state metallurgical technology first grade prize.

Key financials

In 2009, the company's total revenue increased by 30% and net profit increased by 46%. In terms of revenue breakdown by products, its heat recovery boiler and related product accounted for 81% of the total revenue. In 1H10, the company's revenue continued to increase by 5% yoy while net profit increased by 29.3% yoy. Its primary business of waste heat boilers showed an overall revenue decline of 8.4% yoy while gross margins improved by 2.9% to 26.5%. Greater promise came from the container products division where revenues rose 69.3% yoy.

Figure 62: Summary description of Suzhou Hailu Heavy Industry (002255.SZ)

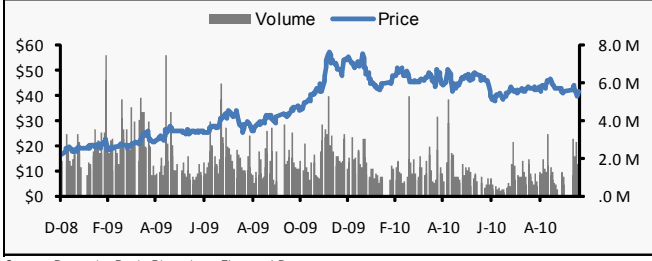
Description	
Address:	1 Renmin Road West Yangshe Town Zhangjiagang, Jiangsu, 215600 China
Website:	www.hailu-boiler.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	752	977	485
EBIT	104	145	75
Net Income	75	109	58
EPS (Diluted)	0.75	0.95	0.45
Book Value per Share	4.6	8.1	8.4
Total Assets	1,403	1,991	1,967
Cash Flow-Oper Activities	11	132	(7)
Capital Expenditures	(46)	(104)	(35)
Free Cash Flow	(35)	29	(42)
Return on Com Eqty (%)	22.3	14.1	15.2
Total Debt/Total Equity (%)	16.5	6.0	9.1

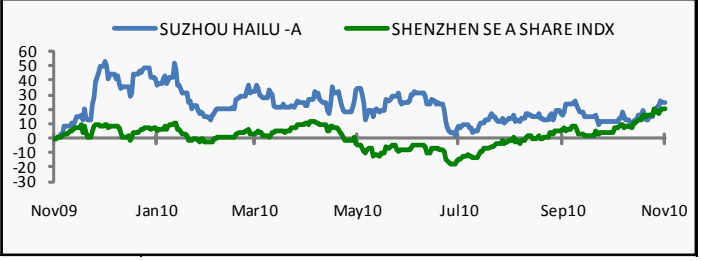
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Heat Recovery Boiler & Related Product	794.98
Container	162.30
Nuclear Container Equipment	16.53
Other Businesses - Sales of Material	5.61

Key Statistics	
Share price (CNY)	46.18
52-Week Range	37.02 - 57.88
YTD performance	-17%
Avg Daily traded Val (3 Months, USD)	10.0
Market Value (USD mn)	895.6
Float %	40.0%
Major shareholder	YUANSHENG XU
% stake	24.8%
No. of employee	1,704

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Greens Holdings (1318.HK, non-rated)

Company background

Greens Holdings (Greens) is a Cayman Islands incorporated company which is directly derived from the Greens UK Company founded by Edward Green, inventor of the Fuel Economizer in 1845. Greens' products include power station boilers, marine boilers, heat recovery steam generators, waste heat boilers, exhaust boilers and petrochemical boilers. Greens also produces wind turbine towers. Greens has a fully owned subsidiary that builds and operates waste heat recovery power generators, biomass power generation and waste to energy power plants.

Business exposure

On the back of its leading reputation, Greens has a 66% market share of economizers in China and 38% globally. The company also remains China's largest supplier of heat recovery steam generators. Ongoing plans for diversified and stable income streams have led Greens to expand into wind turbine tower production and waste heat power generation. The company plans to further expand its manufacturing capacity in China and is also looking to tap the broader markets of South Asia and Central Asia.

Key financials

In 2009, the company's revenue increased by 28.7% yoy while its net profit increased by 13.3% yoy due to strong demand for the company's core product. In terms of revenue breakdown by product, the economizer, waste heat recovery products and boiler products accounted for 38%, 24% and 19% respectively. In 1H10, the company's recorded a 20% yoy decrease in revenue and a 12% reduction in net profit in 1H 2010 due to sluggish global demand and higher finance costs.

Figure 63: GREENS HOLDINGS LTD (Hong Kong: 1318, Currency: HKD)

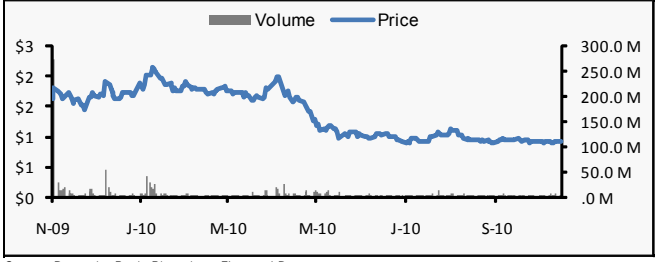
Description	
Address:	Rooms 1003B?1009 10th Floor Hutchison House 10 Harcourt Rd Central Hong Kong (SAR)
Website:	-

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	431	555	256
EBIT	74	84	40
Net Income	60	68	31
EPS (Diluted)	0.08	0.07	0.03
Book Value per Share	-	0.6	0.7
Total Assets	817	1,492	1,461
Cash Flow-Oper Activities	(14)	34	(16)
Capital Expenditures	(31)	(127)	(60)
Free Cash Flow	(44)	(93)	(75)
Return on Com Eqty (%)	22.4	10.8	-
Total Debt/Total Equity (%)	17.6	49.4	47.7

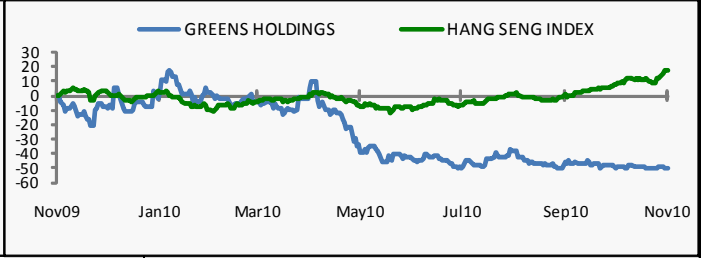
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Economisers	211.28	82.94
Waste Heat Recovery Products	133.18	48.37
Boiler Components	105.97	41.75
Waste Heat Power Generation	54.09	(1.35)
Services and Repairs	36.49	4.67

Key Statistics	
Share price (HKD)	0.9
52-Week Range	0.85 - 2.25
YTD performance	-47%
Avg Daily traded Val (3 Months, USD)	0.2
Market Value (USD mn)	144.6
Float %	26.6%
Major shareholder	ELLIS FRANK
% stake	27.7%
No. of employee	1,009

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Sichuan Crun (002272.CH, non-rated)

Company background

Sichuan Crun (Crun) is principally engaged in the research, development, production and sale of lubrication hydraulic equipment and related integrated systems, boiler components, as well as pressure vessels. The company provides thin oil lubrication system series (thin oil stations), drying oil centralized lubrication system series (drying oil stations), hydraulic control system series and related components, boiler components for large scale power stations, as well as vessels for energy and chemical industries. The company's products are mainly applied in building materials, metallurgical mining, electrical power, petrochemicals, construction machineries, light industry and other industries.

Business exposure

The company has proceeded to invest and sped up the installation of additional production lines for lubricating hydraulic systems (additional capacity of 5,000 systems per annum) which is expected to come online in 2011, a year ahead of schedule. Two additional projects in power generation and pressure vessel production (additional capacity of 150,000 tons p.a.) and waste heat power generation components (additional capacity of 130,000 tons p.a.) are already in initial production or testing.

Key financials

Orders for waste heat boilers shot up 656% from Rmb19m in 1H 2009 to Rmb147m in 1H 2010. Despite the positive order book, production bottlenecks persist and the company's capacity expansion has not yet completed. Accordingly, the company booked a revenue increase of 37.8% yoy for this business line. Overall, the company booked a 34.4% yoy increase in revenues while operating profit fell 31% yoy to Rmb19.5m on the back of increasing competition and cuts in ASP to capture more market share.

Figure 64: Summary description of Sichuan Crun Group (002272.SZ)

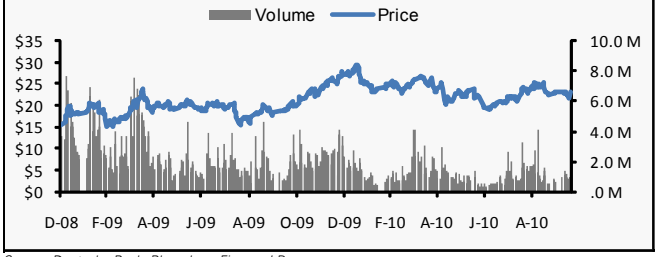
Description	
Address:	85 Gangbeiliu Road Modern Industry Port,Pi County Chengdu, Sichuan, 611743 China
Website:	www.chuanrun.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	319	408	228
EBIT	61	66	21
Net Income	50	61	17
EPS (Diluted)	0.61	0.60	0.15
Book Value per Share	4.0	4.3	6.0
Total Assets	631	829	1,037
Cash Flow-Oper Activities	(21)	(10)	(24)
Capital Expenditures	(115)	(112)	(36)
Free Cash Flow	(135)	(122)	(60)
Return on Com Eqty (%)	18.4	14.3	9.1
Total Debt/Total Equity (%)	22.5	44.9	13.4

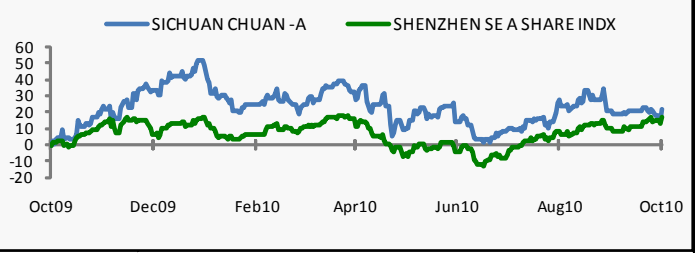
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Lubricating Hydraulic Machinery	275.14
Boiler Parts	106.79
Pumping Equipment	24.96
Others - Wind Electricity Generation	2.69

Key Statistics	
Share price (CNY)	23.06
52-Week Range	18.6 - 29.8
YTD performance	-15%
Avg Daily traded Val (3 Months, USD)	4.2
Market Value (USD mn)	394.0
Float %	21.2%
Major shareholder	LIHUA LUO
% stake	34.0%
No. of employee	1,573

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Dalian East (300125.CH, non-rated)

Company background

Dalian East New Energy is principally engaged in the design, engineering, construction and operation of a wide range of new energy equipments such as industrial waste heat boiler. The company was founded in 2008 through the restructuring of Dalian East Development Company and was listed on the Shenzhen Stock exchange in Oct 2010. The company's major shareholder, DL Like Tech Enginee holds a 30.2% stake and is engaged in the design, manufacturing, and installation of automation equipment systems and pressure vessels.

Business exposure

The company's key product is its waste heat boiler for power generation and various industries such as glass, steel, metallurgy and several chemical industries. To date, the company has received six practical innovative patens and one invention patent for pure low temperature waste heat power generation for cement kiln. The company is also involved in new energy technology for solar energy, wind energy, wave energy, geothermal energy, biogas energy as well as energy management contracting. Going forward, the company plans to rapidly develop and enhance its technology for waste heat boiler for the cement industry such that it will achieve a domestic market share of 20% by 2012.

Key financials

The company's revenue increased by 54% and net profit increased by 36% in 2009 due to higher contribution from the lower margin EPC and equipment installation business. Its gross margin for its equipment manufacturing and technological service improved by 4.5ppt and 6.77ppt, respectively in 2009. In terms of revenue breakdown by product, equipment manufacturing accounts for the bulk of the revenue and contributed 59% of the total.

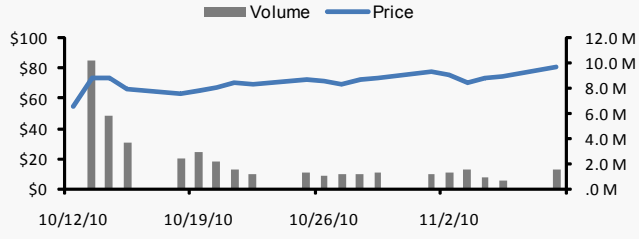
Figure 65: DALIAN EAST NEW ENERGY DEV-A (Shenzhen: 300125, Currency: CNY)

Description			
Address: No.2-1 Xuezi Street Hi-Tech Zone Dalian China			
Website: www.dleast.cc			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	253	389	260
EBIT	35	43	39
Net Income	28	38	34
EPS (Diluted)	0.95	1.07	0.77
Book Value per Share	1.7	4.1	4.8
Total Assets	308	462	533
Cash Flow-Oper Activities	(9)	23	56
Capital Expenditures	(2)	(19)	(3)
Free Cash Flow	(11)	4	53
Return on Com Eqty (%)	80.8	32.6	-
Total Debt/Total Equity (%)	33.2	2.9	0.0

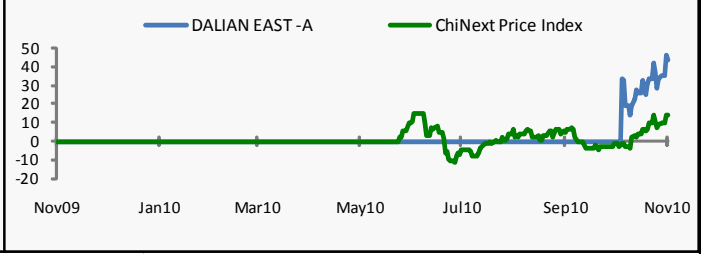
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Equipmment manufacturing	229.02	29.58
Technological Service	15.51	14.46
Design & installation	61.11	17.39
Engineering, procurement & construction (EPC)	83.70	14.59
EMC	2.62	1.97

Key Statistics	
Share price (CNY)	79.49
52-Week Range	55 - 81.82
YTD performance	-
Avg Daily traded Val (20 days, USD)	23.0
Market Value (USD mn)	697.4
Float %	25.4%
Major shareholder	DL LIKE TECH ENGINEE
% stake	30.2%
No. of employee	147

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Shuangliang Eco-Energy Systems (600481.CH, non-rated)

Company background

Shuangliang Eco-energy Systems (Shuangliang), formerly known as Jiangsu Shuangliang Air Conditioning Equipment, is principally engaged in the manufacture and sale of air-conditioning products and parts. Products include flue gas lithium bromide absorption chillers, lithium bromide heat pump chillers, silica gel adsorption chillers, high efficiency exchangers, and direct air-cooled condensers.

Business exposure

Shuangliang specializes in lithium bromide absorption chillers, heat exchangers and other products like silica gel absorption chillers. Shuangliang recently completed the launch of the nation's largest waste heat recovery system in Yangquan, Shanxi. It has about a 20% domestic market share in the lithium bromide absorption chiller market. The air cooler segment of the business has seen a 41% yoy growth for the past two years and remains one of the highest profit contributors to the firm.

Key financials

In 2009, the company's revenue decreased by 5.2% yoy to Rmb3,709m while its net profit increased by 237% yoy to Rmb355m. The decrease in revenue was mainly due to the decrease in industrial machinery sales while net profit increased due to a significant drop in operating cost. In terms of revenue breakdown by product, industrial machinery sales represent the biggest contributor, accounting for 64% of the total revenue. In 1H10, its revenue was up 16.9% yoy, though overall profit was down 38% yoy due to fluctuations in oil price which impacted the company's styrene products.

Figure 66: Summary description of Shuangliang Eco-Energy (600481.SS)

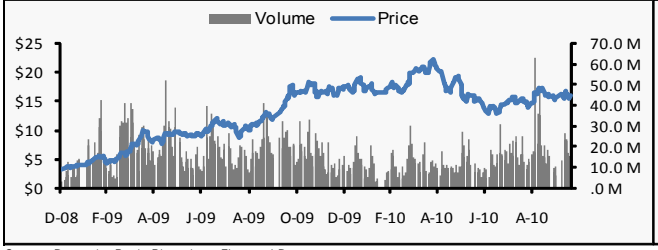
Description	
Address:	Shuangliang Industrial Park Ligang Town Jiangyin, Jiangsu, 214444 China
Website:	www.shuangliang.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	3,913	3,709	1,939
EBIT	169	502	149
Net Income	105	355	96
EPS (Diluted)	0.13	0.44	0.11
Book Value per Share	2.4	2.6	2.7
Total Assets	3,681	3,833	4,545
Cash Flow-Oper Activities	(106)	349	(185)
Capital Expenditures	(76)	(142)	(91)
Free Cash Flow	(182)	207	(276)
Return on Com Eqty (%)	7.3	17.7	14.6
Total Debt/Total Equity (%)	44.5	35.8	62.1

Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Industrial Machinery	2361.48
Air Cooler	574.72
Central Air-Conditioners	559.63
Heat Exchanger	166.01
Other Businesses	50.73

Key Statistics	
Share price (CNY)	17.92
52-Week Range	12.5 - 22.8
YTD performance	1%
Avg Daily traded Val (3 Months, USD)	44.6
Market Value (USD mn)	2,180.8
Float %	40.2%
Major shareholder	JIANGSU SHUANGLIANG
% stake	34.0%
No. of employee	1,911

Price and Volume (1 Year)



Comparative Returns

Source: Deutsche Bank, Bloomberg Finance LP

Ground source heat pump

Geothermal heat pumps basics

Geothermal heat pump or ground source heat pump (GSHP) is a centralized heating or cooling system that utilizes the moderate temperature of the ground surface to extract and transfer heat during the winter and summer seasons. It can transfer heat against its natural direction of flow from a colder space to a warmer space or it can enhance the natural flow of heat from a hotter space to a colder space. The direction of heat flow depends on its application. For heating systems that are designed for buildings, GSHPs extract heat from the ground during winter and transfer heat back during summer. However, for air conditioning, heat is transferred from a colder space to a warmer space.

GSHPs have attracted much public interest as the technology becomes more efficient. It is sometimes combined with solar heating to achieve greater efficiency. According to the US Department of Energy, GSHPs are among the most energy efficient technologies to provide HVAC and water heating.

Figure 67: Comparison with other HVAC technologies

Technology	Advantages	Disadvantages
Ground-Source Heat Pump (GSHPs)	1) Higher efficiency: Can produce 2-4x more energy than they consume 2) Low operating cost and environmentally friendly 3) Requires significantly less labor and maintenance compared to a conventional HVAC system	1) High Initial cost 2) Requires land or a pool of water to function
Air source heat pump	1) Low operational cost 2) Lower initial installation cost compared with GSHP	1) Efficiency of the system drops dramatically during the winter season 2) Higher operating cost compared with GSHPs
Electric heating	1) Low initial investment	1) Lowest efficiency 2) Highest operating cost among the various HVAC technologies
Boiler	1) Low initial investment	1) Pollution maker 2) High operating cost

Source: Deutsche Bank, Clean Energy Ideas

Key components and process

There are three main components in a GSHP system, namely 1) a ground loop, 2) a heat pump subsystem, and 3) a heat distribution system.

- **Ground loop:** The place where the transfer of heat between the GSHP system and the underground takes place. It consists of a pipe/ tubing that is buried underground in horizontal trenches or vertical boreholes. Water or an anti-freeze fluid is pumped through the pipe to extract that heat from the ground and the heat exchanger subsequently extracts the absorbed heat and transfers it to the heat pump.
- **Heat pump**: It is responsible for transferring the heat between the ground loop and the distribution system. The heat pump operates by using the compression and expansion of a refrigerant to drive heat flows between the ground loop and the heat distribution system.
- **Heat distribution system:** The system delivers the heating or cooling from the heat pump to the building.

Business model of GSHP enterprises

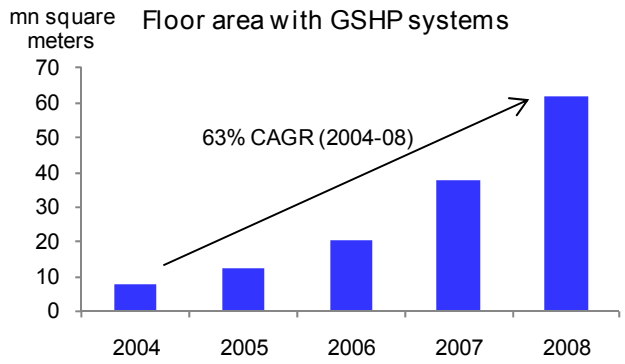
GSHP enterprises are primarily engaged in four main types of business model, namely 1) equipment manufacturers that specialize in heat pump manufacturing, 2) system installers responsible for the design and construction of the GSHP in new and existing buildings, 3) integrated manufacturers, which focus on both equipment manufacturing and system installation, and 4) Energy Management Contract (EMC) service providers responsible for equipment manufacturing and system installation, as well as providing operational and maintenance services for a contractual period.

Ground source heat pumps in China

Historical development

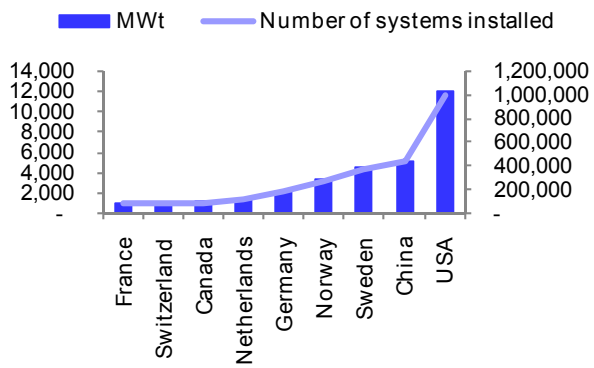
GSHPs were first introduced in China in 1997 through a joint development agreement signed between China's Science and Technology department and the US Department of Energy. The market for GSHP systems remained relatively stagnant until 2003, when it took off. Between 2003 and 2008, China's floor area with GSHPs increased by approximately 15-20m sqm per year to 62m sqm in 2008. Beijing was the first city to utilize GSHPs, followed by Shenyang, which currently has the largest floor area with GSHP systems (estimated 65m sqm by end-2010).

Figure 68: China cumulative floor area of GSHPs



Source: Deutsche Bank, Beijing Municipality New Energy and Renewable Energy Association

Figure 69: GSHP installed capacity in 2009



Source: Deutsche Bank, 2010 Ground Source Heat Pump Introduction Presentation, Lund

China's GSHP capacity second highest in the world

While the US and Sweden were the first countries to utilize GSHPs, China has been catching up rapidly given the benefits of ground source heat pumps over other heat sources. China's total installed capacity grew from only 631MWt in 2005 to 5,210MWt in 2009, representing a CAGR (2005-09) of 70%.

Market potential

China's GSHP market has significant potential for growth given 1) favorable government policies as a result of the country's aggressive energy intensity and carbon emission targets, 2) energy prices are on the rise, making GSHP systems economically more attractive, and 3) a large and growing building market driven by rapid urbanization and industrialization. Below we discuss the key drivers:

- **Favorable policy:** The government has laid out several policies supporting ground source heat pumps at both the national and provincial level. The most important national policy was to set GSHPs as one of the key areas for technological development in the 11th Five-Year Plan.

- **High energy prices:** China's energy prices have been increasing in the last decade due to rapid industrialization. With power tariffs likely to increase in the future, the energy savings from using GSHPs become more material.
- **Growing demand from the building market:** The demand for GSHP from the building market is likely to increase in the future due to 1) increasing awareness of GSHP products, 2) a rise in the number of new buildings due to rapid urbanization and industrialization, and 3) an increase in replacement demand as HVAC systems installed 10-15 years ago are about to reach the end of their useful lives.

Market structure

China's GSHP industry is characterized by a fragmented market structure. There are a large number of small enterprises, none of which has a dominant market share. According to China's GSHP Association, there are over 1,000 enterprises in the GSHP industry, with 20% of them involved in equipment manufacturing and the rest in system installation. There are also a few vertically integrated players involved in equipment manufacturing, system installation and operations and management. Enterprises involved in the operation of GSHPs are often equipment-affiliated EMC enterprises operating under the EMC model (refer to the EMC industry section for more details).

Regulatory framework

In recent years, the Chinese government has been very active in implementing measures to promote green technologies and products, some of which targeted GSHPs:

- In January 2006, the government released the technical code for ground source heat pump systems, which specifies the standards with regard to the design, construction, and operation of GSHPs. This should help to ensure the proper design and installation of ground loops and pump selection.
- In December 2006, GSHP was listed in the 11th Five-Year Plan as one of the key technological development priorities.

Besides these national supportive measures, there have also been some favorable policies implemented at the provincial level. One example is the "Measures for the Implementation of Special Support on Energy Retrofitting Projects," which was introduced by the Shanghai Municipal government. The measure states that the government will award Rmb300/t for every ton of standard coal saved for projects that saved more than 500 tons of coal every year and Rmb50/m^2 for GSHP projects.

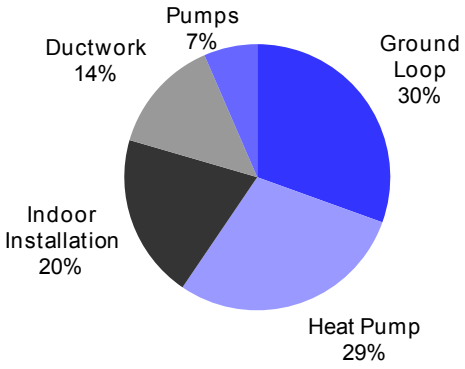
Economics of Ground Source Heat Pumps

The economics of the GSHPs industry are best understood in the context of a cost comparison with other types of HVAC systems, as they could easily be substituted. Below, we discuss the cost characteristics of GSHP against other traditional types of GSHP systems.

Highly efficient, resulting in lower operating costs

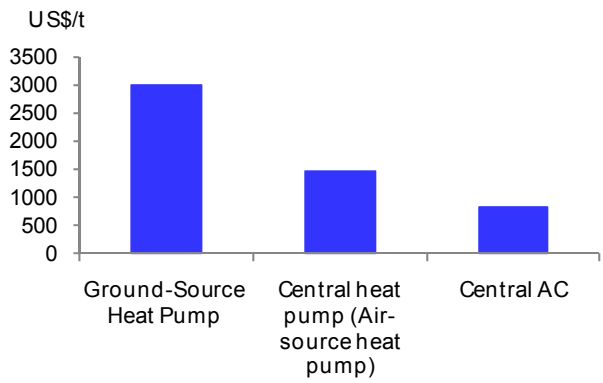
As we mentioned earlier, GSHPs are highly efficient and the amount of power required to heat/cool the area is significantly lower. Dr. John Lund from the Oregon Institute of Technology estimates that the savings in energy cost in the US are approximately 4x compared to electric heating and 2x compared to air source heat pumps, fuel oil and natural gas boilers. However, we would like to highlight that the amount of energy costs saved depends largely on the cost of fuel in the region.

Figure 70: Installation costs breakdown of GSHPs



Source: Deutsche Bank, US Department of Energy

Figure 71: Installation cost of residential HVAC by tech



Source: Deutsche Bank, EIA

Upfront investment and operational costs

The upfront investment cost of a ground source heat pump system that is used for cooling is significantly higher than conventional air conditioning system, at around Rmb500/m^2 vs. Rmb300/m^2. However, the operational cost of a ground source heat pump is 50% lower than the conventional air conditioning system.

Payback period

The payback period is a measure of the cost saved in operations compared to the installation cost. It is calculated as the difference in installation cost divided by the operational cost. Thus, the payback period varies greatly according to the benchmark HVAC system, assumed installation cost and energy cost in the city. Nonetheless, based on a study conducted by the China National Energy Research Institute (ERI), the payback period for typical GSHPs compared to traditional HVAC systems is about 5 to 10 years in China.

Risks

Lower electricity tariff

GSHPs are more efficient than other traditional forms of heat pumps and thus have lower operating costs. However, if the power tariff is low, the immediate advantage of a lower operating cost will not be that significant.

Lack of skilled installers and poor equipment design

The installation of GSHPs is rather complicated and each system is design-specific. Poor equipment design coupled with improper installation leads to less energy savings than expected.

Resource constraint

The application of ground source heat pumps requires a relatively large amount of space and this can be a problem for densely built areas. In addition, some ground source heat pump systems requires a huge body of water, which may not be available or its use may be prohibited.

Frequently asked questions and glossary of terms

How efficient is a ground source heat pump system?
Modern systems are very energy efficient. For each kV of power that is used to operate the heat pump, three to four kV of heat is delivered to the building.

Can the system provide both heating and cooling?
There are reverse-cycle heat pumps that can offer both heating and cooling services.

How do heat pumps compare with conventional alternatives?
GSHPs are generally highly efficiency and have lower operating costs than oil fired boilers and electric heating. However, the initial purchase cost of the heat pumps is a lot higher than conventional alternatives.

In which areas are GSHPs most applicable?
GSHPs are best suited for large building loads such as schools and commercial buildings. They are also better suited for new construction rather than retrofit.

Figure 72: Glossary of terms

Terms	Definition
Heating, Ventilating & Air Conditioning systems (HVAC)	A system that is used to provide adequate thermal heating and maintain good indoor air quality
Refrigerant	A substance that is used to provide cooling in a heat cycle. Common refrigerants include ammonia, sulfur dioxide, non-halogenated hydrocarbons and fluorocarbons.
Heat pump	A machine that transfers heat both to and from a source by employing a refrigeration cycle
Energy efficiency ratio	Ratio of heating output to electricity input
Boiler	A device that is used to create steam by transferring heat energy to water
EMC	Energy Management Contracting (EMC) is a business model in which an energy service company will provide an energy saving project to its customer without cost and share the benefit with the customer subsequently from the additional energy cost saving arising from the project.
Heat exchanger	A device that is built for efficient heat transfer from one medium to another

Source: Deutsche Bank

Ground source heat pump players

China Ground Source Energy (8128.HK, non-rated)

Company background

China Ground Source Energy is engaged in the environmental protection and geothermal energy business in China. Its core business is the shallow ground energy utilization system, which it designs, operates and manufactures. The company was formally known as IIN International Limited and was renamed in 2008 to China Ground Source Energy after its acquisition of two major acquisitions in environmental protection and shallow ground energy. Its main shareholder, Mr. Xu Shengheng, is the company's CEO and owns a 20% stake.

Business exposure

In an effort to promote its shallow ground source energy utilization business, the company has signed several co-operation agreements with various local governments. In 2009, the company entered into a co-operation agreement with the government of Xinbin Manchu Autonomous County and the government of Wafangdian City. In addition, it established a joint venture with Beijing Beiji Mechanical Industrial Co., which is mainly engaged in the production of ground energy heat pump mechanical units.

Key financials

In 2009 the company's total revenue increased 134% yoy to HK$326m, mainly due to the increase in sales of shallow ground energy utilization systems. However, it made a net loss of HK$173m due to a one-off non-cash impairment loss of HK$161m. In terms of revenue breakdown by product, the ground source heat utilization system accounts for 88%. In 1H10, sales of the shallow ground source heat system remained strong and increased 85% yoy.

Figure 73: CHINA GROUND SOURCE ENERGY (Hong Kong: 8128, Currency: HKD)

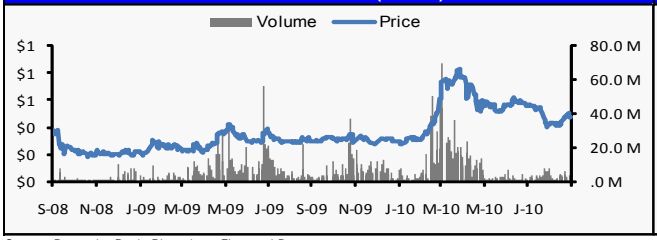
Description	
Address:	Room 1303 York House Landmark 15 Queen's Road Central Central Hong Kong (SAR)
Website:	www.iini.com

Financials (HKDmn)	Sep-08	Sep-09	1H10
Sales	139	326	162
EBIT	38	2	3
Net Income	9	(173)	21
EPS (Diluted)	0.01	-0.11	-46.40
Book Value per Share	0.6	0.5	-
Total Assets	1,554	1,477	1,477
Cash Flow-Oper Activities	189	1	146
Capital Expenditures	(22)	(57)	-
Free Cash Flow	166	(56)	-
Return on Com Eqty (%)	1.8	-20.0	-15.0
Total Debt/Total Equity (%)	28.1	30.0	15.4

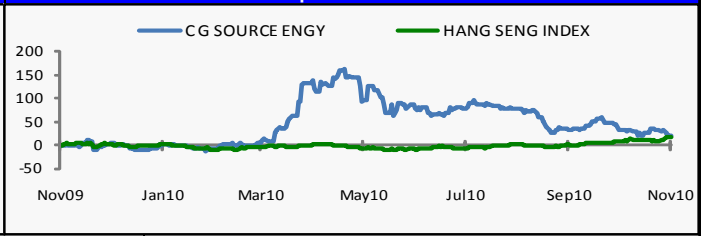
Business Segments (FY: Sep-09)	Revenue
Shallow Groud Energy Utilisation System	286.96
Environmental Protection	28.61
Securities Investment and Trading	9.95

Key Statistics	
Share price	0.38
52-Week Range	0.245 - 0.85
YTD performance	28%
Avg Daily traded Val (3 Months, USD)	0.176
Market Value (USD mn)	89.7
Float %	56.1%
Major shareholder	SHENGHENG XU
% stake	20.5%
No. of employee	600

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Yantai Moon Co. (000811.CH, non-rated)

Company background

Yantai Moon manufactures and sells air-conditioning and refrigeration equipment in Mainland China. The company's products include industrial and commercial refrigeration systems, compressors, condensers, chillers, low-temperature brine chillers, food freezers, evaporative coolers, and parts. It also manufactures other equipment, such as pressure vessels, dry food processing equipments, and vacuum frying equipments. The company was founded in 1988 and is headquartered in Yantai, Shandong province. Yantai Moon Co., Ltd. is c.24%-owned by Yantai Moon Group Co., Ltd.

Cooler way of saving energy

Yantai is a market leader in lithium bromide absorption chillers with about a 35% market share. Yantai and Shuangliang are the twin leaders in the lithium bromide absorption chiller market. Yantai is also a producer of innovative ground source heat pumps (GSHP), in which the heat pump achieved the country's grade I energy saving standard. Its GSHPs have been widely in applied in several areas such as for the heated water system for Guangzhou city as well as the 2008 Olympic Games.

Key financials

In 2009, the company's revenue decreased by 14.5% while its net profit increased by 129% due to a significant decrease in operating cost. In terms of revenue breakdown by product, its air conditioning and refrigeration equipment system accounts for 86% of the total revenue. In 1H 2010 revenues were up 9.7% on the back of strong performance from the air conditioning division. Operating profit was up 102% yoy. Yantai's performance is impressive primarily due to its more diversified end user customer base. Besides the servicing industry; the company is also a market leader in the food industry.

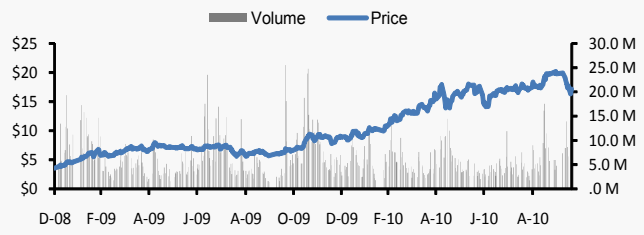
Figure 74: Summary description of Yantai Moon Co. (000811.CH)

Description			
Address: 80 Xishan Road, Zhifu District Yantai, Shandong, 264000 China			
Website: www.yantaimoon.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	1,172	1,000	577
EBIT	8	22	21
Net Income	36	83	58
EPS (Diluted)	0.14	0.31	0.22
Book Value per Share	2.0	2.2	2.3
Total Assets	1,554	1,570	1,631
Cash Flow-Oper Activities	21	176	(2)
Capital Expenditures	(32)	(27)	(5)
Free Cash Flow	(11)	149	(7)
Return on Com Eqty (%)	6.8	14.9	18.7
Total Debt/Total Equity (%)	77.7	61.9	56.4

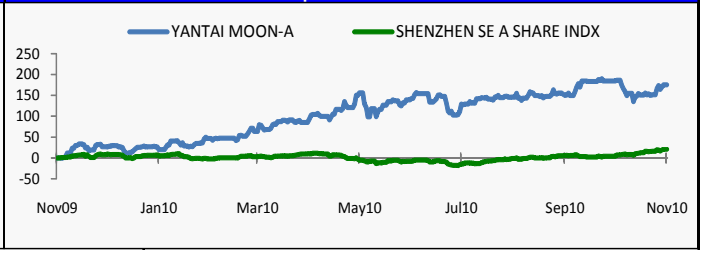
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Air Conditioning and Refrigeration Equipment	862.23
Air-Conditioning and Refrigeration Equipment Installa	93.10
Consulting Services	30.50
Others - Manufacturing and Sale of Material	23.21

Key Statistics	
Share price (CNY)	19.15
52-Week Range	6.94 - 20.5
YTD performance	115%
Avg Daily traded Val (3 Months, USD)	17.6
Market Value (USD mn)	756.8
Float %	50.3%
Major shareholder	YANTAI MOON GROUP CO
% stake	23.8%
No. of employee	1,613

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Light-emitting diode (LED)

LED basics

Light-emitting diode (LED), introduced in 1962, is a semiconductor device that converts electricity power into luminous energy. It is able to emit light of different colors depending on the materials used for its production. As compared to a traditional incandescent lighting system, LED has several advantages, such as more energy efficient, longer lifetime, smaller size and greater reliability. However, LED is relatively more expensive compared to traditional incandescent light sources. Nonetheless, LED is widely applied in general lighting, displays/screens, decoration lighting and backlighting.

Advantages of LED

- **Lighting efficiency:** LEDs emit more light per watt than incandescent bulbs, tungsten halogen lamps, and fluorescent lamps. Moreover, the lighting efficiency of LED bulbs is not affected by its shape and size, unlike fluorescent light bulbs.
- **Longer lifetime:** LEDs have a relatively longer lifetime, spanning from 50,000 to 100,000 hours under normal usage. On the other hand, fluorescent tubes can typically be used for about 10,000 hours, and incandescent light bulbs for about 1,000 hours.

Figure 75: Comparison of lumen and life span among various light sources

Light source	Lighting efficiency (lm/W)	Avg. life span (h)
Incandescent lamp	15	1,000
Fluorescent lamp	70	10,000
Energy saving lamp	60	8,000
Metal halide lamp	75-95	6,000-20,000
High voltage sodium lamp	80-120	24,000
High frequency electronic discharge lamp	50-70	4,000-80,000
LED	200	100,000

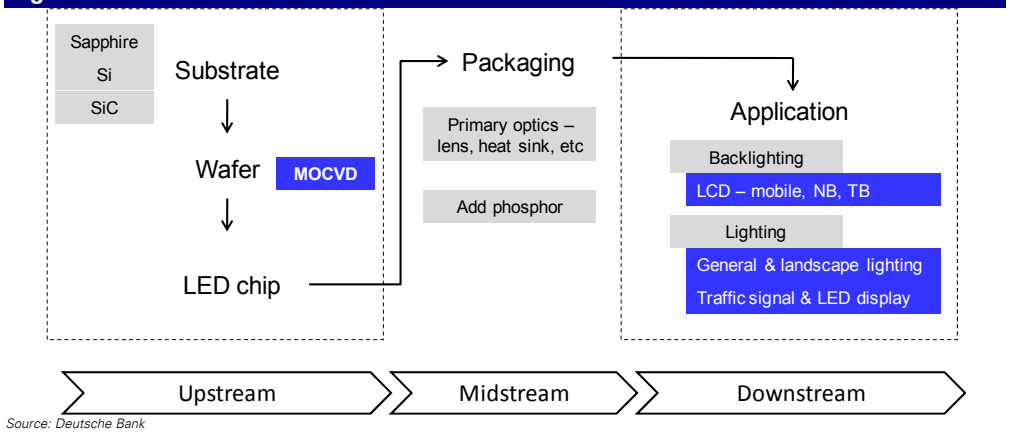
Source: "Semiconductor Lighting Technology", Deutsche Bank

- **Less toxic to the environment:** LEDs do not contain mercury, unlike fluorescent lamps, energy saving lamps and metal halide lamps.
- **Shorter on/off time:** LEDs can light up very quickly within dozens of nanoseconds, while incandescent light bulbs require approximately 0.5 seconds.
- **Stronger structure and shock resistance:** The materials used to manufacture the LEDs are non-brittle and strong; thus, they are less likely to be damaged.
- **Ability to direct and focus the light source:** LEDs can be designed to focus its light at one point while incandescent and fluorescent sources often require an external reflector to collect light.

Overview of LED industry value chain

The LED industry in China can be categorized into upstream (substrate, epiwafer and chip), midstream (packaging and modeling), and downstream (LED lighting applications).

Figure 76: LED value chain



Source: Deutsche Bank

Upstream – substrate, epiwafer and chip

- Step 1: Choosing the appropriate substrate material – sapphire substrate, silicon carbide (SiC) substrate and silicon (Si) substrate
- Step 2: Use MOCVD to grow epitaxy on substrate
- Step 3: Conduct the doping, cutting and sorting of the substrate into LED chip

Midstream – packaging and modeling

- Step 1: Pack the LED chip with primary optics
- Step 2: Add phosphor and electronic
- Step 3: Solidify with optical lens, quality examination thereafter

Downstream – LED light application

- Lighting – general lighting, traffic signals, landscape lighting, automobile lighting application and LED display
- Backlighting – notebook, TV, mobile phone and so forth

As the key focus of this report is on energy saving and energy efficiency, the discussion of LED application will be focused on LED lighting.

Policy for LED industry development

Many countries and regions are now launching policies to promote energy efficiency and environmental protection in the lighting industry by gradually eliminating high energy consuming bulbs.

China

China's policy support for a more energy efficient lighting industry dates back to 2003. Companies that are engaged in the production of LEDs have received subsidies/awards from the National Development and Reform Committee (NDRC) for its technology innovation, new product development and application of energy efficient lighting bulbs since 2006.

- **Progressive plan for LED street lamp replacement:** The Ministry of Science and Technology (MOST) launched an aggressive LED promotion plan in 2008 stating that

street lamps should be replaced with LED light bulbs. During the trial phase of the LED promotion plan, MOST chose 10 cities to install 10,000 LED light bulbs per city.

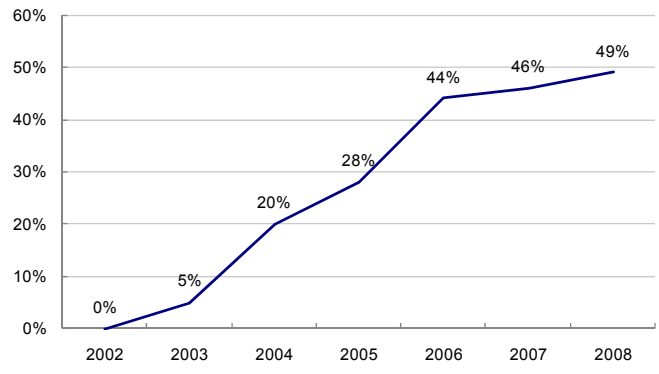
- **Pilot phase (2009):** Around 1m LED street lamps will be installed in 21 cities. In terms of equipment localization requirement, MOST requires that a minimum of 60% of the components be produced in mainland China.
- **Demonstration phase (2010-12):** MOST targets to install 2m LED street lamps within 50 cities. At the same time, it aims to achieve a 70% localization rate for LED-related components.
- **Promotion phase (2013-15):** By the end of 2015, the market share of LED products should account for 30% of the total lighting industry in China.

- **Guidance from NDRC on China's LED development:** In late 2009, the NDRC released the "Opinion on Semiconductor Lighting Industry Development" document, which provides guidance for China LED industry in respect to its market growth target as well as the technology standard. We highlight the key emphasis of the document below.
  - Achieve an average annual growth rate of 30% between 2009 and 2015.
  - Market penetration of LED lighting products to increase to 20% in functional lighting, 50% in backlighting and 70% in landscape lighting by 2015.
  - Promote localization of MOCVD, key raw materials and LED chips. Specifically, the localization of chips should reach 70% by 2015.
  - Enhance market concentration by developing three to five dominant upstream chip manufacturers and 10 leading companies with proprietary technology and brand.
  - An annual electricity savings of 40bn kWh, which is equivalent to 40m tons of carbon emission reduction.

Upstream market – substrate, epiwafer and chip

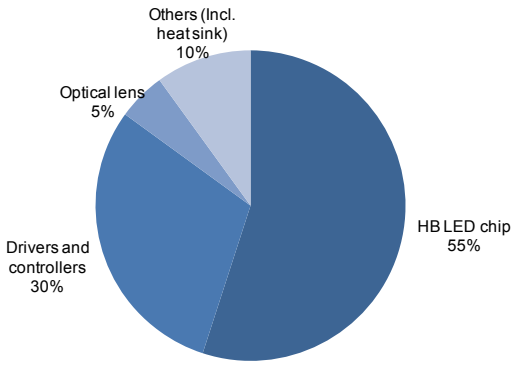
The upstream market of the LED industry consists of luminescent materials, substrates, epiwafers and chips. Upstream players generally make a high profit margin as there is less competition in the upstream market due to the high technology requirement. According to MOST, in terms of segment breakdown, profit from the upstream LED enterprises accounts for up to 70% of the total industry profit.

Figure 77: Localization rate of chip manufacturing



Source: Deutsche Bank, China Solid State Lighting Alliance

Figure 78: Cost breakdown of LED lamp



Source: Deutsche Bank

Equipment and technology for LED upstream market

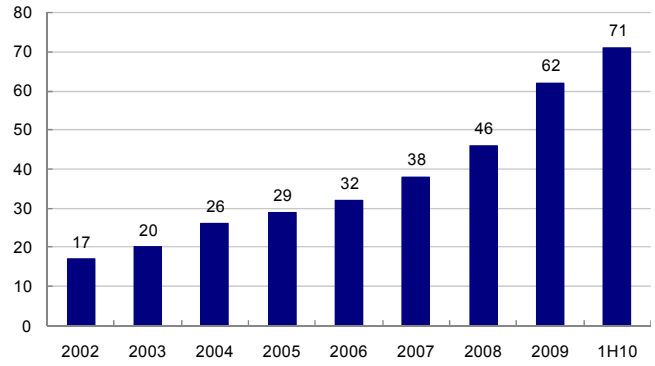
The manufacturing of epiwafer relies highly on special equipment such as the metal-organic chemical vapor deposition (MOCVD) that is used to produce GaN epitaxial wafers and blue/green/purple LED chips. The market structure for MOCVD equipments is characterized as an oligopoly market dominated by AIXTRON (headquartered in Germany) and Veeco (headquartered in the US). Though China launched its first domestic MOCVD production in 2009, the ramp-up process is still ongoing and a quality track record takes time to build.

The material and technology used in the production have a critical effect on the performance of the chip. Currently, there are three types of materials used for production, namely, 1) sapphire, 2) silicon carbide, and 3) silicon. Sapphire substrate, known for its hardness, is the most commonly used material of the three, as the production technology associated with sapphire substrate is relatively more mature. On the other hand, chips produced using SiC or Si substrates have a higher cost but better performance.

China market landscape in LED chip manufacturing

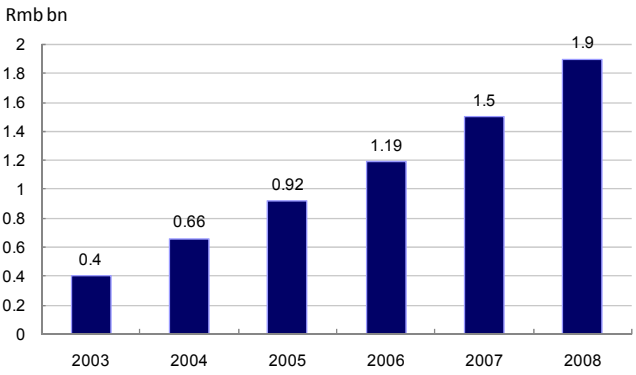
According to LEDinside, the LED chip industry in mainland China has been developing rapidly in the past 10 years, with the number of LED chipmakers increasing significantly from only three in 1998 to 62 by August 2009 and 71 in 1H10 (Figure 79). The market size of China's LED chip industry exceeded Rmb2bn in 2009. In 2010, China plans to introduce over 1,200 MOCVDs in the next few years, and the government is likely to grant subsidies to LED chip manufacturers for purchasing MOCVD equipment at about Rmb8-10m per unit.

Figure 79: Number of LED chip manufacturers in China



Source: LEDinside, China Solid State Lighting Alliance

Figure 80: China LED chip manufacturing market value



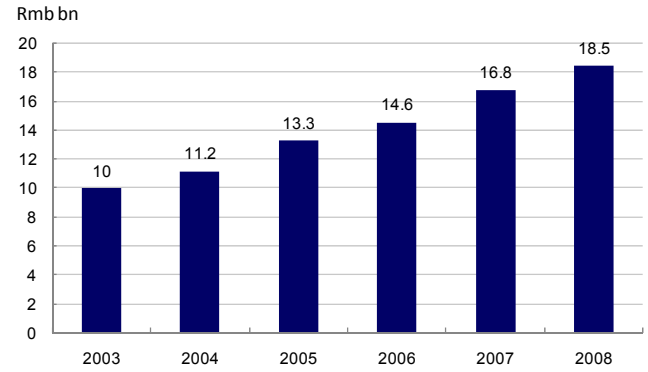
Source: Deutsche Bank, the Optoelectronics Branch of China Electronics Materials Industry Association

Midstream – packaging

LED packing and modeling refers to a series of processes conducted to make the LED chip usable in application. The purpose of packaging is to address three major issues of LED application – concentrated light, heat sink and electrostatic prevention (sapphire, as an insulator, is highly sensitive to static electricity).

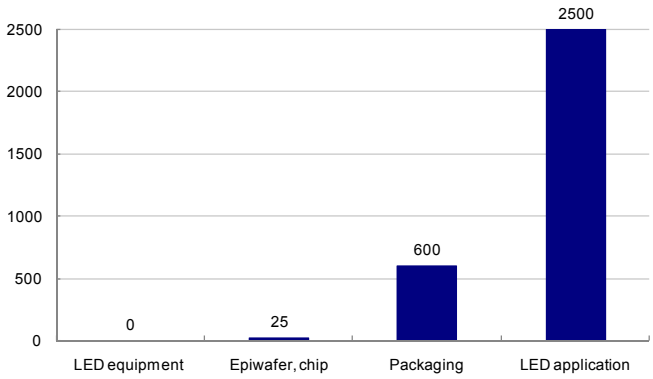
LED packaging is highly labor-intensive. China, with its abundance of labor resource, is able to ride on the exploding packaging market. According to LEDinside statistics, revenue of global LED packaging manufacturers reached US$8bn in 2009, increasing 5% yoy. MOST released that the LED packaging in China grew 10% yoy to Rmb18.5bn in 2008. China accounts for approximately one-third of the global LED packaging market. However, in terms of profit breakdown, packaging merely contributes 10-15% to total profit of the LED industry.

Figure 81: China LED packaging market



Source: Deutsche Bank, LEDinside

Figure 82: Number of LED market players

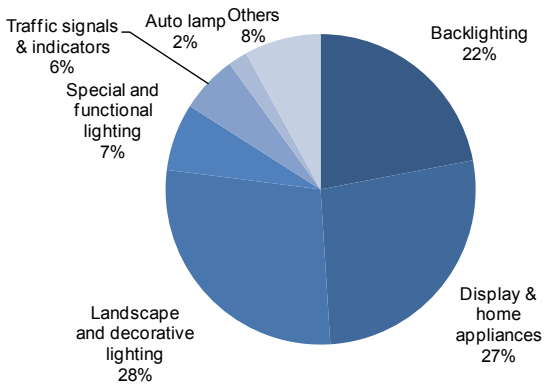


Source: Deutsche Bank, China Solid State Lighting Alliance

Downstream – LED lighting application

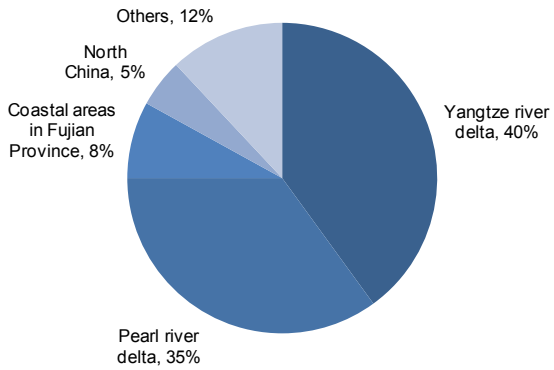
Lighting consumes about 20% of total electricity globally. In China, about 12% of the power consumption is attributable to lighting. Thus, potential energy saving in the lighting industry will have a significant effect on a country's overall power consumption. As such, the government is promoting the use of LED lighting in general lighting, traffic signals, landscape lighting, automobile lighting application, and LED display.

Figure 83: 2008 LED application breakdown



Source: Deutsche Bank, China Solid State Lighting Alliance

Figure 84: China LED market size by region



Source: Deutsche Bank, China Solid State Lighting Alliance

General lighting

General lighting mainly includes portable lighting, indoor lighting and outdoor lighting. High initial investment cost is the major concern for using LED in the general lighting industry. However, when LED is used for general lighting, it has the advantage of consuming less energy and producing less heat, which is important as excessive heat is a fire hazard.

LED miner light

Bulb explosion beneath the ground is one of the major triggers for coalmine accidents. As a result, LED miner light has been greatly promoted since 2005. The advantages of LED miner light are lighter weight, longer lifetime and low maintenance.

Figure 85: Comparison of LED application in miner light

Miner light type	Traditional type	LED type
Weight	2,500g	200g
Explosion-proof	May explode	No
Light efficiency	8lm/W	40lm/W
Life span	150h	10,000h
Maintenance	NA	Low
Lighting feature	Dim after 11 hours	No change

Source: "Semiconductor Lighting Technology", Deutsche Bank

LED street lamp

Currently, the bulk of street lamps in China are high voltage sodium lamps. The replacement of LED street lamps have hastened in the recent years as a result of the government's pilot LED replacement plan. According to scientific research on human vision, people feel that light emitted by LED street lamps is brighter than high voltage sodium lamps.

Figure 86: Comparison of LED application in street lamps

	LED	High voltage sodium lamp	High halide lamp
Wattage	100	250	250
Light efficiency (lm/W)	90	110	90
Lumen	9,000	27,500	22,500
Light output ratio	1	1	1
Utilization factor	1	0	0
Vision sense of light efficiency	Increase	Decrease	Slightly increase
Color rendering index	>80	25	65
Life span	50,000	15,000	10,000

Source: "Semiconductor Lighting Technology", Deutsche Bank

LED application in other lighting fields

The display and landscape lighting industry has become an increasingly important market for LED. A ground LED display was used in the opening ceremony of the 2008 Beijing Olympics with 4,000m² in area, the world's largest full-color ground LED display. LED is also used for decorative lighting in buildings. The Oriental Pearl Tower in Shanghai uses 220 units each of red/green/blue LED lighting bulbs to exhibit a changing color effect. The Water Cube in Beijing uses 500,000 units of larger-power LED lighting bulbs in the appearance of the architecture, making it the world's largest LED decorative lighting construction.

Figure 87: ASP of major products in LED industry move to end

Product	ASP
Substrate	US$25 for 2 inches blue sapphire substrate; US$170-180 for 4 inches blue sapphire substrate
High-brightness LED wafer	US$1/cm2
Chip	US$0.05-0.19 per unit
Chip after packaging	US$0.07-0.25 per unit
Lighting application	
Spotlight (4.5W)	US$15
Recessed light (10W)	US$45
Street lamp (56W)	US$270

Source: Deutsche Bank, LEDinside

Frequently asked questions and glossary of terms

How efficient are LED bulbs compared to incandescent bulbs?
The efficiency of LED light bulbs is more than five times higher than comparable incandescent bulbs. In other words, LED light bulbs use only about 20% as much electricity to produce the same amount of light.

What is the payback period if we replace an incandescent bulb with an LED bulb?
The payback period of replacing an incandescent bulb with an LED bulb is about 5-7 years. It depends on the electricity tariff in different areas, i.e. areas with a higher tariff may have a shorter payback period. With declining LED bulb price and rising electricity price, the payback period could be shorter in the future.

How does the brightness of LED lighting compare to incandescent lighting?
LED light bulbs emit much brighter light than incandescent or halogen bulbs of the same wattage, but LED bulbs are not available in very high wattages. Thus, when replacing high voltage incandescent or halogen lamps with LED lamps, more LED lamps are needed.

What is the gross margin trend along the LED value chain?
Companies in the upstream market of the LED value chain usually enjoy a high gross margin of about 45% as the competition is not as fierce as the middle or downstream markets. The competition is lower due to a higher technology barrier in the upstream market. In LED packaging, the gross margin is lower at around 30-35% for purely packaging companies. For companies engaged in LED application, the gross margin usually ranges from 25-30%.

What is the price of LED, compared with fluorescent bulbs and incandescent bulbs?
A 5W LED bulb usually costs Rmb200, compared to an 11W fluorescent bulb of Rmb65 per unit. However, in terms of lighting efficiency, a 5W LED bulb has a higher lighting efficiency of up to 70-80lm/W, compared to 57lm/W for an 11W fluorescent bulb and 12lm/W for a 40W incandescent bulb.

What is the price trend of LED?
According to LEDinside, the price for LED bulbs has decreased from Rmb0.27/lm (US$0.04/lm) in 1Q08 to Rmb0.14/lm (US$0.02/lm) in 2Q09. The price of LED bulbs may fall further as the raw material price comes down.

Figure 88: Glossary of terms

Terms	Definition
Incandescent lamp	Incandescent light bulb is a source of electric light that works by incandescence. An electric current passes through a thin filament, heating it to a temperature that produces light.
Fluorescent lamp	Fluorescent lamp is a gas-discharge lamp that uses electricity to excite mercury vapor. The excited mercury atoms produce short-wave ultraviolet light that causes phosphor to fluoresce, producing visible light.
High-intensity discharge (HID) lamp	A type of electrical lamp that produces light by means of an electric arc between tungsten electrodes housed inside a translucent or transparent fused quartz or fused alumina arc tube.
Metal-organic chemical vapor deposition (MOCVD)	Specialized equipment to manufacture Gallium Nitride (GaN) epitaxial wafers and blue/green/purple LED chips.
Lumen	A measure of the power of light perceived by the human eye.
Sapphire	A gemstone variety of the mineral corundum; because of the remarkable hardness of sapphires, sapphires are used in some non-ornamental applications, such as very thin electronic wafers, which are used as insulating substrates.
Epitaxial wafer (Epiwafer)	An epiwafer is a wafer of semiconducting material made by epitaxial growth (called epitaxy) for use in making microelectronic devices such as light-emitting diodes (LEDs). Two methods of growing the epitaxial layer on existing silicon or other wafers are currently used: metal organic chemical vapor deposition (MOCVD) and molecular beam epitaxy (MBE).
Backlighting	A form of illumination used in liquid crystal displays (LCDs) to illuminate the LCD from the side or back of the display panel.
Light efficiency	Generally refer to the amount of lumen for a single watt of power

Source: Deutsche Bank

Risks

Technology risk

LED industry is a technology intensive and capital-intensive business in the midstream and upstream markets. China LED players are highly dependent on its foreign counterparts for technological expertise. The localization of core equipment and key material may take a long time to realize or upgrade, which potentially jeopardizes China players' business performance due to low bargaining power with suppliers.

Fierce competition

The market rush in China's LED industry in recent years results in an exploding number of players in the market. Competition in upstream epiwafer/chip producers is emerging, not to mention the downstream market, which usually operates in the OEM mode. The price volatility and margin contraction may be inevitable due to tense market competition.

Policy risk

Current policy support for LED industry development mainly includes subsidies for the purchase of MOCVD and preferential tax treatment for LED enterprises. The penetration of LED is relatively low in the market, creating more need for concrete policy support from the government. Unlike many countries' policies on the prohibition of incandescent light bulbs, policies in China seem to be mild to avoid more market rush. A change in policy stance towards LED will likely hamper the growth of the nascent domestic LED market, which is highly policy driven.

LED players

Neo-Neon (1868.HK, non-rated)

Company background

Neo-Neon is an investment holding company with operating segments of decorative lighting, general illumination lighting, entertainment lighting and all others. As a pioneer in LED application products, Neo-Neon is specialized in the design and manufacturing of LED applications and was listed in Hong Kong in 2006 and the company's president holds a majority stake of 36.74%.

Business exposure

Neo-Neon's product line can be categorized into incandescent decorative lighting, LED decorative lighting, LED general illumination lighting, entertainment lighting and others. The company vertically integrates its LED business in terms of expanding into LED chip manufacturing and LED packaging since 2008. Neo-Neon plans to enlarge its LED manufacturing capacity in Yangzhou and Jiangmen to reach a capacity of 230,000 LED wafers, or 5bn LED chips, per month. The company's production capacity should reach 45,000m units of wafer, or 900m chips, per month (from 15,000 units per month) by end-2010.

Key financials

In 1H10, Neo-Neon recorded revenue of HK$730m and net profit of HK$99m, up 31.7% and 134.8% yoy, respectively. Revenue of LED decorative lighting and LED general illumination lighting reached HK$354m and HK$165m, an increase of 28.1% and 228.5% yoy, respectively, mainly due to increasing demand of LED street lamps.

Figure 89: Summary description of Neo-Neon Holdings (1868.HK)

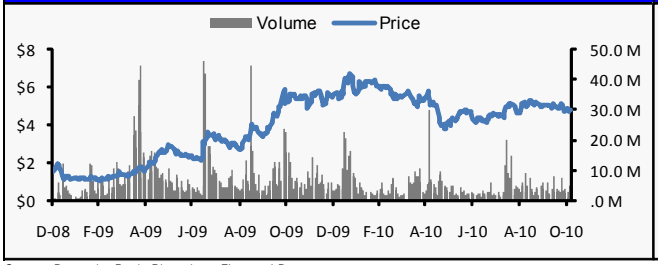
Description	
Address:	13F Tower A New Mandarin Plaza 14 Science Museum Road Kowloon Hong Kong (SAR)
Website:	www.neo-neon.com

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	1,618	1,111	730
EBIT	106	73	118
Net Income	139	158	99
EPS (Diluted)	0.18	0.20	0.11
Book Value per Share	3.3	3.5	3.7
Total Assets	3,125	3,963	4,270
Cash Flow-Oper Activities	160	29	(206)
Capital Expenditures	(238)	(113)	(80)
Free Cash Flow	(78)	(84)	(286)
Return on Com Eqty (%)	5.7	5.5	7.3
Total Debt/Total Equity (%)	13.3	17.0	15.9

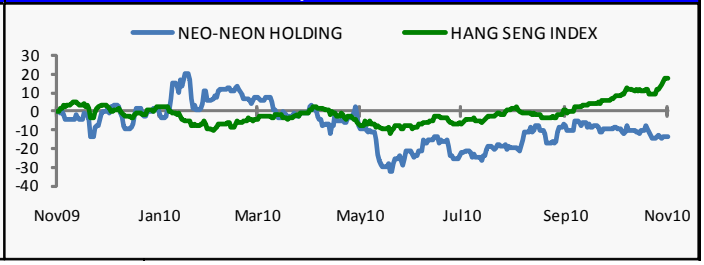
Business Segments (FY: Dec-09)	Revenue
Lighting Products	1111.46

Key Statistics	
Share price	4.77
52-Week Range	3.75 - 6.84
YTD performance	-15%
Avg Daily traded Val (3 Months, USD)	2.8
Market Value (USD mn)	564.5
Float %	60.1%
Major shareholder	BEN FAN
% stake	36.7%
No. of employee	13,000

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Sanan Optoelectronics (600703.CH, non-rated)

Company background

Sanan Optoelectronics is primarily engaged in full-color high-brightness LED wafer and chip manufacturing. The company also manufactures solar cell and PIN photodetectors. Sanan Optoelectronics was listed in Shanghai in 2008 and is controlled by Xiamen Sanan Electronics, which holds a 35% stake of the company.

Business exposure

Sanan Optoelectronics' major products are LED wafer, LED chip and solar products. Equipped with 51 units of MOCVD (21 units in Xiamen manufacturing base and 30 units in Tianjin), the company is ranked first in China and in the top five globally for LED wafer manufacturing, with an annual capacity of 2.7m units in 2009. The company is likely to have over 100 units of MOCVD equipment installed after the completion of the third phase of Tianjin Sanan. The annual capacity of LED chips reached 18bn units in 2009.

Key financials

LED chips were the biggest revenue contributor for Sanan Optoelectronics, accounting for 96.7%, or Rmb454.86m, of total revenue in 2009. In 1H10, revenue from LED chip sales reached Rmb244.8m, or 67.1% of total revenue. In addition, the company booked revenue of Rmb106.3m for LED application from its Wuhu Sanan subsidiary in 1H10. The blended gross margin rose 4.43ppt to 43.54% in 1H10. Sanan Optoelectronics plans to add another 5.3m units of LED-wafers and 117bn units of LED chips of annual capacity.

Figure 90: Summary description of Sanan Optoelectronics Co. (600703.CH, non-rated)

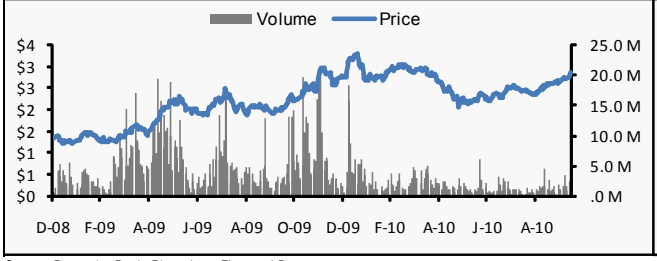
Description	
Address:	72 Sanwan Road High & New Tech Devpt Zone Shashi District Jingzhou, Hubei, 434000 China
Website:	www.tianyi.cc

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	212	465	362
EBIT	71	163	136
Net Income	52	180	202
EPS (Diluted)	0.14	0.36	0.36
Book Value per Share	1.0	2.6	3.0
Total Assets	861	2,062	2,858
Cash Flow-Oper Activities	67	241	475
Capital Expenditures	(83)	(315)	(1,066)
Free Cash Flow	(16)	(74)	(591)
Return on Com Eqty (%)	-	18.6	29.6
Total Debt/Total Equity (%)	61.9	33.9	45.6

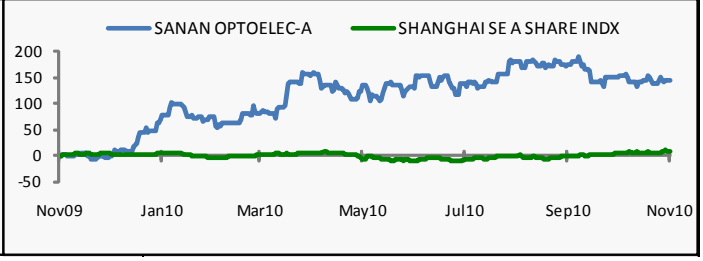
Business Segments (FY: Dec-09)	Revenue -
LED Semiconductor	454.86
Building Materials	11.45
Processing Income	3.10
Rental Income	0.66
Labor Services	0.22

Key Statistics	
Share price	43.37
52-Week Range	16.5 - 53.89
YTD performance	64%
Avg Daily traded Val (3 Months, USD)	49.8
Market Value (USD mn)	4,276.5
Float %	25.4%
Major shareholder	XIAMEN SANAN ELECTRO
% stake	35.0%
No. of employee	1,098

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Lianchuang Optoelectronic (600363.CH, non-rated)

Company background

Lianchuang Optoelectronic, found in 1999, is engaged in the research, design, manufacturing and sales of LED wafer, chip and LED lighting application. The company also produces optoelectronic cables. Lianchuang Optoelectronic was founded in 1999 and was listed in Shanghai in 2001. Jiangxi Electronics Group, as the major shareholder, holds a 24.5% stake in the company. In October 2010, Jiangxi Electronics Group transferred its entire stake to Ganshang United.

Business exposure

Lianchuang Optoelectronic's product line is divided into three categories – LED wafer/chip, LED applications, and optoelectronic cables. Major LED applications include LED street lamp, LED tube light and LED backlighting. The company distributes its products into overseas markets. The company will likely explore business opportunities in energy management contract (EMC) to enhance its market penetration.

Key financials

In 2009, Lianchuang Optoelectronic revenue decreased 8.7% to Rmb1.1bn while net profit increased 12.1% to Rmb36.9m. Revenue from its LED reached Rmb590m and accounted for 53% of total revenue. In 1H10, revenue from the LED business increased 60.4% to Rmb420m, while its revenue mix increased 73.7%. Net profit from the LED business increased 530% to Rmb14.8m. Management expects to achieve total revenue of Rmb1.2bn in 2010. Export revenue reached Rmb141.8m in 1H10, or 24.8% of total income.

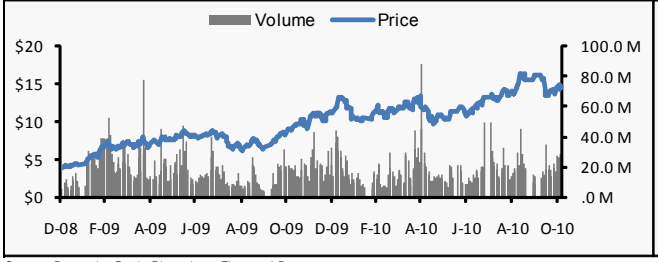
Figure 91: Summary description of Jiangxi Lianchuang Optoelectronic (600363.CH, non-rated)

Description			
Address:	168 Jingdong Avenue Hi-tech Ind Dvlp Zone Nanchang, Jiangxi, 330096 China		
Website:	www.lianchuang.com.cn		
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	1,213	1,108	571
EBIT	48	23	21
Net Income	33	37	47
EPS (Diluted)	0.09	0.10	0.13
Book Value per Share	2.3	2.3	2.4
Total Assets	1,693	1,862	1,764
Cash Flow-Oper Activities	44	88	(20)
Capital Expenditures	(89)	(65)	(25)
Free Cash Flow	(45)	23	(45)
Return on Com Eqty (%)	4.0	4.3	9.1
Total Debt/Total Equity (%)	38.6	45.0	33.0

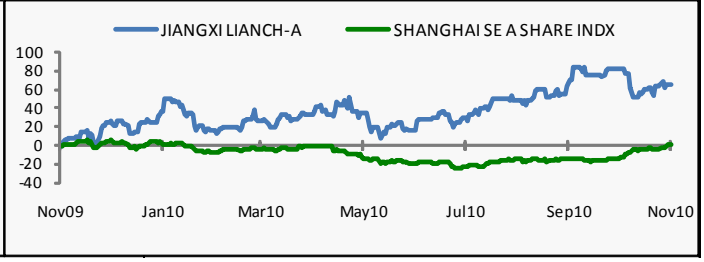
Business Segments (FY: Dec-09)	Revenue	
Opto-electrical Product	592.27	127.07
Cable	366.04	51.61
Telecommunication Product	70.66	39.78
Computer and Software	54.60	2.68
Other Revenue - Telephone	29.32	6.62

Key Statistics	
Share price	14.57
52-Week Range	8.64 - 16.77
YTD performance	31%
Avg Daily traded Val (3 Months, USD)	39.0
Market Value (USD mn)	811.6
Float %	68.0%
Major shareholder	JIANGXI ELECTRONICS
% stake	24.5%
No. of employee	4,939

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Silan Microelectronics (600460.CH, non-rated)

Company background

Silan Microelectronics is engaged in the design and manufacturing of integrated circuit (IC), discrete devices, and LED wafer/chip. Silan was originally a semiconductor manufacturer, but in 2004, the company entered into the LED wafer/chip manufacturing market. The company recently extended its LED business to packaging as well. The company was listed in Shanghai in 2003 and is controlled by Silan Holdings (47.3%).

Business exposure

Silan Microelectronics operates in three product categories – IC, discrete devices and LED wafer/chip. The company's IC products are widely applied in various industries, including digital audio/video, power management, LED lighting driver, remote control transmitter and measurement meter. In the LED business, the company has nine units of MOCVD with a production capacity of 550m units of LED chips per month. Silan Microelectronics plans to invest Rmb500m to expand its capacity of LED chips in its Hangzhou manufacturing base to c.1,100m units per month after a two-year construction period.

Key financials

Silan Microelectronics recorded revenue of Rmb953m and net profit of Rmb76.6m in 2009, Rmb202m of which came from LED business revenue (21% of total revenue) and Rmb28.9m from LED business net profit (38% of net profit). In 1H10, Silan Microelectronics reported revenue of Rmb696m, of which revenue from LED business accounted for 26.5% (Rmb185.9m, increasing 191.9% yoy) in 1H10. The gross margin of LED chips reached 49.25% in 1H10, 14.5ppt higher than the blended gross margin of the company.

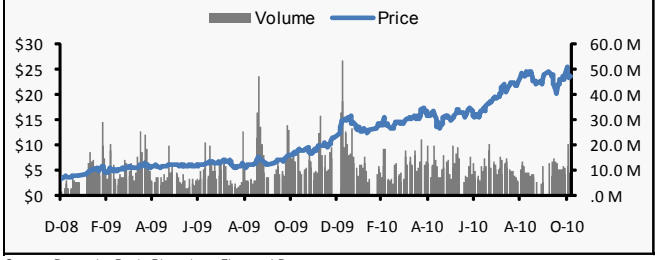
Figure 92: Summary description of Hangzhou Silan Microelectronics (600460.CH)

Description			
Address: 4 Huanggu Shan Street Hangzhou, Zhejiang, 310012 China			
Website: www.silan.com.cn			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	926	953	696
EBIT	18	40	133
Net Income	14	77	119
EPS (Diluted)	0.03	0.19	0.30
Book Value per Share	1.8	2.0	2.2
Total Assets	1,763	1,799	1,895
Cash Flow-Oper Activities	(12)	88	123
Capital Expenditures	(55)	(73)	(113)
Free Cash Flow	(68)	16	10
Return on Com Eqty (%)	1.6	10.0	22.1
Total Debt/Total Equity (%)	107.6	85.9	76.9

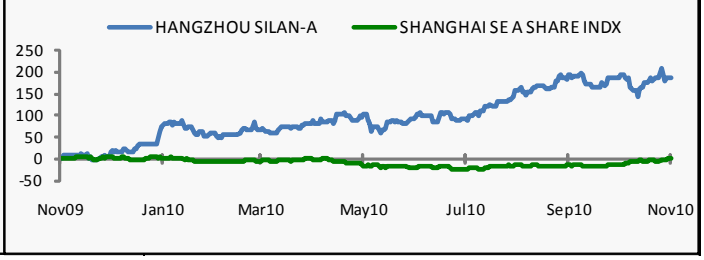
Business Segments (FY: Dec-09)	Revenue
Integrated Circuit	443.72
Discrete Semiconductors	306.52
Light Emitting Diode	201.92
Other Integrated Circuits	5.69
Other Reveue	2.02

Key Statistics	
Share price	23.72
52-Week Range	8.01 - 25.66
YTD performance	110%
Avg Daily traded Val (3 Months, USD)	32.6
Market Value (USD mn)	1,546.8
Float %	38.9%
Major shareholder	HANGZHOU SHILAN HOLD
% stake	47.3%
No. of employee	696

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Zhejiang Yankon (600261.CH, non-rated)

Company background

Zhejiang Yankon is primarily engaged in the development, manufacture and distribution of lighting appliances. The company's lighting products covers applications in office lighting, commercial lighting and household lighting. The company also provides electrical equipment, such as switches and sockets. Established in 1975 from the predecessor of the Shangyu Bulb Factory, Zhejiang Yankon is a leading lighting appliance manufacturer in China and distributes its products in overseas market through original equipment manufacturers (OEM). The company was listed in Shanghai in 2000.

Business exposure

Zhejiang Yankon's major products include integrated electronic energy saving lamps, compact rare earth energy saving fluorescent lamps, T5 high-power energy saving fluorescent lamps and related accessories, LED-related accessories and outdoor lighting. The company extended its product line from the original indoor lighting source to a more comprehensive product structure. Zhejiang Yankon started batch production of LED products and export to the European market in 2009. The company further diversified its products by adding ceramic halide lamps and LED lighting products in 1H10.

Key financials

Zhejiang Yankon recorded revenue of Rmb1,735m and net profit of Rmb120m in 2009. In 1H10, the company reported net profit of Rmb97m (up 100% yoy). To date, Zhejiang Yankon has not formed a scalable capacity for the LED business. The company plans to invest Rmb419.2m in the LED lighting application project in Xiamen and would reach a LED capacity of 20m LED lamps and 5m LED lamp accessories after the project commences operations.

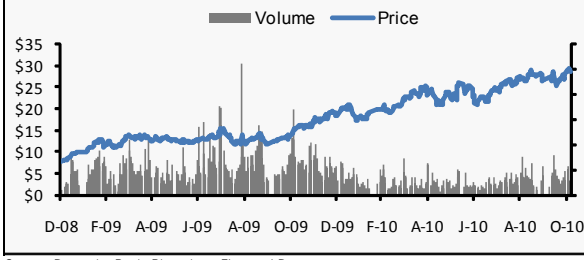
Figure 93: Summary description of Zhejiang Yankon Group (600261.CH)

Description			
Address: 485 Fengshan Road Shangyu, Zhejiang, 312300 China			
Website: www.yankon.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	1,881	1,735	965
EBIT	146	112	107
Net Income	102	120	97
EPS (Diluted)	0.41	0.48	0.39
Book Value per Share	3.9	4.1	4.1
Total Assets	1,947	2,200	2,454
Cash Flow-Oper Activities	123	308	20
Capital Expenditures	(134)	(138)	(169)
Free Cash Flow	(11)	170	(149)
Return on Com Eqty (%)	10.8	12.1	17.2
Total Debt/Total Equity (%)	33.3	39.9	43.9

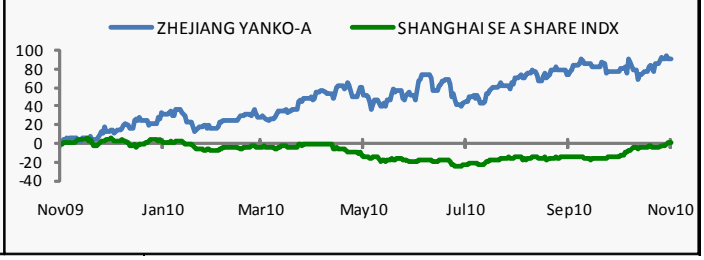
Business Segments (FY: Dec-09)	Revenue
Lighting System Manufacturing	1238.15
T5 Linear Fluorescent Lamp and Related Produ	328.13
Special Lighting Fixtures	124.56
Others - Outdoor Lighting System	31.81
Other Operating Revenue	20.47

Key Statistics	
Share price	28.73
52-Week Range	15.26 - 30.24
YTD performance	55%
Avg Daily traded Val (3 Months, USD)	14.1
Market Value (USD mn)	1,078.0
Float %	45.6%
Major shareholder	CENTURY YANKON HOLDI
% stake	36.9%
No. of employee	7,612

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Han's Laser Technology (002008.CH, non-rated)

Company background

Han's Laser is primarily engaged in laser processing equipment manufacturing for various industries, including consumer electronics, packaging industry, auto parts, jewelries, textile and solar power. Han's Laser was listed on the Shenzhen Stock Exchange in 2004.

Business exposure

Han's Laser's main products are laser information identification equipment, laser welding equipment, laser cutting equipment, harmonic wave laser application devices, laser lithography and printing devices and printed circuit board (PCB) laser equipment. Han's Laser entered the LED market in 2009 through its four subsidiaries, covering LED packaging equipments, LED packaging and LED application. In addition, the company diversified into the design and manufacturing of solar cell and wafer in 2010 and expects to launch a LED welding wire machine in 2H10, which may allow the company to become the first player in China to provide a full set of LED packaging equipment.

Key financials

Han's Laser reported revenue of Rmb1,942 (up 13.7% yoy) and net profit of Rmb3.0m (down 97.8% yoy) in 2009. The decline in net profit was due to the huge provision for financial assets of Rmb80.2m in 2009 and worse-than-expected performance in laser information identification equipment and laser welding equipment. In terms of revenue breakdown, LED equipment accounted for 4% of total revenue in 2009. The company plans to speed up its LED business in 2010. Han's Laser reported LED equipment revenue of Rmb174.2m, or 12.8% of total revenue (Rmb1,354m) in 1H10. The company's blended gross margin in 1H10 was 39.7%, while LED equipment was 18.9% in the same period.

Figure 94: HAN'S LASER TECHNOLOGY CO-A (Shenzhen: 002008, Currency: CNY)

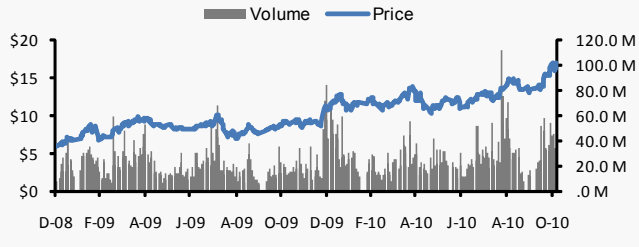
Description	
Address:	9 Xinxi Road, North District Indus Park, Hitech Zone Nanshan District Shenzhen, 518055 China
Website:	www.hanslaser.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,708	1,942	1,354
EBIT	131	67	161
Net Income	135	3	113
EPS (Diluted)	0.21	0.00	0.16
Book Value per Share	2.8	2.9	2.9
Total Assets	3,475	4,428	5,803
Cash Flow-Oper Activities	(58)	61	(90)
Capital Expenditures	(539)	(609)	(266)
Free Cash Flow	(596)	(548)	(356)
Return on Com Eqty (%)	9.2	0.2	4.5
Total Debt/Total Equity (%)	26.5	68.3	96.8

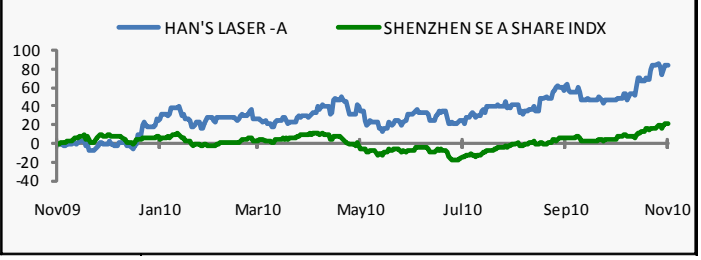
Business Segments (FY: Dec-09)	Revenue
Laser Marker	408.22
Laser Printer	345.86
Laser Cutter	320.55
PCB System	260.86
Adjustments	234.33

Key Statistics	
Share price	16.88
52-Week Range	8.38 - 17.21
YTD performance	56%
Avg Daily traded Val (3 Months, USD)	70.3
Market Value (USD mn)	1,765.6
Float %	61.4%
Major shareholder	SHENZHEN HAN'S INDUS
% stake	18.0%
No. of employee	6,061

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Elec-Tech International (002005.CH, non-rated)

Company background

Elec-Tech International, established in 1996, is principally engaged in the development, production and sale of small domestic appliances (SDA). The company is also involved in the businesses of LED chips, LED epitaxial wafers, packaging and LED application after a series of mergers in 2009. The company was listed on the Shenzhen Stock Exchange in 2004. Zhuhai Dehao Electric Appliance is the major shareholder, controlling a 25.4% stake.

Business exposure

Core businesses of Elec-Tech International include household cooking equipment, LED packaging and LED application products. As the world's second-largest SDA manufacturer, Elec-Tech International distributes its domestic appliances in North America, Europe, the Middle East and Japan. The company entered the LED packaging and display industry in 2H09 by acquiring LED-related assets from one of its shareholders and a 60% stake in Ret0p, which is a leading player in LED video screen manufacturing. Elec-Tech International plans to invest Rmb1.53m from the private offering into its subsidiary in Anhui province for LED chips, packaging and LED lighting application.

Key financials

Elec-Tech International reported revenue of Rmb1,915m and net profit of Rmb49.0m in 2009. The segment revenue from LED was Rmb171.6m, or 8.9% of total revenue, in 2009. In 1H10, the segment revenue from LED reached Rmb151.6m, up 824.65% yoy. In terms of revenue breakdown, revenue of LED packaging and LED application products was Rmb13.6m and Rmb137.9m in 1H10, respectively. The gross margin of the LED business was 33.04%, compared with the company's blended gross margin of 21.56% in 1H10.

Figure 95: ELEC-TECH INTERNATIONAL CO-A (Shenzhen: 002005, Currency: CNY)

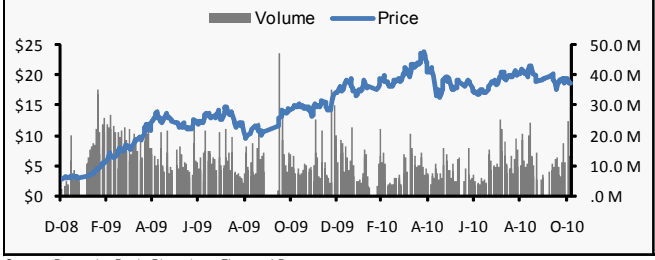
Description	
Address:	1 Jinfeng Road,Tangjiawan Xiangzhou District Zhuhai, Guangdong, 519085 China
Website:	www.gddhrd.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	2,516	1,915	1,066
EBIT	(19)	103	52
Net Income	(62)	49	21
EPS (Diluted)	-0.19	0.15	0.06
Book Value per Share	1.9	2.0	2.1
Total Assets	1,839	2,217	2,680
Cash Flow-Oper Activities	202	61	(211)
Capital Expenditures	(61)	(193)	(97)
Free Cash Flow	141	(133)	(308)
Return on Com Eqty (%)	-9.9	7.8	10.6
Total Debt/Total Equity (%)	83.0	101.3	138.2

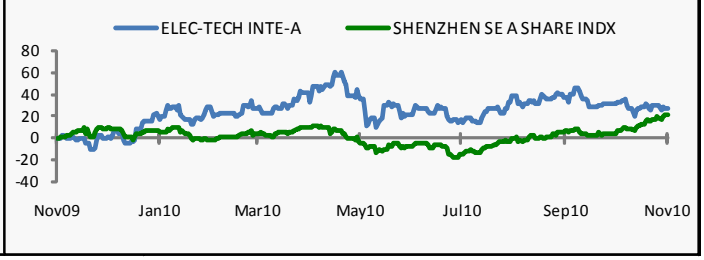
Business Segments (FY: Dec-09)	Revenue
Kitchen Appliances	1485.79
Household Appliances	135.72
LED Applications	95.57
Appliances Wholesale	91.87
LED Packaging	76.06

Key Statistics	
Share price	18.74
52-Week Range	12.91 - 24.49
YTD performance	9%
Avg Daily traded Val (3 Months, USD)	33.8
Market Value (USD mn)	1,360.3
Float %	40.3%
Major shareholder	ZHUHAI DEHAO ELECTRO
% stake	25.4%
No. of employee	8,746

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

NVC Lighting Holding (2222.HK, non-rated)

Company background

NVC Lighting Technology is engaged in the design and manufacturing of a variety of lighting products, focusing on energy saving products. The company also provides electronic products, such as electronic transformers and electronic and inductive ballasts. The company was listed in Hong Kong in May 2010 and is controlled by SB Asia Investment Fund II L.P. with a 22.4% stake.

Business exposure

NVC operates in three product segments: luminaire products (consists of lighting fixtures, lamps and lighting electronics appliances), lamp products (consists of a range of light bulbs and tubes) and lighting electronics products. The company has four manufacturing bases with a total designed capacity of 191.5m units of energy saving lamps or lighting electronics products. The utilization rates of the 156 production lines ranged from 75% to 102% in 1H10. NVC distributes its products to overseas markets through original equipment manufacturer (OEM) and original design manufacturer (ODM) products to Europe.

Key financials

NVC recorded revenue of US$306m and net profit of US$13m in 2009. After listing in Hong Kong in May 2010, the company reported revenue of US$204m and net profit of US$26m in 1H10, up 85.9% and 202% yoy, respectively. In terms of business breakdown, gross profit from LED products reached US$740k in 1H10, 13 times larger than in 1H09. The gross margin of LED product was 23.8% in 1H10, 3.3ppt lower than the blended gross margin.

Figure 96: NVC LIGHTING HOLDINGS LTD (Hong Kong: 2222, Currency: HKD)

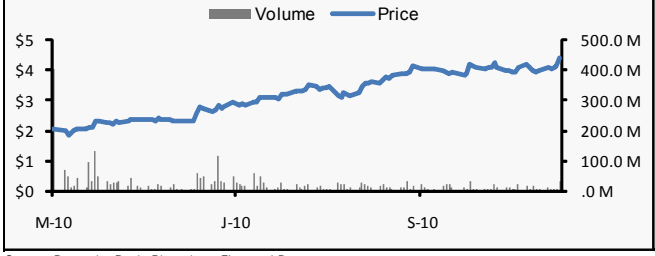
Description	
Address:	NVC Industrial Park Ruhu Town Huizhou, Guangdong, 516021 China
Website:	www.nvc-lighting.com.cn

Financials (USDmn)	Dec-08	Dec-09	1H10
Sales	256	306	204
EBIT	39	45	32
Net Income	18	13	26
EPS (Diluted)	-	-	0.01
Book Value per Share	-	-	0.1
Total Assets	299	356	580
Cash Flow-Oper Activities	14	42	9
Capital Expenditures	(8)	(15)	(12)
Free Cash Flow	5	27	(4)
Return on Com Eqty (%)	23.2	9.6	-
Total Debt/Total Equity (%)	72.9	38.3	2.9

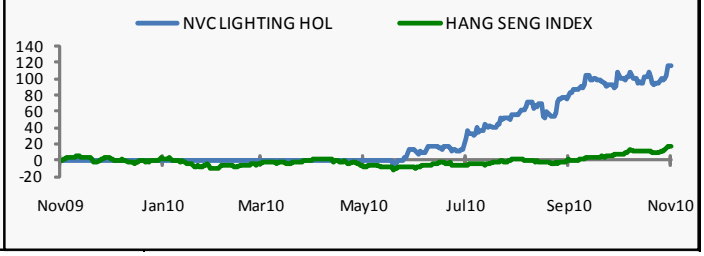
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Luminaire Products	153.80	41.84
Lamp Products	118.05	34.41
Lighting Electronic Products	33.92	7.78

Key Statistics	
Share price	4.38
52-Week Range	1.84 - 4.46
YTD performance	-
Avg Daily traded Val (3 Months, USD)	6.8
Market Value (USD mn)	1,731.6
Float %	66.6%
Major shareholder	CHANGJIANG WU
% stake	22.4%
No. of employee	10,786

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Figure 97: Business exposure of LED players along the value chain

	Epiwafer	Chip	Packaging	Lighting application
Sanan Optoelectronics	√	√		
Lianchuang Optoelectronic	√	√		√
Silan Microelectronics		√	√	
Zhejiang Yankon				√
Neo-Neon		√	√	√
NVC Lighting Technology				√
Han's Laser Technology	√	√	√	√
Elec-Tech International	√	√	√	√

Source: Deutsche Bank, Company data

Energy efficient building materials

Efficient energy standards for buildings

Energy efficiency for buildings is not a new concept. The first energy code for residential buildings, "Energy Conservation Design Standard for Residential Buildings in the Heating Zones", was released in 1986, after the United States (1975) and Japan (1985). This was followed by a more general Energy Conservation Law in 1997 (revised in 2007).

China's building standards have carved the country into five climate zones: Severe Cold, Cold, Hot Summer and Cold Winter (HSCW), Temperate, and Hot Summer and Warm Winter (HSWW). In the Severe Cold and Cold zones, space heating is usually the primary driver of energy demand, whereas the Hot Summer and Cold Winter zone requires both space heating and cooling for increased comfort. South China, which has a Hot Summer and Warm Winter, has also seen an increasing demand for cooling. Correspondingly, China has three sets of national building energy standards that deal with the different needs of the climate zones including a heating code for the Severe Cold and Cold zones and a code each for the HSCW and HSWW zones.

In general, the primary standards in China focus on the building envelope and Heating, Ventilation and Air Conditioning (HVAC). The Chinese Academy of Building Research (CABR) estimates that the building envelope and HVAC have the highest influence on building energy efficiency. Nonetheless, there are separate codes that cover lighting as well. This section reviews the opportunities that exist in efforts to meet China's need for an energy efficient building envelope.

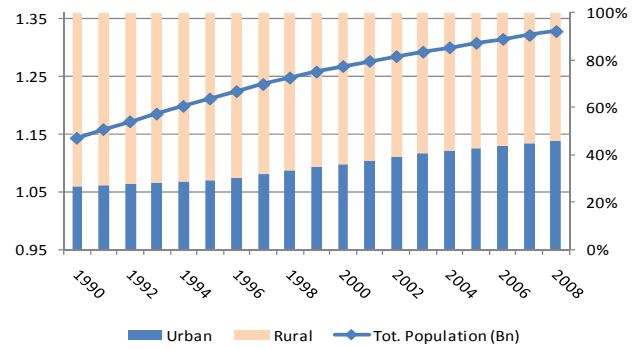
Overview of China's drive for building energy efficiency

Primary drivers for new buildings

Buildings are some of China's largest energy consumers, accounting for 30% of the nation's total energy consumption. Despite slower economic growth ahead, we expect underlying demand to continue driving construction of new buildings. Underlying demand can be decomposed into two primary drivers.

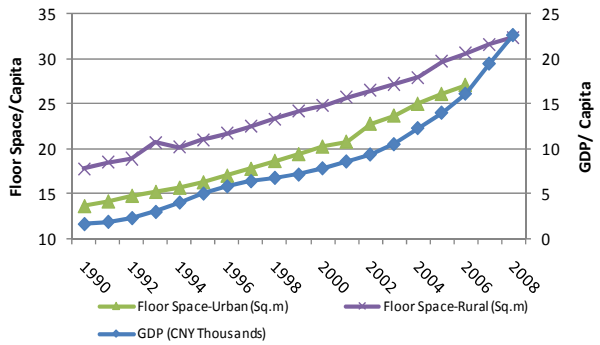
- The first is the absolute growth in the population living in buildings, and more specifically, an increasingly urban population (Figure 98). Current estimates are that the urban population should grow by 20m every year, even as population growth plateaus.
- The second driver is an increase in the overall affluence of Chinese society. Increasing income should lead to increased demand for living space; this trend can be observed in the increasing per capita floor space for both rural and urban populations (Figure 99).

Figure 98: The urbanization of China



Source: National Bureau of Statistics, Deutsche Bank

Figure 99: Per capita welfare indicators



Source: National Bureau of Statistics, Deutsche Bank

Policies to promote energy efficiency in buildings

As a result of macro pressures, the momentum to manage China's energy demand has gained widespread acceptance within the government. The Medium- and Long-Term Energy Conservation Plan (2004) issued by the National Development and Reform Commission (NDRC) sets out targets for new building design standards, requiring 50% energy savings. In certain major cities such as Beijing and Tianjin, more stringent standards of 65% are to be implemented.

More recently, the central government has started to signal that energy conservation should be dealt with urgently. In March 2010, the National People's Congress Standing Committee reported that one of its priority responsibilities was to check compliance with the Law on Energy Conservation and implement the resolution addressing climate change. In May 2010, Premier Wen Jiabao announced that the government would be putting various strategies into effect in order to meet its 11th Five-Year Plan targets. Among other things, the Chinese authorities plan to vigorously promote the use of energy saving and energy efficient products such as air conditioning and appliances. The government should also strictly ensure compliance with all energy conservation regulations and standards.

What is a building envelope?

The building envelope is generally defined as the area that separates the conditioned space from the unconditioned space or the outdoors. A well-designed envelope provides low heating/cooling demand and improves the thermal comfort of its occupants.

There are four main mechanisms by which heat is transferred across the building envelope: infiltration, conduction, convection, and radiation. Energy efficient building materials work by reducing or stopping one or more of these mechanisms.

Bulk insulators

Bulk insulators are materials used to block conduction and convection flow in and out of the building. They can be used as fillers in the hollow cavity between walls, though the wall material itself can be manufactured to have a high thermal insulating property (such as aerated concrete blocks) at the expense of structural strength. Conduction is minimized as the bulk insulators trap air. Air acts as a good thermal insulator, and still air impedes conductive heat transfer. Convection is also interrupted, as the bulk material prevents the formation of air currents within the cavity of the envelope.

Some examples of bulk insulation are summarized in Figure 100.

Figure 100: Some examples of insulation, their materials and their uses

Form of insulation	Insulation materials	Where applicable	Advantages
Blanket: batts and rolls	Fiberglass, mineral (rock or slag) wool, Plastic fibers, Natural fibers	Unfinished walls, including foundation walls, and floors and ceilings.	Do-it-yourself. Suited for standard stud and joist spacing, which is relatively free from obstructions.
Concrete block insulation	Foam beads or liquid foam made of: polystyrene, polyisocyanurate or polyiso, Polyurethane, vermiculite or perlite pellets	Unfinished walls, including foundation walls, for new construction or major renovations.	Autoclaved aerated concrete and autoclaved cellular concrete masonry units have 10 times the insulating value of conventional concrete.
Foam board or rigid foam	Polystyrene, polyisocyanurate or polyiso, polyurethane	Unfinished walls, including foundation walls; floors and ceilings; unvented low-slope roofs.	High insulating value for relatively little thickness. Can block thermal short circuits (bridges) when installed continuously over frames or joists.
Insulating concrete forms	Foam boards or foam blocks	Unfinished walls, including foundation walls, for new construction.	Insulation is literally built into the home's walls, creating high thermal resistance.
Loose-fill	Cellulose, fiberglass, mineral (rock or slag) wool	Enclosed existing wall or open new wall cavities; unfinished attic floors; hard-to-reach places.	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
Rigid fibrous or fiber insulation	Fiberglass, Mineral (rock or slag) wool	Ducts in unconditioned spaces and other places requiring insulation that can withstand high temperatures.	Can withstand high temperatures.
Sprayed foam and foamed-in-place	Cementitious, Phenolic, Polyisocyanurate, Polyurethane	Enclosed existing wall or open new wall cavities; unfinished attic floors	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
Structural insulated panels (SIPs)	Foam board or liquid foam insulation core, Straw core insulation	Unfinished walls, ceilings, floors, and roofs for new construction.	SIP-built houses provide superior and uniform insulation compared to more traditional construction methods; they also take less time to build.

Source: US Department of Energy - Energy Savers Program, Deutsche Bank

While this section covers materials that improve the thermal properties of the envelope, it is important to recognize that other characteristics of the material, such as acoustic insulation and fire safety, affect the final decisions.

Polystyrene

Polystyrene is a colorless plastic that is commonly used to make foam board or as loose-fill insulation, which consists of small beads of polystyrene. This allows it to be poured into hollow concrete blocks or into wall cavities.

Polyurethane

Polyurethane is a type of foam insulation material where the foam cells contain a low conductivity gas such as HCFC. The high thermal resistance of the gas gives the polyurethane insulation a very high R value (a measure of thermal resistance used in the building and construction industry; the bigger the number, the more effective the insulation). This is usually sold in a sprayable form or as foam boards. When manufactured in foam boards, foil and plastic may also be applied to the exterior, which reduces the loss rate of the low conductivity gas or acts as a radiant barrier.

Gypsum board

Gypsum board, also known as drywall, describes panels made of gypsum plaster that are formed between two sheets of thick paper and dried in an oven. The resulting material is

strong, light and stiff. It is usually used in the construction of interior walls and ceilings. Gypsum board has good fire resistance but a relatively low R value, meaning that it is a poor thermal insulator. However, gypsum board use has increased with the increased usage of thermal insulation because most thermal insulators (like polyurethane foam boards) have poor fire resistance, and a thin (half-inch) layer of gypsum board is used as protective covering to meet fire safety requirements.

Radiant insulators

Radiant insulators protect against heat transfer by radiation, reducing solar heat gain in warmer climates and reducing heat loss in cooler climates. A common example is glass when used on the curtain wall or in windows. Windows break the bulk insulation of the envelope and are usually the least insulating part of the building envelope, losing heat four to ten times more than other parts of the envelope. Other than those in tropical climates, most consumers prefer insulated, double-paned, or even triple-paned glass windows. We can observe this in many modern buildings, where the exterior façade is almost entirely covered with glass.

Curtain walls

The curtain wall refers to the outer covering of the building that does not bear any structural load except for its own weight. The primary purpose of this wall is to keep out the external environment, and common construction materials include glass, aluminum or even stone. The use of glass allows light to enter the interior of the building, while aluminum's light weight made it a favored material for a frame to hold the glass. The challenge in modern curtain wall design is that aluminum is an excellent conductor of heat; curtain walls with aluminum frames require special design considerations to minimize heat loss. Designers usually incorporate a thermal break, usually made of PVC, in the joint between the exterior metal and the interior metal of the building to disrupt the heat transfer. In addition, the common use of glass in modern curtain wall design requires the special use of energy efficient glass in order to minimize heat loss.

BIPV

Photovoltaic (PV) curtain walls are a more recent development of interest in China. As the name implies, this process involves the integration of a PV system into the curtain wall during manufacturing. The curtain walls are made of a transparent or translucent solar panel that still allows light to pass through to the interior. However, the additional benefit is that a small photoelectric current passes out of the panel into a system that captures the solar energy and either recycles it to other building systems or feeds it to the electrical grid.

During 2009, the Chinese Ministry of Finance and Science and Technology announced the Golden Sunshine Program, which provided substantial subsidies for the installation of building-integrated photovoltaic (BIPV) projects. BIPV projects use PV materials to replace conventional building materials. As the façade of a building has the largest surface area (compared to other parts like the roof), the PV curtain wall product group stands to benefit the most from the subsidy. The current subsidy stands at Rmb20/W for a non-roof BIPV, which should halve the cost of installing a BIPV system (depending on the technology). With current PV curtain walls costing anywhere from two to four times the price of a normal curtain wall, the Golden Sunshine subsidy should severely tighten the spread that developers have to pay.

Energy efficient glass

There are several types of energy efficient glass, including double- or triple-glazed, low-emissitivity, tinted, and coated glass.

- **Double or triple glazing**: A single layer of glass has poor thermal insulation, but manufacturers can produce a "double glazing" effect by trapping air between two clear panes, thus halving the heat flow. Manufacturers can also trap an inert gas such as argon or krypton to increase the thermal insulation further.
- **Low-emissivity glass**: Low-E glass was first introduced in the late 1970's. It is made by applying a microscopically thin coating, often of metal or metallic oxide, on the glass surface. The coating reduces the overall U factor by reducing thermal radiation. This means that in summer, heat is reflected back to the outside while in the winter, heat is reflected back to the interior. Low-E coatings are transparent to visible light, and different types have been developed to allow for low, moderate and high solar gain. Thus, depending on the climate and the building's typical cooling/heating needs, different types of Low-E glass can be selected. Because Low-E coating is applied to one side of the glass surface, it is normally sold in a sandwich of two glass layers with the Low-E coating in between. The US Department of Energy estimates that Low-E windows can reduce window heat loss by 30 to 40%.
- **Tinting**: Tinted glass (in bronze, gray or green) may be used to reduce solar heat gain, which it does by absorbing the heat. Additional processing is often required to ensure the glass does not crack from heat build-up.
- **Coated glass**: This is achieved by applying a film or coating to the surface. The coating, if made of metal, may increase the reflection of the glass. Coated glass may also be used as an alternative to double glazing.

Frequently asked questions and glossary of terms

How much energy is consumed for building heating?
In Northern China, about 40% of a building's energy use is consumed in heating.

What are the key markets for the use of energy efficient building materials?
There are two key drivers that should lead to increased demand. Firstly, the increasing population and affluence should drive underlying new construction of buildings. We expect energy efficient building materials to make up an increasing proportion of construction. A second driver should be the refurbishment and improvement of China's existing building stock (especially publicly owned buildings like schools) to energy efficient standards.

Can the energy efficiency of older constructed buildings be improved?
According to Tsinghua University's Building Energy Research Centre, the thermal resistance of building envelopes, especially in the Northern regions, can be improved a further 50% before reaching developed country standards. The World Business Council for Sustainable Development research also shows that where the envelope and HVAC were modernized, energy efficiencies of 50-75% were recorded and savings of 30% were a routine achievement.

Energy efficient materials are expensive – why should developers use them in new construction?
Energy conservation is now a national priority in China. Recent actions by the authorities have demonstrated their resolve to meet the 11th Five-Year Plan's energy conservation targets, and we expect the 12th Five-Year Plan to be even more ambitious in pushing for energy efficiency. We expect increased enforcement of the relevant building energy regulations and increased inspection at construction sites. We believe developers are beginning to accept the need for more efficient buildings.

Figure 101: Glossary of terms

Terms	Definition
Batt / Blanket	These are a flexible roll or strip of insulating material in different widths usually made of glass or rock wool fibers. A batt is pre-cut to standard lengths, while a blanket is a continuous roll.
Building Envelope	This refers to the separation between the interior and the exterior environments of a building. This serves to protect the indoor environment as well as to preserve its interior climate.
CDD	Cooling Degree-Days. A measure of how hot a location was over a period of time, relative to a base temperature. In this report the base temperature is 18 degrees Celsius.
Curtain Wall	This refers to the outer covering of a building which does not carry a structural load. Its primary function is to keep out the weather, though in the case of glass curtain walls, they serve to let in natural light as well.
HVAC	Heating, Ventilation and Air Conditioning.
HDD	Heating Degree-Days. A measure of how cold a location was over a period of time, relative to a base temperature. In this report the base temperature is 18 degrees Celsius.
Low-E glass	Low-emissivity glass has a thin coating on the glass that reflects thermal radiation or inhibits its emission, thus reducing heat transfer through the glass. Low-E glass will therefore have a lower U value.
SGHC	Solar Heat Gain Coefficient. The standard indicator of a window's shading ability
Thermal Bridge	These are points in construction which place two materials in contact, thus allowing heat to flow through the path. Insulation around a bridge is of little help in preventing heat loss or gain due to thermal bridging; the bridging usually has to be eliminated by limiting the contact by breaking it with an additional insulating component.
U value	This is heat loss through a construction component such as an external wall, floor, ceiling or roof. It measures heat (in Watts) lost per square meter for a 1 degree Celsius difference.
Visual Transmittance	This is the fraction of visible light that can pass through the material. The higher the fraction, the more natural lighting can penetrate to the interior of the building, thus lowering lighting energy needs.

Source: Deutsche Bank

Risks

Poor enforcement

Although we do not doubt that the central and provincial governments have made energy efficiency one of their top policy imperatives, compliance to the existing building codes remains poor in rural regions. In the major cities (top 30), 80% of buildings is projected to be code-compliant.

Cost perception

Developers continue to regard building materials with improved thermal properties as higher cost. The government banned the use of solid clay bricks in 2000 in favor of thermal insulating and environmentally friendly hollow concrete brick. Despite the ban, solid clay bricks continue to be produced and purchased due to their cheaper cost.

Energy efficient building materials players

CSG Holding (000012.CH, non-rated)

Company background

CSG Holding (CSG) was founded in 1984 and is principally engaged in the manufacture and sale of glass. It is one of the leading Low-E glass manufacturers in China. CSG also produces products for the solar energy industry. The company distributes its products in domestic markets and to overseas markets, including Hong Kong, the US and Australia. The company has a large institutional shareholder base and is controlled by Shenzhen International Holdings.

Business exposure

The company's flat glass segment primarily provides float glass, special glass, solar energy glass, quartz sands and others; the engineering glass segment mainly provides environmental protection and energy saving low-emissivity-coated glass. CSG intends to build on its glass business by investing Rmb1.3bn to expand its output of various kinds of energy saving glass in 2010. In addition, R&D expenditure will be doubled to Rmb100m in 2010.

Key financials

In 2009, architectural glass products and plate glass accounted for 90% of company revenues. Overall, 1H10 revenues increased 65% over the same period in 2009. Revenue growth was anchored by architectural glass, which grew 75%.This was further boosted by a strong showing from the solar business, which grew 313% (as a result of contributions from Dongguan CSG Solar Glass Co. Ltd) to account for 25% of total 1H10 revenues.

Figure 102: CSG HOLDING CO LTD - A (Shenzhen: 000012, Currency: CNY)

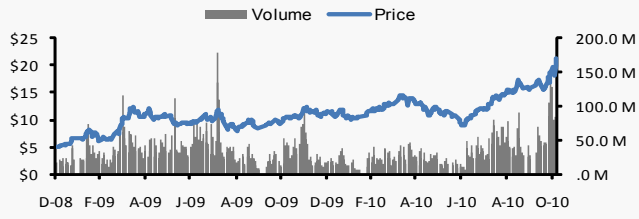
Description	
Address:	Nanbo Building 1, Gongye No.6 Rd Shekou, Shenzhen, 518067 China
Website:	www.csgholding.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	4,268	5,274	3,403
EBIT	703	1,172	850
Net Income	420	832	636
EPS (Diluted)	0.21	0.40	**0.31**
Book Value per Share	2.2	2.6	2.7
Total Assets	10,376	10,913	11,050
Cash Flow-Oper Activities	800	1,438	809
Capital Expenditures	(2,684)	(1,167)	(737)
Free Cash Flow	(1,883)	271	72
Return on Com Eqty (%)	9.8	16.9	23.5
Total Debt/Total Equity (%)	89.6	66.9	67.0

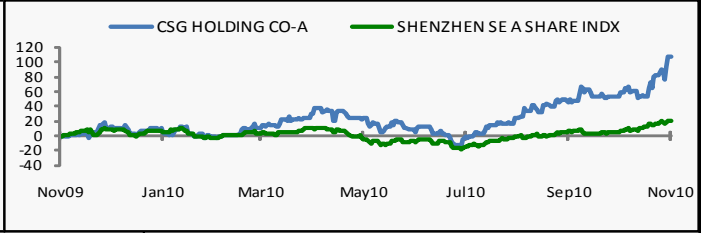
Business Segments (FY: Dec-09)	Revenue
Plate Glass	2759.09
Architectural Glass	1928.64
Display Glass	448.30
Solar Panel Glass	137.23
Others-Glass	5.84

Key Statistics	
Share price	21.34
52-Week Range	8.55 - 21.91
YTD performance	85%
Avg Daily traded Val (3 Months, USD)	134.7
Market Value (USD mn)	5,341.4
Float %	64.4%
Major shareholder	SHENZHEN INTERNATION
% stake	12.9%
No. of employee	10,109

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Wuhu Conch Profiles and Science (000619.CH, non-rated)

Company background

Wuhu Conch Profiles and Science (WCP) is principally engaged in the research, development, manufacture, and sale of building materials in China. WCP provides PVC profiles, sheets, boards, doors, windows, molds, plastic additives, white/colored/grain extruded profiled materials, plastic bars, window roller shutters, window blinds, and other ornament profiled materials. The company distributes its products within China's domestic markets, with eastern and northern China as its major markets. As of 31 December 2009, Wuhu had 10 major subsidiaries. The company, formerly known as Anhui Hongxing Xuanzhi Paper Co., Ltd., was founded in 1996 and is headquartered in Wuhu, China. It is controlled by the Anhui Conch Group.

Business exposure

WCP is the leading producer of PVC window profiles and has an annual capacity of 600,000 tons. These profiles are key components of energy efficient window design, and the company is currently able to manufacture up to 1,000 different kinds of window and door designs. Other new innovations include an eco-friendly, thermal insulating foam door. The company intends to boost capacity to 700,000 tons in 2010. In addition, WCP has also established more than 100 marketing offices throughout the country to take advantage of the continuing push for more energy efficient building materials.

Key financials

In 2009, the company's revenue decreased slightly to Rmb4.0bn while net profit rose 209% yoy to Rmb222m, mainly due to gross margin expansion, lower financial expense, and write-backs of accumulated provisions. In 1H10, the company reported net profit of Rmb97m, down 18% yoy, due to contraction in the gross margin.

Figure 103: WUHU CONCH PROFILES & SCI -A (Shenzhen: 000619, Currency: CNY)

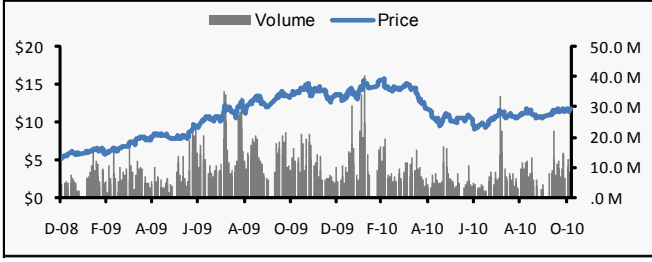
Description	
Address:	Gangwan Road Eco. & Tech. Development Zone Wuhu, Anhui, 241009 China
Website:	pvc.conch.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	4,303	4,033	1,793
EBIT	155	320	122
Net Income	72	222	97
EPS (Diluted)	0.20	0.62	0.27
Book Value per Share	4.6	5.1	5.3
Total Assets	2,764	2,792	3,164
Cash Flow-Oper Activities	312	170	23
Capital Expenditures	(74)	(90)	(206)
Free Cash Flow	238	80	(183)
Return on Com Eqty (%)	4.4	12.7	11.0
Total Debt/Total Equity (%)	32.6	20.0	37.3

Business Segments (FY: Dec-09)	Revenue
Building Materials - Plastic Fence	4018.45
Doors and Windows	17.50
Sales of Scrap Materials	6.55
Building Materials Wholesale	3.12

Key Statistics	
Share price	11.67
52-Week Range	8.67 - 16.05
YTD performance	-14%
Avg Daily traded Val (3 Months, USD)	14.1
Market Value (USD mn)	631.1
Float %	58.1%
Major shareholder	ANHUI CONCH BLDG MAT
% stake	32.1%
No. of employee	1,241

Price and Volume (1 Year)



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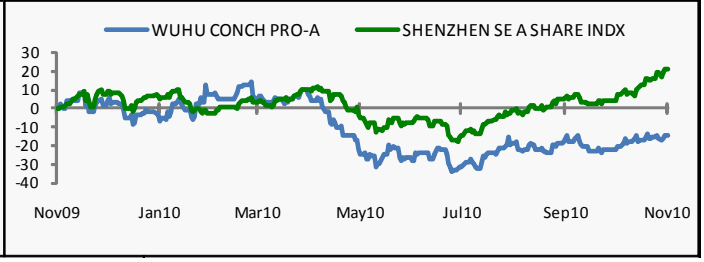


Source: Deutsche Bank, Bloomberg Finance LP

Beijing New Building Materials (000786.CH, non-rated)

Company background

BNBM is principally engaged in the manufacturing and selling of new building materials, new wall materials, pipe fittings, and decoration materials. The company also develops and applies environmental protection and energy saving products. The company operates its businesses through three segments: walling and suspension systems including plaster (gypsum) boards, keels, mineral wool boards and accessories; residential parts systems for energy saving including doors and windows, heating, heat preservation and paint; external walling systems, cement tile roofs; and siding systems. BNBM operates as a subsidiary of China National Building Material Group Corporation.

Business exposure

The company's key product is the gypsum board, which accounted for 81% of its total revenue in 2009. The product has won several quality awards and credits domestically and internationally and is the only product in the industry that has passed the US UL authentication. The company has several gypsum production lines across China with a total annual production capacity of 1bnsqm, making it the largest gypsum board producer in Asia and one of the top three globally.

Key financials

In 2009, despite the general downturn, gypsum board continued to dominate the company's portfolio and grew 12.1% yoy to Rmb3,266m, accounting for 81.1% of total revenues. Gypsum board's gross margin also expanded 11.23ppt in 2009. In 1H10, revenue from gypsum board continued to increase 77.3% yoy to Rmb1,399m, accounting for 77.3% of total revenue.

Figure 104: BEIJING NEW BUILDING MATER-A (Shenzhen: 000786, Currency: CNY)

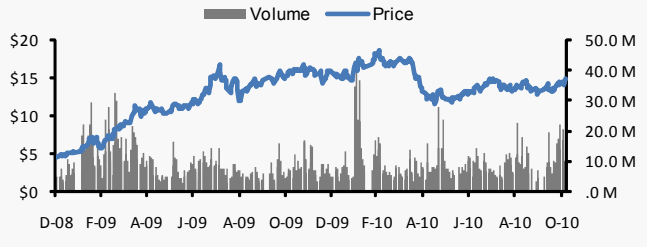
Description	
Address:	No.16 Material Building West Xishan Qi Haidian District, Beijing, 100037 China
Website:	www.bnbm.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	2,490	3,266	1,809
EBIT	222	609	241
Net Income	241	322	151
EPS (Diluted)	0.42	0.56	0.26
Book Value per Share	3.4	3.9	4.0
Total Assets	5,006	5,994	6,793
Cash Flow-Oper Activities	323	690	24
Capital Expenditures	(656)	(654)	(502)
Free Cash Flow	(333)	36	(478)
Return on Com Eqty (%)	13.1	15.4	16.4
Total Debt/Total Equity (%)	99.6	73.4	87.5

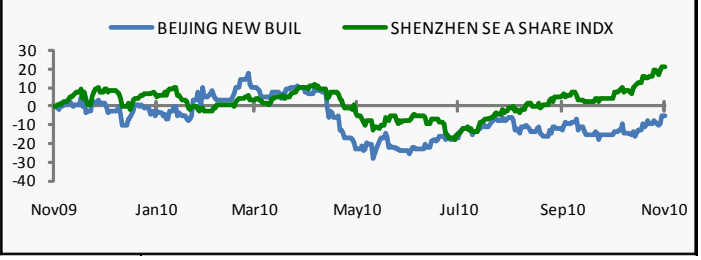
Business Segments (FY: Dec-09)	Revenue
Gypsum Board Manufacturing	2650.26
International Trading	515.82
Others	65.81
Construction and Engineering Services	31.94
Tax Exemptions	10.98

Key Statistics	
Share price	14.89
52-Week Range	11.3 - 18.92
YTD performance	-6%
Avg Daily traded Val (3 Months, USD)	20.6
Market Value (USD mn)	1,286.5
Float %	46.7%
Major shareholder	CHINA NATL BLDG MAT
% stake	52.4%
No. of employee	3,360

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

AVIC Sanxin (002163.CH, non-rated)

Company background

AVIC Sanxin (AS) is principally engaged in the design and undertaking of energy saving curtain wall projects as well as the manufacture and distribution of engineering glass products, electronic glass products and curtain wall doors, and windows products. AVIC distributes its products within domestic markets and to overseas markets.

Business exposure

The company's key product is its green architectural glass product, which accounted for 79% of the total revenue in 2009. The company's special glass materials include offline Low-Emissivity (Low-E) glass, online Low-E glass, electronic functional coated glass, and solar glass, among others. AS has completed a Rmb350m investment in a new ultra-white TCO solar panel glass coating production facility, which is likely to come online in 1Q11.

Key financials

In 2009, the company's total revenue increased 20.8% yoy while its net profit decreased 14.2% yoy. Revenue from curtain engineering, engineering glass, and electronic glass accounted for 79%, 20%, and 5% of the total, respectively. The gross margin was 13.8% in 2009. Total revenues in 1H10 grew 20.5% yoy and net profit decreased 11.6% yoy due to increasing administration expense from the Bengbu and Hainan bases coming into operation. Revenue growth is mainly driven by rising sales of curtain engineering projects (+14.2% yoy) and new contribution from specialty glass products business (Rmb64m).

Figure 105: AVIC SANXIN CO LTD-A (Shenzhen: 002163, Currency: CNY)

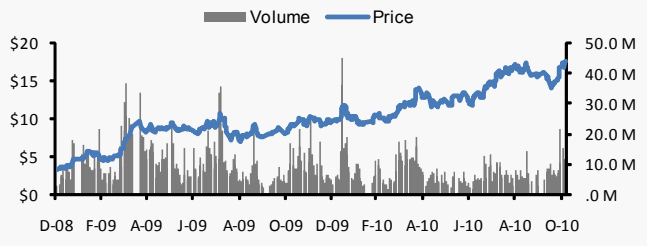
Description	
Address:	17/F New Baohui Building 2061 Nanhai Avenue, Nanshang Shenzhen, 518054 China
Website:	www.sanxinglass.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,365	1,647	813
EBIT	62	65	38
Net Income	44	38	22
EPS (Diluted)	0.14	0.12	0.05
Book Value per Share	1.8	1.8	3.6
Total Assets	1,434	2,745	3,517
Cash Flow-Oper Activities	11	21	(78)
Capital Expenditures	(247)	(877)	(226)
Free Cash Flow	(235)	(857)	(303)
Return on Com Eqty (%)	8.3	6.8	3.5
Total Debt/Total Equity (%)	66.2	231.1	99.2

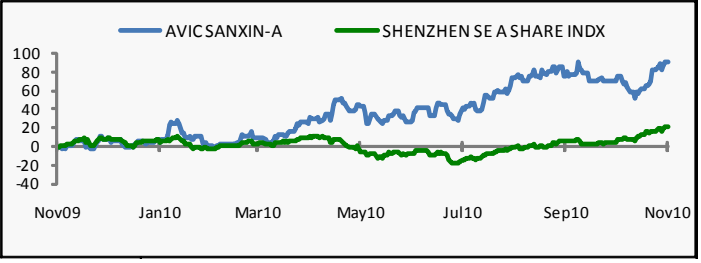
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Green Architectural Product	1295.56	52.49
Project Construction	333.44	151.07
Furniture & Electronics Glass Product	91.38	19.52
Walls & Windows Products	62.26	8.61
Other Revenue	6.95	

Key Statistics	
Share price	17.6
52-Week Range	8.84 - 18.51
YTD performance	83%
Avg Daily traded Val (3 Months, USD)	17.3
Market Value (USD mn)	1,062.3
Float %	54.2%
Major shareholder	PINGYUAN HAN
% stake	19.7%
No. of employee	2,993

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Smart grid

China smart grid basics

China's strong and smart grid, defined by China Electric Power Research Institute (CEPRI), refers to an updated power network combined with advanced digital technologies in measurement, communications and information control across the power system. The incorporation of digital technology in the power grid helps to communicate information about the grid condition to system users, operators and automated devices, making it possible to dynamically respond to changes in the grid condition. In China, the smart grid network comprises the ultra-high voltage (UHV, (±1,000kV AC or ±800kV DC)) power transmission lines, smart meters, upgraded existing grid lines and other monitoring systems.

Why China needs a smart grid

China's drive to develop the smart grid is motivated by two main reasons, namely 1) to optimize inter-regional power transmission and 2) to effectively integrate renewable energy into the grid system.

Transmitting power across regions

The need for inter-regional power transmission is largely driven by the uneven distribution of energy resources in the country. In China, power demand is the highest in the coastal provinces. However, energy resources such as coal and wind are mainly located in the low-power-demand regions (central and northern regions). As such, a smart grid that is able to effectively transmit power across regions will help to optimize the usage of China's energy resource.

Effectively integrating renewable energy

Currently, the power transmission grid is unable to completely absorb the electricity generated from renewable sources such as wind and solar, as power generated from these sources is less stable, given its intermittent nature. Thereby, a smart grid which is able to dynamically respond to changes in grid connection should help to resolve the problem.

China's strong and smart grid features

China's smart grid characterized by UHV transmission and distribution grid lines

As mentioned earlier, a smart grid consists of the UHV transmission lines, smart meters and other automated power systems. Thus, given the broad range of smart grid equipment, the characteristic of a smart grid varies significantly across countries. In China, the smart grid differs from those in the US and Europe as it places a significant focus on the development of UHV power transmission as part of its smart grid investment plan. The key reason for this is that the China Electricity Council (CEC) believes it is the most efficient method of transmitting power with minimal energy loss. As compared to the traditional 500kV transmission lines, UHV power lines can transmit 4-5 times more power and require 60% less land for construction.

Smart grid in the US focuses on distribution infrastructure and automation application

The US Department of Energy (DOE) describes the Smart Grid as a "transformation from a centralized producer-controlled network to one that is less centralized and more consumer-interactive, ensuring a two-way flow of electricity as well as information transfer between the power generators and the power end-user." The US smart grid focuses on distribution, infrastructure upgrading, and replacement and automation application. Core equipment and products in the US smart grid campaign include smart meters and advanced IT systems.

Smart grid in Europe focuses on integrating distributed energy resources
In Europe, the key focus for smart grid development is on the integration of distributed energy resources (DER), such as wind, solar and biomass into its grid system. Thus, most of the investment for the European smart grid is channeled toward power storage equipment and systems.

Six characteristics of China's strong and smart grid
According to CEPRI, China's strong and smart grid should have the following characteristics:

- Robust – the grid should be adapted to China's extreme weather and capable of long-distance transmission with minimum energy loss.
- Self-repair – the grid should be equipped with continuous online analysis and predictive control measures and be able to proceed with self-diagnosis and self-maintenance.
- Compatible – the large-capacity grid should address the grid-connection bottleneck issue of renewable energy generation and be compatible with existing grids.
- Integrated – the grid should be upgraded with advanced technology in communications.
- Optimized – the grid should have better power dispatch and lower operating costs than the existing grid.
- Economical – the grid should boost the development of inter-region power transmission.

Equipment market for China's strong and smart grid

The six stages in the application of China's strong and smart grid are power generation, power transmission, power transformation, power distribution, end user power utilization and power dispatch. Each stage requires specific core equipment for its construction.

Generally speaking, power grid equipment can be divided into two categories: primary equipment and secondary equipment, with the former accounting for 90% of the total grid investment.

Primary equipment
Primary equipment refers to equipment that is directly used to generate, transmit, distribute and utilize electric power. Such equipment includes generators, motors, transformers, switchgear, high/low voltage circuit breakers, fuses, isolators, contractors, reactors, lightning rods, cable, hard/soft conductors and earth termination systems.

Secondary equipment
Secondary equipment functions to monitor, measure, control, protect and dispatch primary equipment, and includes measuring devices such as voltage, current, frequency and electric energy meters; insulation monitoring, control and signaling, relay protection and automation devices; and DC power source equipment such as storage batteries, DC power generators and silicon rectifier devices.

The difference between primary equipment and secondary equipment becomes increasingly obscure, however, when it comes to smart grid applications. By embedding advanced technology into primary equipment, the two categories become indistinguishable.

Figure 106: Main equipment used in the six cycles of smart grid

Cycle	Key investment domain	Selective equipment
Power generation	Traditional power generation	Swift grid-connection device
	Renewable energy	Wind converter, solar inverter
	Power storage	Large-scale power storage module
Power transmission	UHV power grid	SVC, STATCOM, FACTS, CSR
Power transformation	Power substation	Transformer, intelligent substation, instrument transformer, circuit breaker
Power distribution	Distribution grid lines	Switch, distribution transformer, distribution automation
Power utilization	End-user response	Smart meter, rechargeable vehicle, battery
Power dispatch	Power coordination	Intelligent real-time monitoring system

Source: Deutsche Bank, SGCC

Brief description of the main equipment used in the smart grid

Solar/wind inverter

Inverter refers to equipment that converts DC electricity into AC for the purpose of grid connection or home appliance use. As solar and wind power is generated in DC form, an inverter is required to convert the electricity to AC, to make it compatible with home appliances. A power inverter is often one of the most expensive components of an alternative energy system.

Flexible alternating current transmission system FACTS

FACTS is defined by the Institute of Electrical and Electronics Engineers (IEEE) as "a power electronic based system and other static equipment that provide control of one or more AC transmission system parameters to enhance controllability and increase power transfer capability." It is used to increase the capacity that the power grid transfers and ensure stable operation.

Among the core devices in FACTS, the static VAR compensator (SVC), thyristor-controlled series compensation (TCSC), static synchronous compensator (STATCOM and controllable shunt reactor (CSR) are among the most broadly-applied devices in China. The technology of FACTS should help to reduce transmission loss while optimizing overall power transmission in China's UHV-backboned smart grid.

Figure 107: Types of FACTS devices

Product	Features
Static VAR compensator (SVC)	SVC enables a swift and smooth response to reactive power. The parallel connection of controllable reactor and power capacitors enables SVC to synchronously generate and absorb reactive power.
Thyristor-controlled series compensation (TCSC)	TCSC compensates voltage to stabilize current and increase power capacity in the UHV transmission lines. The decline in voltage is caused by the reactance in AC (the same as resistance DC), which hinders current and varies with frequency in AC circuit.
Static synchronous compensator (STATCOM)	STATCOM is independent of voltage, which enables it to function during the power breakdown. STATCOM can not only adjust to reactive power, but can also adjust active power under certain conditions, which will improve the flexibility of the power system.

Source: Deutsche Bank

Figure 108: Compensation equipment

Source: Deutsche Bank, Rongxing Power Electronic

Figure 109: Instrument transformer

Source: Deutsche Bank, Sieyuan Electric

Instrument transformer

An instrument transformer is used for measuring the voltage and current in the electrical power systems for the purpose of system protection and control. The two types of instrument transformer are the current transformer and the voltage transformer.

- A current transformer (CT) is a measurement device for electric current and is commonly used in metering and protective relays.
- A voltage transformer (VT), also known as a potential transformer (PT), is a measurement device used for metering and protection in high-voltage circuits.

Transformer

A transformer is a device that is used to change the voltage of a system. For example, transformers are used in power dispatch centres to step up voltage for power transmission (≥500kV) and step it down for power distribution to industry (380kV) and households (220kV).

Figure 110: Oil cooled transformer

Source: Deutsche Bank, XD Electric

Figure 111: Switchgear

Source: Deutsche Bank, XD Electric

Switchgear

Switchgear is used to isolate electrical equipment. It consists of a combination of electrical disconnects, fuses or circuit breakers. Switchgear is of great importance in the power system as it directly affects the reliability of power supply. Switchgear can be insulated through a vacuum or some special substance. Gas-insulated switchgear (GIS), which is insulated by pressurized sulphur hexafluoride gas (SF6), is commonly used in industry despite it being more costly. There are several common types of switchgears such as oil- or vacuum-insulated switchgear.

Figure 112: Circuit breaker

Source: Deutsche Bank, Sieyuan Electric

Figure 113: Smart meter

Source: Deutsche Bank, Waison Meter

Circuit breaker

A circuit breaker is an automatically-operated electrical switch designed to protect an electrical circuit from damage caused by an overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. Unlike a fuse, which operates once and then has to be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes.

Digital substation

A digital substation refers to a substation that is upgraded by adding or replacing intelligent electronic devices that are more capable of monitoring, controlling, fault detection and power recovery. Digital substations are equipped with digital instrument transformers, optical networks and intelligent systems to optimize data access and communication within a substation.

Smart meter

A smart meter is an advanced meter that records, stores and transmits electricity consumption information with much greater detail than a conventional meter. It enables the recording of real-time energy use.

Two types of measuring meters are in the market – single-phase meters and three-phase meters. A single-phase meter is connected to a 220kV power source while the three-phase meter is connected to a 380kV power source. Both types of meters can be classified as smart meters if they are embedded with 'intelligent' technology. Meters with advanced technology can be classified by function into the following types:

- Multi-function meters, which can measure various electricity parameters;
- Multi-rate meters, which enable time-of-use tariffs;
- Multi-user meters to combine different end-users in one meter;
- Meters with prepayment functions; and
- Carrier-wave meters. This type of meter is usually installed with a carrier chip to transmit, store and output electricity consumption information.

Distribution automation

Distribution automation is a term that is used to describe the extension of intelligent control over the electrical power grid functions at the distribution level and beyond. It is the future target for smart grid development, whether in China, the US or Europe.

Equipment involved in distribution automation includes switchgear (primary equipment), feeder terminal units (FTU, secondary equipment), transformer terminal units (TTU, secondary equipment) and the power source for operation. FTU controls switchgear by collecting operating data of the latter. The unit needs to be equipped with communication technology and mates with switchgear, transformers and storage batteries for a complete set. TTU compensates the reactive power by collecting operating data of the transformer.

Intelligent power distribution systems

Intelligent power distribution systems comprise a combined application of various intelligent switchgear cabinets and computer monitoring systems. Intelligent switchgear cabinets, unlike traditional ones, focus more on online monitoring, instant action and remote control by embedded intelligent instruments.

Configuration of switchgear cabinets and computer monitoring systems varies based on specific project needs, which provides users with greater flexibility. Intelligent power distribution system feature multi-functions, digital characteristics, internet accessibility, compacter structure and low maintenance costs.

Intelligent monitoring systems

Intelligent monitoring systems, as the name suggests, are the online monitoring systems used in various electrical equipment for measuring parameters of voltage, frequency, current, power and electric resistance. It is a combination of measuring equipment such as CT, PT and computer monitoring systems.

In terms of the equipment types being monitored, intelligent monitoring systems can be applied to transformers, capacitors and high-voltage switchgear. Intelligent monitoring systems will likely evolve to be equipped with remote control and failure diagnosis functions.

Advanced metering infrastructure (AMI)

Advanced metering infrastructure (AMI) refers to a type of system that combines equipment and computer software for the purpose of electricity power usage management. Its advanced characteristics lie in that this type of infrastructure not only can measure, collect and analyze energy usage, but also can interact with various meters.

China strong and smart grid plan

The State Grid envisions a complete and advanced smart grid by 2020 after going through three fundamental development phases between 2009 and 2020:

2009-10 kick-off

- Strategic planning and key technology R&D
- Standards framework and critical technology standards
- Nine pilot projects across six cycles in power systems

2011-15 roll-out

- Construction of UHV power grids to speed up
- Major technical breakthroughs and extensive application of smart grid
- Preliminary smart grid operation, control, and interactive service systems

2016-20 scale-up

- A complete strong and smart grid with world-class technology and equipment
- Clean energy installed capacity will increase to 35% of the total

Figure 114: Nine pilot projects under smart grid scheme

Pilot Category	Project Name	Estimated completion date
General	Sino-Singapore Eco-city Smart Power Grid	Phase I is due by the end of 2011
Power Generation	Wind-Solar and Energy Storage Combined	Phase 1 is due by June 2011
Power Generation	Conventional Power Grid Coordinate	Jun-10
Power Transmission	Transmission Line Real Time Monitoring	Dec-10
Power Transformation	Smart Power Converter Station	Jun-11
Power Distribution	Power Distribution Automation	Dec-11
Power Consumption	Power Consumption Information Gathering System	Phase 1: Jul-2010; Phase 2: Dec-2010
Power Consumption	Electrical Charging Station	Nov-10
Power Dispatch	Technology support on power dispatch	Dec-10

Source: Deutsche Bank, SGCC, CSG, China Electric Council, Central Government of Republic of China 2011-15 Roll-out

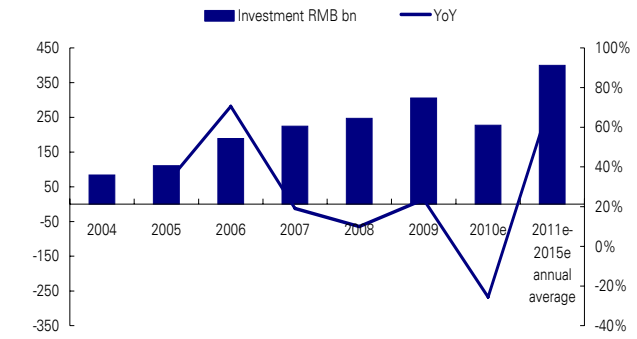
Rmb4tr investment in China smart grid

China grid companies are facing mounting pressure to satisfy increasing supply power generation. The government announced a total Rmb4tr investment into the fledging smart grid industry. The investment breakdown within the three phases is as follows:

- Rmb550bn in 2009-10, in which UHV power grid is set for Rmb83bn;
- Rmb2tr in 2011-15, in which UHV power grid is set for Rmb300bn; and
- Rmb1.7trn in 2016-20, in which UHV power grid is set for Rmb250bn.

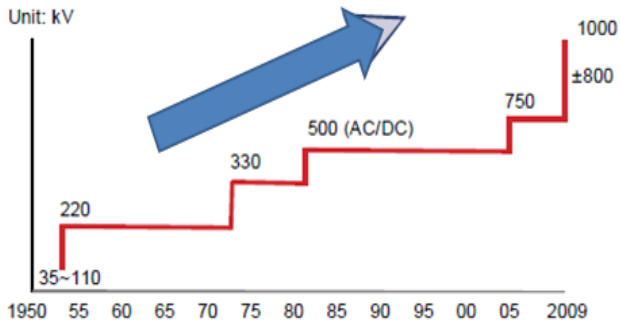
Overall, we see smart grid as a growing trend of high importance in China and will be the strategic priority in China's 12th Five-Year Development Plan.

Figure 115: State Grid investment in power grids



Source: Deutsche Bank, SGCC

Figure 116: China's voltage upgrade trend



Source: Deutsche Bank, SGCC

China UHV power grid plan by 2015

In August 2010, the State Grid announced its 12th Five-Year Development Plan of UHV power grid construction. The company expects to form three horizontal AC lines, three vertical AC lines as well as a ring circular AC line by 2015. In addition, State Grid will kick off the construction of 11 DC power transmission sites during the next five years.

Figure 117: China UHV grid plan by 2015

Vertical lines	**Inner Mongolia (Ximeng) - Jiangsu province (Nanjing)**
	Shaanxi province - Hunan province (Changsha)
	Hebei province (Zhangbei) - Jiangxi province (Nanchang)
Horizontal lines	Inner Mongolia - Shandong province (Weifang)
	Shanxi province - Jiangsu province (Xuzhou)
	Sichuan province - Anhui province
Ring line (Yangtze River Delta)	Jiangsu province (Nanjing, Taizhou, Suzhou) - Shanghai - Zhejiang province - Anhui province (Huainan)

Source: Deutsche Bank, SGCC, NDRC

Frequently asked questions and glossary of terms

What would make the grid a "smart" grid?

The smart grid takes the existing electricity delivery system and makes it "smart" by linking and applying communications systems to the grid so that is can communicate about the grid condition to system users, operators, and automated devices, making it possible to dynamically respond to changes in the grid condition. Such processes would help improve the performance of electric devices, thus reducing overall energy consumption.

What are the economic benefits of UHV transmission?

According to the Chinese Society for Electrical Engineering (CSEE), the capacity of one UHV power transmission line is equivalent to that of four to five traditional 500kV power lines (about 4,000-5,000MVA). At the same, the transmission loss for a UHV line is around 25% of that of a traditional 500kV line. UHV transmission lines can also save 60% of land used in construction, compared with traditional lines.

What is the smart grid investment for China in 2010-20? How much will be spent on equipment?

China government's announced a total Rmb3.7trn investment for the smart grid industry in 2011-20 (another Rmb550bn was invested in 2009-10). As equipment accounts for 60% of total power investment, about Rmb2.2tr is likely to be allocated to equipment.

What is the entry barrier for smart grid equipment manufacturing?

The entry barrier for smart grid equipment manufacturing varies across the value chain. In general, the entry barrier of primary equipment is higher than for secondary equipment as the former requires massive upfront investment and a good track record. In terms of specific equipment, FACTS equipment (SVC, SVG), current valve, substation/distribution automation may be more difficult for new player to enter owing to high technological barriers. Smart meter manufacturing, on the other hand, has a relatively lower entry barrier.

Who are major listed smart grid players in the US, the EU and Japan?

A number of listed-companies are engaged in smart grid products in the US, the EU and Japan. For US smart grid, major players are ESCO Technologies (information management system for smart grid applications), Echelon (network energy services), Itron (automated meter reading [AMR] and AMI), EnerNOC (demand response and energy management solutions) and Badger Meter (meters and smart metering solutions).

In the EU, smart grid players include Schneider Electric, ABB, Siemens, which were previously engaged in power T&D equipments and have in recent years expanded their businesses to include demand response and meter infrastructure, automation systems and grid monitoring systems.

In Japan, smart grid-related listed companies include Kinden (power T&D facilities, monitoring and control systems), DAIHEN (distribution equipment, power transformers), OSAKI (electronic meters and AMR systems), as well as some manufacturing conglomerates such as HITACHI, Toshiba and Mitsubishi Electric, to name just a few.

Figure 118: Glossary of terms

Terms	Definition
AC	Alternating current refers to the movement of an electric charge that periodically reverses direction. AC is the form of electric power delivered to businesses and residences.
AMI	Advanced metering infrastructure refers to an intelligent electricity meter that is use to measure and record data usage.
CSR	Controllable shunt reactor is a device allowing electrical current to pass and generate resistance to the current simultaneously.
DC	Direct current refers to the flow of electric charge in only one direction.
Demand response	In electricity grids, demand response (DR) is similar to dynamic demand mechanisms to manage customer consumption of electricity in response to supply conditions. Demand response is generally used to refer to mechanisms used to encourage consumers to reduce demand, thereby reducing the peak demand for electricity.
Distributed energy	Distributed energy refers to a range of smaller energy sources designed to provide electricity in locations close to consumers. Current popular sources of distributed energy are renewable energy technologies, including solar power, wind power and biomass.
Energy efficiency	A measurement of the efficiency of a process and is calculated by the amount of total amount of output divided by the total amount of energy input.
FACTS	Flexible alternating current transmission system is a system composed of static equipment used for the AC transmission of electrical energy.
Greenhouse gases	Gases that tend to warm the planet's surface through preventing long-wave radiant energy from leaving earth's atmosphere, including water vapour, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride.
Line loss	Electric energy lost during the transmission of electricity. Much of it is heat loss.
Peaking capacity	Capacity of generating equipment normally reserved for operation during the hours of highest daily, weekly or seasonal loads.
SCADA	SCADA stands for supervisory control and data acquisition. It generally refers to industrial control systems, namely computer systems that monitor and control industrial (power generation), infrastructure (electrical power transmission and distribution and wind farms), or facility-based processes (HVAC and energy consumption).
STATCOM	Static synchronous compensator is a regulating device used on alternating current electricity transmission networks.
SVC	Static var compensator is an electrical device for providing fast-acting reactive power on high-voltage electricity transmission networks.

Source: Deutsche Bank

Risks

Potential delay in implementation

Although China remains determined on its strong and smart grid blueprint, there is currently no detailed implementation measure for the development of smart grid from the government. It is possible that the government may delay the pace of implementation of smart grid development due to economic and technological concerns.

Technology risk

The development of China's smart grid depends on both equipment and technological standards. Although China has developed a strong manufacturing base for most equipment products, the country's smart grid technology is relatively nascent and still evolving. Thus, there is a risk that China may take longer than expected to formulate smart grid technological standards.

Smart grid players

Wasion Group (3393.HK, non-rated)

Company background

Wasion Group, located in Hunan province, is a leading supplier of advanced energy metering products and solutions. Wasion distributes its products to China and overseas markets including Southeast Asia and the Americas. Wasion Group was listed in Hong Kong in 2005 and is controlled by Mr. Ji Wei, president of the company, with a 50.5% stake.

Business exposure

Wasion Group is principally engaged in the development and manufacture of electronic energy meters, water meters, gas meters，data collection terminals and metering systems. At the end of 2009, the company had annual production capacity of 3m units of three-phase electricity meters, 10m units of single-phase meters and 1m units of data collection terminals. Wasion Group is also engaged in communication technology to provide total solutions, such as data concentrators and system, for utilities. Recently, Wasion signed a strategic cooperation framework agreement with Siemens to jointly conduct feasibility research for smart grid pilot projects in China.

Key financials

The company recorded revenue of Rmb1.08bn and net profit of Rmb262m in 2009. In terms of business breakdown, revenue from three-phase and single-phase electronic power meters amounted to Rmb471m and Rmb284m, respectively. In 1H10, the company reported flat revenue and net profit. Revenue from three-phase and single-phase electronic power meters in1H10 reached Rmb208.6m and Rmb102m, respectively.

Figure 119: WASION GROUP HOLDINGS LTD (Hong Kong: 3393, Currency: HKD)

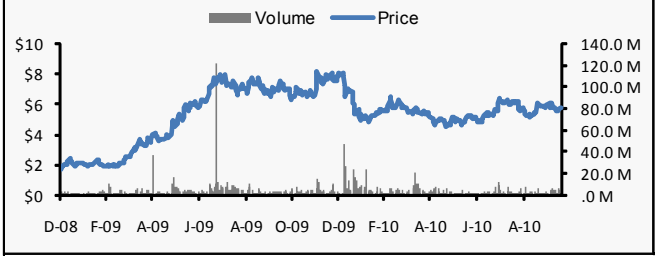
Description	
Address:	16 Harcourt Road Unit B2 A-B 20/F Far East Finance Centre Central Hong Kong (SAR)
Website:	www.wasion.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,059	1,078	463
EBIT	291	280	89
Net Income	262	262	77
EPS (Diluted)	0.31	0.30	0.08
Book Value per Share	1.7	2.3	2.3
Total Assets	2,544	3,176	3,111
Cash Flow-Oper Activities	312	118	(339)
Capital Expenditures	(217)	(190)	(68)
Free Cash Flow	95	(71)	(407)
Return on Com Eqty (%)	20.1	14.8	14.7
Total Debt/Total Equity (%)	32.8	19.5	27.9

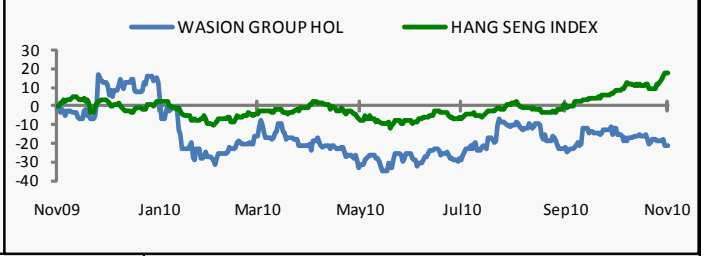
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Electronic Power Meters	828.47
Data Collection Terminals and Related Services	249.69

Key Statistics	
Share price (HKD)	5.42
52-Week Range	4.31 - 8.65
YTD performance	-33%
Avg Daily traded Val (3 Months, USD)	2.1
Market Value (USD mn)	649.5
Float %	44.6%
Major shareholder	WEI JI
% stake	50.5%
No. of employee	2,790

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Clou Electric (002121.CH, not rated)

Company background

Clou Electronics, founded in 1996, specializes in the design and manufacture of power automation products and electrical instruments. The company was listed on the Shenzhen Stock Exchange in 2007 and is controlled by Mr. Rao Luhua, president of the company, holding a 49% stake.

Business exposure

Clou Electronics provides power automation products, including power using automation series products, power operation supplies and frequency converting products, as well as electrical instruments, including standard instruments and electronic power meters. The company plans to raise Rmb550.5m in a private offering and invest Rmb100m in an intelligent substation automation project, Rmb210m into a smart meter project and Rmb52m into converter capacity expansion. In 2009, Clou Electronics extended its business into primary equipment through an equity investment in Wuhan Hemu Electrical, which is engaged in instrument transformer manufacturing.

Key financials

Clou Electronics recorded revenue of Rmb433m and net profit of Rmb79m in 2009. In terms of business breakdown, revenue from power using automation series products and electronic power meters was Rmb152.5m and Rmb182.7m, respectively. Gross margin reached 44.6% in 2009. Clou Electronics recorded its 1H10 revenue up 100% yoy to Rmb285m and net profit up 93.8% yoy to Rmb51m. Margin expanded by 2.3ppt yoy to 47.39% in 1H10.

Figure 120: SHENZHEN CLOU ELECTRONICS -A (Shenzhen: 002121, Currency: CNY)

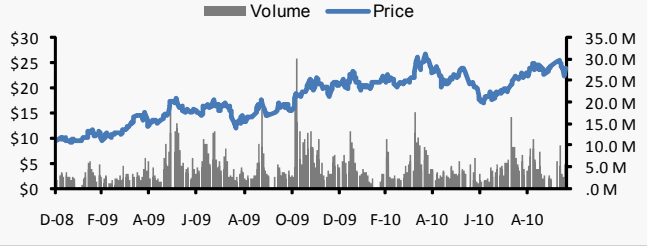
Description	
Address:	5/F, Bldg.T2, South Dist. Nanshan High-tech Ind Park Shenzhen, Guangdong, 518057 China
Website:	www.szclou.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	393	433	285
EBIT	54	86	63
Net Income	56	79	51
EPS (Diluted)	0.23	0.33	0.21
Book Value per Share	1.8	2.0	2.2
Total Assets	677	972	1,183
Cash Flow-Oper Activities	21	59	(90)
Capital Expenditures	(103)	(55)	(36)
Free Cash Flow	(82)	3	(126)
Return on Com Eqty (%)	13.7	17.3	21.5
Total Debt/Total Equity (%)	26.6	37.7	63.6

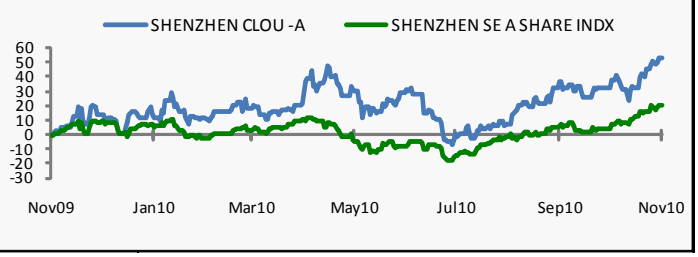
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Electricity Measuring Instrument	254.89	113.01
Electrical Power Automation Machinery	172.91	78.95
Others - Frequency Inverter Equipment	6.94	1.89

Key Statistics	
Share price (CNY)	27.84
52-Week Range	16.11 - 28.59
YTD performance	37%
Avg Daily traded Val (3 Months, USD)	19.2
Market Value (USD mn)	1,003.8
Float %	37.7%
Major shareholder	LUHUA RAO
% stake	49.0%
No. of employee	1,541

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

NARI Technology (600406.CH, not rated)

Company background

NARI Technology, established in 2001, specializes in software and hardware products serving the power industry, as well as the provision of system integration services. NARI Technology has four branch companies, covering power network controls, system controls, industrial controls and rural electrification. NARI Technology was listed in Shanghai in 2003 and is controlled by Nanjing NARI Group, which has a 36.8% stake in the company. Nanjing NARI Group is 100% owned by China State Grid.

Business exposure

NARI Technology has four business segments: power dispatching automation, substation protection and automation, rail-transportation automation and rural power network automation. It has dominant market share of up to 70% in cross-province power dispatch systems. The company plans to invest Rmb760m from a recent private offering into business expansion of rail-transportation control and dispatching systems, substation automation, power user terminal units, smart meters, wind power grid-connection systems and power distribution control systems.

Key financials

NARI Technology reported revenue of Rmb1,762m and net profit of Rmb250m in 2009. In terms of business breakdown, revenue from power dispatching automation and substation automation reached Rmb439m and Rmb697m, respectively. The gross margins of the two business segments in 2009 were 29.6% and 32.8%, respectively. In 1H10, NARI Technology reported revenue of Rmb274m (up 20.32% yoy) in power dispatching automation and of Rmb235m (up 20.46% yoy) in substation automation. The margin of power dispatching automation rose by 9.02ppt yoy to 40.1% in 1H10, 7.6ppt higher than the overall gross margin.

Figure 121: NARI TECHNOLOGY DEVELOPMENT-A (Shanghai: 600406, Currency: CNY)

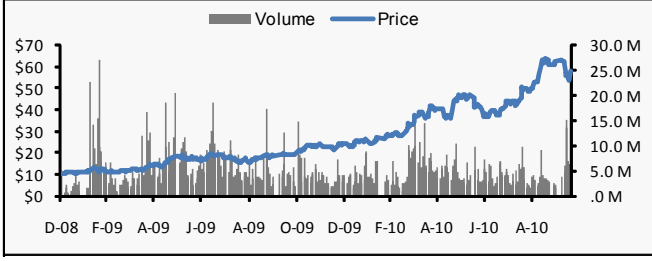
Description	
Address:	20 Gaoxin Road High-Tech Zone Nanjing, Jiangsu, 210061 China
Website:	www.naritech.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,364	1,762	991
EBIT	121	197	143
Net Income	173	250	164
EPS (Diluted)	0.34	0.49	0.32
Book Value per Share	2.4	2.1	2.3
Total Assets	2,529	2,454	2,656
Cash Flow-Oper Activities	207	154	(119)
Capital Expenditures	(54)	(81)	(7)
Free Cash Flow	153	72	(125)
Return on Com Eqty (%)	16.2	22.0	30.6
Total Debt/Total Equity (%)	7.6	15.5	20.4

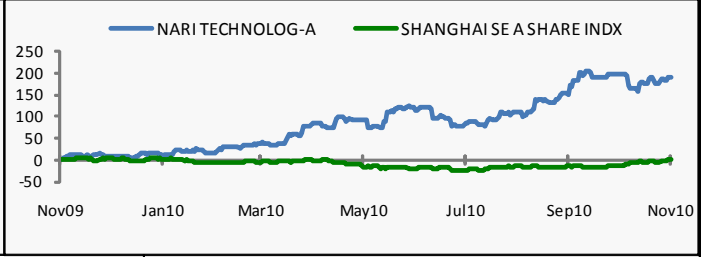
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Integrated Substation Automation	697.15
Power Grid Dispatching Automation	438.78
Rail Transportation Automation	368.04
Rural Power Network Automation	137.55
Electric Control Automation	134.28

Key Statistics	
Share price (CNY)	61.04
52-Week Range	20.85 - 65
YTD performance	149%
Avg Daily traded Val (3 Months, USD)	34.7
Market Value (USD mn)	4,815.8
Float %	48.8%
Major shareholder	STATE GRID CORP OF C
% stake	36.8%
No. of employee	1,762

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Guodian Nanjing Automation (600268.CH, non-rated)

Company background

Guodian Nanjing Automation is principally engaged in the manufacture and distribution of power automation equipment. Predecessor of Guodian Nanjing Automation is Nanjing Electric Power Automation Equipment General Factory founded in 1940. Guodian Nanjing Automation was listed in Shanghai Stock Exchange in 1999 as one of the earliest high-tech listing companies in electric power industry. Major shareholder is China Huadian Corporation, holding 58.2% stake of the company.

Business exposure

Guodian Nanjing Automation's principal businesses cover three major segments: power automation, including hydropower automation, railway automation and industrial automation; renewable energy and energy conservation, including wind/solar converters and other energy saving equipments, and intelligent primary equipment, including digital electric transformers and intelligent switchgear. The company plans to invest Rmb780m in substation automation and instrument transformers, distribution automation systems and intelligent switches, intelligent power utilization, turbine controller/converters, high voltage converters and power plant automation as well as monitoring systems in private equipment.

Key financials

Guodian Nanjing Automation recorded revenue of Rmb1,883m and net profit of Rmb89m in 2009. In terms of the business breakdown, revenue from power grid automation in 2009 reached Rmb973m, with a gross margin of 29.15%. The company reported revenue of Rmb420m in power grid automation in 1H10, decreasing 12.18% yoy.

Figure 122: GUODIAN NANJING AUTOMATION-A (Shanghai: 600268, Currency: CNY)

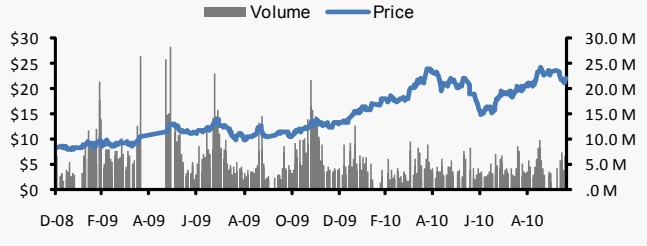
Description	
Address:	38 New Mofan Road Nanjing, Jiangsu, 210003 China
Website:	www.sac-china.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,668	1,883	886
EBIT	99	99	42
Net Income	81	89	20
EPS (Diluted)	0.29	0.31	0.07
Book Value per Share	3.3	3.3	3.2
Total Assets	2,627	2,932	3,457
Cash Flow-Oper Activities	(35)	(66)	(414)
Capital Expenditures	(77)	(139)	(35)
Free Cash Flow	(112)	(206)	(449)
Return on Com Eqty (%)	10.2	10.0	10.5
Total Debt/Total Equity (%)	94.8	99.6	159.9

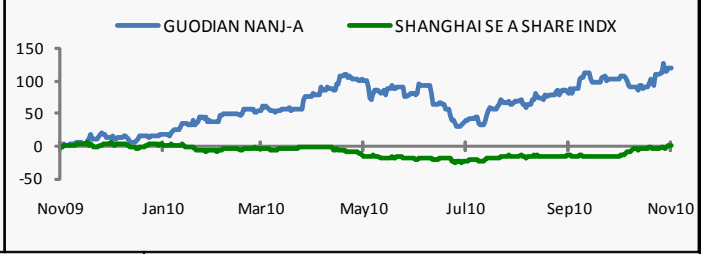
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Industrial Process Automation Machinery Manufa	1772.79
Others	77.34
Other Operating Revenue	46.01

Key Statistics	
Share price (CNY)	25.07
52-Week Range	11.387 - 26.55
YTD performance	90%
Avg Daily traded Val (3 Months, USD)	16.5
Market Value (USD mn)	1,069.1
Float %	38.4%
Major shareholder	CHINA HUADIAN CORP
% stake	58.2%
No. of employee	2,842

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

XJ Electric (000400.CH, not rated)

Company background

XJ Electric is primarily engaged in automation, protection and controlling products for electric power systems. XJ Electric was founded in 1993 and was listed on the Shenzhen Stock Exchange in 1997. The major shareholder is XJ Group, holding 29.9% stake.

Business exposure

XJ Electric's two major business segments are electrical power automation and relay protection and control. XJ Electric is involved in both primary equipment (transformers, switchgears) and secondary equipment (automation systems and electronic measuring meters). The company has high market share for its control and protection equipment for DC power transmission. By product breakdown, the company provides power grid and power generation equipment, transformers, electronics manufacturing services (EMS), power usage products, power distribution network products, electrified railway products and DC power transmission systems.

Key financials

XJ Electric recorded revenue of Rmb3,015m and net profit Rmb130m in 2009. Revenue from control and protection equipment for DC power transmission reached 159m. In 1H10, XJ Electric recorded Rmb1,182m in revenue and net profit Rmb69m, increasing 11.8% and 20.5% yoy, respectively. In terms of business breakdown, revenue from electric transmission systems and distribution products reached Rmb459m and Rmb261m in 1H10. Revenue from the transformer business and DC power transmission equipment in 1H10 amounted to Rmb133m and Rmb50m, respectively. Power utilization products, including electronic measuring meters, rose by 75% yoy to Rmb129m in 1H10.

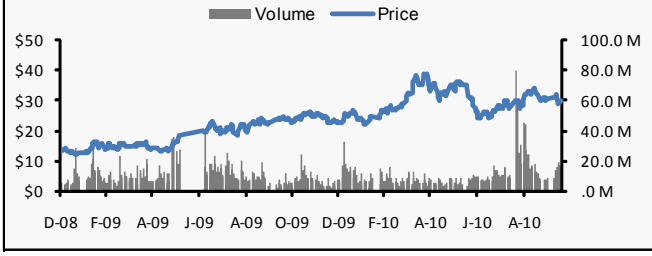
Figure 123: XJ ELECTRIC CO LTD-A (Shenzhen: 000400, Currency: CNY)

Description			
Address: Xuji Boulevard Xuchang, Henan, 461000 China			
Website: www.xjec.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	2,589	3,015	1,182
EBIT	252	317	134
Net Income	38	130	69
EPS (Diluted)	0.10	0.34	0.18
Book Value per Share	5.6	6.0	6.2
Total Assets	4,740	4,605	5,125
Cash Flow-Oper Activities	134	53	(335)
Capital Expenditures	(30)	(65)	(91)
Free Cash Flow	104	(12)	(426)
Return on Com Eqty (%)	1.8	5.9	6.3
Total Debt/Total Equity (%)	51.8	37.3	29.6

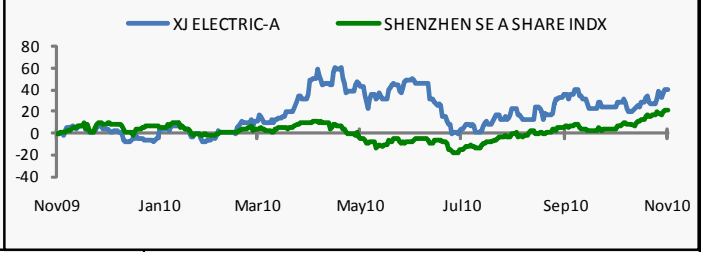
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Electric Transmission System	954.22
Distribution Network	895.63
Transformers	319.35
Electricity System Equipment	234.04
Other Operating Revenue	204.15

Key Statistics	
Share price (CNY)	33.82
52-Week Range	21.2 - 40.38
YTD performance	48%
Avg Daily traded Val (3 Months, USD)	72.8
Market Value (USD mn)	1,921.9
Float %	70.0%
Major shareholder	XJ GROUP CORP
% stake	29.9%
No. of employee	2,758

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Sieyuan Electric (002028.CH, not rated)

Company background

Sieyuan Electric is primarily engaged in power transmission, distribution and monitoring equipment. Specializing in certain traditional electrical equipment including arc-suppressing coil and switchgears, the company further extended its business into the gas-insulated switchgear (GIS), SVG and active power filter (APF) businesses in recent years. Sieyuan Electric was listed in 2004. The largest shareholder is Dong Zengping, president of the company, holding an 18.12% stake.

Business exposure

Sieyuan Electric's major products include power automation equipment (namely, arc-suppressing coils), high-voltage switches, high-voltage transducers, capacitors and reactors. The company plans to further expand its business in SF6 GIS, SVG and digital substations. Sieyuan also plans to invest Rmb228m to achieve capacity of 1,000 sets of SVG equipment and 800 sets of digital substation system equipment by 2012.

Key financials

Sieyuan Electric recorded revenue of Rmb1,875m and net profit of Rmb950m in 2009. In terms of business breakdown, revenue of switchgears and high-voltage transducers reached Rmb607m and Rmb321m in 2009. Blended gross margin in 2009 was 44.6%. In 1H10, Sieyuan Electric recorded flat yoy revenue of Rmb729m, curtailed by the 11% yoy decrease in power automatic equipment sales to Rmb154m. Revenue of switchgear and high-voltage transducers reached Rmb211m and Rmb137m in 1H10, respectively.

Figure 124: SHANGHAI SIYUAN ELECTRIC -A (Shenzhen: 002028, Currency: CNY)

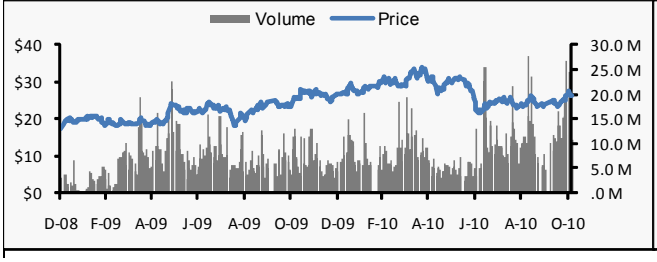
Description	
Address:	3399 Huaning Road Minhang, Shanghai, 201108 China
Website:	www.syec.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,519	1,875	729
EBIT	306	381	119
Net Income	346	950	228
EPS (Diluted)	0.79	2.16	0.52
Book Value per Share	4.9	6.5	6.4
Total Assets	3,018	3,861	3,569
Cash Flow-Oper Activities	142	408	(194)
Capital Expenditures	(188)	(81)	(31)
Free Cash Flow	(46)	327	(225)
Return on Com Eqty (%)	17.6	37.9	36.9
Total Debt/Total Equity (%)	7.4	1.8	1.4

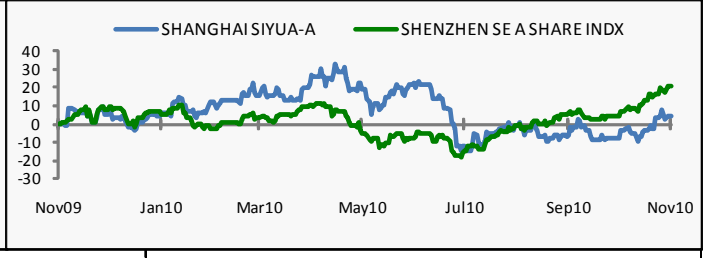
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
High Voltage Switch	606.60
Electric Power Automatic Equipment	400.91
High Voltage Sensor	321.30
Other - Electric Power Measurement Equipment	294.83
Electric Power Capacitor	255.71

Key Statistics	
Share price (CNY)	26.5
52-Week Range	21.35 - 34.5
YTD performance	-1%
Avg Daily traded Val (3 Months, USD)	43.7
Market Value (USD mn)	1,750.4
Float %	53.0%
Major shareholder	ZENGPING DONG
% stake	18.1%
No. of employee	2,951

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Dongfang Electronics (000682.CH, not rated)

Company background

Dongfang Electronics, found in 1957, is principally engaged in the development, production and distribution of electrical and industrial automation control systems. The company was listed in 1997 and parent Yantai Dongfang Electronics Group holds a 19.7% stake.

Business exposure

Dongfang Electronics provides a wide spectrum of products in the field of power automation system, information management systems and electricity measurement systems. Major products include SCADA/EMS/DMS/AMR, RTU, protection relays, substation control systems, multifunction meters, communication devices and so forth. To date, products of Dongfang Electronics have been utilized by more than 400 transmission control centres, 70 cities' distribution control centres and 6,000 power plants and substations.

Key financials

Dongfang Electronics recorded revenue of Rmb427m and net profit of Rmb11m in 1H10. In terms of business breakdown, revenue from electricity automation systems, electronic equipment, and information systems reached Rmb163m, Rmb120m, and Rmb71m, respectively.

Figure 125: DONGFANG ELECTRONICS CO LT-A (Shenzhen: 000682, Currency: CNY)

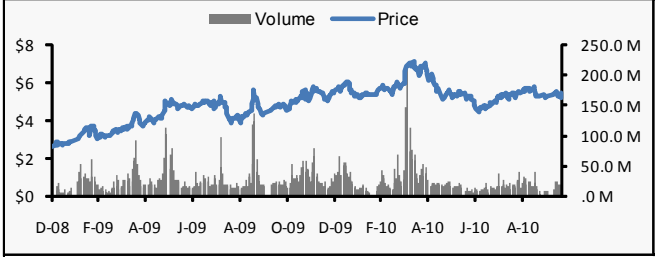
Description	
Address:	2 Airport Road Zhifu District Yantai, Shandong, 264000 China
Website:	www.dongfang-china.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	855	937	427
EBIT	4	5	10
Net Income	19	21	11
EPS (Diluted)	0.02	0.02	0.01
Book Value per Share	1.3	1.4	1.4
Total Assets	1,727	1,733	1,714
Cash Flow-Oper Activities	20	28	(87)
Capital Expenditures	(10)	(24)	(5)
Free Cash Flow	11	3	(93)
Return on Com Eqty (%)	1.4	1.6	1.6
Total Debt/Total Equity (%)	5.4	3.6	2.6

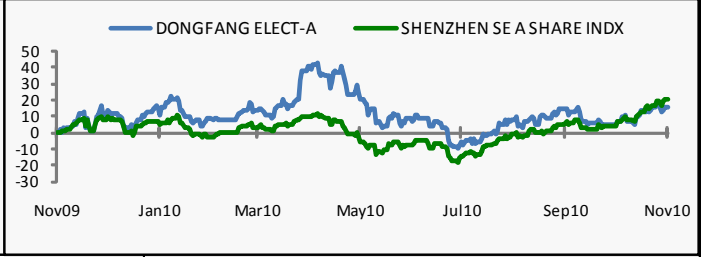
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Electricity Auto-system	380.85	131.28
Electronic Equipment	262.22	11.50
Information System	163.74	107.04
Wireless Access System	94.00	18.36
Leasing	34.87	23.91

Key Statistics	
Share price (CNY)	5.78
52-Week Range	4.27 - 7.25
YTD performance	2%
Avg Daily traded Val (3 Months, USD)	18.0
Market Value (USD mn)	849.3
Float %	78.8%
Major shareholder	YANTAI DONGFANG ELEC
% stake	19.7%
No. of employee	1,702

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

China XD Electric (601179.CH, not rated)

Company background

China XD Electric is a leading player mainly engaged in power transmission, distribution equipment and protection equipment and is an integrated provider of technology and service as well as engineering contracting. The predecessor of the company was Xi'an Electrical Machinery Manufacturing Company, which is established in 1959. China XD Electric was listed in Shanghai in January 2010 and is controlled by China XD Group, which holds a 58.1% stake.

Business exposure

China XD Electric provides switchgear, transformers, rectifiers, insulators, lightning conductors and capacitors. Its switchgear series mainly focuses on high voltage and ultra high voltage (110kV or above), including GIS, GCB, isolating switches and ground switches. Its instrument transformer series includes constant voltage transformers (CVT), current transformers (CT) and potential transformers (PT). In 2009, the China XD Electric engaged in R&D of a series of high-end products, including a converter valve for ±800kV DC construction, a ±1,000kV shunt reactor and SVC.

Key financials

In 2009, China XD Electric recorded revenue of Rmb14bn and net profit of Rmb1.2bn. In terms of business breakdown, revenue from switchgear and transformers reached Rmb5.2bn and Rmb4.8bn, respectively. In 1H10, the company recorded revenue of Rmb6.7bn and net profit of Rmb648m. Revenue from switchgear and transformers reached Rmb2bn (up 4% yoy) and Rmb2.2bn (down 1% yoy) in 1H10.

Figure 126: CHINA XD ELECTRIC CO LTD-A (Shanghai: 601179, Currency: CNY)

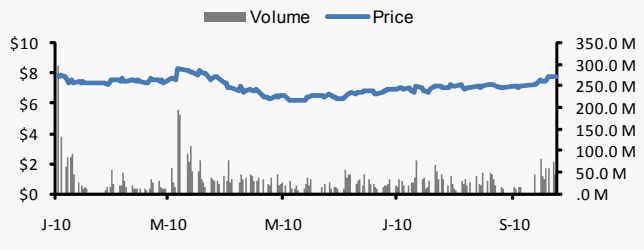
Description	
Address:	Suite A, #7 Tangxing Road High Tech Zone Xian, 710075 China
Website:	www.xdect.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	12,881	13,916	6,600
EBIT	1,448	1,503	724
Net Income	1,007	1,155	544
EPS (Diluted)	-	0.38	-
Book Value per Share	1.3	1.3	3.4
Total Assets	19,116	21,520	27,534
Cash Flow-Oper Activities	1,025	720	(806)
Capital Expenditures	(1,417)	(977)	(250)
Free Cash Flow	(392)	(257)	(1,056)
Return on Com Eqty (%)	-	28.8	13.6
Total Debt/Total Equity (%)	37.8	116.0	15.7

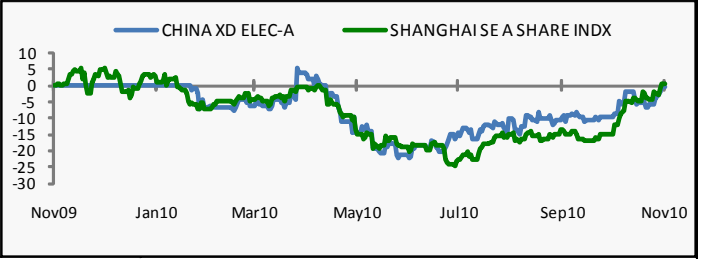
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Switchgear	4757.17
Engineering & Trade	4429.98
Transformers	2933.73
Rectifying Device	944.00
Capacitor	394.08

Key Statistics	
Share price (CNY)	7.88
52-Week Range	5.99 - 8.39
YTD performance	-
Avg Daily traded Val (3 Months, USD)	41.6
Market Value (USD mn)	5,157.8
Float %	30.0%
Major shareholder	CHINA XIDIAN GROUP
% stake	58.1%
No. of employee	15,332

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Tebian Electric Apparatus (600089.CH, not rated)

Company background

Tebian Electric Apparatus engages in the manufacture and distribution of electric power transmission and transformation equipment. The company is also involved in contract construction of power transmission and transformation projects and photovoltaic projects, as well as manufacture of new materials such as aluminum foil. TBEA has nine manufacturing bases in China and distributes its products to overseas markets. TBEA was listed in Shanghai in 1997, and its parentco, Xinjiang Tebian Electric Group, holds an 11.4% stake in the company.

Business exposure

TBEA's major businesses are categorized into three segments: power transmission and distribution, renewable energy and new materials. In the power transmission and distribution segment, main products include transformers of 1,000kV or below, reactors of 750kV or below and converter valves for DC construction of 500kV or below. TBEA has annual output of electrical cables (>110kV) of Rmb2.5bn. In the renewable energy segment, TBEA manufactures solar wafers, solar modules, stand-alone PV systems, comprehensive solar lighting and pumping systems and solar controllers and converters. TBEA plans to invest Rmb3.7bn in the capacity expansion of transformers and cables by adding 43,000MVA and 9,540km capacity, respectively.

Key financials

In 2009, TBEA reported revenue of Rmb14.7bn in 2009. Transformer was the largest revenue contribution in 2009, accounting for 61% of total income. The company reported revenue of Rmb8.7bn in 1H10, of which revenue from transformer income was Rmb5bn (down 0.49% yoy). In terms of geographic breakdown, about 21.5% of the total revenue was derived from overseas market in 1H10, increasing 17.62% yoy.

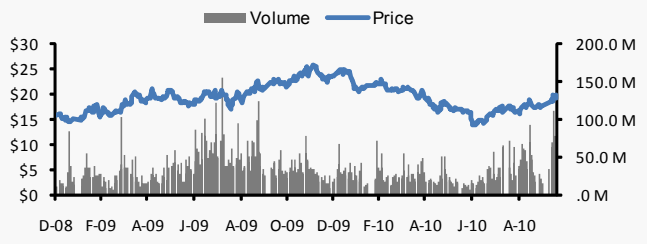
Figure 127: TBEA CO LTD-A (Shanghai: 600089, Currency: CNY)

Description			
Address: 52 Yan'an Road South Changji, Xinjiang, 831100 China			
Website: www.tbea.com.cn			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	12,463	14,687	8,719
EBIT	1,218	1,805	1,107
Net Income	963	1,529	960
EPS (Diluted)	0.56	0.85	0.53
Book Value per Share	2.9	3.9	4.2
Total Assets	15,153	18,868	20,773
Cash Flow-Oper Activities	2,342	1,867	801
Capital Expenditures	(2,524)	(1,643)	(855)
Free Cash Flow	(182)	224	(54)
Return on Com Eqty (%)	25.1	25.1	25.1
Total Debt/Total Equity (%)	48.0	48.0	43.3

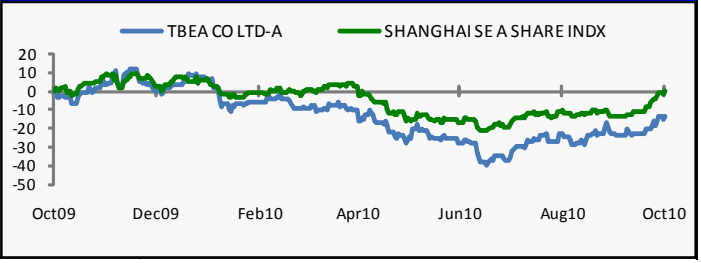
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Transformer	8965.25	2550.15
Wire and Cable Manufacturing	2558.47	455.02
Solar Silicon Wafers and Components	1475.20	55.15
Electrical Contractors Work	1242.99	275.09
Other Operations - Sales of Materials & Others	419.98	80.39

Key Statistics	
Share price (CNY)	19.7
52-Week Range	13.544 - 26.051
YTD performance	-17%
Avg Daily traded Val (3 Months, USD)	100.4
Market Value (USD mn)	6,009.6
Float %	82.7%
Major shareholder	TEBIAN ELECTRIC APPA
% stake	11.4%
No. of employee	10,021

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Zhixin Electric (600517.CH, not rated)

Company background

Zhixin Electric is principally engaged in the design and manufacturing of amorphous metal transformers. The company is the world's largest amorphous metal transformer producer in terms of production capacity and is a technology leader. Zhixin Electric provides a full spectrum of amorphous metal transformers. The company was listed in Shanghai in 2003, and is controlled by Shanghai Zhixin Group, which holds a 32.3% stake.

Business exposure

Zhixin Electric provides amorphous metal distribution transformers, amorphous metal pad-mounted transformers, amorphous metal separated pad-mounted transformers, amorphous alloy semi-buried combination-type transformers, pre-fabricated substations and amorphous metal dry step-up transformers for solar energy. The company has a dominant market share of 80% for its amorphous metal transformers. The company recently launched its new amorphous metal pre-fabricated substation for wind farm projects, which will be officially used in the Dafeng wind farm soon. Zhixin Electric also plans to develop power distribution equipment for wind and solar power in the future.

Key financials

Zhixin Electric recorded revenue of Rmb1,289m and net profit of Rmb255 in 2009. In 1H10, revenue and net profit reached Rmb738m and Rmb166. Revenue from amorphous metal transformers was Rmb1,246m and Rmb715m in 2009 and 1H10. The company guides 2010 revenue of Rmb1.45bn and net profit of Rmb260m.

Figure 128: SHANGHAI ZHIXIN ELECTRIC C-A (Shanghai: 600517, Currency: CNY)

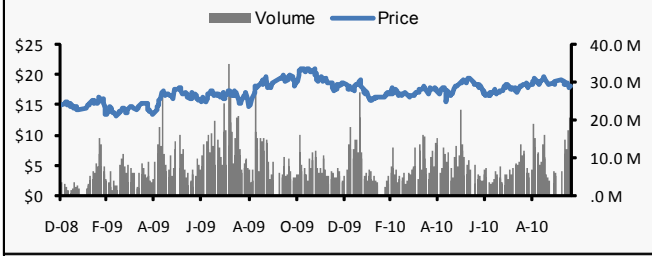
Description	
Address:	2239 Hongqiao Road Shanghai, 200336 China
Website:	www.zhixindianqi.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,591	1,289	738
EBIT	251	358	244
Net Income	211	255	166
EPS (Diluted)	0.34	0.41	0.27
Book Value per Share	1.5	1.9	1.9
Total Assets	1,771	1,722	1,940
Cash Flow-Oper Activities	416	113	(33)
Capital Expenditures	(84)	(60)	(20)
Free Cash Flow	333	53	(53)
Return on Com Eqty (%)	25.1	24.1	25.5
Total Debt/Total Equity (%)	40.2	10.3	13.9

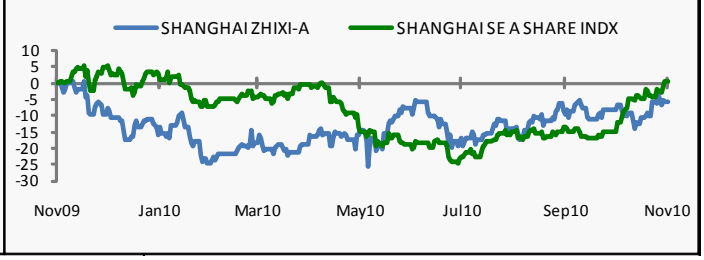
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Electric Power transmission/Control/Distribution	7512.89
Wind Energy	483.23
Others	347.37
Photovoltaics	164.41
Eliminations	(2498.21)

Key Statistics	
Share price (CNY)	19.39
52-Week Range	15.3 - 21.57
YTD performance	4%
Avg Daily traded Val (3 Months, USD)	27.8
Market Value (USD mn)	1,802.2
Float %	54.2%
Major shareholder	SHANGHAI ZHIXIN GROU
% stake	32.3%
No. of employee	1,190

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Rongxin Power Electronic (002123.CH, not rated)

Company background

Rongxin Power Electronic, based in Anshan City, manufactures electrical equipment, primarily in China. The company is mainly engaged in energy saving high voltage electronic equipment through its design and manufacturing business. Its products include the power quality series (SVC, SVG), and Motor Drive Series (HVC, VFS, MABZ). The static var compensator (SVC) is the only SVC ISO9001 certified in China and is produced according to international standards.

Business exposure

The company's motor drive series products consist of an MVC system, a middle-voltage motor energy saving product used in coal, metallurgy, electric power, building materials, petroleum, the chemical industry, papermaking, water supply, and drainage industries; a variable frequency starter that is used to drive soft starts and soft stops of blowers, pumps, compressors, extruders, centrifuges, mixers, compressors, refrigeration compressors,, conveyors, propellers, anchor winches and bilge sewage pumps; and MABZ automatic gas emission devices used for fans controlling the coal mine tunnel working surface.

Key financials

In 2009, the company derived 52.1%, or Rmb480.9m of revenue, from SVC sales; overall revenue totaled Rmb922.2m. Residual heat and pressure energy power generation systems, FC, MABZ, HVC, VFS, SVG and APF represent the remaining 47.9% (13.5%, 11.0%, 2.9%, 13.0%, 0.7%, 1.5%, 0.2% and 5.2%, respectively).

Figure 129: RONGXIN POWER ELECTRONIC -A (Shenzhen: 002123, Currency: CNY)

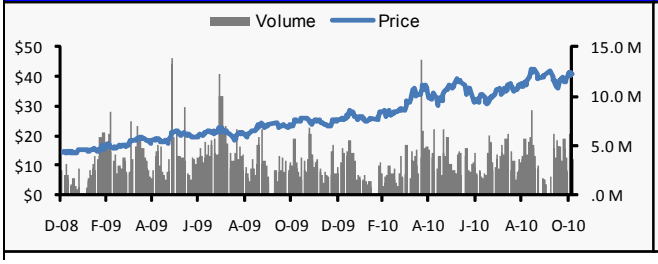
Description	
Address:	108 Tech Rd, Hi-tech Zone Anshan City, Liaoning, 114051 China
Website:	www.rxpe.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	577	914	632
EBIT	94	153	105
Net Income	130	185	96
EPS (Diluted)	0.43	0.58	0.29
Book Value per Share	2.1	3.9	4.2
Total Assets	1,061	2,045	2,533
Cash Flow-Oper Activities	(1)	(35)	(107)
Capital Expenditures	(192)	(148)	(93)
Free Cash Flow	(193)	(183)	(200)
Return on Com Eqty (%)	22.4	19.0	20.4
Total Debt/Total Equity (%)	30.6	25.7	43.7

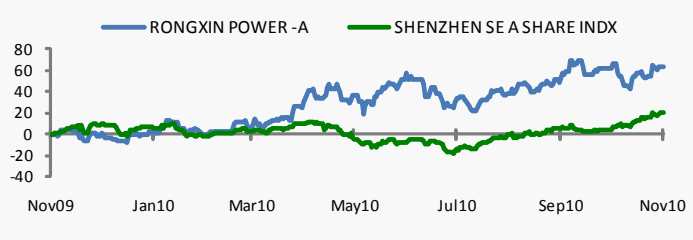
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Power Quality and Safety Control	595.42
Power Transmission Device	152.75
Residual Heat & Pressure Power Generation Sy	124.19
Others	48.07
Source Filters	1.77

Key Statistics	
Share price (CNY)	40.98
52-Week Range	22.66 - 43.6
YTD performance	63%
Avg Daily traded Val (3 Months, USD)	21.4
Market Value (USD mn)	2,068.5
Float %	57.8%
Major shareholder	SHENZHEN-HONG KONG P
% stake	16.5%
No. of employee	859

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Ligong Online Monitoring Technology (002322.CH, not rated)

Company background

Ligong Online Monitoring Technology (LGOM) is engaged in research, development, design, manufacture and distribution of high electric voltage online monitoring products. Originally engaged merely in electrical transformer online monitoring, the company diversified its business into wider applications in recent years, including GIS online monitoring systems, cable online monitoring systems and circuit breaker online monitoring systems. The company was listed in 2009 in Shenzhen, as the first online monitoring listing company in the electric power industry. The largest shareholder is Ningbo Tianyi Century Investment.

Business exposure

LGOM's online monitoring products cover power generation, power transmission, power substations and power dispatching. Major products contain transformer online monitoring systems, including transformer online multi-gas analyzers (MGAs), transformer temperature load online monitoring systems, transformer partial discharge online monitoring systems and transformer iron core grounding monitoring systems; gas insulated switchgear (GIS) online monitoring systems, including GIS partial discharge online monitoring systems, gas leakage online monitoring systems and GIS action features online monitoring systems, among others; cable online monitoring systems, including cable temperature online monitoring systems and cable partial discharge online monitoring systems, as well as other products, including ultraviolet and visible light dual-spectrum imaging systems and transformer switch online oil filters. LGOM's market share of transformer online multi-gas analyzers is ranked No. 1 in China and is widely applied in extra-high voltage (EHV) and ultra-high voltage (UHV) power transmission, railway and nuclear plants.

Key financials

LGOM reported revenue of Rmb123m and net profit of 76m in 2009. In 1H10, the company had revenue of Rmb44m and net profit of 17m, down 15.2% and 28.4% yoy. Transformer online multi-gas analyzers contributed 64.2% to total revenue, while the GIS partial discharge online monitoring systems accounted for 11.1% of total income.

Figure 130: NINGBO LIGONG ONLINE-A (Shenzhen: 002322, Currency: CNY)

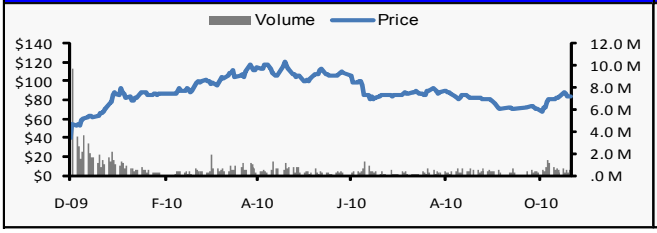
Description	
Address:	Bld.4, Scholars Pioneering Par Ningbo Free Trade Zone Zhejiang, 315800 China
Website:	www.lgom.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	111	123	44
EBIT	45	55	6
Net Income	47	76	17
EPS (Diluted)	0.94	1.52	0.25
Book Value per Share	3.1	12.8	12.5
Total Assets	227	887	884
Cash Flow-Oper Activities	6	54	(26)
Capital Expenditures	(14)	(44)	(43)
Free Cash Flow	(8)	9	(69)
Return on Com Eqty (%)	35.9	15.1	13.8
Total Debt/Total Equity (%)	36.2	1.1	3.6

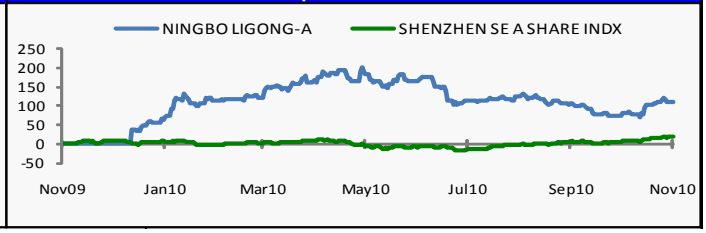
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Multi-Gas Analyzer	106.06	83.07
Online Filter of Oil	9.69	7.25
GIS Local Discharge Analyzer	6.28	
Other Operating Income	1.42	1.42
Other Products	1.01	0.63

Key Statistics	
Share price (CNY)	84.5
52-Week Range	40 - 122.76
YTD performance	37%
Avg Daily traded Val (3 Months, USD)	5.5
Market Value (USD mn)	846.7
Float %	25.0%
Major shareholder	NINGBO TIANYI CENTUR
% stake	38.4%
No. of employee	246

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Boer Power Holdings (1685.HK, not rated)

Company background

Boer Power is primarily engaged in producing high-low-voltage electrical switchgear systems, switch components and electrical network management system. Its products are widely applied in residential, building, industry, energy and infrastructure. The company was developed from its predecessor, Wuxi City Power Instrumentation System Works, founded in 1985. Boer company is one of the largest licensed partners of Schneider Electric in China. Boer Power is also a partner with ABB. Boer Power was recently listed in HK, and is controlled by King Able Limited (66.5%), which is owned by Mr. Qian Yixiang, chairman of the board and CEO and Ms. Jia Lingxia, executive director and COO and also the wife of Mr. Qian Yixiang.

Business exposure

Boer Power's products are classified into four categories: electrical distribution systems (EDS), intelligent electrical distribution systems (iEDS), energy efficiency services (EE) and a components and spare parts business. The company was ranked the sixth largest high-end MV and LV switchgear assembly producer in 2008, in terms of revenue. For electrical distribution systems, its major products are MV and LV switchgear. For intelligent electrical distribution systems, the main products include intelligent power distribution switchgear and power monitoring systems applied in substation automation. For the spare parts business, the company provides mini circuit breakers, multi circuit monitoring units and power monitoring meters and protection relay.

Key financials

Boer Power recorded revenue of Rmb491m and net profit of Rmb76m in 2009. In terms of business breakdown, revenue from EDS and iEDS reached Rmb259m and Rmb161m, respectively, or 53% and 33% of total revenue. In 1H10, Boer Power reported revenue of Rmb432m, up 102.2% yoy. Revenue from EDS and iEDS accounted for 43% and 47% of total revenue in 1H10. Gross margin rose to 35.7% in 1H10. Net profit in 1H10 reached Rmb87m.

Figure 131: RONGXIN POWER ELECTRONIC -A (Shenzhen: 002123, Currency: CNY)

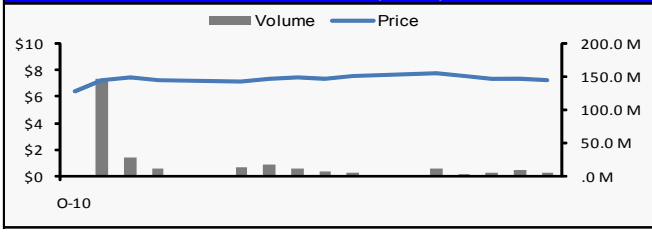
Description	
Address:	National Highway No. 312 Luoshe Town Jiangsu Province China
Website:	www.wuxi-power.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	406	491	433
EBIT	79	112	105
Net Income	52	76	88
EPS (Diluted)	0.09	0.14	0.16
Book Value per Share	-	-	-
Total Assets	541	611	587
Cash Flow-Oper Activities	58	252	(108)
Capital Expenditures	(25)	(20)	(5)
Free Cash Flow	33	232	(112)
Return on Com Eqty (%)	34.3	43.9	-
Total Debt/Total Equity (%)	79.8	24.5	33.4

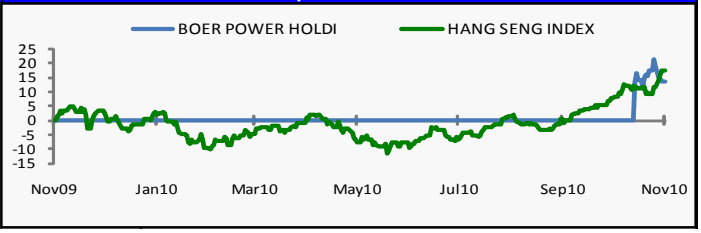
Business Segments (FY: Dec-09 ,CNYmn)

Key Statistics	
Share price (HKD)	7.26
52-Week Range	6.38 - 7.94
YTD performance	-
Avg Daily traded Val (3 Months, USD)	
Market Value (USD mn)	728.9
Float %	27.7%
Major shareholder	KING ABLE LTD
% stake	66.5%
No. of employee	

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Tianwei Baobian Electric (600550.CH, not rated)

Company background

Tianwei Baobian Electric (TWBB) is engaged in the manufacture and distribution of transformers. The company is also involved in construction of energy projects. Its products are applied in the thermal power generation, hydropower generation and nuclear power fields. TWBB is the only supplier of main transformers for domestic nuclear power companies. TWBB is 51% owned by Baoding Tianwei Group and was listed in Shanghai in 2001.

Business exposure

TWBB's major business segments include power transmission and distribution as well as renewable energy. In the power T&D segment, major products are generator transformers, transformers with split windings, transformers for electric power transmission and distribution, reactors and traction transformers. To date, TWBB has manufactured more than 300 main transformers for generating units below 200MW; over 190 main transformers for generating units of 300MW and over 190 main transformers for generating units from 500MW to 1,000MW. In renewable energy, TWBB is involved in solar wafers, solar cells, solar modules, solar application systems, WTGs (wind, turbine and generators) and wind blades. Its capacity of WTGs and wind blades is 500 units and 400 sets annually.

Key financials

TWBB recorded revenue of Rmb6bn and net profit of Rmb586m in 2009. Revenue from transformers reached Rmb4bn in 2009. In 1H10, revenue from transformers reached 2.4bn (down 8.26% yoy), or 88% of total income. Net profit in 1H10 was Rmb414m. The company targets 2010 revenue of Rmb9bn and blended gross margin of 18%.

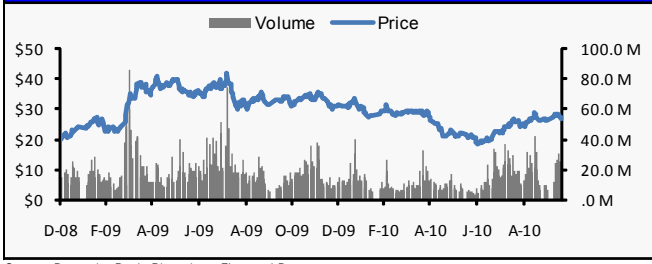
Figure 132: BAODING TIANWEI BAOBIAN-A (Shanghai: 600550, Currency: CNY)

Description			
Address: 2222 Tianwei Road West Baoding, Hebei, 071056 China			
Website: www.twbb.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	4,354	5,987	3,287
EBIT	632	747	330
Net Income	943	586	414
EPS (Diluted)	0.81	0.50	0.35
Book Value per Share	3.2	3.5	3.9
Total Assets	12,184	15,602	16,653
Cash Flow-Oper Activities	127	39	(884)
Capital Expenditures	(1,720)	(1,965)	(353)
Free Cash Flow	(1,593)	(1,927)	(1,237)
Return on Com Eqty (%)	30.1	14.9	13.7
Total Debt/Total Equity (%)	135.7	189.2	183.6

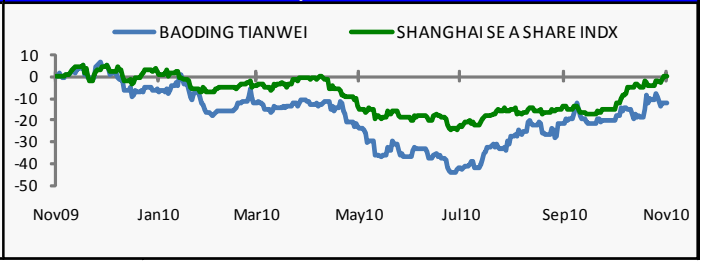
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Transformer	7512.89
Wind Energy	483.23
Others	347.37
Photovoltaics	164.41
Eliminations	(2498.21)

Key Statistics	
Share price (CNY)	29.08
52-Week Range	17.95 - 36.03
YTD performance	-8%
Avg Daily traded Val (3 Months, USD)	82.9
Market Value (USD mn)	5,102.5
Float %	43.4%
Major shareholder	BAODING TIANWEI GROU
% stake	51.1%
No. of employee	2,618

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Figure 133: Company business exposure along smart grid value chain

	Generation	Transmission					Distribution		End users			Dispatch
	Inverter	FACTS	Transformer	Circuit breaker	Digital substation	Current valve	Switchgear	Distribution automation	Smart meter	Monitoring	AMI	Smart dispatch
Wasion Group									√		√	
Clou Electric									√			
NARI Technology					√			√	√	√		√
Guodian Nanjing Automation	√				√		√			√		
XJ Electric		√	√		√	√	√	√	√			
Sieyuan Electric		√					√			√		
Dongfang Electronics					√			√	√			√
China XD Electric			√	√			√					
Tebian Electric Apparatus	√		√									
Zhixin Electric			√									
Rongxin Power Electronic	√	√						√				
Ligong Online Monitoring Technology										√		
Boer Power Holdings				√	√		√					
Tianwei Baobian Electric	√		√									

Source: Deutsche Bank, Company data

Waste recycling

Waste recycling and application in metal-waste recycling

Waste recycling is the process of transforming an obsolete substance into new usable products to save raw material and reduce energy consumption. Waste recycling is applied across several industries, such as paper, textiles, electronics and metals. In this report, we focus on metal-waste recycling, which is highly energy intensive.

Metals can be categorized into primary and secondary. Primary metals are derived directly from the ore or mineral, while secondary metals are recovered from scrap by remelting and refining.

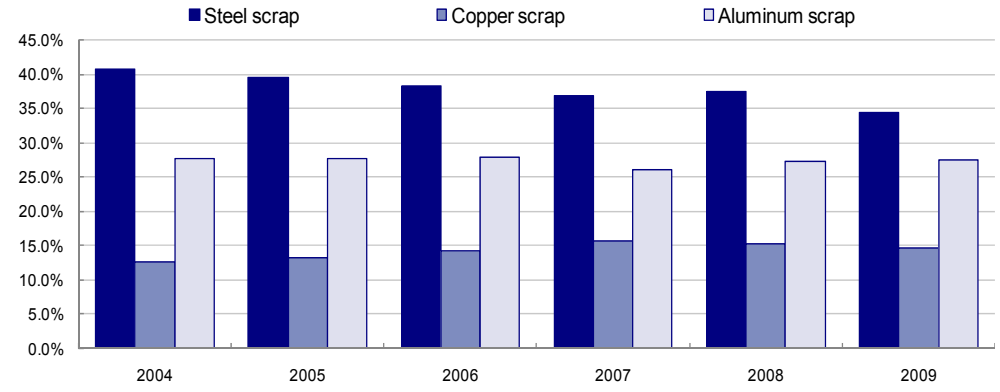
A typical metal-waste recycling process usually contains the following procedures:

- Step 1: Purchase scrap from metal producers, metal scrap dealers or overseas
- Step 2: Separate and sort out the collected scrap through manual or mechanical processes, depending on the type of metal as well as its costs
- Step 3: Melt, oxidize or de-acidize the scrap to improve its purity
- Step 4: Cool, cast and roll the recycled scrap to the required shape

Benefits of metal-waste recycling

Metal-waste recycling has been drawing more attention lately due to its economic and environmental benefits. For one, metal-waste recycling will help reduce the rate at which we utilize our limited and precious natural resources. Next, it will help to reduce energy consumption and greenhouse gas emission as metals that are recycled emits fewer pollutants and use less energy than metals that are directly produced from crude ore or mineral. According to China Association of Metal Scrap Utilization (CAMU), large steel complex conserves energy consumption by up to 60% by using recycled-steel scrap instead of iron ore as a raw material. In addition, the association said it would save 95% of energy if aluminum producers were to use recycled scrap rather than electrolyze natural ore.

Figure 134: Percentage of scrap in metal market

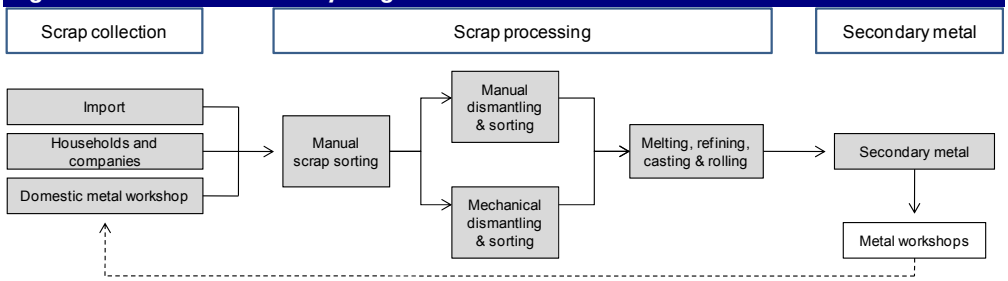


Source: CRU Strategies

Overview of metal-waste recycling value chain

The value chain of metal-waste recycling starts with scrap collection from domestic metal producers and international scrap dealers. The recycling company subsequently conducts the processing work for further purifying, which includes sorting, melting and casting. At the end of the value chain are the domestic metal producers, which purchase the secondary metal as a substitute for primary metal for manufacturing.

Figure 135: Metal-waste recycling value chain



Source: Deutsche Bank

In China, there are some specific features in the value chain regarding metal-waste recycling. These include:

- Scrap is mostly imported and is thus subject to international metal-price fluctuations
- Highly competitive and fragmented market structure resulting in relatively low gross margin
- Not capital intensive resulting in low entry barrier for peers
- Low demand for secondary metal

Major equipment used in the metal-recycling process includes gantry cranes, lifting cranes, shredders, grapplers, balers and wire strippers. Gantry or lifting cranes help to load and move unprocessed scrap metal to a conveyor belt. Shredders shear off large and compacted pieces of scrap metal for further processing. After the dust and dirt are removed by air cyclones, ferrous and non-ferrous metals are separated in an electromagnetic drum.

Policy for metal-waste recycling development in China

China has been launching policies since the late 1980s to support and promote metal-waste recycling. The main authorities involved are the State Economic and Trade Commission (SETC), Ministry of Finance (MOF), Ministry of Commerce (MOC), State Bureau of Material Reserve of NDRC and State Administration of Taxation (SAT).

In 2008, MOF and SAT revised the VAT policy, which states that effective from 1 January 2009, waste recycling companies will receive 70% of the VAT refund in 2009, 50% in 2010, and no refund from 2011.

The National People's Congress adopted the Recycling Economy Law in 2008. The law mapped out long-term guidance for China's recycling economy. Although some incentives for favorable tax policies were not mentioned, the law restated the importance of waste recycling and conveyed the government's determination to promote the recycling industry.

Steel, aluminum, and copper – three largest metal-waste markets

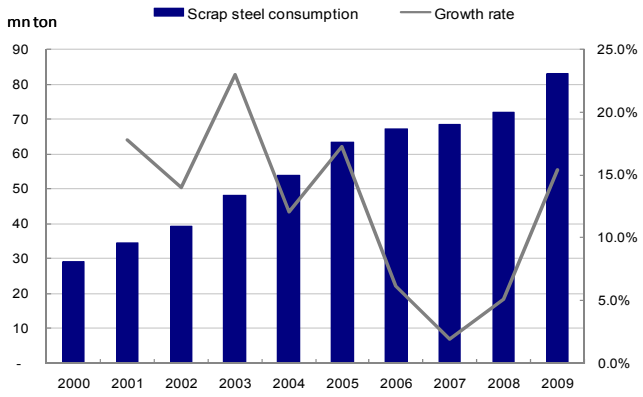
There are several types of metals that can be recycled in the market. Different metal scraps apply different technologies in processing and face varying market supply/demand. In general, the largest metal-waste recycling market consists of steel, aluminum and copper.

Steel manufacturing – demand driven by technology

There are two major types of technologies in producing steel – blast furnace (BF)/basic oxygen furnace (BOF) and electric arc furnace (EAF). For BFs/BOFs, iron ore is the most common raw material for steelmaking. EAFs use ferrous scrap (another name for steel scrap), direct-reduced iron (DRI) or hot-briquetted iron (HBI) as the raw material in steelmaking. Ferrous scrap usually accounts for 80% and 8% of the total raw material input in steelmaking under EAF and BF/BOF techniques, respectively.

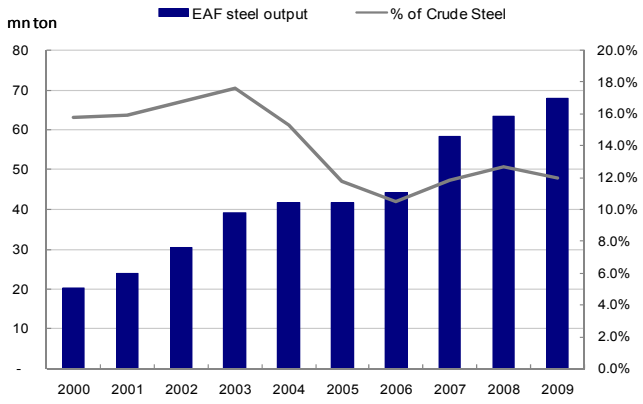
According to CRU Strategies' data presented in Chiho-Tiande's IPO prospectus, crude steel output (crude steel is usually used as a proxy for steel output) produced by BFs/BOFs accounts for 71.2% of total steel output worldwide, with the remainder attributed to EAFs. Nevertheless, in China, crude steel produced by EAFs only accounts for 12% of the total output, declining from 15.7% in 2000 due to a rapid increase in steel output from BFs/BOFs technology (Figure 136).

Figure 136: China ferrous scrap consumption trend



Source: Deutsche Bank, China Association of Metal Scrap Utilization

Figure 137: EAF steel output as % of total output



Source: Deutsche Bank, China Association of Metal Scrap Utilization

Benefits of producing steel from ferrous scrap compared with iron ore

Ferrous scrap steelmaking can help to reduce energy consumed and reduce pollution. According to CAMU, manufacturing steel with ferrous scrap can save up to 60% of energy consumed (0.4 ton hard coke or 1 ton raw coal) compared with metals directly produced from iron ore. The Bureau of International Recycling (BIR) added that compared with traditional iron-ore steel making, ferrous scrap steelmaking reduces waste gas emissions by 86%, waste-water discharges by 76% and solid-residue production by 72%.

China's iron ore reserve is relatively barren, and steel makers rely heavily on the overseas market for iron ore supply. According to General Administration of Customs, China imported 628m tons of iron ore in 2009, increasing by a 27% CAGR from 2001. The price of iron ore also surged to more than US$200/ton in September from US$27/ton in 2001. As such, given China's limited iron ore resource and the significant increase in iron ore price, ferrous-waste recycling is much more appealing today.

China's ferrous scrap utilization rate lower than global average

Despite the benefits of using ferrous scrap, as we highlighted in the previous section, the utilization of ferrous waste in steelmaking is still low. According to CAMU, China's total consumption of ferrous waste in 2009 was 83m tons, or 14.6% of the total steel output. Compared with a world average utilization rate of 40-45% for ferrous scrap, China's utilization rate is significantly lower.

China's economic stimulus plan across industrials has also boosted the ferrous-waste supply since 2009. The supply of ferrous waste grew 8% yoy in 2009, compared with a 4% CAGR in 2007-09. Under CAMU's statistics, ferrous waste in 2009 derived from domestic steelmaking enterprises, retail procurement and imports represents 35%, 50% and 15%, respectively.

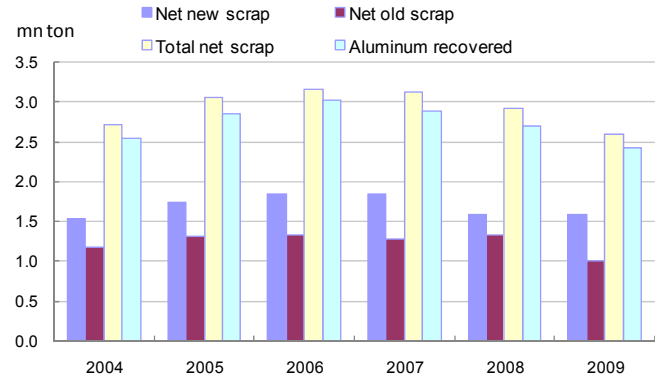
Aluminum – a relatively mature recycling market

China is currently the world's largest primary aluminum and alumina producer, with a total output of 12.96m tons and 23.79m tons in 2009, respectively.

Aluminum recycling has become increasingly important due to environmental and energy conservation concerns. In addition, aluminum recycling is highly efficient as it can be completely recycled without any quality loss due to its highly anticorrosion characteristics.

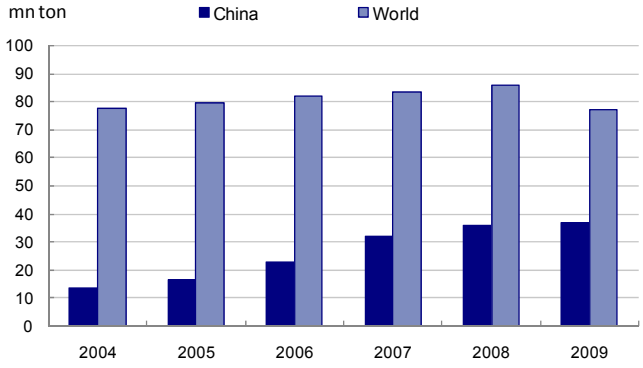
Aluminum scrap is categorized as new scrap and old scrap. New scrap refers to processed scraps that are generated during the industrial production processes, while old scrap refers to post-consumer scrap generated when a product comes to the end of its useful life.

Figure 138: Annual aluminum recovered from scrap



Source: Deutsche Bank, International Aluminum Institute

Figure 139: Production of primary alumina and aluminum



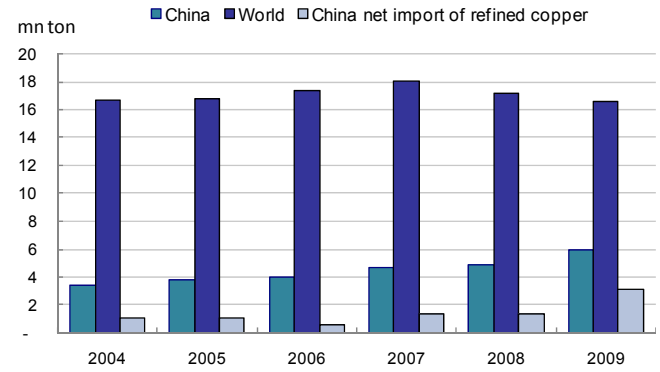
Source: Deutsche Bank, International Aluminum Institute

Traditionally, the production of aluminum products has been mainly carried out through electrolysis, which requires a large amount of electricity. At the same time, the process generates a significant amount of greenhouse gases. Aluminum recycling involves melting the scrap, a process that requires only 5% of the energy used to produce aluminum from traditional method. According to China Nonferrous Metals Industry Association (CNIA), the production of 1 ton of aluminum through the recycling method conserves 10 tons of water, 11 tons of solid raw material, 0.8 ton greenhouse gas and 0.6 ton sulfur dioxide compared with the traditional method. Currently, the utilization of aluminum scraps in total aluminum consumption is only 27.5%, allowing plenty of potential for improvement.

Copper market – Huge dependency on foreign imports

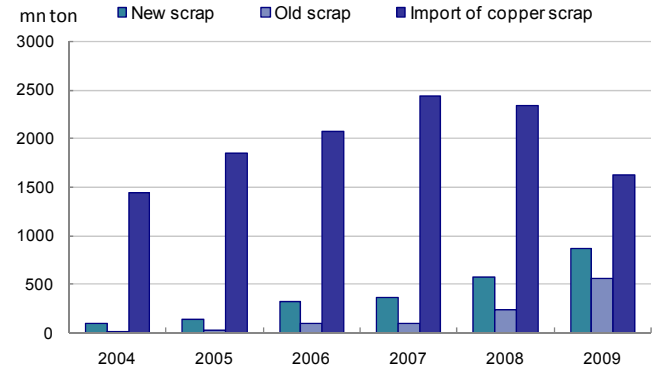
China's copper demand is increasingly met with foreign imports. According to state-backed research firm Antaike, China's copper consumption was 6.1m tons in 2009, which was 50% higher than its production volume. Thus, to satisfy its domestic copper demand, China had to depend heavily on foreign imports. This situation is further exacerbated by the fact that China lacks the raw materials used for producing copper and has to depend on its foreign counterparts for raw materials. CNIA estimates the output of copper mine material in 2009 was 1m tons, which was far below the final output of 4.11m tons of refined copper.

Figure 140: China/world refined copper consumption/import



Source: CRU Strategies

Figure 141: China copper scrap supply



Source: CRU Strategies

Copper recycling – a solution to promote self-sufficiency

Copper recycling, as a major alternative for copper ore exploration and copper raw material import, has become increasingly important to ease the demand/supply in the copper products market and promote self-sufficiency of copper demand. Copper can be recycled without quality loss, and the purity of copper scrap is estimated at 30%. As the substitute of copper mining material, copper scrap can be collected from obsolete equipment, machines, buildings, underground pipe lines and discarded copper scale from factories. Similar to other types of metal recycling, copper scrap is recycled not only for refined copper production (one-third of the copper scrap), but also for semi-finished copper products in the form copper alloy of desired purity (two-thirds of the copper scrap).

Cobalt and nickel – a niche market in metal recycling

Cobalt and nickel is widely used in machinery, chemical industry, metallurgy and medicine. The main applications of products include hard alloys and batteries. China is barren in cobalt/nickel reserves and has relied on import for years, which makes cobalt/nickel recycling an increasingly imperative issue.

There is no standalone cobalt mine in China. Cobalt reserves are usually associated with nickel mines. According to the Ministry of Land and Resources (MOLR), China's cobalt reserve is estimated to be 73,300 tons, of which 40,000 tons of cobalt exploration is economically viable, or 1.03% of the world's total exploratory cobalt reserve. On the other hand, China consumes c.15,000 tons of cobalt annually, approximately 10,000 tons of which are viable for recycling. However, less than 2,000 tons of cobalt is recycled from cobalt waste every year, representing c.13% of annual cobalt consumption.

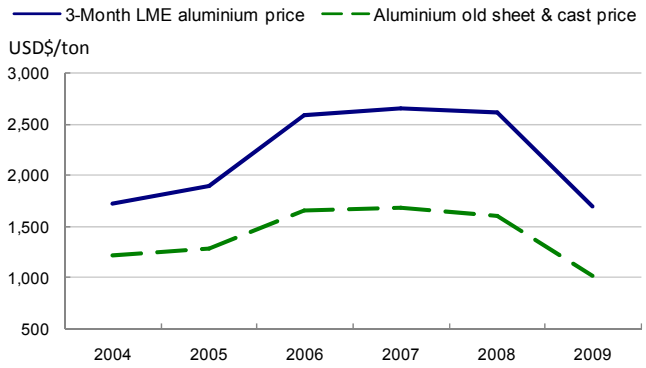
China nickel reserves, as estimated by MOLR, is c.2.32m tons, or 3.56% of the world total. According to CNIA, the annual output of nickel reached 164,800 tons in 2009 and 82,700 tons in 1H10, which means the reserve can only supply nickel production for 14 years.

Cobalt and nickel are toxic metals. Environmental concerns, economical issues and the pressure of barren resources together promote the cobalt/nickel recycling industry.

Scrap metal pricing

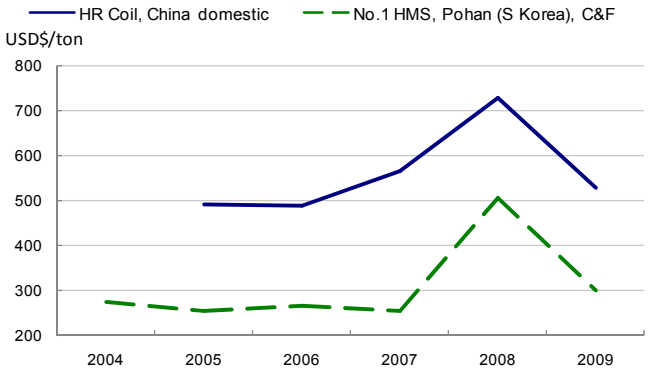
The price of scrap metal is largely determined by the downstream metal price. According to CRU Strategies, a positive correlation ranging between 87.1% and 99.5% is established for the benchmark prices of scrap metal.

Figure 142: Correlation of alum. and alum. scrap price



Source: CRU Strategies

Figure 143: Correlation of steel price and steel scrap price



Source: CRU Strategies

Other than the metal price in the downstream, there are several other factors that determine the price of scrap metal, including the sector demand for scrap metal, extent of difficulty in processing technology and purity of scrap metal.

Frequently asked questions and glossary of terms

What is the market competition structure for the metal-recycling industry?

The metal recycling industry is highly competitive and decentralized, with a large number of market participants in the form of small workshops. Low entry barriers with regard to technology and regulatory requirements have created a competitive market.

What is the market growth potential for the metal-waste recycling industry?

Waste recycling is a stable industry determined by overall metal demand, which is more related to a country's macro economics. Market growth might remain stable in the long term as the rush in metal demand might be offset by the long cycle or lifetime of metal usage (usually it takes approximately 10 years for the metal products to become scrap).

Where are key players located and why?

The location is critical to business operation for waste recycling. Key players are usually located in China's developed regions, such as the Pearl River Delta, the Yangtze River Delta and the Bohai Rim. Several factors need to be considered when choosing a location: 1) local government support; 2) proximity to port facilities, rail and highway networks; and 3) proximity to clients.

Figure 144: Glossary of terms

Terms	Definition
BF	Blast furnace, a type of metallurgical furnace used for smelting to produce industrial metals, generally iron. The end products are usually molten metal and slag phases tapped from the bottom, and flue gases exiting from the top of the furnace.
EAF	Electric arc furnace, a furnace that heats charged material by means of an electric arc. Different from BF, EAF uses ferrous scrap (another name for steel scrap), directly reduced iron (DRI) or hot briquetted iron (HBI) as raw material in steelmaking.
DRI	Direct-reduced iron, also called sponge iron, is produced from direct reduction of iron ore by a reducing gas produced from natural gas or coal.
HBI	Hot-briquetted iron, a compacted form of DRI designed for ease of shipping, handling, and storage.
Mixed metal scrap	Generally refers to scrap that contains both ferrous and non-ferrous elements in varying quantities and includes products such as electric motors, large household appliances such as refrigerators, electric wire etc

Source: Deutsche Bank

Risks

Metal price volatility

Recycled metal, as the intermediate product between metal scrap and metal, is tightly correlated with the metal price. The metal price volatility will likely increase the uncertainty of the profitability of industry players.

Reliance on imported scrap metals

China is one of the largest metal consumers in the world. Its high metal demand results in tight supply domestically, and the country has to heavily depend on foreign imports. For metal recycling companies, the ability to secure metal scrap for capacity expansion is crucial, given relatively slow growth in scrap supply and significant growth in scrap demand.

Policy risk

The Chinese government has been encouraging the recycling of metal scrap for a long time and has explored a set of preferential policies for its development. However, the VAT refund for metal recycling is scheduled to come to an end in 2011. Thereafter, the metal recycling industry might have some policy overhangs.

Waste recycling players

Chiho-Tiande (0976.HK, non-rated)

Company background

Chiho-Tiande is a mixed-metal scrap recycler that specializes in the recycling, reuse and processing of mixed-metal scrap. The company was ranked No.1 in China for total import volume of mixed copper scrap in 2009. In recent years, Chiho-Tiande has expanded into the manufacturing of aluminum-alloy ingots as well as copper rods and wires. The company was listed in Hong Kong in 2010. Fang Ankong, chairman and CEO of Chiho-Tiande, is the company's major shareholder, holding a 34.5% stake.

Business exposure

Chiho-Tiande has three business segments: metal-scrap recycling, foundry and wholesale. The major types of scrap in its recycling business are steel, copper and aluminum. The company also produces aluminum-alloy ingots as well as copper rods and wires on a small scale. Meanwhile, Chiho-Tiande has business in the wholesale of metal scrap, without processing it. In Chiho-Tiande's development plan, the company plans to invest HK$275m in raw materials purchases, HK$110m for the expansion of its procurement network and HK$69m for the capacity expansion of its Ningbo manufacturing base. Recently, Chiho-Tiande established a metal-waste recycling business JV in Shanghai, with an expected capacity of 500,000 tons by 2013.

Key financials

Chiho-Tiande reported revenue of HK$2.44bn (up 260% yoy) and net profit of HK$157m in 1H10. The company recorded a net profit of HK$157m in 1H10 compared with a net loss of HK$16.3m in 1H09. The turnaround in profit was due to the high volatility of raw materials prices. Gross margin in 1H10 was HK$276m, implying a gross margin of 11.3%.

Figure 145: CHIHO-TIANDE GROUP LTD (Hong Kong: 976, Currency: HKD)

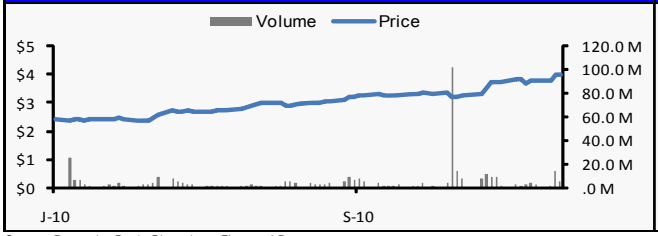
Description	
Address:	Taizhou Ind Zone of Metal Rec Fengjiang Luqiao Taizhou Zhejiang, 318054 China
Website:	www.chiho-tiande.com/

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	2,505	2,339	2,444
EBIT	(274)	513	232
Net Income	(200)	420	157
EPS (Diluted)	-0.27	0.56	0.21
Book Value per Share	-	-	-
Total Assets	1,111	1,852	2,546
Cash Flow-Oper Activities	(306)	43	(298)
Capital Expenditures	(28)	(12)	(6)
Free Cash Flow	(334)	31	(305)
Return on Com Eqty (%)	-	-	-
Total Debt/Total Equity (%)	-	251.5	259.9

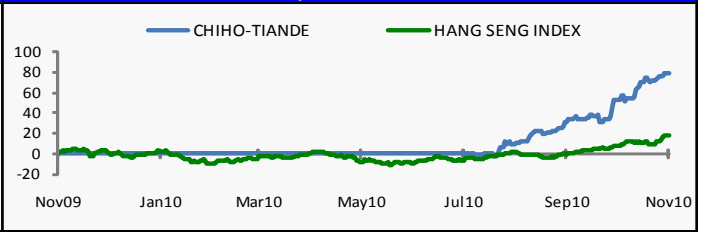
Business Segments (FY: Dec-09 ,HKDmn)	Revenue	Gross Profit
Metal Recycling Business	1854.43	497.11
Foundry Business	370.64	52.81
Wholesale Business	114.17	4.52

Key Statistics	
Share price (HKD)	4.34
52-Week Range	2.01 - 4.35
YTD performance	-
Avg Daily traded Val (3 Months, USD)	2.3
Market Value (USD mn)	559.9
Float %	59.5%
Major shareholder	ANKONG FANG
% stake	34.5%
No. of employee	274

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

China Metal Recycling (0773.HK, non-rated)

Company background

China Metal Recycling is a leading scrap-metal recycling company in China. The company produces recycled scrap ferrous and non-ferrous products from scrap steel, scrap copper and other scrap metal. China Metal Recycling also resells unprocessed metal scrap. The company was listed in Hong Kong in 2009, and Chun Chi Wai, president of China Metal Recycling, holds a 61.6% of stake.

Business exposure

China Metal Recycling is primarily engaged in scrap-metal recycling. The company's annual capacity has reached approximately 4.1m tons for metal-scrap recycling. The company is establishing a wide network of business operation to allocate resources and capitalize metal price differences across the country. China Metal Recycling is planning a new recycling facility in Hubei province. It plans to invest US$100m during 2010-13 in a new sales platform as well as distribution and logistics.

Key financials

China Metal Recycling in 1H10 recorded revenue of HK$8,685m, up 136.8% yoy, and net profit of HK$420m, up 122.4% yoy. In terms of metal types, sales of ferrous metal totaled 660,000 tons, up 191% yoy, and non-ferrous reached 136,000 tons, up 36% yoy. Gross profit in 1H10 was HK$529m, implying margin of 6%. Management is targeting delivery of 1450,000 tons of scrap metal in 2010.

Figure 146: CHINA METAL RECYCLING (Hong Kong: 773, Currency: HKD)

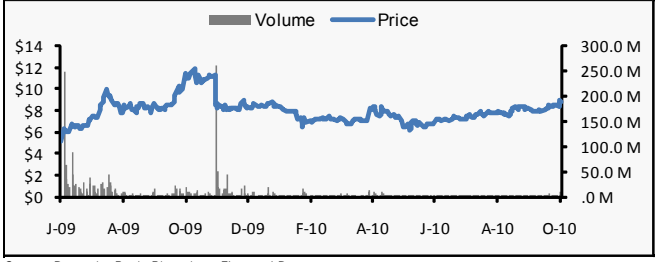
Description	
Address:	Office tower convention plaza 1 harbour road Wanchai Hong Kong (SAR)
Website:	-

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	6,527	9,063	8,685
EBIT	438	689	456
Net Income	294	478	420
EPS (Diluted)	0.42	0.54	0.40
Book Value per Share	-	2.9	3.2
Total Assets	2,102	4,751	8,036
Cash Flow-Oper Activities	(378)	(534)	(456)
Capital Expenditures	(72)	(94)	(69)
Free Cash Flow	(450)	(628)	(525)
Return on Com Eqty (%)	53.0	24.9	23.5
Total Debt/Total Equity (%)	127.3	19.1	64.8

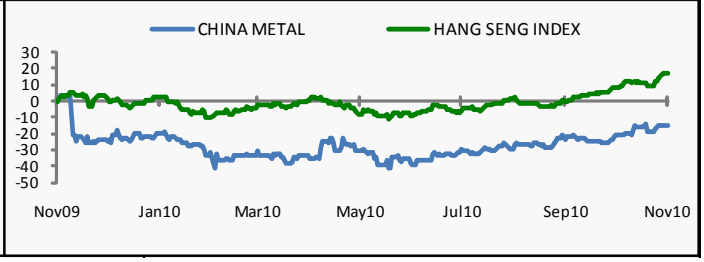
Business Segments (FY: Dec-09 ,HKDmn)	Revenue
Metal Recycling	9063.18

Key Statistics	
Share price (HKD)	9.09
52-Week Range	6.02 - 11.56
YTD performance	7%
Avg Daily traded Val (3 Months, USD)	2.8
Market Value (USD mn)	1,227.7
Float %	38.5%
Major shareholder	Chun Chi Wai
% stake	61.6%
No. of employee	400

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Green Eco-Manu Hi-Tech (002340.CH, non-rated)

Company background

Green Eco-Manu (GEM) Hi-Tech, established in 2002, specializes in collecting and recycling cobalt/nickel scrap to produce high valued-added products of ultra-fine powder. It also provides wood-plastic composites. It is the only domestic company that utilizes waste cobalt and nickel products for powder manufacturing, while others rely on natural mines of cobalt or nickel. The company was listed in Shenzhen in January 2010. Shenzhen Huifengyuan Investment, the major shareholder, holds a 22.8% stake in the company.

Business exposure

GEM Hi-Tech's major products are ultrafine cobalt and nickel products as well as wood-plastic composites from used batteries and other wasted cobalt and nickel resources. The company currently has an annual production of 10,000 tons of ultra-fine cobalt and nickel powder as well as a variety of fine chemical products, including high-purity cobalt carbonate, cobalt oxalate and nickel alloy. The company has extended its recycling business into electronic waste recycling in recent years, which refers to a wide range of electrical and electronic devices other than used batteries, including used computer devices and scrap from home electrical appliances. E-waste recycling manufacturing bases are in Jiangxi, Wuhan and Jingmen. Recently, GEM Hi-Tech launched new products based on electrodeposited copper, a key raw material for printed circuit boards (PCB), from the recycling of e-waste.

Key financials

GEM Hi-Tech in 1H10 recorded revenue of Rmb263m, up 66.7%, and net profit of Rmb37m, up 51.4% yoy. In terms of business breakdown, 1H10 revenue rose 45% to Rmb185m for cobalt and 129% yoy to Rmb38m for nickel powder. Revenue from electrodeposited copper was Rmb30m in 1H10 and Rmb14m in 2009. Gross margin in 1H10 was 34.8%.

Figure 147: SHENZHEN GREEN ECO-MANU-A (Shenzhen: 002340, Currency: CNY)

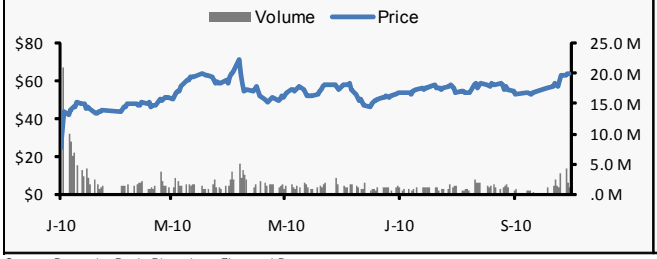
Description	
Address:	Block A, Rongchaobinhai Bldg Xinghua Rd.,Baoan Central Dist Shenzhen, 518101 China
Website:	www.gemhi-tech.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	302	366	263
EBIT	51	78	50
Net Income	41	57	37
EPS (Diluted)	0.46	0.62	0.32
Book Value per Share	2.5	3.1	8.2
Total Assets	482	783	1,512
Cash Flow-Oper Activities	41	49	(291)
Capital Expenditures	(170)	(227)	(176)
Free Cash Flow	(129)	(178)	(467)
Return on Com Eqty (%)	22.8	22.2	11.2
Total Debt/Total Equity (%)	89.9	152.1	49.2

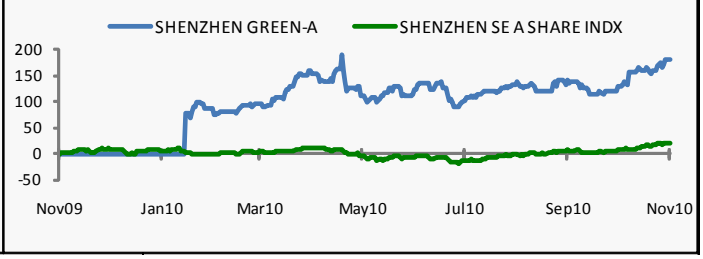
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Cobalt Powder	271.50
Nickel Powder	43.24
Others	18.87
Copper	14.39
Engineered wood	14.17

Key Statistics	
Share price (CNY)	68.66
52-Week Range	24.615 - 71.077
YTD performance	-
Avg Daily traded Val (3 Months, USD)	12.3
Market Value (USD mn)	1,251.5
Float %	24.9%
Major shareholder	SZ HUIFENGYUAN INVS
% stake	22.8%
No. of employee	918

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Dongjiang Environment (0895 HK, non-rated)

Company background

Dongjiang Environment (DJE), established in 1999 in Shenzhen, is primarily engaged in waste management and environmental services. DJE is also engaged in a landfill gas energy program in Shenzhen with a designed maximum annual power generation of up to 60m kWh. It was listed on Hong Kong's Growth Enterprise Market (GEM) in 2003 with a stock code of 8230.HK, and transferred to the main board in September 2010 with a new code of 0895.HK

Business exposure

In recent years, DJE has developed its recycling business from pure waste treatment to providing comprehensive environment services with the integration of waste collection, treatment and disposal, environmental engineering design, construction, operation and consultation. In terms of waste type, DJE recycles waste copper liquid, waste nickel liquid/sludge, waste ferrous liquid, waste animal oil and vegetable oil, waste organic solvent and waste oil, restaurant waste as well as construction and demolition waste. In 2009, DJE signed a cooperative contract with AES Corporation to jointly develop a ventilation air methane (VAM) utilization project.

Key financials

The company in 1H10 recorded revenue of Rmb521m, up 72.2% yoy, and net profit of Rmb74m, up 74.3% yoy. In terms of business breakdown, revenue from the processing and sale of recycled products reached Rmb300m, up 94% yoy, in 1H10. Revenue from waste-treatment services in 1H10 totaled Rmb150m, up 64% yoy. Revenue from environmental protection systems/services rose 20% yoy to Rmb44m in 1H10. The gross margin in 1H10 was 40.43%.

Figure 148: SHENZHEN DONGJIANG ENVIRON-H (Hong Kong: 895, Currency: HKD)

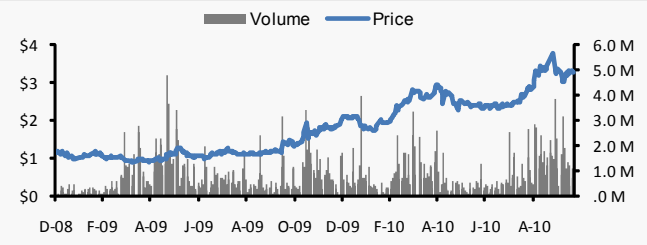
Description	
Address:	Dongjiang Environmental Bldg No 9 Langshan Road North Zone of Hi-tech Industrial Park Nanshan District, Shenzhen,
Website:	www.szdongjiang.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	823	931	521
EBIT	170	171	125
Net Income	106	116	74
EPS (Diluted)	0.08	0.09	-
Book Value per Share	0.4	0.5	0.5
Total Assets	1,193	1,715	1,868
Cash Flow-Oper Activities	52	55	-
Capital Expenditures	(188)	(183)	-
Free Cash Flow	(137)	(128)	-
Return on Com Eqty (%)	23.2	20.4	24.1
Total Debt/Total Equity (%)	48.0	80.6	88.1

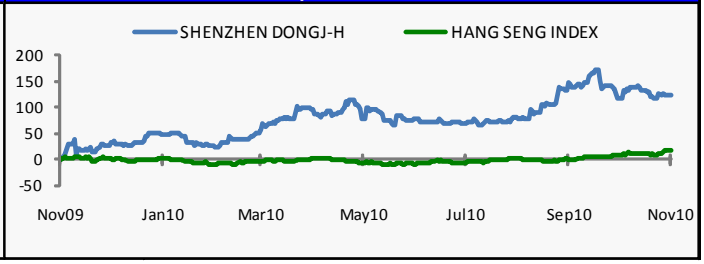
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Processing and sale of recycle products	511.21
Recycled Products and Waste Treatment	229.15
Environmental Protection Systems	148.35
Production of renewable energy	22.01
Trading of Chemical Products	19.95

Key Statistics	
Share price (HKD)	3.09
52-Week Range	1.4 - 5.53
YTD performance	47%
Avg Daily traded Val (3 Months, USD)	0.5
Market Value (USD mn)	321.0
Float %	100.0%
Major shareholder	CHINA ENVIRONMENTAL
% stake	6.5%
No. of employee	2,043

Price and Volume (1 Year)



Comparative Returns



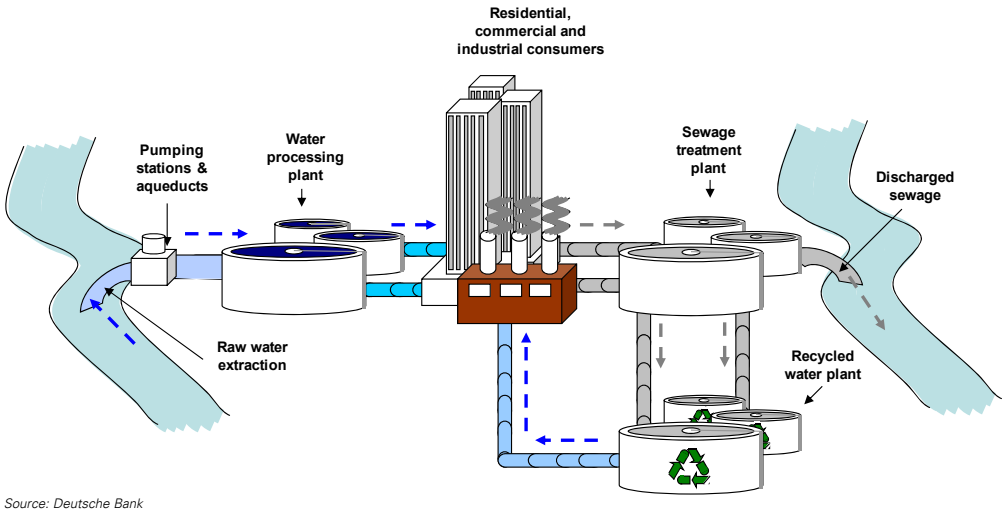
Source: Deutsche Bank, Bloomberg Finance LP

Wastewater treatment

Wastewater treatment basics

Wastewater treatment is the process of removing contaminants from wastewater to produce an environmentally safe liquid and solid waste that is suitable for disposal or reuse. The process includes physical, chemical and biological methods to remove contaminants. Figure 149 below depicts the entire value chain of the water industry.

Figure 149: Water industry flow chart



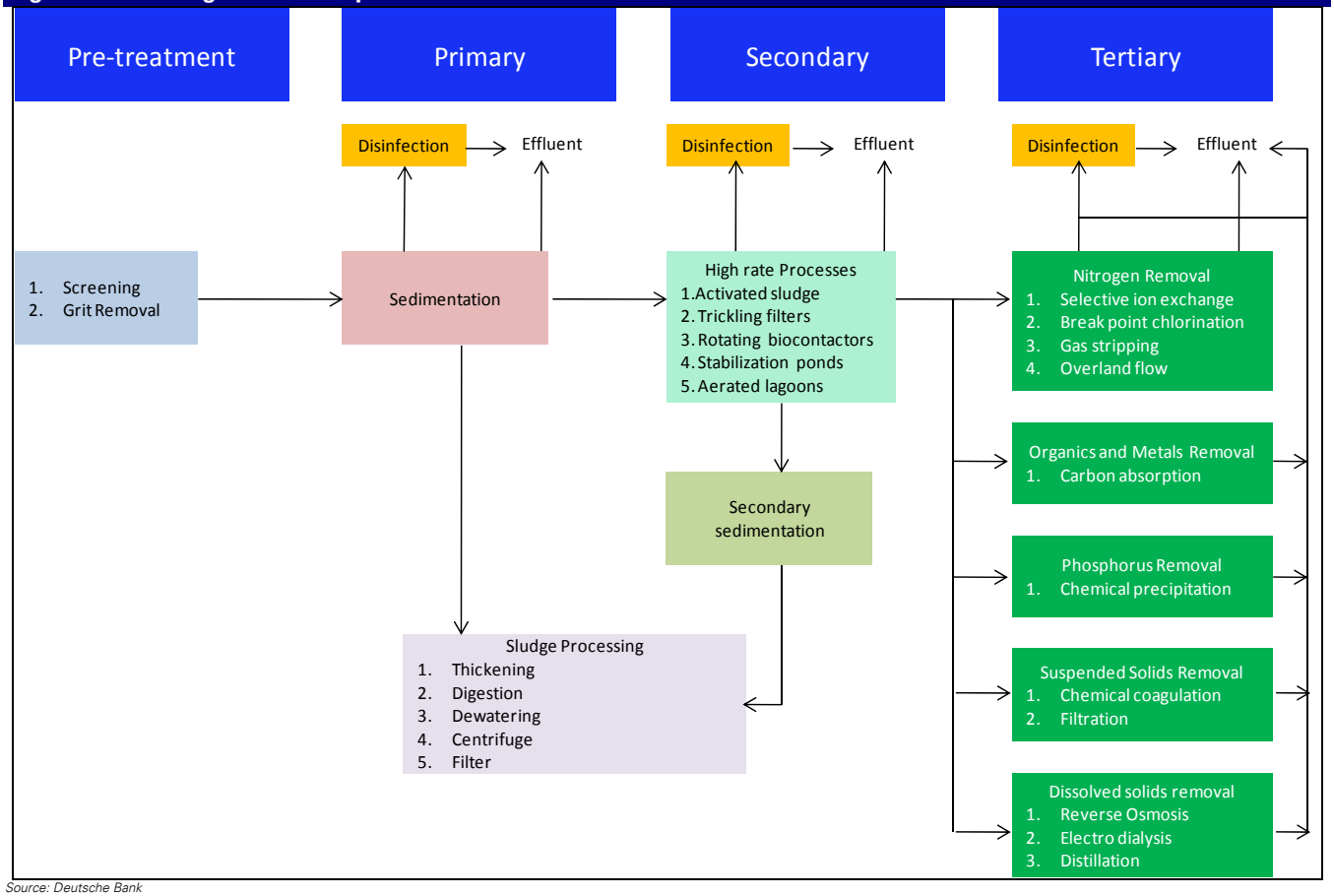
Source: Deutsche Bank

Process

Wastewater treatment process differs between residential wastewater and industrial wastewater, with a more specialized treatment process for the latter. Nonetheless, the treatment process is largely classified into pre-treatment, primary treatment, secondary treatment and tertiary treatment (Figure 150).

- **Pre-treatment:** The first stage of the treatment process uses an automated mechanically raked bar screen to remove large objects in the sewage. This is followed by the removal of particles such as sand that may damage pumps and other equipment.
- **Primary treatment:** In the next stage, wastewater would pass through a sedimentation basin where heavier particles settle to the bottom while oil, grease and lighter particles float to the surface. The settled and floating particles are removed and the remaining liquid is pumped for secondary treatment.
- **Secondary treatment:** In this stage, wastewater enters aeration tanks where air is blown into the liquid to oxidize it and promote the growth of micro-organisms that help to remove the dissolved and suspended biological matter.
- **Tertiary treatment:** After the secondary treatment, the treated wastewater is sometimes disinfected chemically (e.g. using chlorine) or physically (e.g. by lagoons and microfiltration).

Figure 150: Sewage treatment process



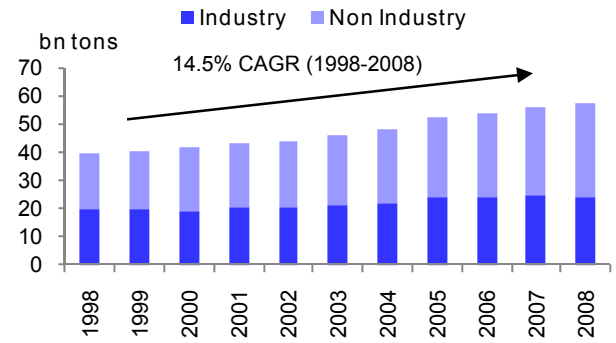
Source: Deutsche Bank

Wastewater treatment in China

Sewage treatment rate is improving, but still below the levels for developed countries

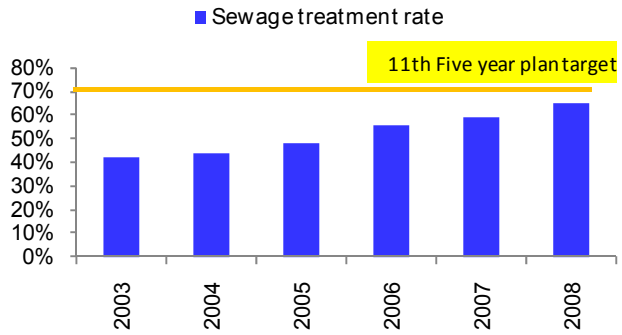
Over the last decade, the amount of sewage discharge has increased significantly at a 14.5% CAGR (1998-08, Figure 68), due to rapid urbanization and industrialization. At the same time, the number of wastewater treatment facilities was also increasing at a 14% CAGR due to significant investment poured into the sector over the last few years of the period. Thus, there has been remarkable improvement in China's urban sewage treatment rate (to 65.3% in 2008 from 42.1% in 2003, Figure 69) and it is likely to reach the 70% target treatment ratio as set by the government for 2010. Nonetheless, China's urban sewage treatment rate is still below the levels for developed countries, which are usually above 80%.

Figure 151: Total water sewage discharge



Source: Deutsche Bank, CEIC

Figure 152: China urban sewage treatment

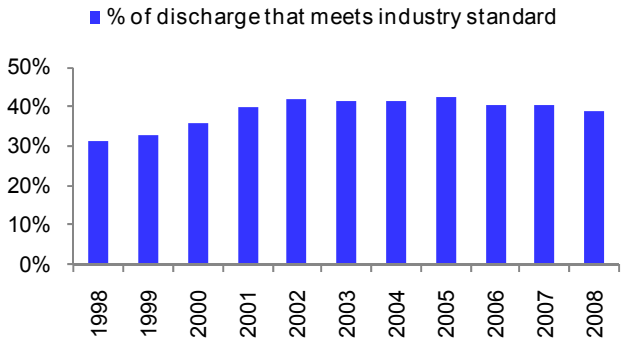


Source: Deutsche Bank, CEIC

Low percentage of discharge meets industry standard

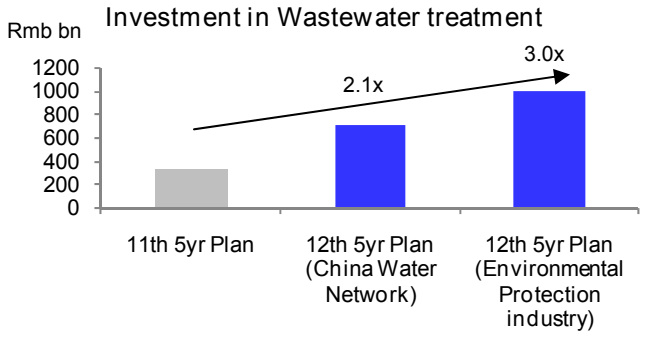
Although the urban sewage treatment rate is rising, the percentage of discharge that meets industry standards remains relatively low (Figure 153). This implies two things: 1) either the sewage treatment facilities are not up to standard or 2) the sewage treatment rate is significantly lower in rural areas.

Figure 153: % of discharge that meets industry standard



Source: Deutsche Bank, CEIC

Figure 154: Investment plans in wastewater treatment

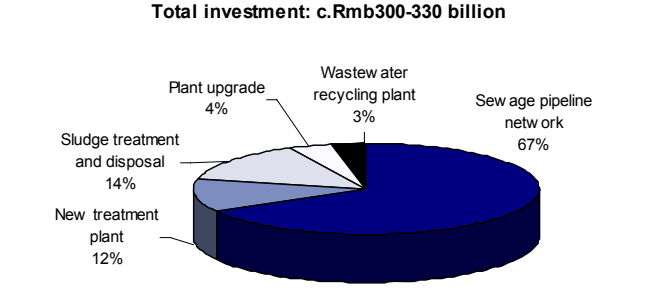


Source: Deutsche Bank, China Water Network, Environmental Protection Industry

China may double or even triple its investments in wastewater treatment

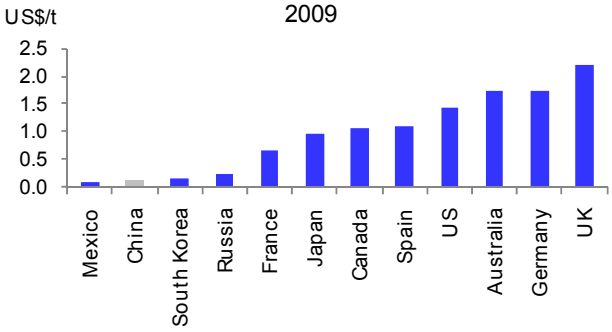
Given the increasing discharge volume in the next few years, and a low and stagnant percentage of discharge that meets the industry standard, the Chinese government is outlining aggressive investment plans for the sector in the next 12th Five-Year Plan. Although the official plan is still finalizing, several industry experts such as Mr. Hao Chun, Deputy Secretary General of China Association of Environmental Protection Industry, said on 8 August 2010 that China will invest more than Rmb1,000bn in industrial and urban wastewater treatment. In addition, in a separate China water industry report, China Water Network forecasts that between 2010 and 2015, China will require a Rmb700bn investment in wastewater treatment (Rmb550bn) and recycling (Rmb110bn). These estimates imply that China may double or even triple its investments in wastewater treatment in the next few years.

Figure 155: Wastewater treatment budget (11th 5-Yr Plan)



Source: Deutsche Bank, China State Council

Figure 156: Wastewater treatment tariff comparison (2009)



Source: Sound Global IPO Prospectus, Local China pricing administration and Deutsche Bank,

c.12% of sewage investment may be channeled to new treatment plants

While total investments in wastewater treatment may reach Rmb1,000bn in the next five years, the actual amount channeled to wastewater treatment plants may be much less, at around Rmb120bn. Based on the wastewater treatment budget in the 11th Five-Year Plan, c.12% of the total wastewater investment was allocated to develop new wastewater treatment plants (Figure 155). Assuming the construction cost for a sewage plant remains at Rmb1,500/ton of daily processing capacity, by the end of 2015 a Rmb120bn investment is likely to translate into an additional 80m tons of daily processing capacity, which is almost double the daily processing capacity of 83m tons in 2008.

China's wastewater treatment tariff still among the lowest in the world

In the last few years, China's residential wastewater treatment tariff has increased steadily at a 9.4% CAGR (2003-08). Such a tariff increase reflects the increasing need to treat wastewater and compensate for the higher treatment cost to meet higher discharge standards. Nonetheless, China's wastewater tariff in 2009 was still significantly lower than most of the countries in the world (Figure 156).

Regulatory framework

China's water industry is heavily regulated by several ministries and government agencies such as the Ministry of Water Resources, the Ministry of Housing and Urban-Rural Development (previously known as the Ministry of Construction), the Ministry of Environmental Protection and the NDRC. These ministries have implemented several regulations in the water industry in the last few years. We highlight key regulations and laws in the sector below:

- **Water Law of the PRC, 1988 (Further amended in August 2009):**
  - Outlines the rules and regulations regarding water resources ownership, development of water transportation infrastructure and water tariff.
- **Notice on the advancement of industrialization of urban sewage and garbage treatment, 2002**
  - Outlines the industrialization path of waste and sewage treatment projects as well as its treatment fee.
- **Notice from the State Council on promoting water tariff reform to encourage water saving and water resources protection, 2004**
  - Outlines ways to encourage water savings, which includes: 1) levying a water resources fee on a broader area, 2) improving the collection of sewage treatment fee and water resources fee and 3) stepping up the supervision of sewage discharge.

- **11th Five-Year Plan on water conservation, 2007**
  - The plan states that by the end of the 11th Five-Year period, the percentage of sewage discharge recycled should reach 20% in the Northern China region and 5%-10% in the coastal region

Technology overview

The process for most modern sewage treatment plants is rather similar, as all attempts to process wastewater do so through primary, secondary and tertiary treatments. However, the key difference in technology for sewage treatment plants is in the application of the secondary treatment. Below we discuss the various types of secondary treatment methods.

Aerobic treatment system: This is a biological technology that uses "good" bacteria to "eat" contaminants. Treatment methods that involve the use of biological methods include an activated sludge process and aerated lagoons.

Microfiltration or synthetic membranes: In this technology, wastewater is passed through filters that are small enough to separate minuscule microorganisms, thus removing them from the water. This method is generally used with chemicals for further decontamination. Treatments that use this technology include de-chlorination and membrane bioreactors.

De-nitrification: This technology uses methanol to promote the growth of certain bacteria that release carbon, which help to remove nitrates from the water. An example of this type of treatment methodology is the biological aerated filters treatment method.

Wastewater treatment value chain

The value chain of sewage treatment can be broken down into four main categories: 1) equipment makers, 2) EPC contractors, 3) project operators, and 4) sludge treatment players. Most of the listed companies in Mainland China and Hong Kong are involved in equipment manufacturing, EPC contracting and project operations and maintenance. Figure 157 illustrates the value chain with the associated market players.

Figure 157: Wastewater treatment value chain

Sewage treatment players	Equipment maker	EPC Contractor	Operator	Sludge treatment
Origin Water	v			
Chengdu Xingrong	v		v	v
Rino Environment	v			
Duoyuan Global Water	v			
Sound Global	v	v	v	
China Everbright Int'l		v	v	v
Beijing Water Business Doctor		v	v	
Tianjin Capital			v	
Beijing Capital		v	v	
Chongqing Water		v	v	
Beijing Enterprises Water Group		v	v	

Source: Deutsche Bank, Company data

Economics of wastewater treatment

Wastewater treatment projects awarded through BOT or TOT basis

Most sewage treatment projects are generally awarded through a bidding process on a Transfer Operate Transfer (TOT) or Build Operate Transfer (BOT) basis for around 25-30 years. Sewage treatment operators are only responsible for the treatment of waste water and do not include the set up of the wastewater network. Thus, the economics of a sewage project is largely related to the revenue and cost from the processing of wastewater. We discuss the key top-line and bottom-line drivers below.

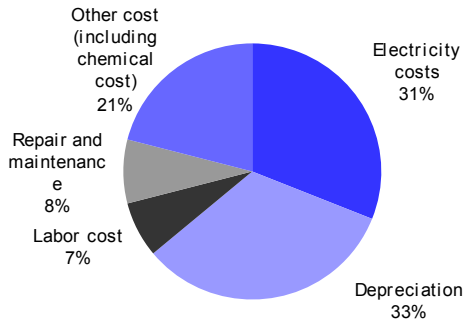
Key revenue drivers

- **Tariff** – Tariff is determined by the government through a bidding process and it is usually set at Rmb1.0-1.25/m^3. As wastewater treatment charge recovered from end users is around Rmb0.7-0.90/m^3, the tariff awarded to project operators is highly subsidized. At the same time, the tariff level varies with the volume of waste processed, with excess volume (as compared to the minimum off-take volume) sold at a heavy discount.
- **Utilization** – To encourage investment in the wastewater treatment sector, the government normally guarantees a minimum off-take volume that is governed by a pre-determined schedule. The schedule often starts at an implied utilization rate of around 50% and ramps up to around 80-90% over the next 1-2 years.

Key operating cost drivers (based on old accounting standards)

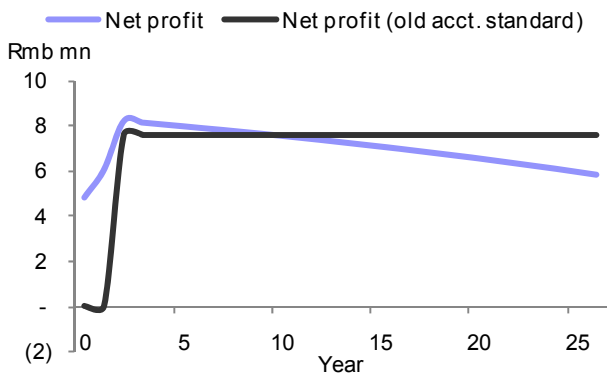
- **Depreciation –** Wastewater treatment plants generally have a useful life of 25 years and are depreciated over this period of time. Depreciation costs normally account for c.33% of total operating costs (Figure 158).
- **Electricity costs** – Power cost forms the second-largest operating cost and typically accounts for 30% of a plant's total operating cost (Figure 158).
- **Other costs -** The other operating costs that are significant include repair and maintenance costs, labour costs, and chemical costs (Figure 158).

Figure 158: Operating costs breakdown



Source: Deutsche Bank, Tianjin Capital

Figure 159: Revenue recognition for BOT project



Source: Deutsche Bank

Accounting change in revenue recognition for BOT project

Since 2008, the Hong Kong International Reporting Standard has allowed the recognition of construction revenue based on the percentage of completion method for the BOT project. What this means is that based on past experience, the company can make significant assumptions about the stage of completion of the project as well as the percentage of cost incurred and book the corresponding revenue and cost. As a result, the company recognizes a positive net profit for the project even before it starts operating. However, as time

progresses, the company's net profit decreases based on the new accounting standard as the revenue is booked as fair-value rather than actual revenue. Figure 71 illustrates the difference in net profit recognition due to the change in accounting standard.

Upfront investment cost
The investment cost of a wastewater treatment plant can vary depending on the equipment type and the discharge standards required. A typical water treatment plant in China costs about Rmb1,300-1,500/ton of daily processing capacity.

Equity IRR of 8-10% in China
The return of a wastewater treatment plant depends on a variety of factors, including the tariff awarded, utilization rate, power cost and other operating costs. In general, the average return in China ranges from 6-9% equity IRR based on an assumed gearing of a 60/40 debt/equity ratio.

Risks

Lower–than-expected utilization rates: This is largely due to an inadequate network to collect wastewater. Thus, a lack of government investment in the wastewater network may result in lower utilization, which may subsequently affect earnings (depending on the off-take contracts with the government).

Single revenue source credit risk: The sewage treatment business typically has only a single off-taker, which is usually the province's local government and is subject to a significant receivables collection risk.

Changes in discharge standards: Any changes in discharge standards such as a more stringent effluent emission may result in higher operating and investment costs.

Frequently asked questions and glossary of terms

Where is the wastewater discharged after treatment?
Treated wastewater is either discharged straight into the sea or sent to water recycling plants.

What are the major sources of wastewater in China?
The major sources of wastewater discharge come from the textile, paper, raw chemical materials, metals and iron manufacturing factories, power generating plants and agricultural food processing factories.

How developed is China's wastewater treatment industry?
China's wastewater treatment industry is underdeveloped, as less than 70% of its wastewater discharge is treated, compared with the average of >80% in most developed countries. To rectify the problem, the country is likely to set aside a huge investment budget for the sector in the 12th Five-Year Plan.

Why is China's wastewater treatment industry underdeveloped?
Under-development in the wastewater treatment industry can largely be attributed to the relatively low wastewater treatment tariff as compared to the rest of the world and the increasing amount of discharge due to the country's rapid urbanization and industrialization.

Is the market structure concentrated among a few dominant players?
The wastewater treatment industry is characterized as a fragmented market structure that has many small players with none having a significant market share.

Are there any foreign players in the sector in China?

The sewage treatment market is mainly dominated by state-owned enterprises. However, foreign players such as Veolia, Hong Kong and China Gas and Suez have entered the market through joint ventures.

How many people can a sewage treatment plant support?

In China, a sewage treatment plant with 550,000 tons of processing capacity per day can normally support sewage from 1.5m people.

Figure 160: Glossary of terms

Terms	Definitions
Activated sludge treatment	It is a treatment process that uses dissolved oxygen to promote the growth of biological flow, which helps to reduce the organic content of the sewage.
Aerobic digestion	A sludge treatment process that occurs in the presence of oxygen. During the process, the bacteria rapidly consume organic material and convert it to carbon dioxide.
Anaerobic digestion	A sludge treatment process that is carried out in the absence of oxygen.
Aerated lagoon	A treatment pond that is provided with aeration to promote the oxidation of wastewater.
Build, Operate and Transfer (BOT)	This is a form of project financing in which the private enterprise receives a concession from the government to finance, construct and operate a facility stated in the contract. The project will be transferred back to the government at the end of the concession period.
Disinfection	It is a method used to substantially reduce the number of microorganisms in the water. Types of disinfection method include Chlorination, Ultraviolet (UV) radiation and Ozone.
Effluent	Treated wastewater that flows out of a treatment plant.
Engineering, Procurement and Construction (EPC)	It is a form of contracting arrangement in which the contractor will design the installation, procure the necessary materials and construct it by itself or subcontract part of the work.
Filtration	A physical method of separating solids from liquids by using a medium that only fluid can pass through
Membrane bioreactors	A wastewater treatment process that combines the membrane process like microfiltration or ultra-filtration with a suspended growth bioreactor.
Screening	The first operation in the wastewater treatment process. The process removes large objects such as paper, plastics and rags to prevent damaging and clogging of downstream equipment.
Sedimentation	This is a physical water treatment process that is used to separate suspended solids in water under the influence of gravity.
Sewage sludge treatment	Process used to manage the disposal of sludge produced during sewage treatment.
Sludge	A semi-solid residue from air or water treatment processes. It can be a hazardous waste.

Source: Deutsche Bank

Wastewater treatment players

China Everbright International (0257.HK, Buy)

Company background

China Everbright International is primarily engaged in environmental protection project investments such as sewage water treatment, waste-to-energy and solid waste disposal. The company also operates a toll bridge in Fuzhou, Fujian province. China Everbright International is controlled by China Everbright Group and has positioned itself as the environmental investment arm of its parent.

Business exposure

In the last few years, the company has successfully expanded its exposure to the wastewater treatment business. As at end-2009, the company has secured a total of 17 waste water treatment projects that have a total designed annual waste water treatment capacity of 550m cubic metres. It has also processed 388m tons of waste water in the year, which represents an increase of 7% yoy. The company's wastewater treatment business is currently located mainly in Shandong and Jiangsu provinces.

Key financials

As of FY09, the company recorded operating revenue of HK$1,766m, mainly from sewage treatment construction and operation services, which represent 52% of its total revenue. Its operating profit margin for its sewage business has remained relatively stable in the last few years at 28-32%. In 1H10, the company's net profit increased 24% yoy to HK$245m despite a 15% decline in revenue due to lower contribution from lower margin construction service revenue.

Figure 161: China Everbright Intl Ltd (Hong Kong: 257, Currency: HKD)

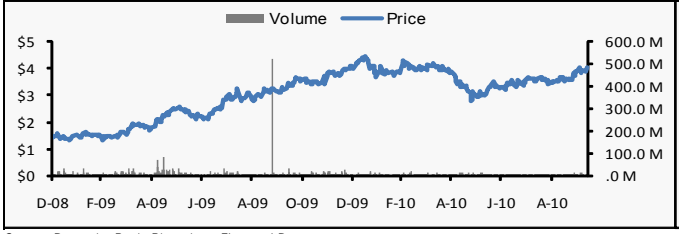
Description	
Address:	Rm. 2703 Far East Finance Ctr 16 Harcourt Road Admiralty Hong Kong (SAR)
Website:	www.ebchinaintl.com

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	1,863	1,766	960
EBIT	526	665	428
Net Income	339	372	245
EPS (Diluted)	0.11	0.11	0.07
Book Value per Share	0.9	1.3	1.3
Total Assets	6,301	8,667	9,105
Cash Flow-Oper Activities	(1,233)	(543)	(740)
Capital Expenditures	(54)	(13)	(12)
Free Cash Flow	(1,287)	(556)	(752)
Return on Com Eqty (%)	12.9	10.1	10.8
Total Debt/Total Equity (%)	76.6	60.6	60.7

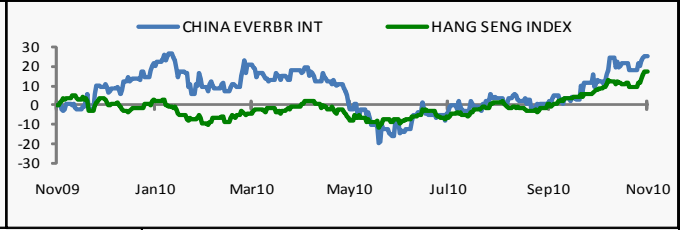
Business Segments (FY: Dec-09)	Revenue	EBITDA
Environmental water project construction & opera	1035.72	345.66
Environmental Energy & alt. enery onstruction & c	615.25	302.03
Infrastructure construction and op.	113.74	107.43
Environmental technology & construction manag	32.54	17.51
Property Investment and Management	1.29	5.73

Key Statistics	
Share price	4.36
52-Week Range	2.73 - 4.48
YTD performance	9%
Avg Daily traded Val (3 Months, USD)	5.4
Market Value (USD mn)	2,049.2
Float %	46.5%
Major shareholder	CHINA EVERBRIGHT HOL
% stake	43.7%
No. of employee	1,200

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Tianjin Capital Environmental Protection (1065.HK, non-rated)

Company background

Tianjin Capital Environmental Protection is primarily engaged in the wastewater treatment business in China, originally constructing/operating plants in Tianjin, and more recently has acquired sewage and water projects outside of Tianjin such as Hubei, Jiangsu, Zhejiang, Yunnan, and Shandong. The company also operates water recycling plants as well as toll stations in Tianjin. Tianjin Capital is listed in Hong Kong and Shanghai and is controlled by Tianjin Municipal Investment Company Limited (TMICL), the investment arm of the Tianjin municipal government.

Business exposure

The company's key businesses include sewage water treatment, recycling water supply, tap water supply and toll roads. In 2009, the capacity of its sewage water treatment plants (including entrusted plants) reached 3.635m cubic metres, and it processed a total of 763.54m cubic metres. The company also sold 3.46m cubic metres of recycled water and 34.97m cubic metres of tap water during the year.

Key financials

In 2009, the company reported revenues of Rmb1,183m (including business tax) and net profit of Rmb243.0m. In terms of business breakdown, the segment profit (EBITDA) from sewage processing services accounted for 87%, while recycled water supply and tap supply accounted for less than 3%. In terms of geographical breakdown, income from the Tianjin municipality accounted for 84% of total revenue. In 1H10, business operations remained stable and the company reported a net profit of Rmb130m.

Figure 162: Tianjin Capital Environ-H (Hong Kong: 1065, Currency: HKD)

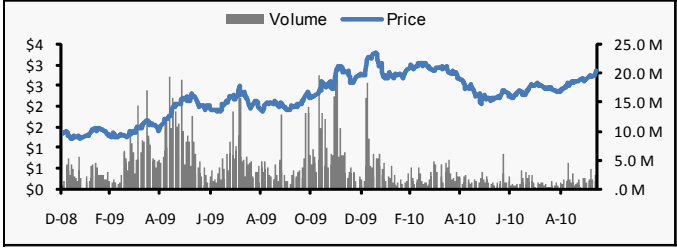
Description	
Address:	TCEP Building 76 Weijin Road South, Nankai Tianjin, 300381 China
Website:	www.tjcep.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,093	1,183	638
EBIT	525	537	249
Net Income	231	243	130
EPS (Diluted)	0.16	0.17	0.09
Book Value per Share	2.2	2.3	2.3
Total Assets	7,560	7,196	7,594
Cash Flow-Oper Activities	80	1,179	(17)
Capital Expenditures	(885)	(714)	(286)
Free Cash Flow	(805)	464	(303)
Return on Com Eqty (%)	7.6	7.6	8.2
Total Debt/Total Equity (%)	121.9	92.9	99.6

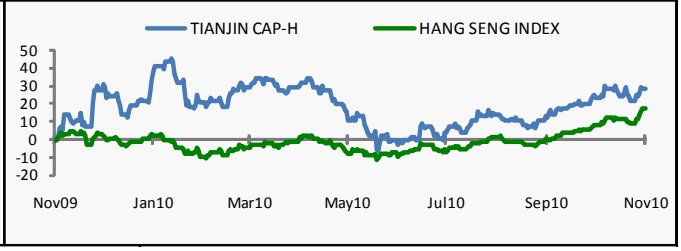
Business Segments (FY: Dec-09)	Revenue
Sewage Water Processing	1066.34
Others	88.55
Water Recycling and Pipeline Connection	56.49
Tap Water Processing	36.60
Reconciliation	(64.49)

Key Statistics	
Share price	2.82
52-Week Range	1.95 - 3.36
YTD performance	2%
Avg Daily traded Val (3 Months, USD)	0.5
Market Value (USD mn)	1,316.0
Float %	90.0%
Major shareholder	EDMOND DE ROTHSCHILD
% stake	10.0%
No. of employee	579

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Sound Global (0967.HK; SGL.SP, non-rated)

Company background

Sound Global is an integrated water and wastewater treatment solutions provider in China and offers services ranging from the design, construction, operation and maintenance of water and wastewater treatment facilities to the manufacturing of water and wastewater treatment equipment. The company is incorporated in Singapore and is listed both in Hong Kong and Singapore.

Business exposure

The company's primary business involves the Engineering, Procurement and Construction (EPC) for water and wastewater treatment projects in China. In the last few years, the company has also started to expand in the Build, Operate and Transfer (BOT) and Operation and Maintenance (O&M) project business model. In 2008, the company has diversified into the equipment manufacturing market through its acquisition of Hi-Standard, an equipment manufacturer for water and wastewater treatment. In 2009, the company penetrated into the overseas market and bagged a Rmb624m EPC contract with a state-linked utility player in Saudi Arabia.

Key financials

As of FY09, revenue from turnkey projects and services (including EPC projects and design and construction work of BOT projects) remained the largest contributor, representing 89.9% of overall revenue, or Rmb1,293m. Revenue from its equipment sales and project operation and maintenance represented c.10% and <1%, respectively. The company plans to expand its BOT project business and international EPC projects and to further develop its equipment manufacturing business through the development of new products. In 1H10, the company's net profit increased 26.1% yoy to Rmb120m due to higher equipment sales, more progressive completion of turnkey projects and services.

Figure 163: Sound Global Ltd (Singapore: SGL, Currency: SGD)

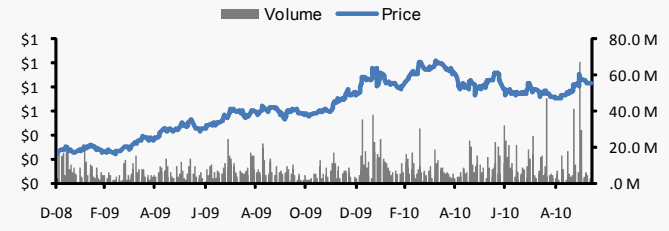
Description	
Address:	Natl Env. Protn. Industry Zone Tongzhou District Beijing, 101102 China
Website:	www.soundglobal.com.sg

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,025	1,293	645
EBIT	275	293	142
Net Income	204	281	120
EPS (Diluted)	0.16	0.22	0.09
Book Value per Share	1.0	1.2	1.3
Total Assets	2,295	2,508	2,760
Cash Flow-Oper Activities	173	383	105
Capital Expenditures	(1)	(1)	(0)
Free Cash Flow	172	383	105
Return on Com Eqty (%)	16.5	19.6	7.9
Total Debt/Total Equity (%)	29.9	14.6	14.3

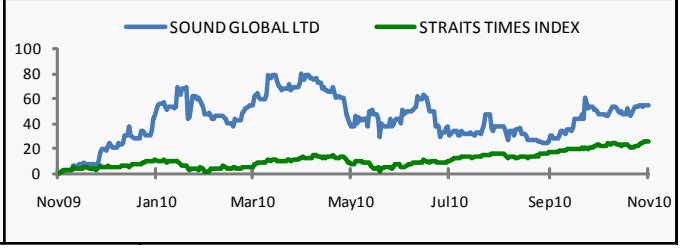
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Environmental Control	1,293.48	375.51

Key Statistics	
Share price	0.875
52-Week Range	0.565 - 1.04
YTD performance	19%
Avg Daily traded Val (3 Months, USD)	6.5
Market Value (USD mn)	878.2
Float %	47.5%
Major shareholder	YIBO WEN
% stake	43.6%
No. of employee	145

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Beijing Capital (600008.CH, non-rated)

Company background

Beijing Capital is principally engaged in the operation, construction and management of water supply and water sewage business with operations in areas such as Beijing, Hunan, Anhui, and Shenzhen. It is also involved in other non-utility businesses such as the management of toll roads and hotels. The company was listed on the Shanghai Stock Exchange in April 2000.

Business exposure

To date, the company has participated in over 27 projects and has a daily sewage processing capacity of 12m cubic metres, serving over 20m people. The company also owns or operates the local water distribution pipeline and supplies water to end users directly. The company plans to develop its water supply business through acquisitions and greenfield projects and expand into the EPC project business model for water sewage plants. At the same time, the company targets to penetrate into the overseas market.

Key financials

As of FY09, the company reported revenues of Rmb2,587m and net profit of Rmb447m. In terms of business breakdown, revenue from sewage processing services accounted for 30%, while the construction of water supply network and water sales accounted for 20% and 18%, respectively. The non-water business accounts for the remaining 32%. In terms of geographical breakdown, income from Beijing, Tianjin, Anhui, and Hainan accounted for 78% of total revenue. In 1H10, the company's net profit was up 31% yoy to Rmb124m, mainly due to higher water tariff and water sales volume.

Figure 164: Beijing Capital Co Ltd-A (Shanghai: 600008, Currency: CNY)

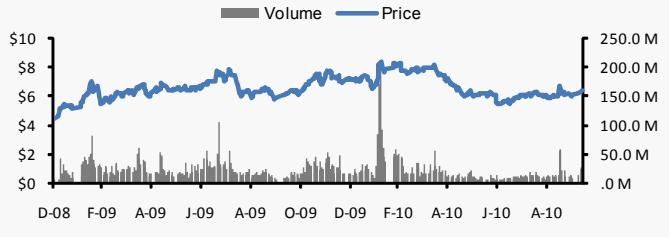
Description	
Address:	3F Jing'an Center 8 Beisanhuan Road East Chaoyang District Beijing, 100028 China
Website:	www.capitalwater.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	1,719	2,587	1,008
EBIT	364	593	227
Net Income	261	447	124
EPS (Diluted)	0.12	0.20	0.06
Book Value per Share	2.1	2.2	2.2
Total Assets	12,903	14,445	15,915
Cash Flow-Oper Activities	93	514	(23)
Capital Expenditures	(583)	(517)	(426)
Free Cash Flow	(490)	(3)	(449)
Return on Com Eqty (%)	5.5	9.3	10.2
Total Debt/Total Equity (%)	45.7	58.7	59.0

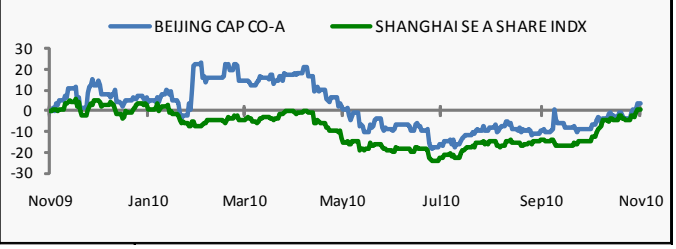
Business Segments (FY: Dec-09)	Revenue
Sewage Treatment	778.47
Water Plant Construction	522.35
Real Estate Development	499.68
Tap Water Supply	458.25
Toll Highway	260.33

Key Statistics	
Share price	6.91
52-Week Range	5.25 - 8.95
YTD performance	-5%
Avg Daily traded Val (3 Months, USD)	15.7
Market Value (USD mn)	2,283.7
Float %	39.8%
Major shareholder	BEIJING CAPITAL CO L
% stake	59.5%
No. of employee	4,981

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Chongqing Water (601158.CH, non-rated)

Company background

The company is principally engaged in the operation and management of water supply and water sewage treatment business in Chongqing municipality. It is also involved in the engineering, procurement and construction (EPC) of public utility and housing projects. Its parent company, Chongqing Waterworks Asset Management, is a state-owned enterprise and owns a 75% stake in Chongqing Water. The company was listed on the Shanghai Stock Exchange in March 2010.

Business exposure

Chongqing Water owns the water supply rights in key areas in Chongqing municipality. It supplies water to over 3.97m people in the municipality, accounting for 39% of the total market share. As of end-2009, the company owns 27 water supply plants that have a total designed capacity of 1.48m cubic metres/day. Besides supplying water, the company is also involved in the water sewage treatment business with a dominant market share of 79% in Chongqing municipality. As of end-2009, the company owns 37 water sewage plants that have a total processing capacity of 1.70m tons/day.

Key financials

In 2009, the company recorded revenue of Rmb2,714m and net profit of Rmb1,014m. Revenue contribution from the water sewage treatment business was the largest, accounting for 64% of total revenue. The remaining segments, including tap water supply and engineering construction, account for 27% and 8% of total revenue, respectively. In 1H10, the company's net profit increased 29% yoy to Rmb628m on an increase in water tariff, water supply and sewage processing volume.

Figure 165: Chongqing Water Group-A (Shanghai: 601158, Currency: CNY)

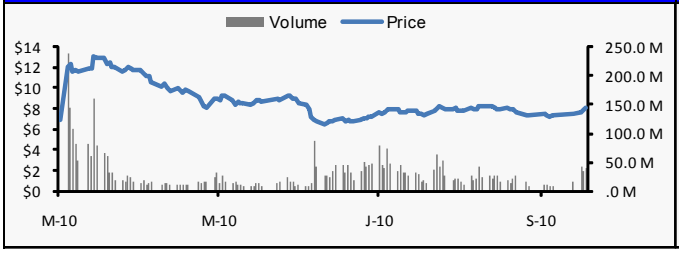
Description	
Address:	No 1 Long Jia Wan YuZhong District Chongqing, Sichuan Province China
Website:	www.cncqsw.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	2,358	2,714	1,443
EBIT	991	1,073	649
Net Income	736	1,014	628
EPS (Diluted)	0.17	0.24	0.14
Book Value per Share	1.5	1.7	2.1
Total Assets	11,532	12,362	15,935
Cash Flow-Oper Activities	383	1,293	182
Capital Expenditures	(647)	(509)	(233)
Free Cash Flow	(264)	784	(52)
Return on Com Eqty (%)	11.6	15.0	12.6
Total Debt/Total Equity (%)	60.0	53.2	36.7

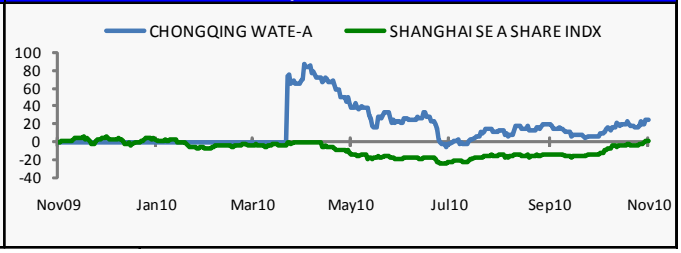
Business Segments (FY: Dec-09)	Revenue
Wastewater Treatment Services	1733.10
Tap Water Sales	745.66
Engineering Construction	221.11
Others	39.47
Elimination	(9.96)

Key Statistics	
Share price	8.59
52-Week Range	6.4 - 13.16
YTD performance	-
Avg Daily traded Val (3 Months, USD)	33.7
Market Value (USD mn)	6,194.2
Float %	10.4%
Major shareholder	CQ WATERWORKS ASSET
% stake	75.1%
No. of employee	4,596

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Beijing Enterprises Water Group (0371.HK, non-rated)

Company background

Beijing Enterprise Water is a state-owned enterprise that specializes in water services and environmental protection in China. It is the flagship vehicle of Beijing Enterprises Holdings (0392.HK, Buy), a state-owned red chip utility conglomerate for expanding into the water service market. The company was listed in Hong Kong in 1992 and Beijing Enterprises Holdings became the controlling shareholder in March 2008.

Business exposure

The company's core operation is primarily involved in wastewater treatment and water supply. As at end-2009, the company has 47 sewage treatment plants, four water supply plants and three recycled plants with a total designed daily processing capacity of 3.597m tons, 1.615m tons of sewage capacity of which is in operation. The company's largest operating region is in Western China and Southern China, where it has 12 sewage treatment plants with a total designed capacity of 10.9m tons/day. The company plans to enter the overseas market and has signed a memorandum with the Malaysian government in respect of 20 sewage treatment service projects. In addition, the company is looking for potential business opportunities in the sludge treatment market.

Key financials

As of FY09, the company recorded operating revenue of HK$1.73bn, mainly from sewage treatment construction contract and services, which represented 62% and 25% of total revenue, respectively. The gross profit margin for its sewage treatment services was 63%, water supply services 38%, construction services 12%, sewage technical services 92% and sales of sewage treatment 25%. In 1H10, the company's revenue increased 4.1x yoy and net profit increased 2.5x yoy in a series of acquisitions of sewage treatment plants.

Figure 166: Beijing Enterprises Water Group (Hong Kong: 371, Currency: HKD)

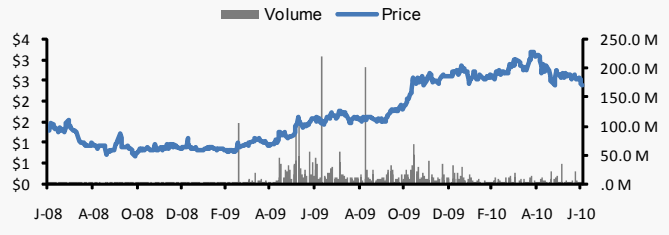
Description	
Address:	Room 4301 43/F Central Plaza 18 Harbour Road Wanchai Hong Kong (SAR)
Website:	www.bewg.com.hk

Financials (HKDmn)	Jun-08	Dec-09	1H10
Sales	11	1,730	2,208
EBIT	(6)	390	287
Net Income	(9)	193	145
EPS (Diluted)	-0.06	0.05	0.04
Book Value per Share	0.6	0.8	0.8
Total Assets	529	7,424	12,770
Cash Flow-Oper Activities	-	(1,212)	-
Capital Expenditures	-	(61)	-
Free Cash Flow	-	(1,274)	-
Return on Com Eqty (%)	-7.8	13.6	11.2
Total Debt/Total Equity (%)	162.5	106.4	199.2

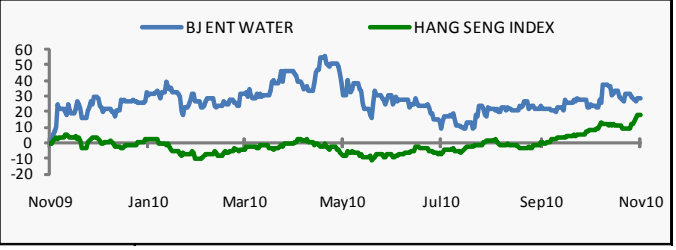
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Sewage Treatment and Construction Sevices	1505.62	405.16
Sale of Sewage Treatment Facilities	94.78	24.12
Sewage Technical Services	69.16	63.55
Water Supply Services	60.46	23.10

Key Statistics	
Share price	2.64
52-Week Range	2.04 - 3.26
YTD performance	2%
Avg Daily traded Val (3 Months, USD)	2.8
Market Value (USD mn)	1,555.5
Float %	38.6%
Major shareholder	BEIJING ENT ENVIRO C
% stake	43.7%
No. of employee	1,830

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Origin Water Technology (300070.CH, non-rated)

Company background

Beijing Origin Water Technology Company is a non state-owned enterprise established in 2001 by a group of scientists and professionals from overseas and domestic universities. The company's business spans from sewage treatment and recycling to water and drinking water research to solid waste disposal, project design, and construction. The company was listed in April 2010.

Business exposure

The company's core operation is primarily involved in developing and supplying sewage treatment systems to its customers in China. It processes six core technologies for sewage treatment, including the large-scale membrane bioreactor unit (MBRU), compact membrane bioreactor (MBR), small-scale wastewater treatment system (CWT-M), double membrane recycled cleaning water technology (DMW), alternating anaerobic and aerobic membrane bioreactor (3AMBR) and wetland and biological channel technology (WBC).

Key financials

As of FY09, the company recorded operating revenue of Rmb309m, mainly from sewage treatment systems, which represented 99% of total revenue. Its gross profit margin, operating profit margin and net profit margin have improved over the year to 48.1% (vs. 43.1% in 2008), 39.7% (vs. 36.7% in 2008) and 34.3% (vs. 33.8% in 2008), respectively. In terms of geographical breakdown of its revenue stream, Beijing accounted for 45% of the total with the rest of China accounting for the remaining. In 1H10, the company's net profit increased 41.6% yoy to Rmb47.6m on a significant increase in the sale of sewage treatment system (revenue up 54% yoy) and membrane bioreactor unit (revenue up 43% yoy).

Figure 167: Beijing Origin Water Techno-A (Shenzhen: 300070, Currency: CNY)

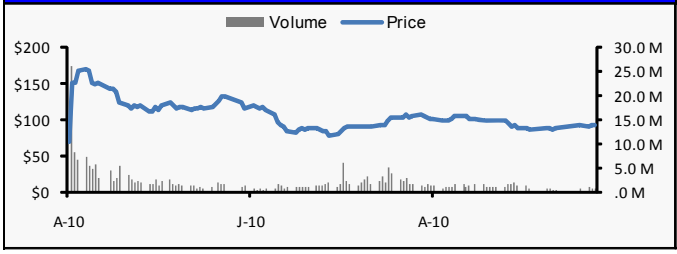
Description	
Address:	2/F JiYou Bldg, 2Changximen Rd Haidan District Beijing, 100097 China
Website:	www.originwater.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	218	309	167
EBIT	77	124	55
Net Income	75	107	47
EPS (Diluted)	-	-	0.39
Book Value per Share	2.0	2.9	19.0
Total Assets	284	507	2,984
Cash Flow-Oper Activities	105	135	(61)
Capital Expenditures	(40)	(52)	(70)
Free Cash Flow	65	82	(132)
Return on Com Eqty (%)	39.3	39.6	-
Total Debt/Total Equity (%)	0.0	0.0	0.0

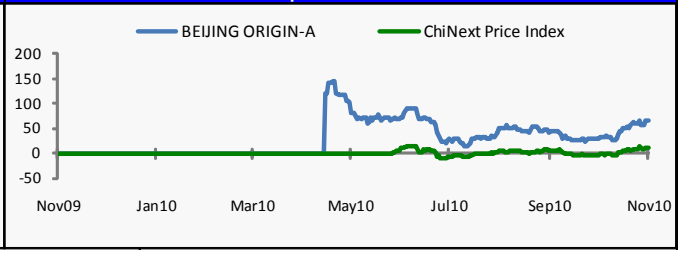
Business Segments (FY: Dec-09)	Revenue
Sewage Treatment	313.43
Other Operating Income	0.12
Membrane Bioreactor Unit (MBRU)	0.02

Key Statistics	
Share price	113.8
52-Week Range	69 - 175.58
YTD performance	-
Avg Daily traded Val (3 Months, USD)	20.7
Market Value (USD mn)	2,513.1
Float %	25.2%
Major shareholder	JIANPING WEN
% stake	25.4%
No. of employee	404

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Beijing Water Business Doctor (300055.CH, non-rated)

Company background

Beijing Water Business Doctor is a non-state owned company that provides water treatment and management services for a range of industries including refining, petrochemical, coal chemical, metallurgy, electricity, and mining. The company was established in Beijing in 1998 and listed in Shenzhen Stock exchange in Feb 2010.

Business exposure

The company provides a full range of water treatment services for industries through trust management, BOT (Build-Operate-Transfer), and EPCC (Engineering-Procurement-Construction and Commission) arrangements. Its water treatment services include industrial waste-water treatment, recycling and water supply. In the last few years, the company has successfully bagged several large-scale water treatment industry projects such as the Shenhua Dongmei Coal Chemistry water treatment BOT project.

Key financials

In 2009, the company recorded total revenue of Rmb465m and net profit of Rmb81m. Its gross profit margin and net profit margin was 26% and 18%, respectively. In terms of business segment breakdown, revenue from engineering contracting (EPC projects) was the highest, accounting for 97% of the total revenue. Other businesses such as trust management, merchandise sales and technical services account for 2%, 0.5% and 0.5%, respectively. The operating profit margin for its engineering contracting, trust management, merchandise sales and technical services was 25.1%, 60.7%, 50.8% and 73.5%, respectively. In 1H10, the company's net profit increased 144% yoy to Rmb24m due to a significant increase in trust management operations and a higher petro-chemical EPC project type mix, which has a high profit margin.

Figure 168: Beijing Water Business Doc-A (Shenzhen: 300055, Currency: CNY)

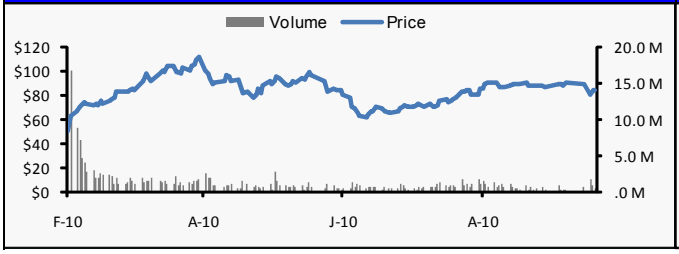
Description	
Address:	Rm.9311, Jingshi Bldg. No.19, Waidajie, Xinjiekou Haidian District, Beijing, 100016 China
Website:	www.waterbd.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	366	465	111
EBIT	51	99	27
Net Income	38	81	24
EPS (Diluted)	0.823	0.945	0.22
Book Value per Share	1.4	2.0	13.6
Total Assets	178	423	1,764
Cash Flow-Oper Activities	16	79	(113)
Capital Expenditures	(3)	(27)	(60)
Free Cash Flow	13	52	(172)
Return on Com Eqty (%)	72.6	61.1	-
Total Debt/Total Equity (%)	0.0	0.0	0.0

Business Segments (FY: Dec-09)	Revenue	Gross Profit
Engineering Contracting	463.38	116.24
Trust Management Operations	9.34	5.67
Merchandise Sales	2.11	1.07
Technical Services	1.91	1.40

Key Statistics	
Share price	108.2
52-Week Range	50.531 - 115.308
YTD performance	-
Avg Daily traded Val (3 Months, USD)	10.2
Market Value (USD mn)	1,859.5
Float %	25.0%
Major shareholder	PIAOYANG WANG
% stake	30.9%
No. of employee	80

Price and Volume (1 Year)



Comparative Returns

Source: Deutsche Bank, Bloomberg Finance LP

Rino International Corp (Rino.US, non-rated)

Company background

Rino International Corp is engaged in the design, development, manufacture and installation of industrial equipment that are mainly used for environmental protection equipment for the iron and steel industry in China. The company was originally incorporated in Minnesota in 1984 as Applied Biometrics but was restructured in 2007 into an environmental protection equipment manufacturer.

Business exposure

The company has three principal products, namely: 1) Lamella Inclined Tube Settle Waste Water Treatment System, 2) Circulating, Fluidized Bed, Flue Gas Desulphurization System and 3) High Temperature Anti-Oxidation System for Hot Rolled Steel. Among these, its core product is the Lamella Inclined Tube Settler Waste Water Treatment System, which is sewage treatment equipment widely used in China's iron and steel industry. The system includes industrial water treatment equipment, complete sets of effluent-condensing equipment, solid and liquid abstraction dewatering equipment and coal gas dust removal and cleaning equipment. The company also owns several patents on its equipment products.

Key financials

In 2009, the company recorded total revenue for US$193m and a net profit of US$56m. In terms of business segment breakdown, revenue from its flue gas desulphurization product was the highest and accounted for 60% of total revenue, while its wastewater treatment equipment was the second highest and accounted for 23.9% of total revenue. Among its various products, revenue increase from its wastewater treatment equipment was the highest (up US$32.4m yoy) due to a significant increase in the number of wastewater treatment projects. For 1H10, the company continued to record strong growth across all its product lines.

Figure 169: Rino International Corp (NASDAQ GS: RINO, Currency: USD)

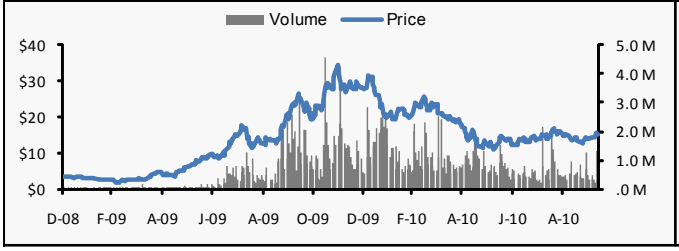
Description	
Address:	11 Youquan Road Zhanqian Str Jinzhou District Dalian, 116100 China
Website:	www.rinogroup.com

Financials (USDmn)	Dec-08	Dec-09	1H10
Sales	139	193	113
EBIT	-	55	28
Net Income	21	56	39
EPS (Diluted)	0.85	2.22	1.37
Book Value per Share	-	7.1	8.5
Total Assets	-	259	301
Cash Flow-Oper Activities	-	31	(48)
Capital Expenditures	-	(0)	(1)
Free Cash Flow	-	31	(49)
Return on Com Eqty (%)	-	-	23.5
Total Debt/Total Equity (%)	-	0.7	6.2

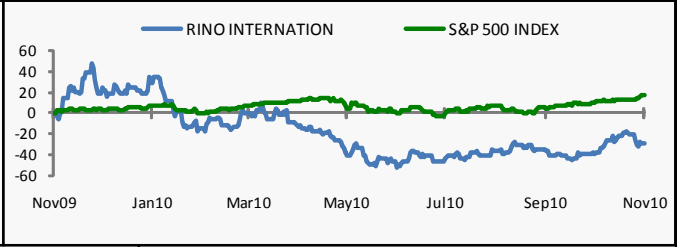
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Pollution Control Equipment	192.64	72.31

Key Statistics	
Share price	16.6
52-Week Range	10.87 - 35.15
YTD performance	-40%
Avg Daily traded Val (3 Months, USD)	11.2
Market Value (USD mn)	474.8
Float %	37.4%
Major shareholder	DEJUN ZOU
% stake	62.6%
No. of employee	270

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Duoyuan Global Water (DGW.US, non-rated)

Company background

Duoyuan Global Water is a privately owned sewage equipment supplier in China, offering over 80 types of products and solutions for industrial and residential wastewater treatment. The company was incorporated in June 2007 and was listed on the New York Stock Exchange in June 2009.

Business exposure

The company offers several products along the sewage treatment processing chain, including filtration, water softening, water-sediment separation, aeration, disinfection and reverse osmosis. Their products are classified under three main categories; 1) circulating water treatment equipment, 2) water purification equipment and 3) wastewater treatment equipment. In addition to offering a large variety of sewage treatment products, the company has an extensive distribution network with over 80 distributors throughout China in 28 provinces. The company also owns an in-house research and development team that has helped to develop more than 75 new products across all its three product categories.

Key financials

In 2009, the company recorded total revenue for Rmb783m and net profit of Rmb117m. In terms of sales breakdown by product, wastewater treatment was the highest and accounted for 40% of the total revenue, while circulating water treatment product was the second highest and accounted for 37% of its total revenue. In terms of sales breakdown by business process, equipment manufacturing (Duoyuan Langfang) was Rmb582m, while product distribution was Rmb783m (Duoyuan Beijing). In 1H10, the company continued to record strong revenue growth (up 35% yoy) mainly due to the increase in demand across all its product lines.

Figure 170: Duoyuan Global Water Inc-Adr (New York: DGW, Currency: USD)

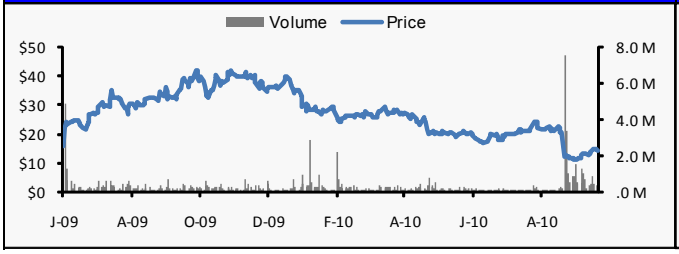
Description	
Address:	No 3 Jinyuan Road Daxing Industrial Dev Zone Beijing, 102600 China
Website:	www.duoyuan-hq.com

Financials (USDmn)	Dec-08	Dec-09	1H10
Sales	593	783	454
EBIT	197	188	138
Net Income	134	117	103
EPS (Diluted)	-	6.31	4.17
Book Value per Share	-	59.0	77.7
Total Assets	538	1,373	2,048
Cash Flow-Oper Activities	242	155	-
Capital Expenditures	(22)	(67)	-
Free Cash Flow	219	88	-
Return on Com Eqty (%)	-	13.5	6.7
Total Debt/Total Equity (%)	4.5	1.6	0.0

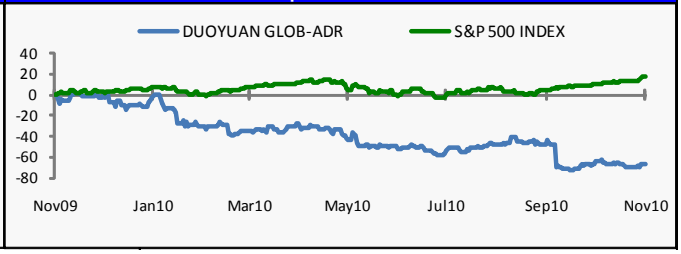
Business Segments (FY: Dec-09)	Revenue
Duoyuan Beijing	783.41
Duoyuan Langfang	581.86
Eliminations	(581.86)

Key Statistics	
Share price	13.29
52-Week Range	10.3805 - 44
YTD performance	-63%
Avg Daily traded Val (3 Months, USD)	7.4
Market Value (USD mn)	327.1
Float %	100.0%
Major shareholder	SAM SUSTAINABLE ASSE
% stake	8.4%
No. of employee	1,166

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Solid waste treatment

Solid waste can largely be classified into 1) municipal waste such as food, papers, bottles, plastics and clothing, 2) industrial waste such as coal sludge and chemicals, 3) agricultural waste such as rice husks and wheat straw, and 4) hazardous waste such as hospital waste and nuclear fuel waste. Among the various types of solid waste treatment, the municipal and industrial waste treatment is the most developed and has the largest market in terms of processing volume. Thus, this section focuses on industrial and municipal waste treatment industry, and discusses about the various type of treatment methods available and the challenges and opportunities in China.

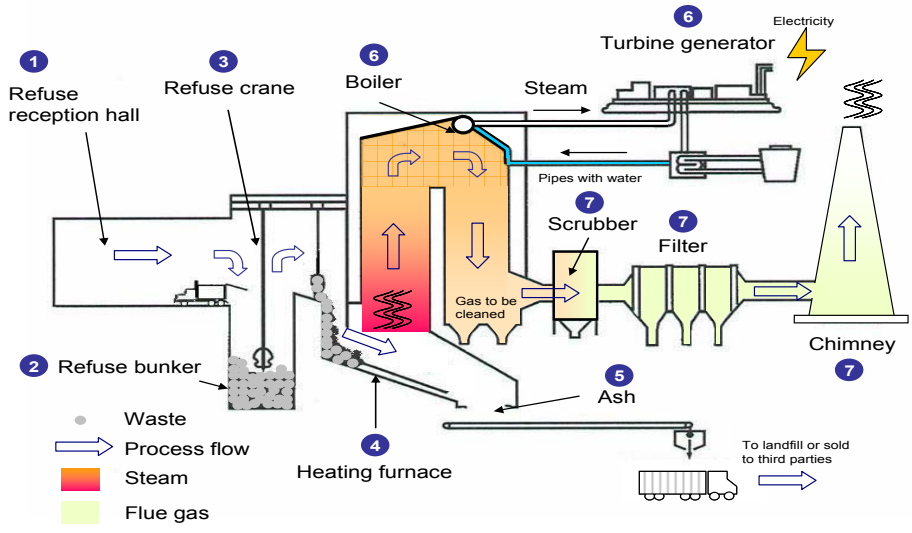
Solid waste treatment method overview

There are three different methods to treat solid waste, namely 1) waste used for power generation (also known as waste to energy), 2) landfill, and 3) Composting. We discuss the three various methods below.

Waste-to-energy

Waste to energy is the process of generating power or heat energy through the incineration of a waste source. There are several types of waste-to-energy (WTE) technology, including incineration, fermentation, gasification, and pyrolysis. Currently, the most widely used method is incineration, in which solid waste is burnt in a furnace to generate heat. In a waste-to-energy process, the heat created from the incineration is used to boil water in a boiler. The water turns into steam and drives a turbine generator to produce electricity. We provide a graphical illustration of the process in Figure 171.

Figure 171: Typical process flow of a waste-to-energy plant through incineration



Source: Deutsche Bank, Veolia, Covanta

Landfill

A landfill is a designated area for waste disposal and is the most common method of waste treatment. Waste is dumped, spread out, crushed, covered with soil and compacted by heavy equipment.

The basic parts of a landfill are the bottom liner system, cells, storm water drainage system, leachate collection system, methane collection system, and covering. The bottom liner

separates the waste from the outside soil and groundwater, while the cells store the waste. Storm water drainage system keeps rainwater from entering landfills. However, rainwater still gets into landfills and leachate collection systems collect the liquid that mixes with the waste.

Composting

The process of composting involves organic materials decomposing into soil known as compost. The breakdown process is aerobic (uses oxygen) and involves bacteria, fungi, insects and animals breaking down the waste materials into humus.

Figure 172: Comparison of various solid waste treatment methods

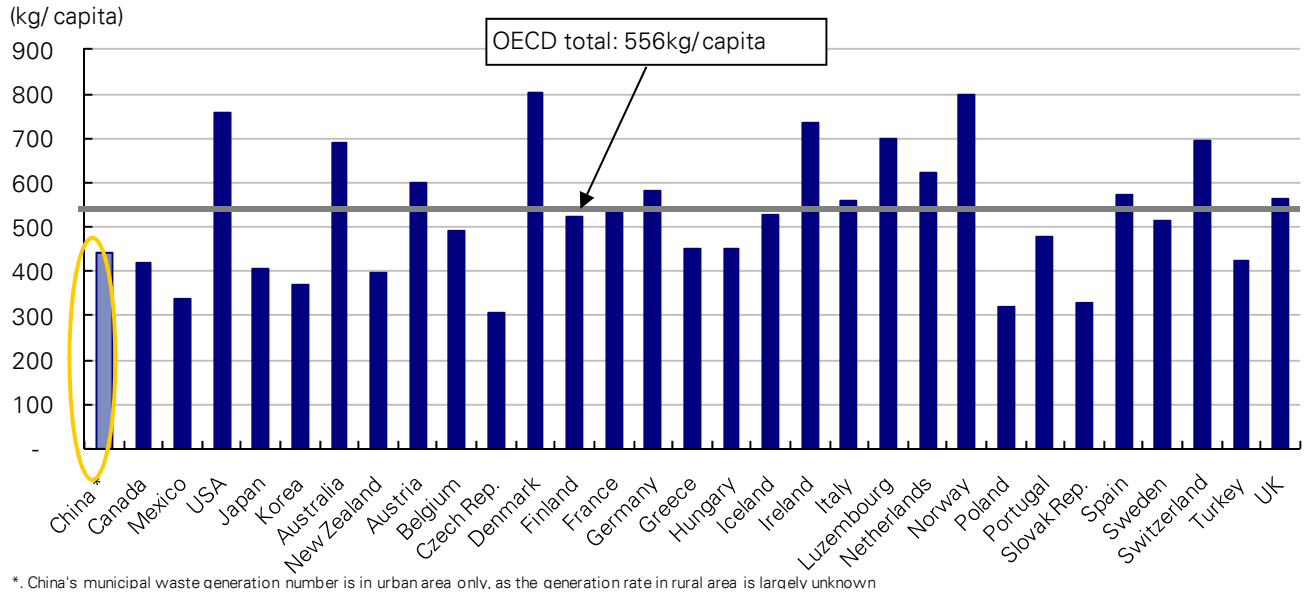
	Landfill	Composting	Waste-to-energy
Minimization of waste	Low	Medium	High
Land occupation	High	Medium	Low
Environmental impact	Medium	Low	Low to Medium
Investment cost	High	Medium	High
Operating cost	High	Medium	High
Comprehensive utilization	None	Compost as by product	Electricity/heat/bricks as by products

Source: Deutsche Bank, ZhongDe Waste Technology AG

Solid waste treatment market in China

China has become the world's largest municipal solid waste producer (157 million tons in 2009, Figure 174). However, waste per capita is currently at low levels on a global comparison (Figure 173) and the industry waste treatment ratio of 71% in 2009 is also low when compared to developed countries.

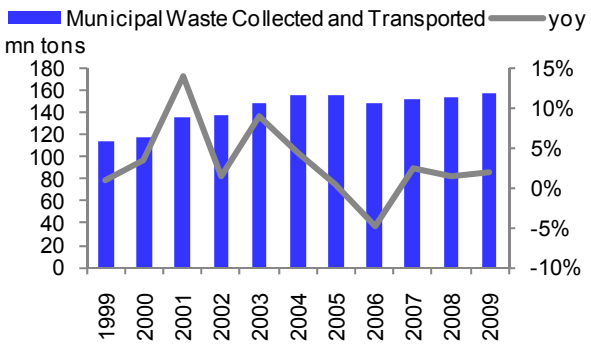
Figure 173: Municipal waste by country (2008)



*. China's municipal waste generation number is in urban area only, as the generation rate in rural area is largely unknown

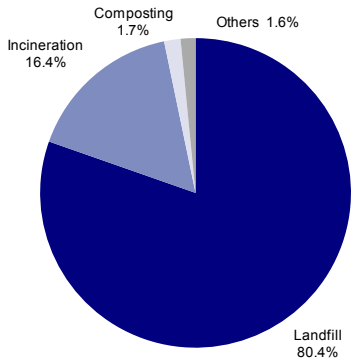
Source: Deutsche Bank, OECD

Figure 174: Volume of municipal solid waste produced



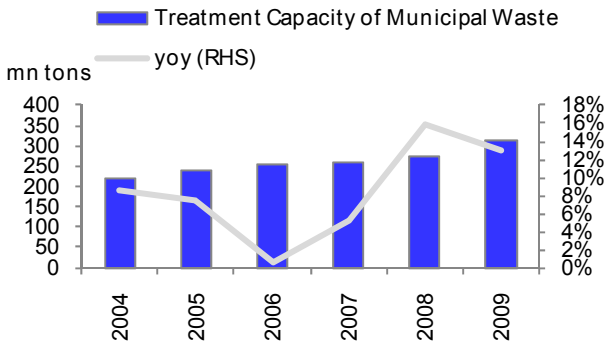
Source: Deutsche Bank, CEIC

Figure 175: Waste treatment capacity breakdown



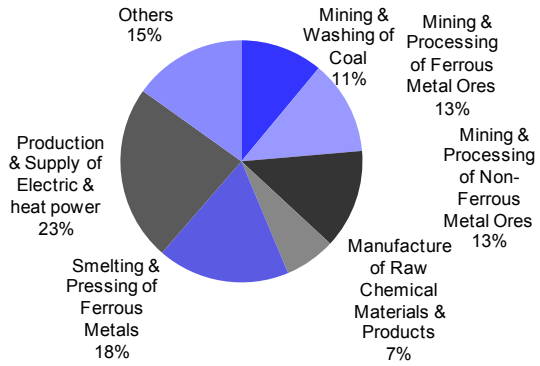
Source: Deutsche Bank, CEIC

Figure 176: Treatment capacity of municipal waste



Source: Deutsche Bank, CEIC

Figure 177: Breakdown of industrial solid waste source



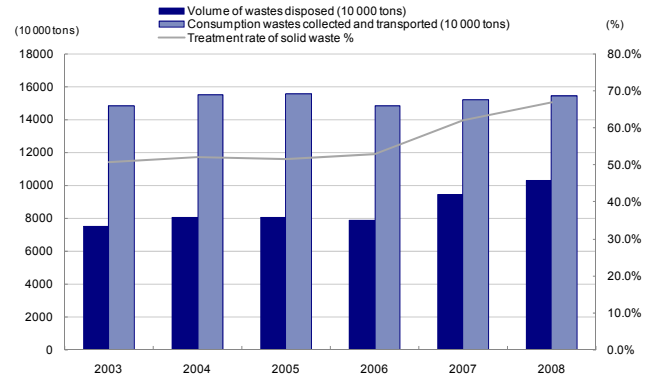
Source: Deutsche Bank, China Statistical year book

The average treatment rate of municipal waste has improved over the years from only 51% in 2003 to 71% in 2009. The increase in treatment rates was due to the increase in investment in this sector, resulting in an increase in both the treatment capacity and the number of municipal waste treatment facilities. According to the Ministry of Construction, there were 509 (471 in 2005) municipal waste treatment facilities in China's 661 cities, with a total treatment capacity of 315,153 tons/day (256,312 tons in 2005) at end-2008.

Solid waste treatment methods in China

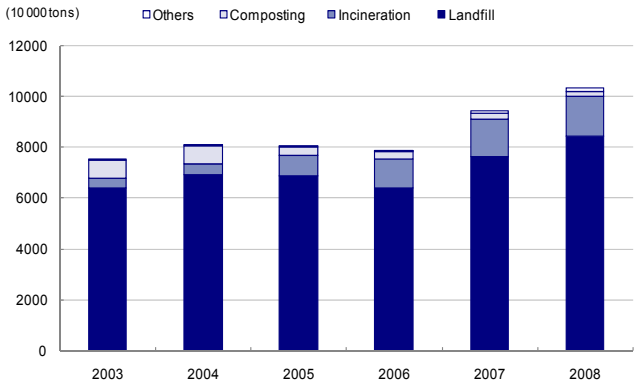
The main form of solid waste treatment in China is the landfill method, which deals with approximately 80% of waste at about 407 treatment facilities. Landfills have a processing capacity of 253,268 tons per day and they disposed a total of 84.2m tons of waste in 2008. Incineration is a distant second, but has increased rapidly from 4.9% of total waste disposal in 2003 to 16.4% in 2008. There are now 74 incineration facilities, with a treatment capacity of 51,606 tons per day. Waste disposed by incineration totaled 15.7m tons in 2008. Composting is not widely used, accounting for only about 1.7% of solid waste treatment. The mix in treatment methods may change in the future with incineration likely to replace disposal by landfill in most urban areas, especially in big cities, due to the scarcity of resources for landfill.

Figure 178: Waste treatment rate



Source: Deutsche Bank, CEIC

Figure 179: Volume of waste disposed (10,000 tons)



Source: Deutsche Bank, CEIC

Market potential

With anticipated rapid economic development and a rising urbanization rate, municipal solid waste is likely to further increase in the next few years. According to the World Bank, China's annual solid waste quantities should increase another 150% from 190m tons in 2004 to 480m tons by 2030, mainly due to urbanization, urban population growth, and increasing affluence. The Chinese Academy of Social Sciences estimates that the urbanization rate is likely to increase to 52% in 2015 and 65% in 2030 from 46.5% in 2009.

With the likely increase of solid waste disposed, the investments required to treat solid waste should increase as well. According to the China Environmental Planning Institute, total investment in solid waste area is likely to be Rmb800bn in the 12th Five-Year period (2011-15), tripling the amount spent in the 11th Five-Year period. The major areas of investment are municipal waste, sludge from water treatment plants, and sludge from river basins.

Technology overview

Three major types of waste-to-energy through incineration

Several types of incinerators are used, including the grate incinerator, the fluidized bed incinerator, and the rotary-kiln incinerator.

Grate incinerator: In a grate incinerator, solid waste is combusted inside a furnace and the flue gas generated is used to heat steam for generating electricity. The grate incinerator can be further classified as either a moving grate incinerator or fixed grate incinerator. The difference between these incinerators is that the former has a conveyor system to ensure a more thorough combustion.

Fluidized bed incinerator: In a fluidized bed incinerator, solid waste is mixed with sand particles and placed in a compartment that allows strong airflow to flow through and create a 'fluidized bed'. This allows a higher burning efficiency and more thorough combustion of the solid waste.

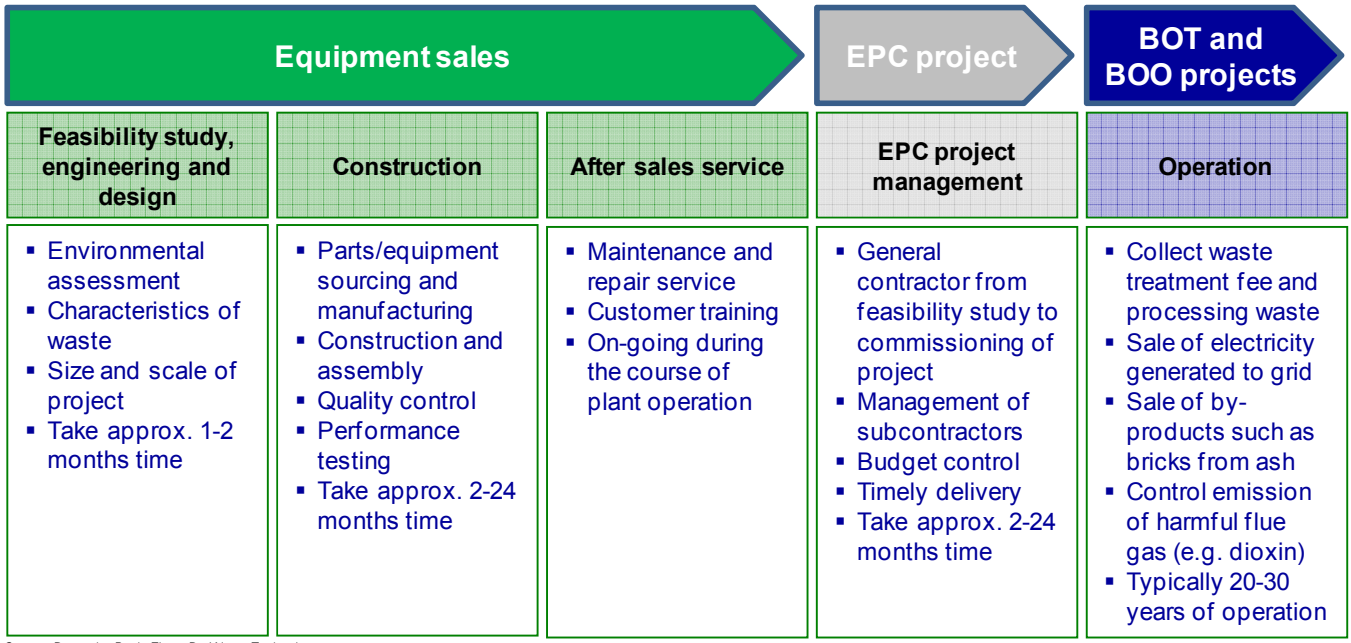
Rotary-kiln incinerator: In a rotary-kiln incinerator, solid waste is placed in a slightly inclined cylinder, which rotates on its axis to allow heat to be evenly refracted during combustion.

Solid waste value chain

There are normally three different types of groups along the value chain of the solid waste treatment market (Figure 180):

- **Equipment suppliers:** these include suppliers of incineration equipment, thermal treatment equipment, handling equipment, and sorting equipment (including air compressors, air separating compressors, blowers, filter presses and sludge dryers).
- **EPC players:** act as a general contractor, responsible for conducting assessment and feasibility studies for the project, design and architectural planning, and project management.
- **Operators:** responsible for the operation and management of the project under a build–operate-transfer ("BOT") or transfer-operate-transfer ("TOT") arrangement, with a typical 20-25 years of operating concessions.

Figure 180: Graphical illustration of the value chain for waste-to-energy projects



Source: Deutsche Bank, ZhongDe Waste Technology

Solid waste treatment costs

Operators of waste-to-energy through incineration have two main revenue streams: the income from the sale of electricity to the grid, and waste disposal subsidies that governments pay the operators to deal with the waste. Other sources of revenue could come from the sale of heat/steam for district heating and fly ash for road pavement construction.

Preferential tariff and tipping fee

The development of WTE facilities is supported by preferential electricity tariffs (representing a significant premium to the average on-grid tariff for thermal power plants).

- According to the Measures for Pricing and Sharing of Expenses of Renewable Energy, which was enacted by the State Council on 1 January 2006, local governments require the local power grid to offer a subsidy of Rmb0.25/KWh to waste-fired plants on top of the standard on-grid price.

Waste disposal subsidy
WTE plants are also entitled to waste disposal subsidies (WDS) from local governments for municipal waste treatment. The amount is closely related to the WTE's operation and treatment of residues such as fly ash and leachate.

- In China, there are currently no unified WDS standards and WDS varies according to province (e.g. ranging from Rmb10 per ton to Rmb240 per ton in 2008).

Upfront investment cost
A WTE plant includes components such as boiler, turbine generators and scrubbers. The investment cost can vary depending on the equipment type and the emission standards required. A typical WTE plant in China with a daily processing capacity of around 800 tons per day would normally cost around Rmb400m to construct.

Operating and maintenance costs
This is mainly comprised of some fuel costs (to facilitate waste incineration), labor costs, the cost of ash disposal, and other material costs, which vary depending on the design of different WTE plants and the emission standards they are required to meet.

Frequently asked questions and glossary of terms

How do waste-to-energy facilities affect greenhouse gases?
Waste-to-energy facilities reduce greenhouse gas emissions from the landfilling of waste. One ton of carbon dioxide equivalents can be reduced for every one ton of trash processed by a waste-to-energy plant.

What are the environmental benefits of using WTE instead of landfilling?
WTE plants conserve fossil fuels by generating electricity and reduce carbon dioxide emission, while landfilling does not. Also, WTE plants reduce the space required for landfilling by about 90%.

What is the minimum amount of solid waste that is needed for a WTE plant?
Larger plants can result in lower costs per ton of municipal solid waste processed. For example, most WTE facilities range from 500 to 3,000 tons of waste processing capacity per day in China.

Are most WTE facilities in China eligible for preferential tax?
WTE plants are eligible for preferential corporate tax. The tax rate varies in different provinces. In 2008, the Ministry of Finance, State Administration of Taxation issued a 'Value-added tax policy for companies on comprehensive utilization of resources' (Tax {2008} No. 156), stating that from 1 July 2008, no value-added tax is required for qualified WTE plants.

Figure 181: Glossary of terms

Term	Definition
Aerobic composting	Aerobic microbial decomposition of organic wastes by micro-organisms, including bacteria and fungi, that require oxygen to survive and metabolize organics.
Anaerobic digestion	Anaerobic microbial decomposition of organic wastes that requires an anoxic environment for metabolism of organics.
Biodegradation	The breaking down of organic (carbon-containing) compounds into carbon dioxide, water and minerals by the action of microorganisms, such as bacteria.
Combustibles	Burnable materials in the waste stream, including paper, plastics, wood, and garden wastes.
Compost	The finished material resulting from composting. Compost can be used as a soil conditioner and suppresses plant diseases, and can augment fertilizers (making them more available to plants).
Disposal	The final handling of solid waste, following collection, processing, or incineration. Disposal most often means placement of waste in a dump or a landfill.
Hazardous waste	Waste that is reactive, toxic, corrosive, or otherwise dangerous to living things and/or the environment. Many industrial by-products are hazardous.
Incineration	The process of burning solid waste under controlled conditions to reduce its weight and volume, and often to produce energy.
Landfilling	The final disposal of solid waste in a controlled manner in a place intended to be permanent.
Leachate	Rainwater combined with harmful chemicals and other material from waste within a landfill.
Materials recovery facility (MRF):	A facility for separating mingled recyclables by manual or mechanical methods.
Organic waste	Technically, waste containing carbon, including paper, plastics, wood, food wastes and yard waste.
Recycling	The process of transforming materials into raw materials for manufacturing new products, which may or may not be similar to the original product.
Sludge	A semi-solid residue from any of a number of air or water treatment processes; can be a hazardous waste.

Source: Deutsche Bank

Risks

Low heat value for the waste. The heat value of municipal waste varies across countries. For example, in China, urban households seldom sort their rubbish, which results in a high level of water content and unburnable elements, such as glass and cement. As a result, incineration plants, especially those using circulating fluidized bed boilers, have to bear the high cost of the sorting process.

More stringent emission requirements. It is likely that higher emission standards could potentially be imposed due to rising environmental awareness. This may increase the investment and operating costs of waste-to-energy plants and could reduce economic return if the government does not compensate the operator for the additional cost.

Local community resistance. WTE plants generally are not welcomed by local communities. The most publicized concerns involve the fear that they produce significant amounts of dioxin and furan emissions, which are considered to pose serious health hazards. There have been increasing numbers of protests against local waste-to-energy plants.

Change in government policy. WTE plants are made economically viable by waste disposal subsidies and preferential on-grid tariffs from governments. Any adverse change in government policy would affect the economic return of the project.

Solid waste treatment players

China Everbright International (0257.HK, Buy)

Company background

China Everbright International is primarily engaged in environmental protection project investments such as sewage water treatment, waste-to-energy and solid waste disposal. The company also operates a toll bridge in Fuzhou, Fujian province. China Everbright International is controlled by China Everbright Group and has positioned itself as the environmental investment arm of its parent.

Business exposure

In the last few years, the company has successfully expanded its exposure to the wastewater treatment business. As at end-2009, the company has secured a total of 17 waste water treatment projects that have a total designed annual waste water treatment capacity of 550m cubic metres. It has also processed 388m tons of waste water in the year, which represents an increase of 7% yoy. The company's wastewater treatment business is currently located mainly in Shandong and Jiangsu provinces.

Key financials

As of FY09, the company recorded operating revenue of HK$1,766m, mainly from sewage treatment construction and operation services, which represent 52% of its total revenue. Its operating profit margin for its sewage business has remained relatively stable in the last few years at 28-32%. In 1H10, the company's net profit increased 24% yoy to HK$245m despite a 15% decline in revenue due to lower contribution from lower margin construction service revenue.

Figure 182: China Everbright Intl Ltd (Hong Kong: 257, Currency: HKD)

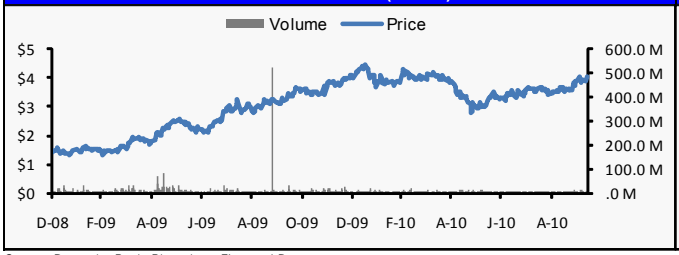
Description	
Address:	Rm. 2703 Far East Finance Ctr 16 Harcourt Road Admiralty Hong Kong (SAR)
Website:	www.ebchinaintl.com

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	1,863	1,766	960
EBIT	526	665	428
Net Income	339	372	245
EPS (Diluted)	0.11	0.11	0.07
Book Value per Share	0.9	1.3	1.3
Total Assets	6,301	8,667	9,105
Cash Flow-Oper Activities	(1,233)	(543)	(740)
Capital Expenditures	(54)	(13)	(12)
Free Cash Flow	(1,287)	(556)	(752)
Return on Com Eqty (%)	12.9	10.1	10.8
Total Debt/Total Equity (%)	76.6	60.6	60.7

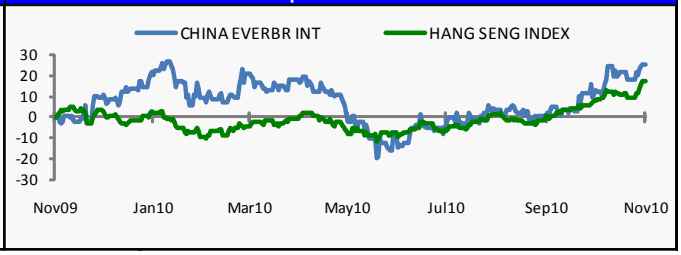
Business Segments (FY: Dec-09)	Revenue	EBITDA
Environmental water project construction & opera	1035.72	345.66
Environmental Energy & alt. enery onstruction & c	615.25	302.03
Infrastructure construction and op.	113.74	107.43
Environmental technology & construction manag	32.54	17.51
Property Investment and Management	1.29	5.73

Key Statistics	
Share price	4.36
52-Week Range	2.73 - 4.48
YTD performance	9%
Avg Daily traded Val (3 Months, USD)	5.4
Market Value (USD mn)	2,049.2
Float %	46.5%
Major shareholder	CHINA EVERBRIGHT HOL
% stake	43.7%
No. of employee	1,200

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

New Environmental Energy (3989.HK, non-rated)

Company background

New Environmental Energy, formerly known as Hembly International Holdings, is a provider of waste treatment and environmental infrastructure services in China. Before diversifying into waste treatment and waste-to-energy business, the company was mainly engaged in the distribution and retailing of apparel and footwear. With the acquisition of Smartview Investment Holdings in December 2009, the company entered the waste treatment industry with operations in five provinces and has a target to treat over 6,000 tons of waste per day.

Business exposure

The company's Shenzhen Pinghu plant, with a designed daily treatment capacity of 675 tons and annual electricity generation capacity of 74m KWh, has already come into operation. The company's Beijing Dongcun plant is currently undergoing a trial run and is expected to commence operations in 4Q10. Furthermore, the construction of the Shanghai Putuo plant is expected to be completed by end-2010 and to start operation in early 2011. By 2012, the company expects its portfolio of projects to have a total designed daily treatment capacity of 6,425 tons and annual electricity generation of 569m KWh.

Key financials

The financial impact from the newly acquired waste-to-energy business was minimal, with the majority of the company's revenue in 1H10 still derived from supply chain services. Waste treatment only accounted for 4.6% of total revenue (HK$369m), at a gross margin of 22.4%. In August 2010, the company raised HK$76m through a placement of 148.4m new shares at HK$0.537/shr to fund working capital use and debt repayment.

Figure 183: NEW ENVIRONMENTAL ENERGY HOL (Hong Kong: 3989, Currency: HKD)

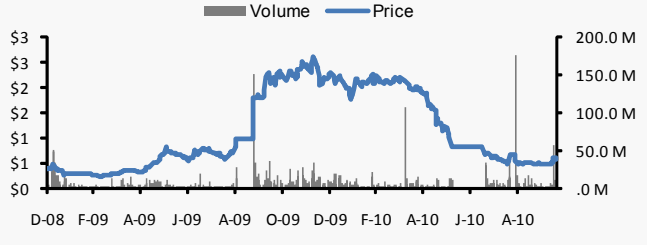
Description	
Address:	Room302 B, 3F New World Tower 16-18 Queen's Road Central Kowloon Hong Kong (SAR)
Website:	www.hembly.com

Financials (HKDmn)	Dec-08	Dec-09	1H10
Sales	1,095	740	369
EBIT	68	(134)	(105)
Net Income	8	(978)	(293)
EPS (Diluted)	0.01	-2.26	-0.38
Book Value per Share	2.1	0.7	0.5
Total Assets	1,644	1,938	1,982
Cash Flow-Oper Activities	10	(140)	(178)
Capital Expenditures	(93)	(5)	(47)
Free Cash Flow	(82)	(145)	(225)
Return on Com Eqty (%)	1.3	-185.1	-245.7
Total Debt/Total Equity (%)	113.3	157.2	194.4

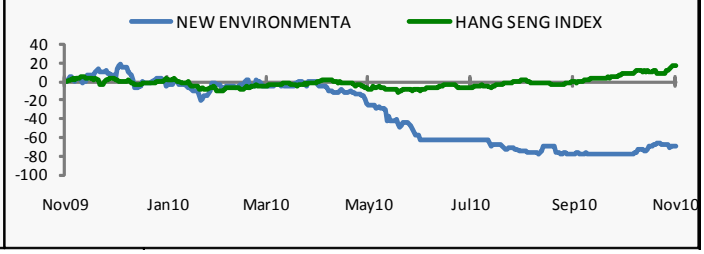
Business Segments (FY: Dec-09 ,HKDmn)	Revenue
Apparel Manufacturing	728.82
Waste Treatment and Waste-to-Energy Busines	11.40

Key Statistics	
Share price (HKD)	0.66
52-Week Range	0.465 - 2.74
YTD performance	-71%
Avg Daily traded Val (3 Months, USD)	0.9
Market Value (USD mn)	85.8
Float %	62.3%
Major shareholder	BEST VIEW ENTERPRISE
% stake	15.3%
No. of employee	1,100

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Shenzhen Dongjiang Environmental Co. (0895.HK, non-rated)

Company background

Shenzhen Dongjiang Environmental Company (DJE), listed on the Growth Enterprises Market in Hong Kong in 2003 and transferred to a Main Board listing in September 2010, is an environmental company specializing in waste management and environmental services. DJE is primarily engaged in three business segments: (1) waste collection, treatment, transportation and disposal; (2) the construction and provision of environmental systems and services; and (3) the production and sale of recycled products and renewable energy. The company was established in 1999 and is headquartered in Shenzhen.

Business exposure

DJE has eight waste treatment plants with an annual capacity of over 300,000 tons. The company has over 800 clients in sectors such as electronics, electroplating, machine manufacturing, chemical engineering, energy and pharmaceuticals, with geographical exposure covering the Pearl River Delta, Yangtze River Delta and Southwestern China. DJE recently announced its intention to apply for A-share listing in Mainland China and raise equity for future project developments, such as the dismantling and comprehensive utilization of electrical waste in Qingyuan, the hazardous waste treatment base in Longgang Shenzhen, and collection and utilization of landfill gas in Xiaping Shenzhen.

Key financials

The processing and sale of recycled products is the largest revenue contributor. This line of business generated revenue of Rmb511.2m in 2009 and Rmb300m in 1H10, representing c.55% and c.56% of total revenue, respectively. The company plans to focus on pursuing more business opportunities in the treatment and disposal of industrial waste, further expanding its waste treatment and disposal capacity, and capturing more market share.

Figure 184: SHENZHEN DONGJIANG ENVIRON-H (Hong Kong: 895, Currency: HKD)

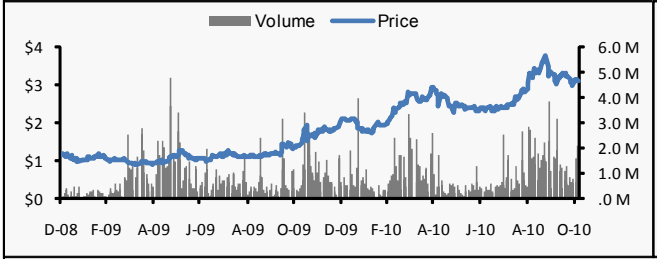
Description	
Address:	Dongjiang Environmental Bldg No 9 Langshan Road North Zone of Hi-tech Industrial Park Nanshan District, Shenzhen,
Website:	www.szdongjiang.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	823	931	521
EBIT	170	171	125
Net Income	106	116	74
EPS (Diluted)	0.08	0.09	-
Book Value per Share	0.4	0.5	0.5
Total Assets	1,193	1,715	1,868
Cash Flow-Oper Activities	52	55	-
Capital Expenditures	(188)	(183)	-
Free Cash Flow	(137)	(128)	-
Return on Com Eqty (%)	23.2	20.4	24.1
Total Debt/Total Equity (%)	48.0	80.6	88.1

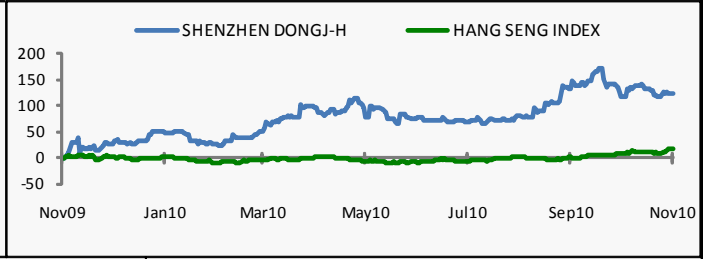
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Processing and sale of recycle products	511.21
Recycled Products and Waste Treatment	229.15
Environmental Protection Systems	148.35
Production of renewable energy	22.01
Trading of Chemical Products	19.95

Key Statistics	
Share price (HKD)	3.09
52-Week Range	1.4 - 5.53
YTD performance	47%
Avg Daily traded Val (3 Months, USD)	0.5
Market Value (USD mn)	321.0
Float %	100.0%
Major shareholder	CHINA ENVIRONMENTAL
% stake	6.5%
No. of employee	2,043

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

ZhongDe Waste Technology AG (ZEF.GY, non-rated)

Company background

Established in 1996, ZhongDe Group is a provider of small and medium-sized waste incineration equipment in China. The company designs, manufactures and installs pyrolytic, grate and rotary kiln waste incinerators for the disposal of solid medical, municipal and industrial waste. Furthermore, as an investor in BOT projects, ZhongDe also operates waste-to-energy plants. The company was listed on the Frankfurt Stock Exchange in 2007. Most of ZhongDe Group's operations are based in Fuzhou city, Fujian province.

Business exposure

ZhongDe Group's waste incinerators are sold primarily to dedicated operators responsible for the disposal of medical waste created by the health industry, and also to small and medium-sized municipalities. Since 1996, the company has completed approximately 200 waste disposal projects in about 13 provinces in China. Datong EPC project, the company's first large waste-to-energy project, was completed at the end of 2009 and has a treatment capacity of 360,000 tons. The Zhucheng project, an incinerator with a capacity of 500 tons of waste per day, should be completed by the end of 2010. As of 1H10, the company had four EPC and four BOT projects under construction.

Key financials

In FY2009, ZhongDe reported total revenues of €40.2m. EPC and BOT project revenues accounted for 72% of total revenues in 2009, with a gross margin of around 25%. Order intake in 1H10 totaled €25.5m, while order backlog reached €188m. The company has signed a new EPC contract with Shouguang Fuyuan Waste to Power for a waste-to-energy plant with a capacity of 600 tons per day.

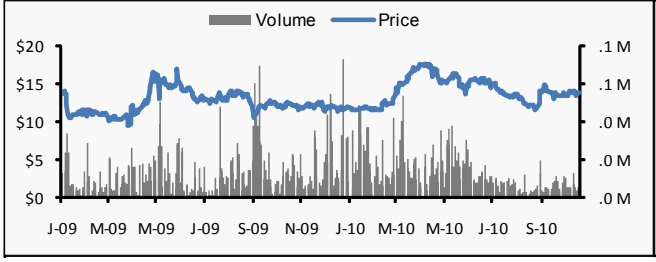
Figure 185: ZHONGDE WASTE TECHNOLOGY AG (Xetra: ZEF, Currency: EUR)

Description			
Address: Stadthausbruecke 1-3 Hamburg, 20355 Germany			
Website: www.zhongdetech.com			
Financials (EURmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	46	40	15
EBIT	20	8	-
Net Income	22	6	9
EPS (Diluted)	1.73	0.44	0.68
Book Value per Share	9.8	9.8	-
Total Assets	140	142	-
Cash Flow-Oper Activities	24	16	-
Capital Expenditures	(7)	(2)	-
Free Cash Flow	17	15	-
Return on Com Eqty (%)	19.8	4.5	-
Total Debt/Total Equity (%)	0.0	0.0	-

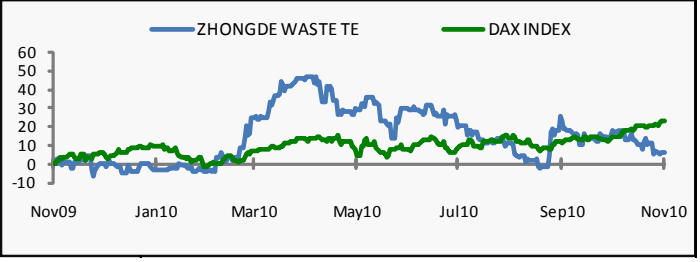
Business Segments (FY: Dec-09 ,EURmn)	Revenue	Gross Profit
EPC Project Business	24.37	6.78
Municipal Solid Waste Incinerator	10.72	6.74
BOT Project Business	4.59	1.14
Medical Waste Incinerators	0.51	0.36
Unallocated Revenues	0.02	

Key Statistics	
Share price (EUR)	12.61
52-Week Range	10.83 - 17.85
YTD performance	5%
Avg Daily traded Val (3 Months, USD)	0.1
Market Value (USD mn)	230.0
Float %	38.3%
Major shareholder	CHEN ZEFENG
% stake	50.8%
No. of employee	343

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Sound Environmental Resources (000826.CH, non-rated)

Company background

Sound Environmental Resources is listed on the Shenzhen Exchange and is primarily engaged in the municipal/industrial solid waste treatment and water business. The company has operations in Hubei, Jiangsu, Zhejiang, Beijing, Inner Mongolia and other regions. The company is c.44.9%-owned by Beijing Sound Group. Beijing Sound Group has another listed vehicle, Sound International (0967.HK, NR), which focuses on wastewater treatment.

Business exposure

The company is a vertically integrated solid waste treatment and disposal player that provides services in project consulting, process design, engineering and construction, and equipment manufacturing. With a plan to move further downstream, the company is building two waste-to-energy plants with a daily processing capacity of 1,500 tons each, which are scheduled to commence operations in 2011 and 2013, respectively. In addition, the company is seeking project acquisition opportunities and has invested in a manufacturing base of solid waste equipment in Hubei province, which is due to start production by the end of 2010.

Key financials

In FY09, the company reported revenue of Rmb676m and net profit of Rmb146m. The bulk of revenue (62.2%) came from municipal waste project construction and technical services. Municipal wastewater treatment operations represented 19.7% of revenue, but increased by 69.9% yoy. In 1H10, the company recorded revenue and net income of Rmb395m and Rmb85m, up 35.8% and 33.1% yoy, respectively. Solid waste treatment contributed 73% revenue, with the rest from wastewater and tap water businesses.

Figure 186: SOUND ENVIRONMENTAL RESOUR-A (Shenzhen: 000826, Currency: CNY)

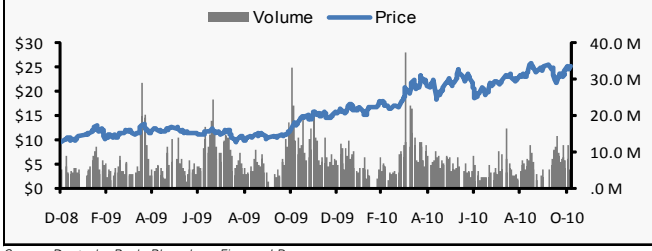
Description	
Address:	No 77, Luuluo Road Yichang, Hubei, 443000 China
Website:	http://www.eguard-rd.com/

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	515	676	395
EBIT	165	210	120
Net Income	111	146	85
EPS (Diluted)	0.28	0.35	0.21
Book Value per Share	2.3	2.6	2.8
Total Assets	2,358	2,644	2,924
Cash Flow-Oper Activities	(12)	(15)	45
Capital Expenditures	(316)	(471)	(90)
Free Cash Flow	(328)	(486)	(44)
Return on Com Eqty (%)	16.3	14.4	15.5
Total Debt/Total Equity (%)	85.0	85.1	79.9

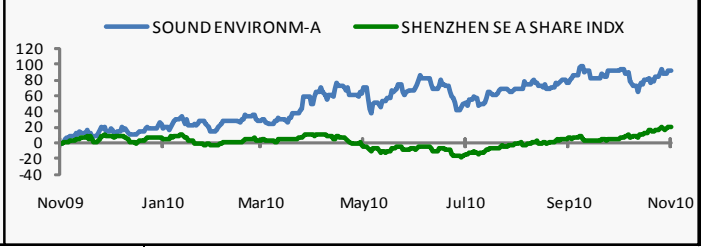
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Solid Waste Treatment Facilities	425.63
Sewage Management	135.03
Water Supply	65.24
Solid Waste Management & Environmental Con	50.00
Other-Solid Water Treatment	8.56

Key Statistics	
Share price (CNY)	25.1
52-Week Range	13.04 - 26.8
YTD performance	62%
Avg Daily traded Val (3 Months, USD)	22.9
Market Value (USD mn)	1,558.7
Float %	51.5%
Major shareholder	BEIJING SOUND GROUP
% stake	44.9%
No. of employee	1,196

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Wuxi Huaguang Boiler (600475.CH, non-rated)

Company background

Wuxi Huaguang Boiler, based in Wuxi in Jiangsu province, was listed on the Shanghai Stock Exchange in 2003. The company mainly specializes in the manufacturing of boilers for power plants, industry boilers, heat recovery steam generators, boilers for garbage, life-form fired boilers, and flue gas desulfurization and purification equipment. The company is 45%-owned by Wuxi Guolian Environmental and Energy Group, which is ultimately owned by the Wuxi municipal government.

Business exposure

The company is a leading CFB (circular fluidized bed) boiler maker in China. CFB is mainly used in the cogeneration area. In 2009, the company purchased Grate incinerator technology from Hitachi in Japan and secured its first orders from the Wuxi municipal government. Going forward, it intends to enhance its system integration capabilities from a pure manufacturing model. The company is geared to gain more orders in the fast-growing waste energy boiler, gas turbine heat recovery and IGCC gasification areas. Meanwhile, it has also stated a proactive export strategy for its heat recovery boiler.

Key financials

Revenue from CFB boiler was Rmb1280.2m in 2009, accounting for 50% of the company's revenue. The revenue contribution of the remaining segments was as follows: boiler 6.7%, special boiler 21.3%, electricity and heat 16.6%, and auxiliary boilers and other products 5.3%. In 1H10, the company generated total revenue and net income of Rmb1,517m (+19.5% yoy) and Rmb65m (+5.6% yoy), respectively. New order intake has also reached record levels.

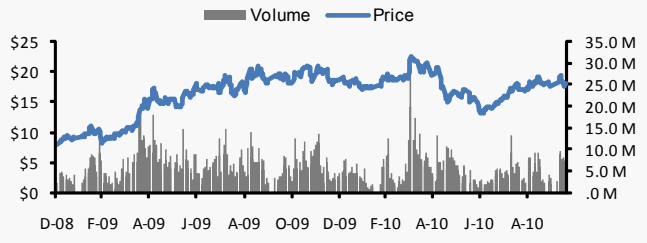
Figure 187: WUXI HUAGUANG BOILER CO-A (Shanghai: 600475, Currency: CNY)

Description			
Address: 3 Chengnan Road Wuxi, Jiangsu, 214028 China			
Website: www.wxboiler.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	2,773	2,570	1,510
EBIT	146	133	85
Net Income	103	118	65
EPS (Diluted)	0.40	0.46	0.25
Book Value per Share	3.7	3.9	4.1
Total Assets	4,693	4,413	4,766
Cash Flow-Oper Activities	(173)	242	141
Capital Expenditures	(80)	(41)	(50)
Free Cash Flow	(253)	200	91
Return on Com Eqty (%)	10.5	12.1	12.2
Total Debt/Total Equity (%)	98.8	85.4	96.1

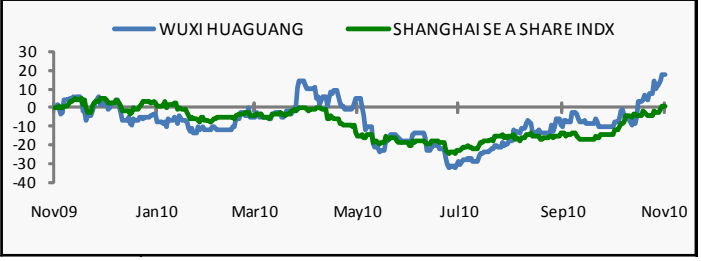
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Circulating Fluid Bed Boilers	1280.23	206.36
Special Boilers	546.57	89.78
Energy Generation and Distribution Machinery	425.36	92.49
Coaldust Boilers	172.82	30.66
Boiler Auxiliary Engines	136.63	22.36

Key Statistics	
Share price (CNY)	22.99
52-Week Range	12.7 - 23.6
YTD performance	23%
Avg Daily traded Val (3 Months, USD)	18.1
Market Value (USD mn)	884.2
Float %	49.2%
Major shareholder	WUXI GUOLIAN GREEN E
% stake	45.0%
No. of employee	1,454

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance L.P.

Shanghai Chengtou Holding (600649.CH, non-rated)

Company background

Shanghai Chengtou Holding, formerly Shanghai Municipal Raw Water Company, was founded in 1992 and is based in Shanghai. Shanghai Chengtou's main operations include the supply of fresh water and tap water, engineering design, pipeline construction and maintenance; mechanical and electrical equipment installation; sewage cleaning and solid waste disposal; and the sale of real estate.

Business exposure

In FY09, Shanghai Chengtou transported 920,000 tons of garbage with landfill disposal of 620,000 tons. Within solid waste incineration, the company incinerated 1.1m tons of solid waste. Furthermore, the Zhangzhou Pu Jiang Lingsheng waste incineration power plant, with a total investment of Rmb396.7m, was approved by the government in September 2009. Phase I of the project will have a treatment capacity of 700 tons per day and a total investment of Rmb309.7m, while Phase II will have treatment capacity of 1,050 tons per day and total investment of Rmb87m. The project has an operating concession of 30 years and a two-year construction period.

Key financials

As of FY09, the company reported core operating revenue of Rmb3,262m, mainly from two segments: 1) Rmb1,264.5m from water treatment, which accounted for 38.3% of revenue, and 2) Rmb1,329.5m from property sales business, which accounted for 40.3% of revenue. The company's environmental protection and merchandising businesses generated revenues of Rmb365m and Rmb340.9m, which accounted for 11% and 10.3% of total revenue, respectively.

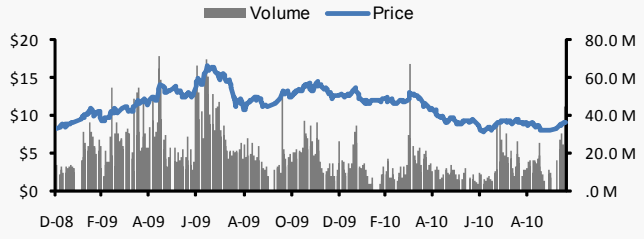
Figure 188: SHANGHAI CHENGTOU HOLDING-A (Shanghai: 600649, Currency: CNY)

Description			
Address: 39/F, 500 Pudong Road South Shanghai, 200120 China			
Website: www.rawwater.com.cn			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	3,106	3,262	1,863
EBIT	665	716	512
Net Income	1,271	761	468
EPS (Diluted)	0.55	0.33	0.20
Book Value per Share	4.5	4.8	4.9
Total Assets	17,726	20,235	23,406
Cash Flow-Oper Activities	2,688	265	(1,142)
Capital Expenditures	(551)	(481)	(314)
Free Cash Flow	2,137	(217)	(1,456)
Return on Com Eqty (%)	12.1	7.1	7.7
Total Debt/Total Equity (%)	41.2	38.9	50.9

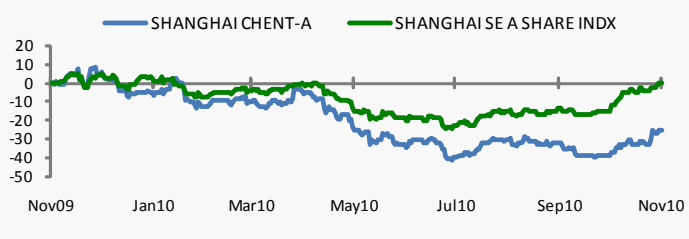
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Property Development	1329.53
Water Supply and Treatment	1264.46
Solid Waste Treatment	365.01
Petroleum Sales	340.93
Other Operations	58.76

Key Statistics	
Share price (CNY)	9.78
52-Week Range	7.58 - 14.58
YTD performance	-23%
Avg Daily traded Val (3 Months, USD)	26.2
Market Value (USD mn)	3,376.4
Float %	44.0%
Major shareholder	SHANGHAI CHENGTOU CO
% stake	55.6%
No. of employee	1,629

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Nanhai Development Company (600323.CH, non-rated)

Company background

Nanhai Development, based in Nanhai District, Foshan, Guangdong province, is primarily engaged in tap water products and supply, sewage treatment and waste-to-energy electricity generation. The company is listed on the Shanghai Stock Exchange and is 28%-owned by Foshan Nanhai Water Supply Group, a municipal state-owned enterprise. Currently, the company derives all of its revenue in Foshan city.

Business exposure

Within its sewage treatment segment, the company is currently operating about 230,000 tons per day of sewage treatment capacity, while its sewage treatment capacity under construction is about 328,000 tons per day. In FY09, the company treated c.42.3m tons of sewage. The company's tap water business has a total daily capacity of about 1.26m cubic meters with a total tap water supply of about 338.66m cubic meters in FY09. In the company's solid waste disposal segment, it treated 96,528 tons in FY09 with power generation of 24.4m kWh.

Key financials

In FY09 the company recorded core operating revenue (excluding other services) of Rmb462m, mainly from the tap water segment, which accounted for 84.1% or Rmb377.3m. Sewage treatment and waste-to-energy electricity generation recorded revenue of Rmb47.9m and Rmb23.1m, respectively, with a gross margin of 41.8%.

Figure 189: NANHAI DEVELOPMENT CO LTD-A (Shanghai: 600323, Currency: CNY)

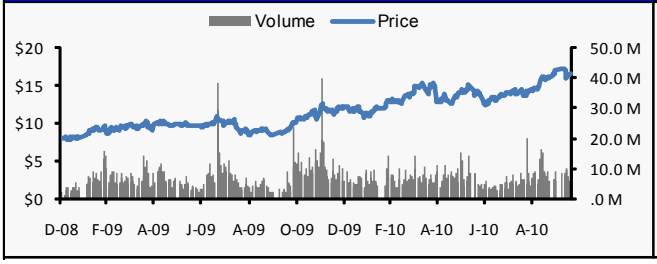
Description	
Address:	21F Jianhang Bldg, Nanhai Ave Guicheng, Nanhai District Foshan, Guangdong, 528200 China
Website:	www.nhd.net.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	421	462	257
EBIT	157	150	84
Net Income	96	104	49
EPS (Diluted)	0.35	0.38	0.18
Book Value per Share	3.5	3.7	3.7
Total Assets	1,733	2,130	2,960
Cash Flow-Oper Activities	119	180	62
Capital Expenditures	(308)	(457)	(367)
Free Cash Flow	(189)	(276)	(305)
Return on Com Eqty (%)	10.5	10.6	10.8
Total Debt/Total Equity (%)	62.8	74.7	83.4

Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Tap Water Supply	377.26
Sewage Management	47.94
Trash Management	23.13
Other Revenue-Technical Consulting Services	16.90

Key Statistics	
Share price (CNY)	17.5
52-Week Range	10.34 - 18.3
YTD performance	44%
Avg Daily traded Val (3 Months, USD)	19.2
Market Value (USD mn)	712.6
Float %	66.2%
Major shareholder	FOSHAN NANHAI WATER
% stake	28.2%
No. of employee	417

Price and Volume (1 Year)



Comparative Returns

Source: Deutsche Bank, Bloomberg Finance LP

Exhaust gas control

Sources of exhaust gas

Combustion of fossil fuels such as coal, gas and oil in commercial and industrial boilers results in emissions of nitrogen, oxygen, carbon monoxide, nitrogen oxide, sulfur oxides, volatile organic compounds and particulate matters. Some of these emissions are considered pollutants, which are known to be directly or indirectly harmful to humans and the environment.

- Sulfur compounds (SOx): The combustion of fossil fuels containing sulfur compounds (mainly oil and coal) results in a pollutant in the form of SO_2 (sulfur dioxide) and SO_3 (sulfur trioxide), collectively known as SOx. SOx is classified as a pollutant due to its reaction with water vapor to form acid rain. Acid rain is known to be corrosive and harmful to the environment.
- Nitrogen compounds (NOx): The primary nitrogen pollutants emitted by boilers are nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NOx.

Air pollution control method overview

SOx control method

The main method used to remove SO_2 emissions is flue gas desulphurization (FGD), which removes sulphur dioxide (SO_2) from the flue gas that is released into the atmosphere by burning coal. The process is based on a chemical reaction that occurs when the warm exhaust gases come into contact with limestone. The mixture of limestone and water is sprayed over the flue gas, which reacts with the SO_2 to form gypsum or calcium sulphate. The gypsum is then removed and used in the construction industry. As a result of this reaction, c.90% of sulphur dioxide is removed.

NOx control method

NOx pollutant controls are classified into two main categories: post combustion methods and combustion control techniques. In the post combustion method, NOx emissions are addressed after the formation, while combustion control technique prevents the formation of NOx emissions during the combustion stage.

- Combustion control method: NOx emission control in China is mainly through the control of combustion, such as the use of "low NOx burners". Flue gas recirculation (FGR) is the most effective and popular method for low-NOx technology. The process of FGR involves channeling a portion of cool exhaust gases back into the combustion stage in order to lower the flame temperature and reduce NOx formation. These specially designed burners restrict the amount of oxygen available in the hottest part of the combustion chamber, where the coal is burned. This minimizes the formation of the gas and requires less post-combustion treatment.
- Post combustion method: Selective Catalytic Reduction (SCR) will likely become the mainstream in China driven by its high reliability, technology advancements and high NO_x removal efficiency. For example, 90% of the NO_x can be successfully removed under SCR technology. The key component in SCR technology is the catalyst, the cost of which usually accounts for 30%-40% of the total investment for de-NO_x equipment.

Exhaust gas control in China

Sulphur dioxide emissions in China

China has been world's largest emitter of SO_2 since 2005 and air pollution has been getting worse. A recent survey conducted across 338 cities in China suggests that more that 70% of cities are classified as polluted, failing the Chinese air cleanness assessment. 40% of these cities are classified as heavily polluted.

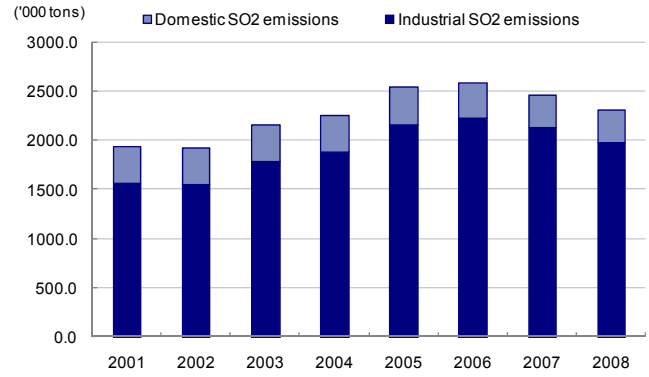
Figure 190: Comparison of emission standards

	Particulate mg/m³	SO_2 mg/m³	NO_x mg/m³
China	50	400-1,200	450-1,100
Developed countries	30-50	100-850	200-400

Source: Deutsche Bank, CPI

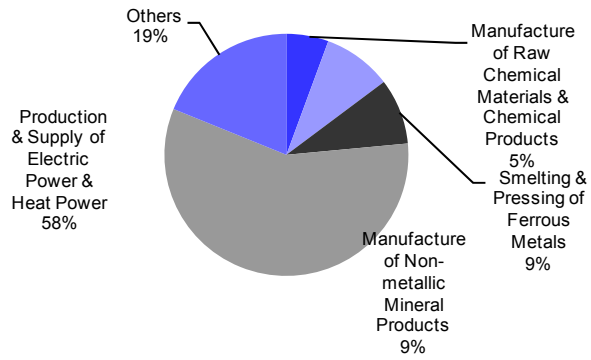
China's 11th Five-Year Plan (2006-10) set a target of a 10% reduction in SO_2 levels from 2005 figures by the end of 2010. According to recent reports from the Ministry of Environmental Protection, sulfur dioxide emissions in 2009 had fallen 13.1% from 2005 levels. However, 1Q10 sulfur dioxide emissions increased 1.2% yoy due to the output of energy consuming industrial products.

Figure 191: Sulphur dioxide emissions



Source: Deutsche Bank, Ministry of Environmental Protection

Figure 192: Source of SOx emission



Source: Deutsche Bank, Ministry of Environmental Protection

China's first commercialized desulphurization device for thermal power plants arrived in 1991 with the limestone-gypsum wet flue gas desulphurization (WFGD) device. Currently, the limestone-gypsum WFGD method accounts for about 90% of the applications used to reduce SO_2 emissions. The core technology used in thermal power plant flue gas desulphurization originally came from foreign companies such as ABB and Mitsubishi Heavy Industries, but these technologies have been transferred and absorbed by local players who were historically only engaged in construction and installation (not equipment supply).

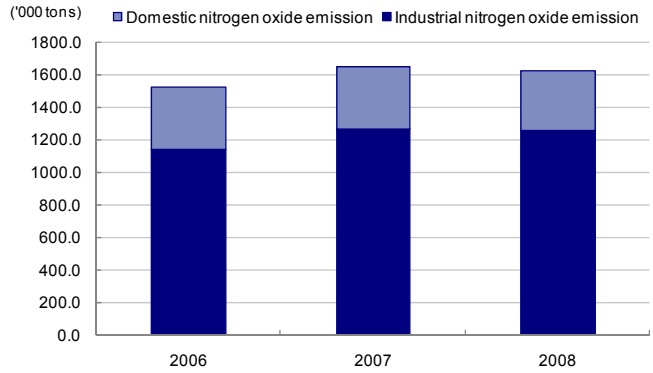
Nitrogen emissions in China

Since 2005, China's nitrogen oxide emissions have also decreased, but only by 1.2% to 1.2tons by end-2008. The smaller reduction reflects a lesser focus by the government as nitrogen emission targets were not included in the 11th Five-Year Plan. Only recently has China started to implement flue gas de-NO_x technology to reduce NO_x emissions.

In January 2010, the Ministry of Environmental Protection released the "Notice of Fossil-Fired Power Plant NO_x Emission Prevention and Treatment Policy," which established the framework for the NO_x reduction policies to be implemented under the 12th Five-Year Plan.

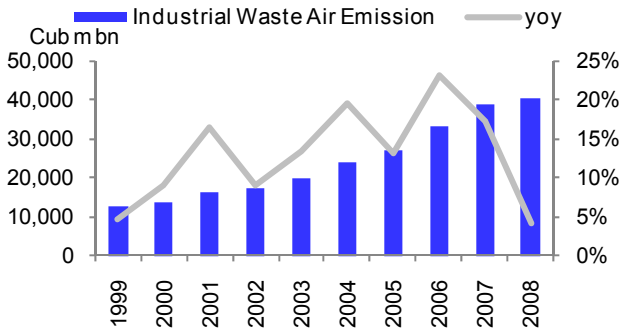
Under the notice, coal-fired power plants and co-generation units that are 200 MW or larger (except those in areas around Shanghai, Beijing, and Guangdong) should install low-NO_x combustion technologies (low-NOx burners) in any new-build, rebuild or expansion project. If NO_x emissions levels still exceed the emission standards, then flue gas de-NO_x technology should then be installed.

Figure 193: Nitrogen oxide emissions



Source: Deutsche Bank, Ministry of Environmental Protection

Figure 194: Industrial waste air emission



Source: Deutsche Bank, CEIC

Exhaust gas control costs – desulphurization

Investment costs

The cost of air pollution control systems, specifically flue gas desulphurization (FGD), depends on the specifics of the site. In terms of the capital cost for a FGD plant, technical factors such as volume of flue gas to be treated, degree of desulphurization required, concentration of SO_2 in the flue gas, design life, and other environmental constraints all have an impact. Furthermore, the complexity of the process can cause wide differences in capital costs. Since the first commercial application on utility boilers, the capital costs of FGD plants in China have fallen from Rmb800/KW to Rmb150/KW due to advancement in technology, reduction or elimination of equipment redundancy and competition.

Operating costs

For the operating costs of a FGD plant, disposal of the by-products and power costs are the main factors. The amount of flue gas processed will determine the steam, power, water, etc costs associated with the process. FGD plants that produce a saleable by-product such as gypsum (limestone gypsum) or ammonium sulphate (ammonia scrubbing) have lower operating costs than FGD plants that do not produce saleable by-products and incur disposal costs. For thermal power plants in China, the government granted a Rmb15/MWh tariff premium to compensate the overall capital and operation costs of installing an FGD plant.

Frequently asked questions and glossary of terms

What are the most common types of air pollutants?

Sulphur oxides, nitrogen oxides, volatile organic compounds (VOC) and small dust particles (aerosols).

What causes air pollution?

The main sources of air pollution are industry, agriculture and traffic, as well as energy generation. Air pollutants are emitted during combustion processes and other production processes.

Where do NOx emissions come from?

The main source of NOx emissions is the combustion of fuels in motor vehicles, residential and commercial furnaces, industrial and electrical-utility boilers and engines, and other equipment.

Figure 195: Glossary of terms

Term	Definition
Acid rain:	Sulfur dioxide (SO_2) and nitrogen oxides (NOx), along with other chemical compounds, are released during the combustion of fossil fuels. When these gases react in the atmosphere with water, oxygen, and other chemicals, they form acidic compounds.
FGD:	Flue gas desulphurization, a technology that employs a sorbent, usually lime or limestone, to remove sulphur dioxide (SO_2) from the gases produced by burning mineral or fuels.
Nitrogen oxides (NOx)	Nitrogen oxides are byproducts of nitrous oxide from fossil fuel combustion.
Particulates	Particulates are criteria pollutants that include dust, dirt, soot, smoke and other miniscule solids released into the air and can affect heart and respiratory health.
Sulfur dioxide (SO_2)	Sulfur dioxide is a criteria pollutant that contributes to respiratory problems and the creation of acid rain. Sulfur dioxide is created by burning fossil fuels with trace amounts of sulfur, like coal and oil.

Source: Deutsche Bank

Exhaust gas control players

Fujian Longking Co., Ltd. (600388.CH, not rated)

Company background

Fujian Longking Co., Ltd. is principally engaged in the production, distribution, and installation of electrofilter equipment. It is also involved in the operation of desulphurization projects; sale and leasing of real estate properties; management of properties; generation of hydropower electricity; and provision of technologies. The company is based in Longyan, China and distributes its products in China and internationally.

Business exposure

The company's principal products include electrofilters, flue gas desulphurization equipment, pneumatic transmission devices, electrical bag-type dust removers, industrial personal computer intelligent electrofilter control systems, microcomputer control high-voltage silicon rectifier equipment, and microcomputer control low-voltage control panels. The company is based in Longyan, China.

Key financials

The company's main revenue contribution comes from electrostatic precipitators (ESP) and desulphurization engineering projects, which represented 43.2% (Rmb1.5bn) and 34.4% (Rmb1.2bn) of total FY09 revenue, respectively. In 1H10, the revenue mix from ESP increased to 65.1% (Rmb915m) while the mix of desulphurization engineering projects decreased to 23.4% (Rmb329m) of total revenue. The company recorded export revenue of Rmb193m in 1H10, up 2,002% yoy. Fujian Longking bagged an export order to Indonesia for Rmb1,130m in the first half of 2010.

Figure 196: Summary description of Fujian Longking Co. (600388.CH)

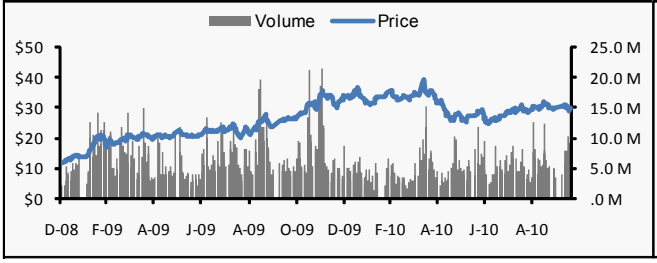
Description	
Address:	81 Lingyuan Road Xinluo District Longyan, Fujian, 364000 China
Website:	www.longking.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	2,897	3,360	1,399
EBIT	226	311	126
Net Income	175	258	109
EPS (Diluted)	1.04	1.35	0.53
Book Value per Share	6.6	9.5	9.3
Total Assets	4,172	4,886	5,098
Cash Flow-Oper Activities	288	208	19
Capital Expenditures	(12)	(113)	(45)
Free Cash Flow	276	96	(26)
Return on Com Eqty (%)	16.2	16.8	13.0
Total Debt/Total Equity (%)	7.1	1.6	0.8

Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Electrostatic Precipitators	1477.10
Flue-gas Desulfurization Equipments	1175.92
Property Development	364.80
Installation Services	295.82
Electrostatic Precipitators Material	77.87

Key Statistics	
Share price (CNY)	35
52-Week Range	24.06 - 39.31
YTD performance	2%
Avg Daily traded Val (3 Months, USD)	29.7
Market Value (USD mn)	1,093.1
Float %	53.6%
Major shareholder	FUJIAN DONGZHENG INV
% stake	17.7%
No. of employee	3,905

Price and Volume (1 Year)



Comparative Returns

Source: Deutsche Bank, Bloomberg Finance LP

Chongqing Jiulong Electric (600292.CH, non-rated)

Company background

Chongqing Jiulong Electric Power Co. Ltd. is engaged in electric power production and electric power technology services. It also sells electric machines, electricity transmission equipment and electronic components, and is involved in environment protection technology research and development. The company has an installed capacity of 2,102MW, mainly located in Chongqing city. China Power Investment Corporation, which owns a 31% stake, has indicated its plan to transform the company into a pure environmental player in the future.

Business exposure

In 2009, the company signed 10 new projects in desulphurization (DeSox) and denitrogenation (DeNox) and completed 13 of 19 sets of power flue gas desulphurization. In September 2010, the company announced that it would raise Rmb1.7bn from its parent, China Power Investment Corporation, via a private placement plan to finance an acquisition of nine sets of concession-based desulphurization facilities from the parent. In October 2010, the company signed an EPC contract of SRTF (Site, Radioactive, Treatment Facility) with Shandong Haiyang Nuclear Power Ltd for Rmb243m.

Key financials

The company's revenue is split into power generation and environmental engineering and technical services. In FY09, the power generation segment accounted for 44% or Rmb1,218m of revenue, while engineering and technical services accounted for 39% or Rmb1,099m. In 1H10, revenue mix from power generation and environmental engineering declined to 39.4% and 29.5%, respectively. However, the margin for the environmental engineering business expanded 4.36ppt yoy to 14.2% for environmental engineering.

Figure 197: Summary description of Chongqing Jiulong Electric (600292.CH)

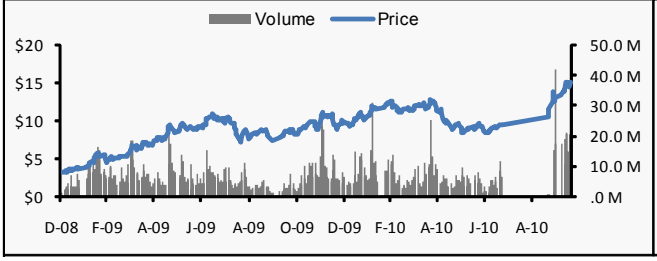
Description	
Address:	15 Yangjiaping Qianjin Zhi Rd Jiulongpo District Chongqing, Sichuan, 400050 China
Website:	www.jiulongep.com

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	2,180	2,766	1,599
EBIT	(15)	145	100
Net Income	(131)	52	26
EPS (Diluted)	-0.39	0.15	0.08
Book Value per Share	2.3	2.6	2.7
Total Assets	4,328	5,323	5,267
Cash Flow-Oper Activities	(21)	1,153	(450)
Capital Expenditures	(171)	(385)	(122)
Free Cash Flow	(191)	768	(572)
Return on Com Eqty (%)	-15.6	6.3	6.5
Total Debt/Total Equity (%)	173.4	192.0	185.8

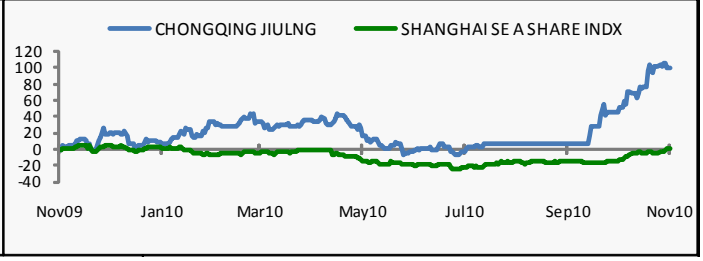
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
Electric Power	1213.40
Environmental Engineering	1099.26
Others - Intelligent Control / System Integration	872.93
Other Operations - Utility Support	5.87
Eliminations	(409.53)

Key Statistics	
Share price (CNY)	17.72
52-Week Range	8.04 - 19.18
YTD performance	81%
Avg Daily traded Val (3 Months, USD)	15.9
Market Value (USD mn)	890.4
Float %	49.0%
Major shareholder	CHINA POWER INVESTME
% stake	30.6%
No. of employee	171

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Pan Asia Environmental Protection (0556.HK, not rated)

Company background

Established in 1998, Pan Asia is an integrated environmental protection services provider, with capabilities in design and project execution. It is principally engaged in the sale of water and flue gas treatment products and equipment, and undertakes environmental protection construction engineering projects. It offers engineering design, ancillary product design, procurement, manufacturing and processing, assembly, installation, construction and after-sale services to customers in industries such as textile and dyeing, iron and steel, and power.

Business exposure

Within the water treatment system segment, the company completed 52 water treatment sales contracts in FY09. The company has started an engineering project in Henan worth Rmb80m for a FGD project, with phase I already completed. Apart from power plants, the company is also planning to provide FGD services catering for the iron and steel, cement, and glass industries. Apart from flue gas desulphurization (FGD), the company's another focus is flue gas denitrification to reduce the emission of nitrogen oxides. It is currently in discussions to form a joint venture to produce the catalysts used in a selective catalytic reduction denitrification ("SCR DeNOx") system. The Group is planning to commence the construction of a production line for the catalysts by the end of this year. The investment in this production line is likely to be around Rmb300m. The company is currently constructing the phase II flue gas desulphurization project in Henan that is scheduled for completion by the end of 2010.

Key financials

In FY09 the sale of environmental protection products and equipment, mainly in waste treatment products and equipment, contributed Rmb421.5m or 69.2% of total revenue, while environmental protection construction engineering projects accounted for Rmb179.4m or 29.5% of total revenue. In 1H10, the sale of environmental protection products and equipment increased 52.2% yoy to Rmb226.6m. In 1H10, the company completed two contracts involving the sale of flue gas treatment equipment, contributing revenue of c.Rmb37.9m.

Figure 198: Summary description of Pan Asia Environmental Protection (0556.HK)

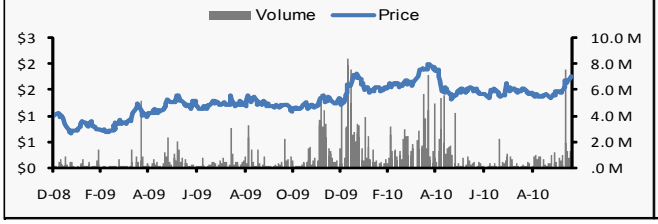
Description	
Address:	Suite 6302 The Center 99 Queen's Road Central Hong Kong (SAR)
Website:	www.paep.com.cn

Financials (CNYmn)	Dec-08	Dec-09	1H10
Sales	594	609	242
EBIT	141	107	46
Net Income	78	88	35
EPS (Diluted)	0.10	0.11	0.04
Book Value per Share	1.3	1.4	1.5
Total Assets	1,356	1,406	1,556
Cash Flow-Oper Activities	(108)	(112)	-
Capital Expenditures	(1)	(0)	-
Free Cash Flow	(109)	(112)	-
Return on Com Eqty (%)	7.4	7.9	7.7
Total Debt/Total Equity (%)	7.7	1.4	1.4

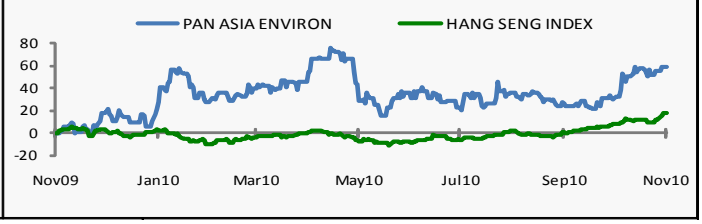
Business Segments (FY: Dec-09 ,CNYmn)	Revenue
EP Products	421.52
EP Construction	179.39
EP Professional Services	8.07

Key Statistics	
Share price (HKD)	1.76
52-Week Range	1.06 - 2.08
YTD performance	47%
Avg Daily traded Val (3 Months, USD)	0.1
Market Value (USD mn)	181.7
Float %	25.0%
Major shareholder	PRAISE FORTUNE LTD
% stake	75.0%
No. of employee	280

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Rino International Corp (Rino.US, non-rated)

Company background

Rino International Corp is engaged in the design, development, manufacture and installation of industrial equipment that are mainly used for environmental protection equipment for the iron and steel industry in China. The company was originally incorporated in Minnesota in 1984 as Applied Biometrics but was restructured in 2007 into an environmental protection equipment manufacturer.

Business exposure

The company has three principal products, namely: 1) Lamella Inclined Tube Settle Waste Water Treatment System, 2) Circulating, Fluidized Bed, Flue Gas Desulphurization System, and 3) High Temperature Anti-Oxidation System for Hot Rolled Steel. Among these, its core product is the Lamella Inclined Tube Settler Waste Water Treatment System, which is sewage treatment equipment widely used in China's iron and steel industry. The system includes industrial water treatment equipment, complete sets of effluent-condensing equipment, solid and liquid abstraction dewatering equipment and coal gas dust removal and cleaning equipment. The company also owns several patents on its equipment products.

Key financials

In 2009, the company recorded total revenue for US$193m and a net profit of US$56m. In terms of business segment breakdown, revenue from its flue gas desulphurization product was the highest and accounted for 60% of total revenue, while its wastewater treatment equipment was the second highest and accounted for 23.9% of total revenue. Among its various products, revenue increase from its wastewater treatment equipment was the highest (up US$32.4m yoy) due to a significant increase in the number of wastewater treatment projects. In 1H10, the company booked revenue of US$113m and net profit of US$39m, increasing 48.4% and 12% yoy, respectively.

Figure 199: Rino International Corp (NASDAQ GS: RINO, Currency: USD)

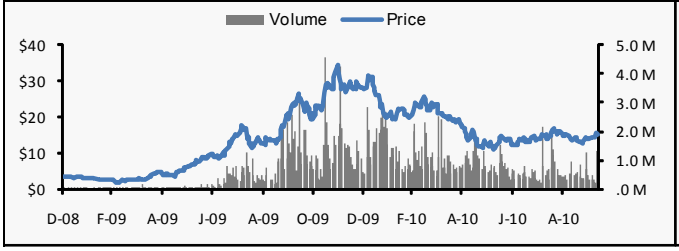
Description	
Address:	11 Youquan Road Zhanqian Str Jinzhou District Dalian, 116100 China
Website:	www.rinogroup.com

Financials (USDmn)	Dec-08	Dec-09	1H10
Sales	139	193	113
EBIT	-	55	28
Net Income	21	56	39
EPS (Diluted)	0.85	2.22	1.37
Book Value per Share	-	7.1	8.5
Total Assets	-	259	301
Cash Flow-Oper Activities	-	31	(48)
Capital Expenditures	-	(0)	(1)
Free Cash Flow	-	31	(49)
Return on Com Eqty (%)	-	-	23.5
Total Debt/Total Equity (%)	-	0.7	6.2

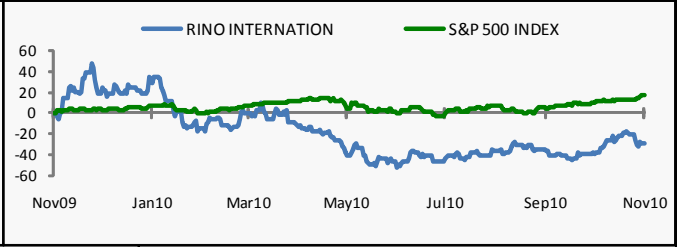
Business Segments (FY: Dec-09)	Revenue	Gross Profit
Pollution Control Equipment	192.64	72.31

Key Statistics	
Share price	16.6
52-Week Range	10.87 - 35.15
YTD performance	-40%
Avg Daily traded Val (3 Months, USD)	11.2
Market Value (USD mn)	474.8
Float %	37.4%
Major shareholder	DEJUN ZOU
% stake	62.6%
No. of employee	270

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Zhejiang Feida Environmental Sci. & Tech. (600526.CH, not rated)

Company background

Zhejiang Feida Environmental is based in Zhuji City, Zhejiang, and was listed on the Shanghai Stock Exchange in July 2002. The company mainly focuses on designing and manufacturing equipment for air quality control. As of end-1H10, the company was c.36%-owned by Feida Group, which is wholly owned by the Zhuji State-owned Assets Supervision and Administration Commission.

Business exposure

Zhejiang Feida Environmental Science & Technology currently manufactures environmental protection equipment such as flue gas desulphurization systems, electrostatic precipitator (ESP), filters, pressure vessels, and pneumatic ash conveying systems.

Key financials

In 2009 the company recorded a 17.2% yoy increase in revenue to Rmb1.4bn. The company's main revenue contributor was ESP, which accounted for 64% of revenue (or Rmb918.8m), followed by flue gas desulphurization equipment and filters, which accounted for 10.1% and 9.3% of total revenue, respectively.

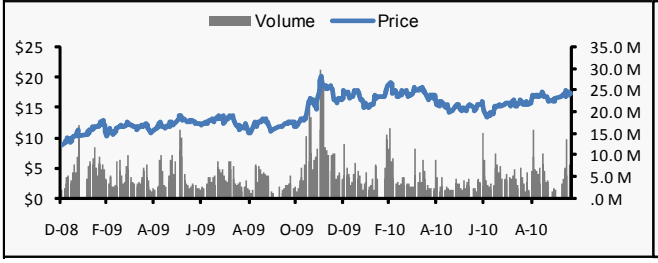
Figure 200: Summary description of Zhejiang Feida Environment (600526.CH)

Description			
Address: 88 Wangyun Road Zhuji, Zhejiang, 311800 China			
Website: www.zhejiangfeida.com			
Financials (CNYmn)	**Dec-08**	**Dec-09**	**1H10**
Sales	1,606	1,435	709
EBIT	51	53	23
Net Income	10	12	6
EPS (Diluted)	0.07	0.09	0.04
Book Value per Share	3.6	3.7	3.7
Total Assets	2,048	2,105	2,105
Cash Flow-Oper Activities	141	(115)	(51)
Capital Expenditures	-	(24)	(8)
Free Cash Flow	141	(140)	(59)
Return on Com Eqty (%)	1.9	2.5	2.6
Total Debt/Total Equity (%)	147.0	125.2	161.8

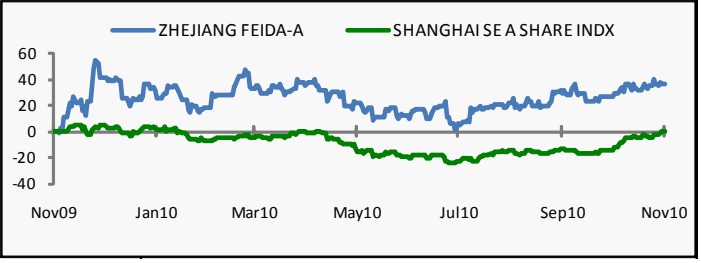
Business Segments (FY: Dec-09 ,CNYmn)	Revenue	Gross Profit
Electrostatic Precipitators	918.82	112.89
Flue-Gas Desulfurization Equipments	145.16	18.09
Bag Filter	133.48	18.14
Electrical Parts	95.84	17.74
Installation Services	71.13	11.39

Key Statistics	
Share price (CNY)	17.71
52-Week Range	12.71 - 20.87
YTD performance	-1%
Avg Daily traded Val (3 Months, USD)	13.8
Market Value (USD mn)	372.5
Float %	59.7%
Major shareholder	FEIDA GROUP CO LTD
% stake	36.2%
No. of employee	1,493

Price and Volume (1 Year)



Comparative Returns



Source: Deutsche Bank, Bloomberg Finance LP

Related Deutsche Bank published reports

Figure 201: Related published reports

Report Title	Author	Publication date	Pages
Australian Renewable Energy - Blowing in the wind	John Hirjee, HughMorgan, Andrew Lewandowski	9-Nov-10	78
Smart Grid Overview - Survey highlights surprisingly strong regulatory support	Carter Shoop, Bheeshm Chaudhary	7-Oct-10	62
Taiwan LED Industry - Shining light through the smoke	Kyle Su	29-Sep-10	25
Taiwan LED Industry - Shining light through the smoke	Kyle Su	29-Sep-10	25
Asian Alternative Energy - A Beginner's Guide	Michael Tong	5-May-10	128
Cable Industry - Current accelerating. Initiate on Prysmian/Nexans w/Buy	Luis Fañanas, Frederic Caumon, Peter Reilly	24-Mar-10	107
Japan's competitiveness - Looking at the machinery, shipbuilding, and plant sectors	Toshiharu Morota	4-Dec-09	130
Industrial waste disposal - Transform into eco-industry	Masaaki Kitami	13-Nov-08	90
French Water and Waste - Staying afloat in a stormy market	Bertrand Lecourt	29-Aug-08	45
21 innovative technologies - Stockpicking based on METI's Cool Earth GHG reduction plan	Toshiharu Morota	3-Apr-08	117
Enabling Sustainability - Initiating coverage of three "greentech" companies	Carter Shoop	13-Dec-07	108
China Water - Turning bearish on China water	David-J Clark, Eric Cheng	13-Jul-07	98
Cree - At a crossroads	Carter B Shoop	13-Jul-07	32
Yaskawa Electric - Initiating coverage: Leading robot market. Key is solutions business	Toshiharu Morota	4-Apr-07	48
LED sector - Year of LEDs: earlier and bigger than expected in 2007	Frank Lee	26-Feb-07	103
Energy machinery - Inconvenient truths	Toshiharu Morota	11-Dec-06	261

Source: Deutsche Bank

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Appendix 1

Important Disclosures

Additional information available upon request

For disclosures pertaining to recommendations or estimates made on a security mentioned in this report, please see the most recently published company report or visit our global disclosure look-up page on our website at http://gm.db.com/ger/disclosure/DisclosureDirectory.eqsr**.**

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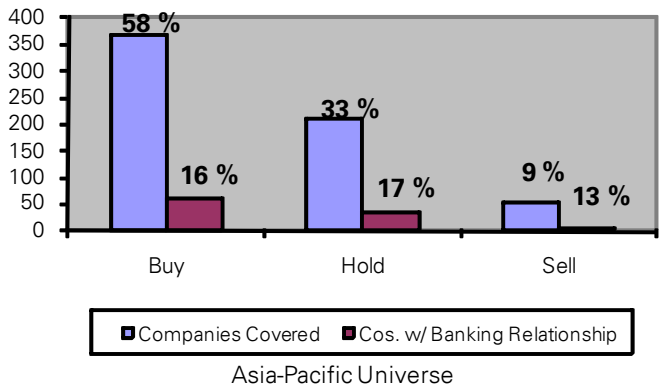
Equity rating key	Equity rating dispersion and banking relationships

Buy: Based on a current 12- month view of total share-holder return (TSR = percentage change in share price from current price to projected target price plus projected dividend yield) , we recommend that investors buy the stock.
Sell: Based on a current 12-month view of total share-holder return, we recommend that investors sell the stock
Hold: We take a neutral view on the stock 12-months out and, based on this time horizon, do not recommend either a Buy or Sell.
Notes:
1. Newly issued research recommendations and target prices always supersede previously published research.
2. Ratings definitions prior to 27 January, 2007 were:
Buy: Expected total return (including dividends) of 10% or more over a 12-month period
Hold: Expected total return (including dividends) between -10% and 10% over a 12-month period
Sell: Expected total return (including dividends) of -10% or worse over a 12-month period



Regulatory Disclosures

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Aside from within this report, important conflict disclosures can also be found at https://gm.db.com/equities under the "Disclosures Lookup" and "Legal" tabs. Investors are strongly encouraged to review this information before investing.

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