



The green tech market in China

In the face of its huge and growing energy needs and its environmental and energy security challenge, China needs to develop green technologies that will help the country to produce cleaner energy and to consume it more efficiently. The main market opportunities for European SMEs will be found in areas where large State Owned Enterprises (SOEs) or multinationals have not yet invested and where they can leverage their know-how and technologies. In this context, this report highlights the energy efficiency services and water and waste treatment sub-sectors as presenting particular opportunities for European SMEs.

1. China's green tech sector

1.1 Defining green tech

'Green tech' in this report encompasses the OECD's definition of 'eco-industries'.¹ These eco-industries in turn are defined as activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. The sector therefore includes "technologies, products and services that reduce environmental risk and minimise pollution and resources such as waste and wastewater management, renewable-energy sources, environmental consulting, air pollution and control, and eco-construction."²

Energy & power supply			Energy efficiency			Water & waste		Others*
Cleaner conventional energy	Renewable energy	Electric power infrastructure	Green building	Cleaner transportation*	Others	Clean water	Waste management	Sustainable forestry and agriculture
Cleaner coal	Wind	Transmission	Green building design	Road	Efficient processing*	Water extraction	Waste collection	Sustainable management
Cleaner oil	Solar	Distribution	Sustainable materials	Rail	Optimised Design*	Water treatment	Waste recycling	Optimised crops
Cleaner Gas	Bioenergy	Energy storage	Power efficiency	Air	Sustainable materials*	Water distribution	Energy from waste recovery	
Nuclear power	Hydropower	Demand management	Water efficiency	Waterway	Monitoring systems	Water use	Waste treatment	
		Supply flexibility	Energy efficient appliances			Wastewater treatment	Sustainable waste disposal	

*Not covered in this report.

¹ OECD/Eurostat, 1999. *The Environmental Goods & Services Industry*.

² Copsey, T. & Hilton, I., 2011. *Greening China: Outlook for European SMEs*. China Dialogue.

1.2 The green tech market

Driven by growing urgencies in energy security, food and water supply, and pollution on an immense scale, the green tech industry has become the top priority among China's strategic industries.

To sustain economic growth while reversing its negative impact on the environment, China is pushing ahead with its green tech policies and spending. Within just a few years, China has emerged as a green tech leader at the centre of almost every green tech market.

By the end of 2010, China became the world's largest investor in clean energy at CNY 354 billion (EUR 42.9 bn³), installed 44.7 GW of wind power and built 8,358 kilometres of high speed rail.⁴ China is making ambitious moves, not only seeking to securely meet domestic needs but also to capture global green tech markets.

By 2013, the Chinese green tech market is expected to reach between EUR 364.2 billion and EUR 728.3 billion.⁵ Substantial progress has been made in the following fields and more developments are underway:

Wind: 44.7 GW installed by 2010 (18.9 GW were installed in 2010 alone), the installed capacity will more than double by 2015.

Smart meters: 50-60 million automatic-meter-reading (AMR) smart meters will be installed in 2011 alone; China may replace the country's meters again in 2015 with automated meter infrastructure (AMI) meters.

Smart grid: CNY 384 billion (EUR 46.6 bn) will be invested by the State Grid to build a national "strong and smart" grid by 2020, and over CNY 300 billion (EUR 36.4 bn) will be invested in thousands of kilometres of new ultra-high voltage (UHV) lines to move excess intermittent power to where it is most needed.⁶

High-speed rail: By the end of 2010, 8,358 kilometres of high-speed rail were in operation. China plans to build 16,000 kilometres of high-speed rail by the end of 2015.

Subways: Beijing's new subway has 155 stations covering 228 kilometres—in just a decade the system has quadrupled in length and almost quadrupled in numbers of passengers. Other major Chinese cities such as Shanghai, Shenyang and Wuhan are building, or expanding, similar systems.

Municipal wastewater treatment: By the end of 2010, China had surpassed its 11th five-year plan treatment goal by 7% to achieve a 75% treatment rate. By early 2011, 3,000 municipal wastewater treatment plants had been constructed, up from only 792 plants in 2005, with 18 new plants added every week. There are plans for a further investment of CNY 90 billion (EUR 10.9 bn) over the next two years to raise the number of plants to 5,000 with a treatment capacity of 1.6 billion cubic meters of wastewater per day.

Low carbon zones: Low carbon zones in eight cities⁷ and five provinces⁸ are currently under development.

³ Currency conversion as at December 27, 2011: USD 1 = EUR 0.7283 (Federal Reserve); CNY 1 = EUR 0.1213 (Bank of China).

⁴ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

⁵ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

⁶ Haitong Securities, 2011. Smart Grid: total investment of CNY 3.45 trillion in ten years.

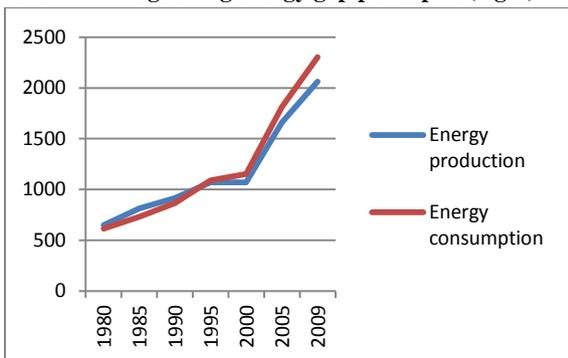
⁷ Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding.

2. Growth drivers

2.1 Pressing needs

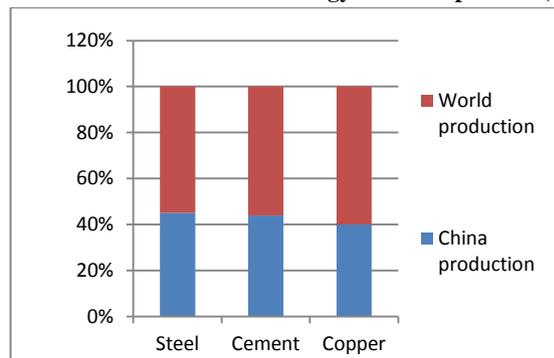
The gap between China's energy consumption and production has been widening since 2000 (see chart 1) and energy usage is extremely intensive (see chart 2) and cannot be sustained in the long run. China relies heavily on coal which causes major environmental damage. In order to address its environmental and energy security challenges, China needs to develop green technologies that will help the country to produce cleaner energy and to consume it more efficiently.

Chart 1. The growing energy gap per capita (Kgce)



Source: China Energy Yearbook, 2010

Chart 2. China's share of energy intensive products, 2009



Source: China Greentech Initiative, 2011

2.2 Targets set by the government

The 12th five-year plan (FYP: 2011 – 2015) defines investment priorities for the next five years. It was published in March 2011 and clearly underlined energy issues as being a key area for government policy. The latest FYP indicated seven strategic areas which would receive investment of up to CNY 10 trillion (EUR 1.1 tn): alternative fuel cars, biotechnology, energy-saving and environmentally friendly technologies, alternative energy, high-end manufacturing and advanced materials, and new-generation information technology. New energy and energy saving technologies are slated to get more than 50% of the planned investment.

Table 2. Key targets: 12th five-year plan

The plan sets some key targets to be met by 2015:

- Decreasing energy intensity (energy consumed per unit of GDP) by 16%;
- Decreasing carbon intensity (carbon emissions per unit of GDP) by 17%;
- Increasing renewable energy as proportion of primary energy to 11.4%;
- Increasing R&D expenditures by 2.2% of GDP;
- Decreasing water intensity (water consumed per unit of value-added industrial output) by 30%;
- Increasing forest coverage rate to 21.7%;
- Decreasing sulphur dioxide and chemical oxygen demand by 8%, and reducing nitrogen oxide and ammonia nitrogen by 10%.⁹

⁸ Guangdong, Liaoning Hubei, Shaanxi, Yunnan.

⁹ Finamore, B., 2011. *The Next Five Year of Climate Protection and Clean Energy in China*.

Table 3. Investment (targets) in low-carbon technologies during the 12th five-year plan

Sector	Investment
New energy	CNY 5 trillion (EUR 606.5 billion, by 2020)
Energy saving	CNY 4.5 trillion (EUR 545.9 billion)
Environmental protection	CNY 3 trillion (EUR 363.9 billion)
Alternative vehicles	CNY 100 billion (EUR 12.13 billion)
Power	CNY 5.3 trillion (EUR 642.9 billion)

Source: E3G, Chinese Challenge or Low Carbon Opportunity: The Implications of China's 12th Five-Year-Plan for Europe

3. Market structure

Decisions in the Chinese green tech sector are driven by the central government. The five-year plan establishes priority technologies and state-owned enterprises (SOEs) play a major role in implementing them.

There are more private players in areas such as solar power and smart grid and also within the energy efficiency services area which covers consultancy and audit. The following table gives a flavour of the different types of organisation within these areas.

Table 4. Players and influencers in China's green tech sectors

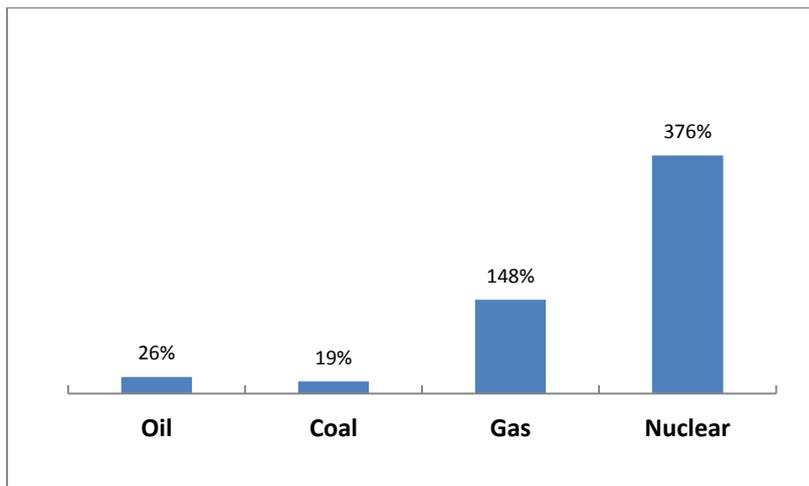
	Cleaner conventional energy	Electric power infrastructure	Renewable energy	Water & waste	Energy efficiency services
Domestic	<p>Petroleum and chemical CNPC Sinopec CNOOC Sinochem Shanghai Huayi Group Tianjin Bohai Chemical Ind. Group Shandong Haihua Group Sichuan Hongda Chemical Corp. Jiangsu Sanfangxiang Ind. Co.</p> <p>Coal Shenhua (incl. carbon capture and storage) China National Coal Corp.</p> <p>Nuclear China Nuclear Engineering Group (CNECC) China Guangdong Nuclear Power Group (CGNPC)</p>	<p>T&D State Grid Corp. of China China Southern Power Chint Group Corp.</p> <p>Smart grid, smart meters Ningbo Sanxing Electric Holley Metering Jinpan International Linyang Electronics Pax Electronic Shenzhen Clou Wasion (Weisheng) Group</p>	<p>Wind Guodian Datang Dongfang Huaneng Huadian Guohua Jingneng China Energy Conservation and Environmental Protection Group Jointo</p> <p>Solar Suntech Yingli LDK Trina Himin</p>	<p>Clean water Origin Water Technology Beijing Kejingyuan Sound Environmental Resources Beijing Water Business Doctor Beijing Enterprises Water Group</p> <p>Solid waste management China Everbright Anyang Aierwang Jiangsu Welle TEDA Environmental Protection Weifang Jinsida Shanghai Environment Group</p>	<p>QiDi Daring Energy Technology Top Energy</p> <p>Energy Service Companies (ESCOs) See page 9</p> <p>Design institutes Beijing General Municipal Engineering Design and Research Institute (BMEDI) State Engineering Research Centre of Municipal Water Resources Development</p>
Foreign	<p>Petroleum and chemical Shell, Total, BP Chevron, ConocoPhillips BASF Bayer DuPont Dow Corning Huntsman</p> <p>Coal Peabody AES</p> <p>Nuclear EDF</p>	<p>Alstom ABB Emerson Electric Honeywell Schneider Electric IBM Siemens</p>	<p>Wind AES Duke Energy Gamesa General Electric Suzlon Vestas</p> <p>Solar First Solar Canadian Solar</p>	<p>Clean water Veolia Environmental Services SUEZ Group Berlin Wasser Kardan Water Läckeby Water Group Halma</p> <p>Solid waste management Waste Management, Inc. Covanta</p>	<p>Arup Azure International Cowi DHV Siemens Veritas</p> <p><u>EU SMEs</u> Ecofys Internat Terao</p>

3.1 Cleaner conventional energy

China lacks gas and oil resources with coal accounting for over 70% of China's overall energy supply. China holds 14% of the world's coal reserves, yet it accounted for 45% of total coal extractions in 2009. Coal production has grown 8.1% since 2005 to 3.2 billion tons in 2010. Coal fired power plants, steel plants, chemical producers and building materials were the key consumers of coal and this has contributed greatly to establishing China as the world's largest greenhouse gas emitter. At current speed, China will run out of coal in 38 years, making it even more imperative that cleaner conventional energy solutions are found in the interim.

During the past years, China has developed some of the world's most efficient coal-fired power plants. Among conventional energy sources, the government plans to boost the usage of natural gas and nuclear power by 148% and 376% between 2011 and 2015 (see chart 3). It is also in the process of phasing out small to medium sized coal fired power plants from 11,000 plants in 2010 to 4,000 in 2015, while establishing higher discharge standards of De-SO_x and De-NO_x (removal of SO_x and NO_x), for existing and new power plants to promote cleaner coal technologies. The Chinese clean coal market is estimated at CNY 1.1 trillion (EUR 133.4 billion).¹⁰

Chart 3. Conventional energy growth projections by percentage, 2011-2015



Source: NEA and China Green Initiative

*Like many countries, China may reevaluate the development of nuclear power after Japan's nuclear plant melt down caused by the earthquake and tsunami in March 2011.

Pricing and tax on conventional fuel, electricity and carbon emissions greatly impact the dynamics of the cleaner conventional energy market. The current price set by the government does not reflect the cost of power generation and many electricity providers in China are running with very challenging budgets and this in turn impedes adoption of cleaner technologies, which are more costly at the initial stages.

The conventional energy and power supply sectors are dominated by large SOEs. For instance, the state-owned coal company Shenhua holds almost half of China's coal production; the Chinese power generation industry is dominated by five state owned companies; electricity transmission and distribution by the State Grid Corporation of China and China Southern Power; the oil industry by

¹⁰ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

Sinopec, China National Petroleum Corp (CNPC), China National Offshore Oil Company (CNOOC) and Sinochem.

3.2 Electric power infrastructure

Both energy efficiency targets and usage of renewable energy require a stronger and a more advanced electric power grid in China. The State Grid supplies around 80% of the electricity and China Southern Power provides the rest (20%) to six provinces in the south.

50-60 million automatic-meter-reading (AMR) smart meters will be installed in 2011 alone; China may replace the country's meters again in 2015 with automated meter infrastructure (AMI) meters.

China is the largest investor in smart grid in 2010 at CNY 47.5 billion (EUR 5.8 bn), followed by the US (EUR 5.2 bn) and Japan (EUR 0.62 bn). The State Grid plans to invest CNY 3.45 trillion (EUR 418.5 bn) in infrastructure upgrade by 2020, which includes CNY 384 billion (EUR 46.6 bn) on smart grid, and over CNY 300 billion (EUR 36.4 bn) on ultra-high voltage (UHV) transmission. China Southern Power is likely to follow suit with similar upgrade plans.

Distribution and consumption will account for over half the smart grid investment total and are relatively open to private participation. The electric power infrastructure sector is monopolised by state grids with complex organisational structures. Scale, low cost solutions and strong relationship with decision makers at the central and local level are key to success in this field.

3.3 Renewable energy

Although China invests massively in renewable energies, coal will remain the main source of energy over the next few decades. By 2020, the total installed capacity for power generation in China will increase to 1880 GW from 960 GW in 2010. China needs urgently to increase the share of clean energies (i.e. solar, wind, hydraulic power and bioenergy) in its energy mix.

In 2009, China invested almost CNY 250 billion (EUR 30.3 bn) in renewable energy. The share of non-fossil fuel should increase from 8.3% in 2011, to 11.4% by 2015, and 15% by 2020 (see chart 4). These goals are ambitious, but seem to be realistic.

China is now a global leader in wind power and solar photovoltaic manufacturing. Again, SOEs are responsible for 90% of the current onshore wind projects and so far 100% of the bids for large scale solar projects in China were awarded to SOEs.

The nation's offshore wind energy potential is around 750 GW, three times the potential on land. The offshore wind power industry remains in its developing stages in China due to the many challenges in technology and operations. Europe has the most offshore plants in the world, with Denmark, Sweden and the UK leading the field.

Biomass continues to receive less attention than solar and wind power in China. Although a nationwide biomass feed-in-tariff and a retroactive tax reduction for biodiesel producers was enacted in 2010, additional growth of the sector is likely to require further support, as growth has stagnated in recent years due largely to restraints on feedstock supply.

In terms of distributed renewable energy (DRE), China has significant capacity in small hydropower, household biogas digesters and rooftop solar water heating. However, without grid improvements,

more cost-effective energy storage and subsidies, promising DRE technologies will not reach their full potential.¹¹

Chart 4. Evolution of energy mix, 2010 to 2020

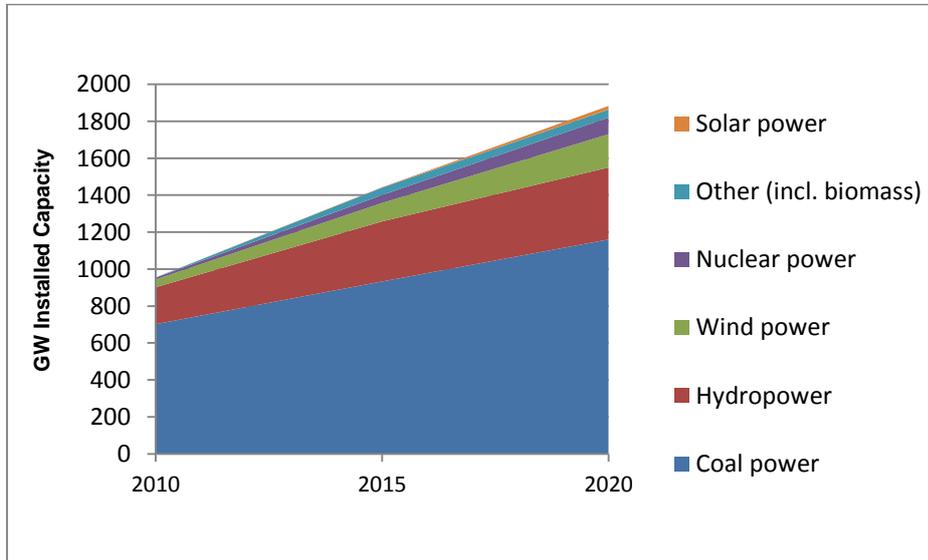


Table 5. China's energy mix (GW installed capacity)

	Total	Coal power	Hydropower	Wind power	Nuclear power	Other (incl. biomass)	Solar power
2010	955.2	702	200	42	10	0.6	0.6
2015	1443	933	325	100	43	40	2
2020	1883	1160	390	180	90	43	20

Source: E3G, China Electricity Council

3.4 Energy efficiency

Green building

The urban population in China has increased from 20% in 1980 to 47% in 2010, showing no sign of slowing down. Over 600 million people today live and work in the Chinese cities, about 400 million more will join them by 2030.¹² To meet demand, China adds over two billion square meters of new floor space to its building stock annually, representing half the world's construction market. Less than 0.5% of these constructions are green buildings which are more energy efficient and sustainable than conventional ones.¹³

Low design and construction quality, negligence in building maintenance and inefficient heating systems especially in the north are causing substantial energy waste. Building energy consumption currently accounts for nearly 30% of China's overall energy consumption. The government has realised that energy efficiency improvements during the lifespan of buildings is the most cost

¹¹ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

¹² McKinsey & Company, 2009. *Preparing for China's Urban Billion*.

¹³ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

effective means to achieve its target of lower carbon intensity and is therefore highly incentivised to promote the development of green buildings.

The 11th five-year plan (2006-2010) stipulated a 50% reduction on energy consumption of new buildings; municipalities including Beijing, Shanghai and Tianjin are required to deliver a 65% energy reduction. In the 2011-2015 period, this 65% benchmark will be carried out in other cities and areas in China.

To tackle the existing building stock in China, the government has identified energy service companies (ESCOs - see box below) as a way to promote retrofit to improve building energy efficiency.¹⁴ Retrofits can be done directly by the building owner or indirectly through an ESCO. Over the last five years the building energy efficiency retrofit market has almost quadrupled as government policies support growth.

Box 1. ESCOs in China

An energy service company (ESCO) provides energy solutions leading to enhanced productivity. ESCOs were introduced in China at the end of the 1990s by the World Bank and the International Finance Corp.

In order to develop ESCOs, the Chinese government has recently decided to provide them with tax exemptions. An ESCO has to be an independent legal person with no requirement regarding the country it is registered in. However, the regulation also states that the company should be registered with a minimum registered CNY capital which implies that the company has to be established in China.

By March 2011, the central government's list of officially approved ESCOs totalled 984 (NDRC and Ministry of Finance, 2010 and 2011). However, many observers believe the majority of these are "phantom" companies merely taking advantage of the ESCO status to receive financial and tax benefits that were introduced in 2010 to promote the ESCO industry.¹⁵

According to statistics from the China Energy Conservation Association, China currently has a building area of 43 billion square meters, in which the public building area accounts for over half, and less than 10% of these are energy efficient, the potential market value of the public building retrofit project is estimated at CNY 50 trillion (EUR 6 tn).

This sector is relatively open to foreign companies with some restrictions regarding government buildings; National Development and Reform Commission (NDRC) and Ministry of Finance (MOF) have shortlisted domestic and foreign ESCOs to receive incentives;¹⁶ domestic developers dominate the residential market and show a preference for domestic building material suppliers; multinational corporations are more likely to turn to higher cost foreign suppliers of green building materials.

¹⁴ ESCOs are engaged across many other energy efficiency segments such as efficient processing, optimised design and sustainable materials.

¹⁵ Kostka, G. & Shin, K. *Energy Service Companies in China: The Role of Social Networks and Trust*. Frankfurt School of Finance & Management, Working Paper No. 168.

¹⁶ The list of ESCOs can be found at www.gov.cn and www.ndrc.gov.cn.

Barriers hindering development in this sector are:

- Confusion of different standards, adding to the cost of construction, also making it hard for buyers to discern which materials are truly “green”;
- Lack of detail in regulations for practical enforcement and supervision, government subsidies are still too small;
- Low electricity rates prevent suppliers from being able to offer competitive solutions;
- A low-cost mentality and low awareness of energy efficiency in both construction industry practitioners and end consumers.

3.5 Clean water

China is facing severe water shortages and pollution in its water system. China has tripled the number of municipal wastewater plants, initiated the massive South-to-North diversion project, and planned desalination projects near urban areas. Between 2010 and 2020, CNY 4 trillion (EUR 485.2 bn) will be invested in water infrastructure improvements.

The government encourages private domestic and foreign investment in the clean water sector, though many private companies have formed partnerships with local utilities, only 10-20% of investment came from the private sector. Waste water treatment is the main area of participation compared to water supply.

Accessibility to the wastewater treatment market is open with certain restrictions; private sector participation in the market is allowed but usually done in cooperation with government entities. Participation is mostly through build-operate-transfer/transfer-operate-transfer (BOT-TOT) and operation and maintenance (O&M) arrangements. The number of municipal wastewater treatment plants has grown from 792 in 2005 to 3,000 by early 2011 and more growth is expected over the next two years.¹⁷

Sludge treatment has recently been integrated into sewage treatment to prevent improper disposal of sludge into the environment. Investment in the sludge treatment market is expected to increase from CNY 32.3 billion (EUR 3.9 bn) in the 11th five-year plan to CNY 100 billion (EUR 12.13 bn) by the end of the 12th five-year plan.

3.6 Solid waste management

Population growth, unprecedented urbanisation and industrialisation are rapidly driving up the quantity of solid waste generated in China. In 2003, China collected 148 million tons and 1 billion tons of municipal solid waste (MSW) and industrial solid waste (ISW) respectively. By 2010, the two figures were 160 million tons and 2.4 billion tons, up 8% and 140%. The average annual growth rate of industrial solid waste was 13.3% from 2003 to 2010.¹⁸

Mining gangue, coal gangue, coal ash, boiler slag and iron blast-furnace slag account for over 75% of the total ISW. The coal mining and processing industry generates the most ISW of any Chinese industrial sector. The generation and discharging characteristics of ISW are different in each region depending on the industrial structure of the region.

¹⁷ China Greentech Initiative, 2011. *The China Greentech Report 2011*.

¹⁸ Research In China, 2011. *China Solid Waste Treatment Industry Report, 2011*.

Currently, around 90% of MSW disposed of is landfilled, only a small percentage is incinerated and composted. Kitchen residues account for about 60% of the garbage collected by the municipal services. The high water content and bio-organic components pose major problems for MSW disposal such as leachate.

By 2008 there were 495 disposal facilities for MSW in China, capable of disposing only half of the estimated total MSW generated. The government plans to build an additional 475 waste disposal plants with higher disposal capacity by 2015.

Improvement measures to be taken in China include reducing the quantity of waste from the source, promoting the recycling of solid waste, improving disposal levels, increasing the percentage of incineration and compost, attracting foreign capital and technologies, and reforming solid waste management systems.

4. Opportunities for European SMEs

Common to the initial stage of the green tech industry in many countries, effective policies and enforcement of these policies are still in their early stages in China. Once domestic policies and practices in a segment are relatively developed, however, they are more likely to favour Chinese players unless the foreign companies can prove substantial advantages in terms of technology, know-how, performance or pricing.

In this fast growing and changing green tech market, the vast market size does not necessarily translate directly into opportunities for European SMEs. The main market opportunities for SMEs will be found in areas where the large SOEs or multinationals have not yet invested and where SMEs can leverage their know-how and technologies.

Advanced products/services for niche demand, close monitoring of green tech policies and good relationships with provincial governments are key to success in this challenging market.

4.1 Opportunities highlighted by sub-sector

Cleaner conventional energy

Carbon capture and storage technologies

China is expected to develop its coal conversion industry into the world's largest by 2020. According to China Shenhua CTL & CTC Research Institute, China's capacity of coal liquefaction projects would hit the equivalent of 20 million tonnes of oil, that of coal-to-gas would reach 50 billion cubic meters, and coal-to-chemical 10 million tonnes of oil equivalent. Clean coal conversion technologies that help capture and store carbon dioxide efficiently during the process will be needed in China.

Renewable energy

Biomass

Some renewable energy subsectors such as biomass remain underdeveloped in China but they are likely to grow quickly in the coming years. Feed-in-tariffs set by the government will help facilitate the distribution of energy from renewable sources.

Energy efficiency

Energy efficiency services and technology upgrade

China lacks knowledge and experience in energy auditing, energy efficient processing/machineries and in developing green buildings; it still needs to rely on foreign technologies and know-how.

In July 2011, the Ministry of Housing and Urban-Rural Development (MOHURD) had a preliminary selection of 40 Chinese cities which will be required to revamp no less than 4 million square metres of public buildings (in each city) over the next two years at a subsidy of CNY 20 (EUR 2.4) per square metre from the government. The market value of this revamp will be around CNY 400 billion (EUR 48.5 bn).

According to the China Greentech Initiative (CGI), ESCOs have great potential to improve energy efficiency, but their near-term potential in China is unclear.

In the green building field, the most important policies affecting ESCOs are targets for urban heating in northern China and energy management of large public buildings; however, progress in these programs is uneven and subsidies for ESCOs are too small to make a meaningful difference. CGI research suggests the most attractive segments for ESCOs include government, SOEs, single-owner offices, supermarkets and hotels.

Plants also need new technologies to improve their energy use, for instance, in the areas of waste heat or metering. Foreign invested manufacturing enterprises should be a particular target in this area.

International projects sponsored by the multilateral organisations such as the World Bank also present opportunities for foreign companies. The procurement process on these projects is likely to be more transparent and standardised.

When approaching Chinese companies and organisations, however, it should be noted that they are still not used to paying for intangibles such as services. This attitude will change in time, as the Chinese government funds more programmes to incentivise energy and environmental conservation.

Energy efficient materials

Certified sustainable materials from Europe will appeal to foreign designers and developers, government example green building projects or more established and forward thinking developers in China.

Clean water

Water treatment equipment, technology and expertise

Over half of water treatment plants in China were medium scale with a treatment capacity of 10,000 to 100,000 cubic metres per day located around first and second tier cities in 2008. More small scale

plants are planned for other second and third tier cities. Wastewater treatment plants will increasingly adopt secondary or tertiary treatment processes. Sludge treatment was only incorporated into the water treatment process by the end of 2010, and lags behind sewage treatment.

European water treatment equipment, technology and expertise that can help increase efficiency, recover energy or recycle waste will have an advantage in the market.

Solid waste management

Consulting services for solid waste treatment operations

The solid waste treatment business is still in its early stages. Investment in the disposal capacity of incineration and compost will benefit companies with advanced technologies. Consulting services on plant operation, efficient processing, optimised design and environment impact measurement services that help improve measurements of pollution, waste and water treatment will be in demand.

Mechanical and biological pre-treatment of waste

Mechanical and biological pre-treatment of waste can speed up decay, prevent leakage and reduce greenhouse gas emission. Machineries, know-how and local adaption are needed for this under developed market in China.

Waste tyre recovery

Recovery rate of waste tyres in China was 5% in 2009 (13 million units) compared to around 45% in developed countries. The government's target is to reach 25% by 2015. European SMEs with operational experiences in converting waste tyres into energy, carbon black and reusable metal can find opportunities in this fast growing market.

Others

Air quality and emissions monitoring equipment

China's drive to improve its air quality will present opportunities to EU SMEs who can provide Air Quality Monitoring System (AQMS) and Continuous Emission Monitoring System (CEMs) solutions. There were 911 AQMS installed in China by the end of 2008 and it is estimated that annual demand will be 400 sets per year for the near future giving an estimated market of CNY 280 million (EUR 32 m).

For CEMs, in 2008, about 4,618 sets of CEM equipment were installed by the end of 2008. If current trends continue, the market for CEMs will reach CNY 12.5 bn (EUR 1.4 bn) by 2013.¹⁹

5. Challenges of the market

Many of the opportunities in the green tech sector remain difficult for European SMEs to exploit. Local companies are catching up in terms of their technological knowledge and have distinct advantages when it comes to the relationships with local government and SOEs and when accessing finance.

¹⁹ FECC, 2010. *Air Pollution Monitoring and Control Report*.

5.1 European SMEs approaching the market: typical business cycle

European SMEs usually enter the Chinese market with the objective of selling high-end products they have developed in Europe, for instance biogas or energy audits in buildings. But their product often needs to be adapted to China and the market is usually not mature enough, due to lagging regulation or fiscal policies.

After a while, regulations evolve but new challenges appear: the European SME has to face new Chinese competitors who emerge en masse and offer low-price products. The competition is usually extremely tight between Chinese companies who tend to lower their prices to provide cheaper products. It is usually impossible for European companies to compete on price with Chinese companies.

The best strategy for the European company is to maintain its higher quality and technology standards and aim for the higher value service or product markets.

Table 6. Development of green tech markets in China - the typical business cycle

	Stage 1 Development of the product in the European market*	Stage 2 Introduction of product/service in Chinese market	Stage 3 Product localisation	Stage 4 Emergence of Chinese competitors
European SME activity	European SME develops and pilot tests product.	Investigation of Chinese market begins. Potential customers identified and perhaps some preliminary exports take place.	Encouraged by potential market and success in exports, European company sets up a wholly foreign owned enterprise (WFOE) or joint venture.	The European invested company fights local competitors for market share.
Product development	New technology developed and piloted in Europe.	By this stage a high-end product has been developed. European SME has strong know-how.	The product is adapted to the Chinese market.	Product must be constantly improved to stay ahead of the competition.
Chinese regulatory environment	No regulations exist at this stage.	No regulations exist at this stage.	Regulations and fiscal policy are established to support the new technology.	Strong support of national industry.
Competition in Chinese market	No real competition.	No real competition.	Chinese players begin to emerge and develop new products.	Increasingly fierce competition.

* This cycle applies to the development of services as well as 'products'.

5.2 Legal and regulatory barriers

Developing market

Although growing quickly, the green tech market is still in the process of developing. Regulations and policies still need to be adapted to enable the development of new green tech sub-sectors. Usually, the government waits for a large Chinese player to emerge before issuing regulations for the industry. In this way, it creates incentives for other Chinese entrepreneurs to invest in this industry and exploit opportunities generated by the new regulation. Although regulations should help European SMEs develop in the market, they also make the market more attractive to Chinese companies; more formalised regulation equates to more Chinese competitors.

So far, regulations have been issued in the wind energy sector (incentives to develop installed capacity), for energy services and to a lesser extent in the solar energy sector. Regulations for the biogas sector are still under developed.

Standards and conformity

China first adopted minimum energy performance standards (MEPS) in 1989. Today, there are standards for a wide range of domestic, commercial and selected industrial equipment. In 1999, China launched a voluntary endorsement label, which has grown to cover over 40 products including water-saving products. Furthermore, in 2005, China started a mandatory energy information label (also referred to as the “energy label”). Today, the energy label is applied broadly to a number of home appliances, consumer electronics, office equipment, lighting and other industrial equipment. The EU SME Centre has produced a guideline to the energy label which can be accessed here: www.eusmecentre.org.cn/content/energy-efficiency-label-guideline.

Bureaucracy

Setting up a foreign invested business in China can be challenging. The bureaucratic process takes much longer than in the EU, requiring an approval process. Green technologies are usually encouraged sectors (see the priorities defined by the FYP) but it is difficult for foreign companies to take advantage of this status. For instance, a foreign company is not allowed to have a design or a construction licence (to build a power plant or to design a building) in China and has to partner with a domestic company.

Protecting IPR

European SMEs in the green tech industry looking to sell or export green tech products to China should be wary of the high risk of IPR infringement in China and the difficulty in enforcing these rights. Innovative technologies and know-how will be a key competitive advantage for European green tech companies that should be protected rigorously. Joint venture partnerships in particular should be approached with caution. More advice on IPR protection can be found on the IPR SME Helpdesk website: www.china-iprhelpdesk.eu.

5.3 Market barriers

Unfair competition from SOEs

The Chinese government considers the green tech industry as strategic. SOEs enjoy important advantages in terms of relations with the government and accessing contracts. They also benefit from very advantageous banks loans. The sector is often reported as being difficult for foreign companies²⁰ who cannot access the same relationships or benefits.

Increasing local competition

Chinese green tech companies are developing very quickly and can provide lower prices than their foreign competitors. China is already a world leader in some green tech areas (in the solar industry, for example, 74% of Suntech's revenue in 2009 came from its European sales).²¹ In general, Chinese companies are still lagging behind European ones when it comes to technology level but they are investing substantial amounts of time and money in order to catch up.

Chinese companies also have a competitive advantage when it comes to understanding the local market and developing products suited to the local environment. Close relationships with local governments and SOEs in this industry can also be critical when bidding for contracts, and this is another area where local companies will maintain an advantage.

²⁰ Bradsher K., 2010. "To Conquer Wind Power, China Writes the Rules". The New York Times, December 14.

²¹ Suntech Unlimited. <http://ap.suntech-power.com/?lang=en>.

6. Report summary

	Cleaner conventional energy	Renewable energy	Energy efficiency	Clean water	Solid waste management
Opportunities	<ul style="list-style-type: none"> Clean coal conversion technologies. 	<ul style="list-style-type: none"> Components for the wind, solar and biomass industries. 	<ul style="list-style-type: none"> Establishing energy service companies. Energy efficient devices. 	<ul style="list-style-type: none"> Secondary or tertiary treatment. Sludge treatment. 	<ul style="list-style-type: none"> Consulting services on operations. Mechanical and biological pre-treatment of waste. Waste tyre recovery.
Legal barriers	<ul style="list-style-type: none"> These sectors in general are restricted to foreign investment. However, EU SMEs will be able to access the market by exporting and via licensing agreements. 	<ul style="list-style-type: none"> Strategic sector with priorities given to domestic companies. 	<ul style="list-style-type: none"> It is still unclear whether foreign energy service companies (ESCOs) are eligible for the tax exemptions outlined below. 	<ul style="list-style-type: none"> Strategic sector with priorities given to domestic companies. 	<ul style="list-style-type: none"> None known.
Market barriers	<ul style="list-style-type: none"> The industry is dominated by large state-owned players. Access to and relationship with state-owned players required. Differentiation from local/competitor's technology. 	<ul style="list-style-type: none"> The industry is dominated by very large and usually state-owned players. Intense competition drives prices down. Large capital investment and of scale economies required. Access to local governments required. Market immature for biomass. 	<ul style="list-style-type: none"> Low demand from Chinese companies. Need to develop direct relations with the clients. 	<ul style="list-style-type: none"> Intense competition. Local protectionism. Price driven, limited budget for more advanced solutions. 	<ul style="list-style-type: none"> Still in early stages of development. Lack of enforceable standards and supervision. Lack of funding. Low public awareness for MSW segregation.
Taxes applicable	<ul style="list-style-type: none"> Corporate income tax (CIT) for resident enterprises is normally 25%. Income generated by a resident enterprise undertaking qualified environmental protection and energy conservation projects is eligible for a three-year exemption and three-year 50% reduction in CIT. Resident enterprises engaging in activities in the green technology could be qualified as High and New Tech Enterprises. The tax rate of CIT for High and New Tech Enterprises amounts to 15%. Products or services making comprehensive use of resources (i.e. reuse of waste materials) are eligible for VAT exclusion or certain preferential policies. Income earned by qualified energy-saving service companies is exempted from business tax. Other preferential policies provided by local authorities. 				

Resources

Further reading
<p>The China Greentech Report 2011 http://www.china-greentech.com/report Published by: China Greentech Initiative, April 2011 Accessed on 29 April 2011</p>
<p>China's Green Revolution: Prioritizing Technologies to Achieve Energy and Environmental Sustainability http://www.mckinsey.com/locations/greaterchina/mckonchina/reports/china_green_revolution_report.pdf Published McKinsey & Company, 2009 Accessed on 9 May 2011</p>
<p>Greening China: Outlook for European SMEs http://www.friendsofeurope.org/Contentnavigation/Library/Libraryoverview/tabid/1186/articleType/ArticleView/articleId/2319/Greening-China-Outlook-for-European-SMEs.aspx Published by: Friends of Europe, China Dialogue, spring 2011 Accessed on: 29 April 2011</p>
<p>Chinese Challenge or Low Carbon Opportunity: The Implications of China's 12th Five-Year-Plan for Europe http://www.e3g.org/programmes/europe-articles/chinese-challenge-or-low-carbon-opportunity/ Published by E3G, 2011 Accessed on 9 May 2011</p>
<p>Low Carbon Technology: A Framework for EU-China Dialogue http://www.e3g.org/programmes/europe-articles/low-carbon-technology-a-framework-for-eu-china-dialogue/ Published by E3G, 2010 Accessed on 9 May 2011</p>
<p>Energy Service Companies in China: The Role of Social Networks and Trust www.frankfurt-school.de/dms/Arbeitsberichte/Arbeits168.pdf Published by Frankfurt School, June 2011 Accessed on 25 Aug 2011</p>
<p>Municipal Solid Waste Management in China: Status, problems and challenges www.sciencedirect.com/science/article/pii/S0301479710000848 Published by Elsevier, 2010 Accessed on 30 Aug 2011</p>
<p>Unlocking Energy Efficiency in China: A Guide to Partnering with Suppliers http://www.bsr.org/reports/BSR_Unlocking_Energy_Efficiency_in_China.pdf Published by BSR, May 2010 Accessed on 13 Sept 2011</p>
<p>APEC launches test-case for Low Carbon Model Town http://www.apec.org/Press/Features/2011/0128_lowcarbon.aspx Published by APEC, Jan 2011 Accessed on 13 Sept 2011</p>
<p>Chinese Challenge or Low Carbon Opportunity: The Implications of China's 12th Five-Year-Plan for Europe http://www.e3g.org/images/uploads/E3G_Chinese_Challenge_or_Low_Carbon_Opportunity_updated.pdf Published by E3G, March 2011 Accessed on 13 Sept 2011</p>

Exhibitions**IFAT CHINA**www.ifat-china.com

7-Mar-12 to 9-Mar-12, Shanghai New International Expo Centre

IFAT CHINA was introduced from IFAT, the world's largest environmental trade fair. IFAT CHINA covers an extensive range of practice-oriented solutions in the areas of water supply, sewage, waste disposal, recycling, air pollution control, environmental technology and natural energy sources.

Email: ifatchina@mimi-shanghai.com

The 12th China International Petroleum & Petrochemical Technology and Equipment Exhibition (CIPPE)www.cippe.com.cn

19-Mar-12 to 21-Mar-12, New China International Exhibition Centre, Beijing

One of the top three petroleum exhibitions in the world, there were 12 International pavilions at CIPPE2011 with 80,000 sqm of exhibit space and 1500 exhibitors. The professional visitors reached 40,000.

E-mail: cippe@zhenweixpo.com

Aquatech China 2012www.china.aquatechtrade.com/cn/en/Pages/default.aspx

6-Jun-12 to 8-Jun-12, Shanghai World Expo Exhibition & Convention Centre

With over 24,612 visits from the national and international water world, the show has strengthened its position as the largest and most important water technology show in South East Asia in 2011

E-mail: simon@chcbiz.com

Water Expo China 2012www.waterexpo.cn/expo/index.asp

29-Oct-12 to 31-Oct-12, National Convention Center Beijing, China

In 2011 over 18,000 visitors from over 34 countries and regions came to visit Water Expo China. The expo covers all areas of water business including exploitation, utilisation and protection of water resources and water related equipment.

E-mail: expo@mwr.gov.cn

Websites**China Climate Registry**

An online Energy and Climate Registry system to monitor the energy use and GHG emissions from domestic and multinational corporations, cities and organizations.

<http://www.chinaclimaterregistry.org/en/index.asp>

The Europe-China Clean Energy Centre (EC2)

A five-year cooperation project funded by the European Union founded in April 2010. EC2's main tasks are to promote an increased use of clean energy in China and to support the Chinese Government's efforts to shape a more sustainable, environmental friendly and efficient energy sector.

<http://ec2.org.cn>

The Innovation Center for Energy and Transportation (iCET)

A leading policy think-tank in the area of low-carbon development and climate change, an independent non-profit, professional organization registered in China and the US.

<http://www.icet.org.cn/english/index2.asp>

The China Energy Group at Lawrence Berkeley National Laboratory (LBNL)

LBNL seeks to understand China's energy needs and the opportunities arising from these needs. They have a strong resource of publication related to energy and climate change.

<http://china.lbl.gov/publications>

List of designated operational entities (DOEs) for China provided by the United Nations Framework Convention on Climate Change (UNFCCC).

<http://cdm.unfccc.int/DOE/list/index.html>

Switchboard, NRDC staff blog (Barbara Finamore)

Natural Resources Defense Council (NRDC) is an environmental action group from the U.S.

<http://switchboard.nrdc.org/blogs/bfinamore>

China Clean-tech Portal (in Chinese)

Environmental industry information platform including case studies, market news and product promotions. Members can access database on companies and institutions in the supply chain of the water and solid waste sector.

<http://www.tsinghuan.com/>

China Water and Solid Waste

A portal website on the water and solid waste sectors in China.

<http://english.chinawater.net/> (<http://www.h2o-china.com/> and <http://www.solidwaste.com.cn/> in Chinese)

China Dialogue

chinadialogue.net is a non-profit organisation based in London, Beijing and San Francisco which provides news, analysis and discussion on China related environmental issues.

<http://www.chinadialogue.net>

EU Commission - DG Trade

DG Trade provides a large number of guides, research reports and policy documents for all sectors and trading partners.

<http://trade.ec.europa.eu/doclib>

China IPR SME Helpdesk

Useful advice and guides on how to protect IPR in China.

<http://www.china-iprhelpdesk.eu>



Contact the Centre at:

Room 910, Sunflower Tower
37 Maizidian West Street
Chaoyang District
Beijing, 100125

T: +86 10 8527 5300
F: +86 10 8527 5093

www.eusmecentre.org.cn
enquiries@eusmecentre.org.cn

The EU SME Centre assists European SMEs to export to China by providing a comprehensive range of free, hands-on support services including the provision of information, confidential advice, networking events and training. The Centre also acts as a platform facilitating coordination amongst Member State and European public and private sector service providers to SMEs.

The Centre's range of free services cover:

- Business Development – provision of market information, business and marketing advice
- Legal – legal information, initial consultations and practical manuals
- Standards – standards and conformity requirements when exporting to China
- HR and Training – industry and horizontal training programmes
- Access to a service providers directory and information databases
- Hot-desking – free, temporary office space in the EU SME Centre to explore local business opportunities
- Any other practical support services to EU SMEs wishing to export to or invest in China.

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