Opportunity Assessment:

*Clean Technologies and Renewable Energy in Tianjin, China*

*Prepared By: GreenWorld Capital, LLC*

*February, 2012*

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About this report

We would like to extend special thanks to GreenWorld’s Tianjin Project Team that was primarily responsible for creating this report: Yan Wang (team leader), Han Zhang, Erika Ho, and James Sun. Xi Zhang and Vivek Stalam provided editorial support. GreenWorld maintains an active internship program with leading academic institutions across the United States. Our interns are extraordinary and we are very grateful for their efforts. Their skill, dedication, creativity and attitude reflect the very best characteristics of the future leaders in the new energy economy and add great value to GreenWorld and our clients.

We would also like to extend our appreciation to Terry Cooke, founder of the China Partnership of Greater Philadelphia and author of “Sustaining U.S. – China Cooperation in Clean Energy” for his review and contribution in finalizing this report.

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“Tianjin is the fastest growing city in the fastest growing country in the world. It is also ground-zero for Beijing’s strategic development of China’s clean energy industry.”

- Terry Cooke, author of *Sustaining U.S.-China Cooperation in Clean Energy*

**Highlights**

As the above quote underscores, there are compelling reasons for companies and investors involved in renewable energy and clean technology to investigate growth opportunities in Tianjin. Tianjin ranked #1 in GDP growth among all 31 provinces and cities in China during the first 6 months of 2011. This growth is predicted to continue, with McKinsey and Company forecasting that between 2007 and 2025 Tianjin’s GDP growth will be the 4th fastest of all the world major cities.

One of China’s four municipalities under the direct administration of central government, Tianjin is poised to strengthen its leadership position as the epicenter of China’s renewable energy and clean technology activities. Tianjin’s central role was announced in China’s 11th Five Year Plan (FYP) and has been solidified in the 12th FYP which was approved in 2011.

This report is intended to provide summary information to companies and investors interested in exploring opportunities in Tianjin.
About Greenworld Capital, LLC

GreenWorld Capital, LLC (“GreenWorld”) is an international merchant bank focused exclusively on serving the financial and strategic needs of cleantech companies and investors in the U.S. and abroad.

GreenWorld’s senior professionals have completed over 400 transactions with an aggregate value approaching $10 billion. Complementing this broad transaction experience is extensive cleantech industry knowledge backed by a network of international relationships and a suite of proprietary information tools. GreenWorld is well positioned to identify and implement effective strategic and financial solutions on behalf of public and private companies as well as their investors in the areas of M&A, tax equity, debt and equity capital.

GreenWorld works diligently to anticipate industry trends, rather than simply react to them and is committed to be a creative source of innovative ideas and opportunities for our clients and partners. With offices in Philadelphia and Palo Alto in the U.S. and Nanjing in China, GreenWorld provides geographical coverage of North America and Asia while maintaining numerous relationships which provide the firm access to European and other overseas markets.

Unlike many other firms, which are active in multiple industries, GreenWorld’s sole focus is the cleantech and renewable energy sector. GreenWorld believes that the complexity of the cleantech environment, as well as the magnitude of its potential, demand dedication. GreenWorld delivers its investment banking services with a client-centric perspective. In addition on the merchant banking side, GreenWorld proactively pursues entrepreneurial opportunities that emerge as a consequence of today’s dynamic global energy marketplace and the underlying environmental challenges driving national policies in this marketplace.

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Executive Summary

Tianjin has emerged as China’s premiere hub for cleantech and renewable energy deployment. It is an international port city and the largest seaside city in the North of China, located 137 km away from Beijing, the capital of China. Its central role was announced in China’s 11th Five Year Plan (FYP) which was approved in 2006 and has been solidified in the 12th FYP which was approved last year.

The 12th FYP focuses on reducing pollution, increasing energy efficiency and ensuring a stable, reliable and clean energy supply. Tianjin is at the epicenter of much of the priority clean tech and renewable energy activity in the FYP. More specifically, Tianjin’s Binhai New Area is focusing on the development of four key sectors of renewable energy: wind power industries, solar PV (please refer to Glossary at end of this report), energy storage (e.g., a green battery for EVs) and lighting, especially LEDs. To spur development and growth of these green energy-related industries, the government is offering incentives such as interest-rate subsidies and reduced income taxes for investment from outside China.

Tianjin has been an economic powerhouse. In the first half of 2011, Tianjin recorded gross product of RMB509.865 billion, a 16.6 percent year-on-year increase placing Tianjin first among 31 provinces and cities in China for GDP growth. Soon Tianjin is expected to surpass the Guangzhou region as the No. 3 economic engine in all of China. The region’s economy is diverse, it’s human capital pool extensive (e.g., the “local” population exceeds 12 million and Beijing is less than an hour away by train) and its education system is top tier.

The region’s long-term outlook is very promising. The Tianjin’s projected compound annual GDP growth of 12 percent is, according to the McKinsey Global Institute, the 4th fastest growth of all cities in the world; this momentum will propel Tianjin’s overall economy to become the 11th largest of all economic entities in the world by 2025. The region’s advantageous location, vibrant economy and comprehensive infrastructure should sustain and support its continued growth.

Tianjin has attracted significant investment capital from home and abroad. Approximately 60% of the Fortune 500 Companies have a presence in Tianjin. The Tianjin Economic-Technology Development Area (TEDA) and various government related agencies have created an environment in which Tianjin has blossomed into China’s showplace for innovation, advanced technology development and financial reform - - it is a place where you want to have a presence.
I. Introduction to Tianjin

a. Fact Sheet

<table>
<thead>
<tr>
<th>Population – Urban</th>
<th>4,342,770</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population - Municipality</td>
<td>12,938,224</td>
</tr>
<tr>
<td>Population Density</td>
<td>1,100.2/km² (2,849.5/sq mi)</td>
</tr>
<tr>
<td>Population Rank in China</td>
<td>6th</td>
</tr>
<tr>
<td>Area - Urban</td>
<td>174.9 km² (67.5 sq mi)</td>
</tr>
<tr>
<td>Area – Metro</td>
<td>5,606.9 km² (2,164.8 sq mi)</td>
</tr>
<tr>
<td># of County Level Divisions</td>
<td>15 districts, 3 counties</td>
</tr>
<tr>
<td># of Township Divisions</td>
<td>240 towns and villages</td>
</tr>
<tr>
<td>GDP in 2010</td>
<td>RMB911 billion (US$141 billion)</td>
</tr>
<tr>
<td>GDP per capita in 2010</td>
<td>RMB62,403 (US$9,681)</td>
</tr>
<tr>
<td>City’s average disposable income per head</td>
<td>RMB21,430 (US$3,137)</td>
</tr>
<tr>
<td>Foreign Investment in 2010</td>
<td>RMB73 billion (US$10.8 billion)</td>
</tr>
</tbody>
</table>

b. Economic Overview: Structure and Momentum

Tianjin, one of China’s four municipalities under the direct administration of central government, is poised to strengthen its leadership position as China’s cleantech and renewable energy hub. It is an international port city and the largest seaside city in the North of China, located 137 km away from Beijing, the capital of China. Its central role was announced in China’s 11th Five Year Plan (FYP) which was approved in 2006 and has been solidified in the 12th FYP which was approved last year. Tianjin has strong economic winds at its back.

Tianjin has a national mandate for clean energy leadership under China’s two most recent FYPs. Under the current 12th FYP (2011-16), Tianjin is specifically mandated as the testbed for technology deployments to help reduce pollution, increase energy efficiency, and ensure a stable and reliable supply of clean energy. Tianjin is at the epicenter of much of the priority clean tech and renewable energy activity in the FYP. More specifically, Tianjin’s Binhai New Area (TBNA,) one of four specially designated industrial zones in Tianjin, is emphasizing the development of four key sectors of renewable energy: wind power, solar PV, energy storage (e.g., a green battery for electric vehicles) and LED lighting. To spur development and growth of these green energy-related industries, the government has offered incentives such as interest-rate subsidies and reduced income taxes for foreign direct investment.

Tianjin is an economic powerhouse. During the first half of 2011, Tianjin recorded gross product of RMB509.865 billion which translated to a 16.6 percent year-on-year increase
thereby placing Tianjin first among 31 provinces and cities in China for GDP growth; this followed exceptional growth for the region during 2010 (please see chart at bottom of this page).

The Tianjin’s compound annual GDP growth positions Tianjin, according to the McKinsey Global Institute, as the 4th fastest growth of all cities in the world and will propel Tianjin’s overall economy to become the 11th largest of all economic entities in the world by 2025. The region’s superior location and comprehensive infrastructure should sustain and support its continued growth. Finally, per McKinsey’s projections, Tianjin will be the 3rd largest megacity in all of China in 2025 (please see following map).

The region’s economy is diverse, it’s human capital pool extensive (e.g., the “local” population exceeds 12 million and Beijing is less than an hour away by train) and its education system is top tier. The recently expanded Tianjin Binhai International Airport is being expanded again to handle up to 40 million passengers a year. Per the Civil Aviation Administration of China, the average annual compounded growth rate of the number of passengers arriving through Tianjin’s airport was 23.0% between 2000 to 2008. Growth in industrial activity registered 9.5 percent, according to the National Bureau of Statistics Tianjin branch.

GDP of the first 10 cities in China in 2010

<table>
<thead>
<tr>
<th>City</th>
<th>GDP (Billion US$)</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai</td>
<td>256.3</td>
<td>9.9%</td>
</tr>
<tr>
<td>Beijing</td>
<td>209.3</td>
<td>10.2%</td>
</tr>
<tr>
<td>Guangzhou City</td>
<td>163.3</td>
<td>13.0%</td>
</tr>
<tr>
<td>Shenzhen</td>
<td>146</td>
<td>10.7%</td>
</tr>
<tr>
<td>Tianjin</td>
<td>141.3</td>
<td>16.5%</td>
</tr>
<tr>
<td>Chongqing City</td>
<td>118</td>
<td>17%</td>
</tr>
<tr>
<td>Suzhou City</td>
<td>113.39</td>
<td>11%</td>
</tr>
<tr>
<td>Hangzhou</td>
<td>90.66</td>
<td>16.7%</td>
</tr>
<tr>
<td>Wuxi City</td>
<td>90.1</td>
<td>13.1%</td>
</tr>
<tr>
<td>Qingdao</td>
<td>88.66</td>
<td>12.9%</td>
</tr>
</tbody>
</table>
c. Energy Overview

Tianjin generates virtually all of its electricity from coal, and most of the demand (73%) comes from the industrial sector. Tianjin is dependent on the import of coal (mostly from other provinces within China) since no coal is produced within Tianjin. Additionally, 18% of its electricity is imported because the electricity generated locally is insufficient to meet the current energy demand. Since Tianjin's electricity demand far exceeds supply, the pressure to improve energy efficiency is great and growing. Approximately 1.6 billion m² of Tianjin’s building stock is not compliant with the energy efficiency standards set by the municipal government. Furthermore, co-generation facilities have the potential to supply 85% of end users’ heating needs. Although most of the region’s energy providers are state-owned enterprises, there are priority policy mandates encouraging private and foreign investment to accelerate the development of renewable energy sources.

II. Industrial Zones

a. The Tianjin Binhai New Area (TBNA)

TBNA, located on the eastern coast, encompasses 2,270 km² which includes three administrative regions (i.e., the Tanggu District, Hangu District and Dagang districts) and eight industry functional zones under construction as well as world-class Sino-Singapore Tianjin Eco-City (“SSTEC”); in all, TBNA has a coastline of 153 km and a population of 1.72 million. With many competitive advantages, it has become the most technologically-advanced and dynamic of China’s “New Areas.”

It has strong industrial foundations; during 2007 TBNA registered Industrial Output value of RMB628.3 billion and high-tech industrial output represented 47% of the total output. Tianjin attracted the equivalent of US$62 billion in foreign capital during 2009 when more than 15,000 foreign-funded enterprises registered in TBNA, including 89 Fortune 500 enterprises. The TBNA region accounts for about 27% of the country's science and technology talent pool. TBNA is also an experimental zone that is authorized to evaluate and implement a variety of major economic initiatives and reforms in advance of their broad adoption in the rest of China.

b. The Tianjin Economic-Technological Development Area (TEDA)

TEDA is one of many special ‘economic development zones’ specifically sanctioned by the central government of China. The Ministry of Commerce issues a comprehensive appraisal on investment environment of all national-level development zones which covers eight major indicators, including overall economic strength, infrastructure and operation cost. For 14 years in a row, TEDA has topped the list.

• A Platform for Foreign Investment

By the end of Dec 2010, TEDA had approved 4,870 overseas projects in aggregate from 76 countries and regions (including Hong Kong, Macao and Taiwan) representing a total investment of US$62.2 billion. Many Fortune 500 Companies have invested in 158 projects in
TEDA. TEDA focuses on four main industries as follows:

· **A Link to the Rest of China and the World**

TEDA’s success is coupled to its strategic location. As the heartland of the Tianjin Binhai New Area, it sits right at the converging point of the Circum-Bohai Economic Belt and the Beijing-Tianjin-Hebei megalopolis. To the east is Tianjin Port and to the west is the Tianjin Binhai International Airport. After decades of significant infrastructure investments, TEDA also enjoys easy access to a myriad of expressways and railways, including the Beijing-Tianjin Express Train, which provides a 30 minute commute between the two cities.

· **Tianjin Export Processing Zone**

In April 2000, with the approval of the State Council, Tianjin Export Processing Zone was established with a planned area of 2.54 km². As one of the first 15 state-level export processing zones, Tianjin Export Processing Zone enjoys various preferential policies granted by the State such as highly efficient and speedy customs supervision procedures, flexible and convenient foreign exchange control systems, and taxation incentives with outstanding advantages. The Zone encourages investment from home and abroad.

· **An Eco-friendly City**

Building an eco-friendly and resident-friendly city has always been an integral part of TEDA’s mission. It obtained the ISO14000 Environment Quality Certification in 2001 and was named a pilot zone for Environment Management of China’s Industrial Parks in 2002. TEDA has successfully promoted energy efficiency, set up a material recycling model for other industrial parks, and realized waste minimization breakthroughs. It also has encouraged a “zero emission” pollution standard. TEDA advocates a life-cycle perspective regarding the economic use of raw materials by emphasizing reuse and recycling of wastes wherever possible so as to optimize both resource efficiency and pollution mitigation before, during and after the production process.

c. **The Sino-Singapore Tianjin Eco-City (SSTEC)**

SSTEC is a landmark bilateral project between China and Singapore with private-sector investment and development. Located in the TBNA (40 km away from Tianjin city centre), the 30 km² SSTEC was conceived to create a model sustainable community, supporting 350,000 residents, to better meet the needs of an urbanizing China. Total investment in SSTEC is expected to reach US$10 billion. SSTEC is a world-class showcase of sustainability and efficiency.

· **Eco-industrial Park (EIP)**

Construction for the EIP at the northern region of SSTEC began on Dec 30th 2009. It will cost about RMB4 billion to develop and is expected to draw in RMB4 billion worth of investments and about 10,000 jobs when completed. The EIP will be home to light clean industries organized into green business clusters such as clean energy, green building, green transport, clean water, and clean waste management.

· **Key Features and Goals of SSTEC**

- **Environmental Quality Certification**
- **Zero Emission**
- **Zero Discharge and Efficiency**

- **Usage of Renewable Energy** - Renewable energy should account for at least 15% of the energy utilized in SSTEC by 2020. Possible sources of renewable energy for SSTEC include geothermal energy, hydropower and solar power.
- **Proportion of Green Buildings** - All buildings in SSTEC should meet green building standards.

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- Eco-culture, Wetland and Biodiversity - An 'eco-culture' with regional features is being developed for the purpose of promoting a green and healthy style of life as well as balanced consumption. To accomplish this, existing wetlands and biodiversity will be preserved and SSTEC will draw a significant part of its water supply from non-traditional sources such as desalinated water.

- Integrated Waste Management – This will be implemented with particular emphasis on the reduction, reuse and recycling of waste. A light-rail transit system, supplemented by a secondary network of low-carbon trams and buses, will be the main mode of transportation in SSTEC.

d. Tianjin Binhai Hi-Tech Industrial Development Area

Tianjin Binhai Hi-Tech Industrial Development Area, approved by the State Council in March 1991, is one of the original national hi-tech industrial parks in China. It covers a total planned area of 85.74 square kilometers. Tianjin Binhai Hi-Tech Industrial Development Area includes several industrial parks, with Huayuan Industrial Park and Binhai Industrial Park at the core. Tianjin Binhai Hi-Tech Industrial Development Area’s leading industries include renewable energy, biomedical, IT, equipment manufacturing and advanced services. Nearly 5000 enterprises operate in the Tianjin Binhai Hi-Tech Industrial Development Area. The annual GDP growth rate of this area has been above 30% for 10 years. Furthermore, 60% of the Tianjin region’s green energy-related sales come from this economic development area, which has a fiscal budget of RMB200 million per year to support renewable energy-related development activities.

· Huayuan Industrial Park

- Covers about 1.75 million square meters, construction area of about 1.9 million square meters, total investment RMB30 billion.
- Includes the Goldin 117 Building, a 1,959 foot tall building to be completed in 2015
- Also includes high-end residential areas

· Binhai Industrial Park

- The core area of Tianjin Binhai Hi-Tech Industrial Development Area
- Area of 30.5 Km²
- China’s renewable energy industry production and application base

III. China’s 12th FYP

a. 12th FYP

Chinese planners have created several preferential tax, fiscal and procurement policies designed to develop seven “Strategic Emerging Industries” (SEIs): biotechnology, new energy, high-end equipment manufacturing, energy conservation and environmental protection, clean-energy vehicles, new materials, and next-generation IT. The government is projected to spend more than RMB4 trillion on these industries during the 12th FYP period (2011-16) with an aim to increase SEI’s economic contribution from today’s approximately 5 percent of GDP to 8 percent by 2015 and 15 percent by 2020.

The 12th FYP contains preferential measures for developing energy-efficiency technology, as well as for mandating a 16 percent reduction in carbon emissions (from the 2010 level). Below is a summary graph of renewable energy targets for hydro, wind, solar and...
For the first time, this FYP holds local government officials accountable for attaining ‘green development’ goals and sustainability targets, such as water consumption per unit of GDP, and the proportion of GDP that is invested in environmental protection. The 12th FYP includes a cap on domestic coal production, China’s largest energy source and a major contributor to the country’s environmental problems. It also contains significant support for nuclear and hydropower development with wind power having a threefold expansion in capacity over the term of the plan and domestic natural gas utilization expected to double.

b. Chinese Government Incentives

The Chinese government intends to use comprehensive interest-rate subsidies as well as other incentives to support development of the new energy and new materials sectors. The Ministry of Finance stated that the central government would provide a subsidy for the retrofit of public buildings in selected cities to reduce energy consumption by more than 20% (or 30% in some cases) over the five-year period. Revenues earned by green projects, or green service companies are eligible for a three-year exemption and a three-year 50% reduction in corporate income taxes. The Corporate Income Tax Law and its implementing regulations provide other tax incentives to purchases of special-purpose equipment related to environmental protection as well as energy and water conservation. Many enterprises engaging in activities in the green sector are classified as ‘high’ and/or ‘new’ technology (i.e., R&D-focused) enterprises, which can be granted a reduction in CIT tax liability.

Products or services contributing to “comprehensive utilization of resources” through recycling or energy-efficient processing have been eligible for VAT exclusion since 2008. For the green building sector, VAT exemptions are given for selling self-manufactured products which contain a minimum 30 percent recycled material in their inputs. Wind turbine component importers and equipment manufacturers also receive VAT benefits. Among the government tax incentives specifically targeted at this sector is an immediate VAT rebate...
(50 percent) applied to selling electricity from wind power.

**c. Tianjin’s Investment Opportunities**

Historically, Tianjin’s position as the largest coastal city in North China has made it one of China’s earliest and most active players in international trade as well as an experienced and frequent recipient of foreign investment. Of the top 500 enterprises in the world, more than 110 have invested a total of $77.8 billion USD in Tianjin. xii In 2009, the average value of contracts signed with foreign enterprises was $33.3 million, representing an increase of 20.5% from 2008. Coincident with the development of TBNA, Tianjin’s trade and investment promotion campaigns have been increasingly successful. In 2009, contracted foreign capital directly utilized by TBNA reached $10.5 billion and accounted for vast majority of such activity in the Tianjin region. xiv

**IV. Cleantech in Tianjin**

**a. Key Clean Tech Activity in Tianjin xv**

Tianjin’s national mandate for clean energy leadership under China’s FYP is potent. Based on a newly issued government policy which will boost the development of new energy (government incentives include interest-rate subsidies and reduced income tax rates) for the next three years, TBNA will spend RMB1.8 billion in support of four key sectors of renewable energy: wind power, solar PV, energy storage, and lighting. Please see Appendix A for a summary of Tianjin’s priority clean tech initiatives.

**Other Clean Tech Areas of Regional Interest**

**b. Energy Efficiency** - Tianjin’s economic development is energy intensive. Tianjin’s energy intensity has dropped gradually as Tianjin adjusted its industry structure and phased out old production facilities. Tianjin’s target is aligned with the national target which is an emission intensity reduction of 40-45% per unit of GDP by 2020, a huge challenges for Tianjin government. xvi

**c. Smart Grid xvi** - China’s Smart Grid challenge of delivering “intelligent” electricity to it’s enormous population has captured the attention of companies and investors across the world. China’s smart grid market is expected to rise at an annual growth rate of 29.1 percent over five years from a base of $22.3 billion in 2011. xvii

**d. Geothermal** - Tianjin was the pioneer city in geothermal space heating in China and the Wanglanzhuang geothermal field was the first field explored in Tianjin in the 1980’s.xix

**e. Hydro Power** - China is one of the world’s largest hydropower producers. The country’s hydro installed capacity is increasing by 15 GW every year, and expected to reach 380 GW by 2020 from just under 200 GW today. As the biggest industrial center in North China, Tianjin has a strong position in heavy-duty hydropower equipments.xx

**f. Electric Vehicles** - China’s government adopted a plan aimed at turning the country into one of the leading producers of hybrid and all-electric vehicles within three years, and making it the world leader in electric cars and buses thereafter. xxi Tianjin was authorized in 2002 as one of pilot cities in China for the use of electric vehicles.

**g. Biomass and Biofuel** - Biofuels will play an important role in mitigating dependence on fossil fuels and lowering carbon dioxide emissions. Tianjin University is one of the Bio-energy pioneers in the state; they have established a strong reputation in biodiesel production technology.
V. Conclusion

Tianjin, the largest industrial city in north China, is now emerging as a leading municipal driver of the global economy as well as a leading innovator across the various sectors of the new ‘clean energy economy.’ As the national test bed for China’s national clean tech and renewable energy initiatives, Tianjin offers both a target-rich corporate environment and a favorable investment environment. The region’s economic development areas aggressively promote both the formation of capital and the application of technology.

Tianjin\(^1\) is the economic twin sister to China’s capital, Beijing, much the way New York City has emerged as Washington, DC’s economic twin in the US. Tianjin’s railway connecting to mainland China, its large international airport, and its world-ranked port combine to make the region a commerce hub and gateway to mainland China. Looking to the future, Tianjin’s universities and research institutes assure an abundance of human talent and technological innovation.

GreenWorld believes there is no better place for foreign companies to establish a presence in China and a place from which to expand that presence into other regions of China than Tianjin.

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\(^1\) Tianjin and Philadelphia, GreenWorld’s home town, have been “twin cities” since 1980.
VI. Glossary
BIPV- Building Integrated Photovoltaics
CdTe- Cadmium Telluride
CIT- Corporate Income Tax
CO2- Carbon Dioxide
CPV- Concentrating Photovoltaic
EIP- Eco-Industrial Park
EV- Electric Vehicle
FYP- Five Year Plan
GDP- Gross Domestic Product
GW- Gigawatt
ISO- International Organization for Standardization
IT- Information Technology
LED- Light-Emitting Diode
M&A- Mergers and Acquisitions
MW- Megawatt
Ni-H- Nickel-Hydrogen
PV- Photovoltaic
R&D- Research and Development
RMB- Renminbi
SEI- Strategic Emerging Industries
SO2- Sulfur Dioxide
SSTEC- Sino-Singapore Tianjin Eco-City
TBNA- Tianjin-Binhai New Area
TEDA- Tianjin Economic Development Area
VAT- Value Added Tax
VBR- Vanadium Redox Battery
VII. References


3 Source: “Tianjin Ranks No. 1 by GDP Growth in China”, from Middle East North Africa Financial Network (2011)


7 Source: Official Website of Tianjin Economic-Technological Development Area (TEDA), http://en.investteda.org/


X “China’s 12th Five-Year Plan: How it actually works and what’s in store for the next five years”, by APCOworldwide (2010)


XII Eunice Ku and Dezan Shira, “Selected Tax Incentives in China’s Environmental Sector”, on Understanding China.EU (2011)


XV “China’s 12th Five-Year Plan: How it actually works and what’s in store for the next five years”, by APCOworldwide (2010)


### Appendix A. Overview of Tianjin’s Priority Clean Tech Industries

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>Thin film, CPV, BIPV, crystalline silicon cells, CdTe cells</td>
<td>No</td>
<td>Nankai University and CETC’s 18th institute provide 70% of core technical personnel for Chinese solar companies</td>
<td>Output: 1.8 GW</td>
<td>Output: 4.1 GW</td>
<td>Tianjin currently covers entire supply chain of solar industry</td>
</tr>
<tr>
<td>Wind Power</td>
<td>Wind turbines, offshore turbines, components of turbines</td>
<td>Under construction.</td>
<td>Tianjin University’s research on wind and grid-connection; Hebei University’s research in turbine components</td>
<td>Output: 4.5 GW Revenue: RMB45 billion</td>
<td>Output: 6.45 GW Revenue: RMB65 billion</td>
<td>Currently research focus on turbine design, offshore turbines, converter equipment, integration between wind power and desalination</td>
</tr>
<tr>
<td>Energy Storage</td>
<td>Anode/cathode material, electrolyte, battery components, lithium-ion battery, the Ni-H battery, the Super lead-acid battery, super capacitors, VBR</td>
<td>No</td>
<td>Nankai University, Tianjin University, Hebei University actively research energy storage; Tianjin Lishen Battery Co., Ltd. has a research center which has developed its own battery and super capacitor technology innovation system</td>
<td>Investment: RMB15 billion Revenue: RMB50 billion</td>
<td>Investment: RMB30 billion Revenue: RMB100 billion 10% global market share</td>
<td>Current supply chain includes raw materials, lithium-ion cell manufacturers, and integrated battery companies</td>
</tr>
<tr>
<td>Lighting</td>
<td>Semiconductor lighting, large scale LED backlights, high power LED white-light source</td>
<td>Under construction.</td>
<td>Tianjin University has a Semiconductor Light R&amp;D Center, a national leader in LED research; Tianjin Zhonghuan Semiconductor Co., Ltd. has several research centers in Tianjin</td>
<td>Revenue: RMB5 billion</td>
<td>Revenue: RMB10 billion</td>
<td>Tianjin currently covers entire supply chain of lighting industry</td>
</tr>
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