

Green Economic Development with Renewable Energy Industries

SUMMARY

The local government of a city can actively support the establishment of local renewable energy (RE) industries, such as the creation of clusters for private actors, public stakeholders and research institutions. Such synergies can also stimulate innovation and economic development. A recent successful example of this can be found in the City of Dezhou in China. In 1997, the municipality and local government of Dezhou elaborated a Development Plan for the Dezhou Economic Development Zone to centralise solar technology research and development, manufacturing, education and capacity building. The local government of Dezhou would attract direct investments by implementing supportive policies on land-usage, tax-return and financing to overcome the relatively small size of the local solar energy industry, the lack of well-developed financing mechanisms for growing industrial companies and the shortage of sector-related skills and expertise. Dezhou now boasts over 120 solar energy enterprises which generate an annual turnover of USD 3.46 billion. It has established a mature technology innovation system, as well as excellent capacities in engineering, research and commercialisation. This case study, among others, illustrates how local governments are essential to stimulating RE industry and can simultaneously catalyse economic development in the region.

Figure 1: Solar Valley Micro E Hotel, a landmark of Dezhou, and a solar energy, micro-emission hotel.



INTRODUCTION

Many companies are looking for new business models and opportunities to develop, produce and sell sustainable products and services; be they multinationals, large manufacturers or small- to medium-size enterprises. While the pace of growth of this sector remains difficult to measure, the trend is clear: green businesses are rapidly growing. The RE sector is one such example. A growing number of firms have developed new products and services used for the generation of solar, wind, hydro, geothermal and bioenergy, amongst others. In 2011, global investments in the RE sector were estimated at USD 257 billion. In light of the increasing world demand for energy and finite fossil fuel reserves, alongside global efforts to reduce anthropogenic climate change, the RE sector is increasingly gaining importance.



Through the proximity of activities, cities hold a number of opportunities to realise cluster effects and industrial agglomeration economies. Economic actors can realise opportunities for specialisation, optimised resource flows, and diffusing new products and services to a large local population. The density of population and infrastructure in cities also allows for greater interaction and exchange of ideas, technologies and specialised labour, which together can encourage innovation.

A local government of a city has the opportunity to support the establishment of local RE industries. Local governments can play an important role in promoting the linkages between the economic development of the city and the diffusion of RE. As such, local governments can play any of the following five development roles:

- » *Incubators* pursue a strategy to create a new industry sector, with the aim to make the location attractive to business development. This requires a vision, committed city leaders and creative, resourceful support from within the local government.
- » *Reformers* are motivated by their history, such as an industrial legacy with challenging future prospects. Green business such as RE offers a window of opportunity for the city administration to support the reform of a city's economic (and environmental) profile.
- » *Multipliers* see a city cluster as a tool to strengthen their existing RE industry, creating momentum and additional economic value in the sector (ideally leading to more locally taxed income).
- » *Executors* are local governments that serve as a local node of implementing broader (i.e. national) policy frameworks. The 'initiative power' of the municipality can be of significance, potentially even as a bottom-up mobilisation factor for improving policy frameworks.
- » *Visionaries* are local governments that base their cluster policy on a longer track record of ambitious environmental policies. Having already succeeded in implementing a green agenda, the municipality aims to co-develop the local entrepreneurial potential through establishing a local cluster.

The case of Dezhou shows that the city espoused the role of an *incubator* (developing a viable industry cluster) and that of *multiplier* (by drawing upon the existing local solar business).

Cluster

The term cluster refers to a geographic concentration of interconnected economic and innovative activities in a particular field. Clusters exist whether companies are aware of it or not, and exist independently of any intervention, project or organisation. A cluster consists of members from industry, academia and government institutions (the triple helix) - often co-ordinated by an organisational unit in the cluster.

Source: University of Amsterdam and ICLEI (2012)

Cluster initiative

The term cluster initiative denotes a cluster development project or cluster organisation. It refers to the governance structure in place to manage a cluster. The main functions are to strengthen collaboration within the cluster and to facilitate joint activities between units in the cluster, e.g. information exchange, training and seminars, joint corporation projects, marketing and public relations, as well as internationalisation.

Source: University of Amsterdam and ICLEI (2012)

CONTEXT

A SOLAR CITY STRENGTHENS ITS REGIONAL ADVANTAGES: DEZHOU, CHINA

The urban economy and the industrial sector of the City of Dezhou were lagging behind eastern regional counterparts until the 1990s. Later, the city began to prosper with the economic growth of the entire country, as well as through the efforts of the local government.

Dezhou is geographically located between Beijing-Tianjin Metropolitan Economy Zone and Jiao Dong Peninsular Coastal Economy Belt. Being a third tier city with no harbour or airport, Dezhou's arteries are highways and railways. The city is situated in a transportation hub at the core of multiple highways and speed railways including the high speed rail between Beijing and Shanghai.

Through its geographical location the city receives large amounts of sunlight (2,666 hours per year or 7.3 hours per day), meaning Dezhou receives the second most intense total annual solar radiation throughout the country. The theoretical solar energy resource is approximately 164,000 GWh/year, according to Wind and Solar Energy Resources Centre of China Meteorological Administration.

CITY IN FOCUS:
Dezhou,
Shandong Province,
China
Population 5.8 million
(2011)

DESCRIPTION OF ACTIVITIES

DEZHOU ECONOMIC DEVELOPMENT ZONE

In 1997, the Municipal Party Committee of Dezhou, together with the local government of Dezhou, elaborated the Development Plan for the *Dezhou Economic Development Zone*. The main goal of the plan was to attract investments. To reach this goal, decision makers started to design policies geared at building up the Zone's hard and soft infrastructure on a piece of previously unused land. An investor-oriented service community was promoted by the municipality to improve administrative efficiency.

The plan stipulated that any company can invest and build in the Zone, as long as it meets the requirements of China's national industrial development policy, does not pollute, and has high growth potential.

In 1998, the city government started to build the Dezhou Economic Development Zone, with the endorsement of the People's Government of Shandong Province. The Zone developed around different sectors, such as solar energy, biomedicine, environmental conservation equipment manufacturing, and new materials. From the very beginning, however, the most important industry developing in the Dezhou Economic Development Zone was the solar energy industry.

Dezhou's Commitment in the National Context

Dezhou's commitment to developing RE was strengthened by China's Central Government legislation and policies. In 2005, the Standing Committee of the National People's Congress promulgated the *Renewable Energy Law* in China. This Law seeks to promote the development and utilisation of RE, improve the energy structure, diversify energy supplies, safeguard energy security, protect the environment, and realise the sustainable development of the economy and society in China. In September 2007, the State Council formally announced the *Renewable Energy Medium to Long Term Development Plan*. With this plan the Chinese government presented policies that would facilitate the use of RE sources to account for 10% of total energy consumption by 2010 and 15% by 2020. In 2008, the National Development and Reform Committee released the *11th Five-Year Renewable Energy Development Plan*. Its objectives included the promotion of solar energy, with the aim of having 150 million m² of total installed capacity of solar water heaters (solar thermal systems) and 300,000 kW of solar photovoltaic (PV) by 2010. According to the *12th Five-Year Plan*, the installed capacity of solar power projects will, by 2015, amount to more than 21 Gigawatt (GW).



Figure 2: The 20 MW Solar PV Power Station developed by China Energy Conservation and Environmental Protection Group in Dezhou. Amongst the largest solar PV power plant in Asia.

DEZHOU IS CHINA'S SOLAR CITY

In August 2005, the Standing Committee of the local government of Dezhou called an extended meeting to propose the transformation of Dezhou into China's Solar City. An already developed solar energy industry, coupled with the national *Renewable Energy Law* to promote RE released by the national congress in the same year, contributed to the local government's decision. A special Solar Industry Promotion Committee was established to execute the *Dezhou Solar City Plan*. The committee was comprised of the mayor, the party secretary, and officers from the departments of reform and development, urban planning, finance, and new technologies. Over the following years, a mix of measures was put in place to support the solar energy supply and demand, including the following:

Incentives to business. The municipality implemented supportive policies on land-usage, tax-return and financing. These new policies allowed land prices to be negotiated on a case by case basis, promoting favourable prices depending on when the business would move into the Zone, the industry sector and the business size. Foreign companies, export-oriented companies or high-tech companies received a two-year tax waiver, followed by a three-year tax reduction. In addition, during the following three years, if the company remained in the high-tech sector, it would receive a 50% tax rebate. The Dezhou local government also lowered the barriers to entrance of new solar energy ventures by allowing enterprises with a capital reserve of less than USD 157,480 (RMB 1 million) to qualify for two-year instalments. Low-interest loans and financing channels were provided to enterprises with patented technologies.

Integration of solar energy systems into new buildings. The *Million Roof Project* was launched in 2008 in the urbanised areas of the municipality to support local RE deployment. The project required all new residential buildings in Dezhou to be equipped with solar thermal facilities: low to mid-level buildings (less than 12 levels) to install solar thermal rooftop facilities and high-level buildings to install wall-mounted or centralised solar thermal equipment. The policy also applied to the renovation of existing buildings. Since 2009, the local government of Dezhou has spent USD 7.87 million (or RMB 50 million) each year and the national government has spent no less than USD 4.72 million (or RMB 30 million) a year in support of the RE building integration demonstration project.

The local government of Dezhou also released the *Announcement to Accelerate Solar Energy Application*. This required Dezhou Urban Planning Administration and Construction Administration to supervise construction, consultancy, and check-upon-delivery of newly designed or built buildings, to fulfil the requirements of integrating solar thermal or PV energy. The *Thousand Bathroom Project* was launched in the same year and targeted rural households, aiming to provide a solution to the scarcity of hot water in winter for the peasants in Dezhou by building solar public bathrooms in villages. The project costs were shared between the solar water heater manufacturers, the government of Dezhou and local rural residents.

Solar energy companies in the Zone benefited from the regional tax return and preferential land use policies, as well as educational and promotional activities. As a consequence, the growth of these solar energy companies boosted the reputation and capacity of the Zone. A mutually beneficial relationship between the local government, private businesses, and the economic development of the city as a whole was established. Among the 216 projects built and operating in the Dezhou Economic Development Zone, 120 projects are RE related.

Photovoltaic demonstration project. Beginning in 2008, the City of Dezhou implemented the *5555 Photovoltaic Demonstration Project*, which installed, or replaced conventional lights with solar lights at 50 traffic junctions, 5 main roads, 5 residential districts, including providing street and landscape lighting in 5 scenic areas.

Research and Development (R&D). Both the private sector and the municipality have undertaken numerous initiatives to boost R&D in the solar energy industry. Companies like Himin Solar invest heavily in R&D. The local government has also led and been involved in more than 20 National High-tech R&D Programmes on solar energy. Additionally, in September 2010, Dezhou hosted the 4th International Solar City World Congress.

Challenges to the economic development strategy. Initially, the city had to overcome the relatively small size of the local solar energy industry, poorly developed financial mechanisms for growing industrial companies, and the shortage of sector-related skills and expertise. In addition, the absence of quality standards led to the emergence of a large number of workshop-type solar water heater manufacturers in Dezhou and in other parts of China. Manufacturers engaged in a local solar thermal “price war”, which led to a number of quality issues with parts and a reduction in post-sales services.

To address the shortage in expertise, the local government of Dezhou built local knowledge in advanced technologies. A solar energy department and an RE research institute was established in Dezhou College to attract and develop talents for research institutes and solar energy enterprises. Solar energy technology was launched as a specialised major subject at Dezhou Technology College and Vocational Schools. The local government of Dezhou also sought to develop co-operation with research institutes in Australia, Japan, and Germany.

RESULTS

ECONOMIC AND FINANCIAL RESULTS

Between 2005 and 2010, the annual growth rate of the solar energy industry was over 30%. In 2006, about 30,000 people were engaged in solar energy-related businesses in Dezhou. Out of 66,000 new jobs that were created in Dezhou in 2010, 30% were in the solar energy business. At the time, Dezhou had over 120 solar energy enterprises, generating an annual turnover of USD 3.46 billion (RMB 22 billion).

Himin Solar Corporation

The choice of the sectors (solar energy, biomedicine, etc.) were driven by national industrial development priorities (China’s *9th 5-Year Plan*) and by the industries that were already locally settled and prospering. The Himin Solar Corporation for example, one of the earliest solar water-heating manufacturers in China, was founded three years before the creation of the zone. Huang Ming, Chairman of Himin Solar Corporation and a pioneer of solar thermal energy in China, published the *Solar Energy Popular Science Newspaper* in 1996. In the same year, he started a lobbying campaign called *10-Thousand Miles Solar Energy Popularization* by giving lectures targeted at 100 cities, of which Dezhou was amongst. In 2011, Huang Ming won the *Right Livelihood Award* for developing cutting-edge technologies for harnessing solar energy.



Figure 3: Integration of solar energy into new buildings in Dezhou

In 2011, the gross domestic product (GDP) of Dezhou Economic Development Zone hit USD 2.5 billion (or RMB 15.7 billion), which is 139 times greater than in 1998. Among the 216 new investment projects in the Dezhou Economic Development Zone, 120 projects are RE related. A RE industry cluster has also emerged in Dezhou which is not exclusively restricted to the Economic Development Zone. Today, the 130 RE businesses in the Dezhou Economic Development Zone generate an annual revenue of USD 3.15 billion (or RMB 20 billion).

According to the *Dezhou National New Energy Demonstration City Development Plan* formulated by Dezhou Development and Reform Committee in 2010, 10,000 jobs will be created in the RE sector (solar energy, biofuel, ground source heat pumps, new energy vehicles) between 2011 and 2015. Around 5,300 jobs will be created in the PV industry and about 3,200 jobs in the solar thermal industry. During the same period, the estimated market demand created for the solar PV industry is USD 687 million (or RMB 4.363 billion) while for the solar thermal industry this figure is USD 252 million (or RMB 1.6 billion).

TECHNOLOGICAL RESULTS IN R&D

Dezhou has established a complete technology innovation system plus excellent capacities in engineering, research and commercialisation. Core technologies include high efficiency solar thermal vacuum tubes, solar thermal power generation, solar central air conditioning and integrated solar systems for the building sector. Since 2010, Dezhou's solar businesses have been developing over 500 new solar thermal technologies, production processes and products each year.

A number of R&D initiatives have created additional investment opportunities and improved Dezhou's reputation as China's Solar City. The Ministry of Science and Technology and State Intellectual Property Office of the People's Republic of China approved Dezhou as the only National Research Centre for Solar Thermal Utilisation and Engineering Technology and as an independent intellectual property (new energy) pilot base.

ENERGY AND ENVIRONMENTAL RESULTS

Coal is still the dominant energy source in Dezhou. In 2009, 3.6 million tonnes of standard coal were consumed. The energy consumption per unit of GDP was 1.17 tonnes of standard coal per USD 1,574.8 (RMB 10,000). In 2008, Dezhou's urban air pollution index was 2.86, with sulphur dioxide (SO₂) at 37.3%, and nitrogen dioxide (NO₂) at 13.1%. According to Dezhou's development plan, by 2015 the energy consumption per unit of GDP will decrease to 0.875 tonnes of standard coal. The adoption of RE will be critical to realising this reduction. Transformation from coal power generation to RE is expected to significantly reduce SO₂ emissions in the coming years.

Solar water heater use exceeds three million square meters in Dezhou, approximately equal to the total installed base in the European Union or twice that of the United States. Integrated solar thermal or PV technology are in 95% of new buildings and those under construction in Dezhou.

COSTS AND FINANCING

In the ten years spanning from 1998 to 2008, the local government of Dezhou allocated USD 15.7 million (or RMB 100 million) annually to invest in the solar energy industry. This amounts to approximately 2% of Dezhou's municipal total fiscal revenue of 2008. By 2010, Dezhou stakeholders had invested an accumulated USD 1.23 billion (or RMB 7.8 billion) in solar energy development, production and application. In addition to local government fiscal expenditure, the private sector is a key funding source, with approximately every dollar invested by the government stimulating USD 78 in private investment.


LESSONS LEARNT FOR REPLICATION

An adopted holistic strategy can be realised in collaboration with different stakeholders. Investment and policy initiatives that promote RE industries can be optimised when considered within a more integrated development plan. Policies aiming to support the production and the supply of RE businesses need to be matched with a broader strategy to boost local demand and act as an attractive environment for investment. Such a holistic approach can be facilitated by an implementing body engaging different stakeholders, including experts in urban planning, finance and new technologies, who hail from public institutions as well as business and academia.

Fully explore local assets and potential. Characteristics of the locality such as the socio-economic structure, climate (e.g. irradiation levels) and geography can be important assets for a strong relationship between RE development and economic growth. While it might be difficult to build an industry cluster from scratch, applying local resources, developing adequate infrastructure and establishing a supportive legal framework can provide an important cost-effective stimulus.

Renewable energy as a leading sector for urban development. RE has proven to be a leading sector of the urban economy and due to the variety of RE sources allows for the use of many different technologies and appliances. These are characterised by a great number of backward and forward linkages, which provide an important stimulus to the economy as a whole, as they also support the development of small and medium-sized enterprises in their start-up phase. With energy being centrally positioned within the production process of sustainable goods and services, it can provide a community with important arguments towards the promotion of a green image in the region. However, specialisation in one sector can bring economic risks in a global market.

Different levels of intervention are possible. While the creation of a RE industry cluster might not be suitable for all urban areas, different levels of intervention are possible. RE policies might offer new employment opportunities, which in turn can improve the quality of life of the community.



First steps towards a RE cluster, Casablanca, Morocco (population 3.7 million)

Casablanca, Morocco, is developing a vision to increase its renewable energy supply to the local industry. With 39% of Morocco's total industrial activity in Greater Casablanca, the city has benefited from a well-trained workforce in the engineering sector. Casablanca's Regional Investment Center is investigating the possible establishment of a cluster, which can act as a one-stop-shop for potential investors in the metropolitan region.

Source: University of Amsterdam and ICLEI (2012)

Green Power Valley, Baoding, China (population 11.2 million)

In 1992, the Chinese government approved the creation of the Baoding National High Tech Industrial Development Zone as one of 54 similar initiatives in China. After a number of corporate success stories from the development zone, the municipality decided to establish the first RE park in China in 2003. The national *Renewable Energy Law* that was passed in 2005, served as an additional incentive for Baoding's local authorities to further strengthen the city's RE profile. The local government published a range of regulations to encourage investment in the so-called power valley, ranging from tax exemptions to supporting new arrivals of workers' families. Today Baoding's green power valley hosts more than 200 companies.

Source: University of Amsterdam and ICLEI (2012).

Renewable Energy Hamburg Cluster, Hamburg, Germany (population 1.8 million)

Hamburg, Germany, historically was an important sea-port that has seen a growing wind turbine manufacturing scene since the mid-1980s, when the various wharfs throughout the wider region struggled to keep businesses afloat. In terms of the engineering, wind turbine towers can be built with the infrastructure and know-how provided by the local ship-building industry. Fighting an economic downturn, the municipality saw the potential of the cluster as a means to diversify Hamburg's economic portfolio. In 2011, the local government introduced supporting policies and set-up with existing interested private companies, a cluster agency.

Source: University of Amsterdam and ICLEI (2012)

Further readings:

See additional relevant case studies at www.iclei.org/casestudies, for example:
89 - Renewable Energy in Low-income Housing - Betim, Brazil
113 - Stakeholder involvement groups for Local Renewables in Betim and Porto Alegre - Betim and Porto Alegre

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ACKNOWLEDGEMENTS

Author: Wei Yong, Working Committee of Low-carbon Economy, China Association of Plant Engineering Consultants (CAPEC)
Contributors, editors and reviewers: Policy Advisory Services and Capacity Building Directorate (PACB) of IRENA; Richard Simpson, Nicola da Schio (ICLEI WS); Maryke van Staden and Siegfried Zöllner (ICLEI ES); and Ulrich Mans (University of Amsterdam).