Summary Report

of

The Public Private Dialogue on Renewable and Clean Energy Trade and Investment

-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

August 11, 2014

Beijing, People's Republic of China

APEC Committee on trade and Investment

Publication Number : **APEC#215-CT-01.7**

Summary Report

of

The Public Private Dialogue on Renewable and Clean Energy Trade and Investment

-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

August 11, 2014

Beijing, People's Republic of China

APEC Committee on trade and Investment

Publication Number : **APEC#215-CT-01.7**

Project Number: CTI 23 2013T

Overseen by

Mr. CHEN Chao

Department of International Trade and Economic Affairs

Ministry of Commerce (MOFCOM), China

Project team

Project Consultant: WANG Bo

Team Members: YU Xiang, WANG Ran, GUO Lin

The report is written by

WANG Bo, YU Xiang, WANG Ran and GUO Lin

University of International Business and Economics, Beijing

Institute for Urban and Environmental Studies, Chinese Academy of Social Sciences, Beijing

Produced for

the Asia-Pacific Economic Cooperation (APEC) Secretariat

35, Heng Mui Keng Terrace Singapore 119616

Tel: (65) 6775 6012   Fax: (65) 6775 6013

E-mail:info@apec.org

Website: www.apec.org

Table of Contents

Summary Report

of

The Public Private Dialogue on Renewable and Clean Energy Trade and Investment

-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

August 11, 2014

Beijing, People's Republic of China

I. Background of the Project

APEC leadership has put climate mitigation and sustainable development as top priorities in the APEC Leaders Declarations and Ministerial Meetings. The project aims to help to fulfil the APEC Leaders' recognition that "…joint research, development, deployment and transfer of technologies will be crucial in our shared efforts to address climate change." The project will also contribute to the APEC goal of "increasing the utilization and dissemination of EGS Environmental Goods and Services, reducing barriers to trade and investment in EGS, and enhancing the capabilities of economies to develop their EGS sectors" as described by APEC Leaders in 2010.The project will also directly contribute to the APEC Strategy for Investment, which says" APEC will strengthen its activities to increase member economies' ability to create investment opportunities through information sharing on investment opportunities regarding particular sectors…"

The project was designated to fulfil the APEC Leaders' recognition that climate mitigation and sustainable development are top priorities for APEC community. The implementation of the project will help to achieve the "green growth" goal and implement the "APEC EGS Work Program" in a focused and effective way through information sharing on successful cases of RCE trade and investment.

In 2013 AELM, APEC endorsed the proposal of Public Private Partnership on Environmental Goods and Services. It is envisaged this project will serve as a kick off activities on Public Private Partnership.

II. Objectives of the Project

This project's objectives were three-fold:

1. To establish a platform for industry representatives and government officials to carry out dialogue on issues related to RCE trade and industry development, with a view to increasing understanding, experience-sharing, facilitating trade and investment, and preventing trade frictions.

2. To raise understanding and awareness on some aspects of EGS trade, including, the role and forms of trade and investment in RCEs, how investment can disseminate technologies, the facilitation and promotion of RCE trade and investment, and development of RCE sector, through sharing experience, lessons, opinions and best practices on successful cases of RCE trade and investment in APEC;

3. To develop recommendations on enhancing coordination and cooperation on EGS trade and investment issues of importance, with a view to assisting economies (both public and private sectors) in designing and implementing policies, strategies and actions to promote EGS particularly, RCE trade and investment, and avoid frictions, as well as improving the business climate in APEC region and creating a strategic vision of developing regional RCE industry for the economic benefit of all APEC economies.

III. Implementation of the Project

To meet the above objectives, a dialogue was held on 11August, 2014 on the sidelines of SOM3 2014 in Beijing, China. Over 20 Speakers and about 100 active participants presented and exchanged their views on current RCE developments in the region. Among them are leaders from private sectors, government, experienced negotiators and academics sharing their first hand experiences including both challenges and best practices. Based on the discussion, key proposals and consensus are reached and submitted to the CTI and was accepted. The proposal regarding the promotion of future RCE trade and investment in the region is further included in the ministerial meeting later 2014 and reflected in the APEC leaders' declaration. (The link is: http://www.apec.org/Meeting-Papers/Ministerial-Statements/Annual/2014/2014_amm/annexb.aspx)

IV. Summary of the Dialogue

Mr Zhang Shaogang, Director General of Department of International Trade and Economic Affairs and Dr John Larkin, the APEC CTI Chair, attended and opened the dialogue. Over 90 participants of public and private leaders and academics from APEC and non-APEC economies participated in the dialogue. 23 speakers gave speeches on RCE trade and investment at the meeting. Among them, 6 government officers, 6 private sector leaders (Hanergy, Canadian Solar, GE, Dow Chemical, Trina Solar, UL) , 5 RCE trade and business association leaders and 6 academics. At least 14 APEC economies sent their delegates to attend the meeting as speakers or active participants: Australia, Canada, Chile, China, Chinese Taipei, Indonesia, Japan, Korea, Malaysia, New Zealand, Russia, Thailand, United States, and Vietnam. EU also sent their delegate to attend the meeting.

The main discussion topics were round the trend of RCE trade and investment, challenges RCE sectors face and proposals to promote and facilitate RCE trade and investment in APEC region.

Speakers are all encouraged by the robust growth and development of RCE in the past years and optimistic about its future growth potential in APEC region (e.g. Liu Hengwei, Li junfeng, Qin Haiyan, Frank Zhu). Particularly, Chinese speakers (government officers and RCE industries associations) all stress that Chinese government has very ambitious objectives to increase the share of RCE in China's energy portfolio which would mean potential international trade and investment opportunities for all APEC stakeholders. However, China also faces challenges ranging from policy innovation to standards harmonization and other issues which require international cooperation (XUAN Xiaowei). Developing economies (e.g.

Thailand) also call for cooperation among APEC economies in capacity building and best practice sharing.

Speakers and participants expect APEC to lead the multilateral arrangement in RCE trade and investment for the next round world trade negotiations. Both speakers and participants agree that the PPEGS is an ideal platform to discuss RCE trade and investment in APEC as it is not only an energy issue but more an environmental and sustainable development one. (Peter Brun, the SETI-Alliance)

Tariff barriers and non-tariff barriers are among the key concerns of RCE private sector leaders. Particularly all the solar business leaders are very concerned that the ongoing antidumping investigations on solar sector in some economies will seriously blow the emerging promising sector and set back it development which will benefit nobody. Some ongoing antidumping investigation is more politicalized than seeking an equitable trade scheme for solar energy products. Different economies' different situations have to be discerned.

All business leaders strongly call for more predictable transparent and rigorous governmental support including fiscal and financial leverages to enable the RCE sectors to survive, grow and eventually compete fairly with fossil fuels. They strongly call for APEC economy stakeholders, particularly, policy makers and industrial associations, to reach an agreement on governmental subsidies for RCE sectors among APEC community so as to avoid trade frictions and disputes among members. Some speaker calls for the identification of best practice of government supporting policies for RCE investment among APEC as the first step to forge consensus on government subsidies (John Smirnow). Some speakers call for setting up an RCE fund in APEC to support RCE investment.

All participants agree that technology innovation ("the Third Industrial Revolution" by Frank Zhu from Hanergy) is one of the key factors that drives the cost of RCE deployment down and eventually competitive to fossil fuels. Therefore, the public sector should provide adequate enabling environment to incentivize stakeholders to invest cross border in RCE research and development. An RCE technology friendly environment includes a comprehensive IPR protection mechanism, networking with academic institutes and convenient cross border flow of researchers. (Jake Colin, Global Trade Issues)

Another key focus of the discussion at the dialogue is the harmonization of the standards of RCE products and services. Public- private, private –private dialogue and cooperation should be carried out to facilitate the harmonization of RCE Products and services standards. APEC could provide platform for such communication and cooperation. (Lisa Salley from U Laboratory)

V. The Official Output of the Dialogue

2014 APEC Ministerial Meeting Annex B - ***APEC Statement on Promoting RCE Trade and Investment.***

"Promoting Renewable and Clean Energy (RCE) trade and investment is crucial for meeting our current and future energy needs. Greater use of RCE will diversify our energy supply and reduce environmental impact. In recent years, the market for RCE has been consistently growing, but various patterns of barriers in cross border trade and investment remain a persistent challenge. In 2014, a Public Private Dialogue on RCE Trade and Investment was held to launch the APEC Public Private Partnership on Environmental Goods and Services (PPEGS), promote RCE trade and investment and increase the utilization of RCE. Based on previous APEC work on RCE and the recommendations of the 1st PPEGS dialogue, bearing in mind the non-binding and voluntary nature of APEC, we agreed to undertake the following:

1. Promote market openness by further addressing trade barriers on RCE products among APEC member economies, work together to fight against all forms of trade protectionism in the RCE sector and deepen our cooperation on monitoring and resisting protectionist measures;

2. Prevent trade frictions in cross border RCE trade and investment by strengthening coordination and cooperation among APEC economies, including by holding public private dialogues regularly and building broader understanding and trust among APEC economies;

3. Promote regulatory coherence and cooperation in areas affecting RCE trade and investment, including by exploring the alignment of standards and certification systems in the RCE industry, to ensure the supply of high quality RCE products in this region;

4. Ensure that all government support and incentive programs aimed at promoting environmental goods and services are transparent and consistent with WTO rules;

5. Strengthen the protection and enforcement of intellectual property rights and recognize the importance of comprehensive and balanced intellectual property systems that provide for and protect the incentives that encourage creativity and innovation, and provide substantial support to RCE research and development;

6. Encourage economies to report progress in realizing the objectives of the 2011 Leaders Declaration on Trade and Investment in Environmental Goods and Services on voluntary basis;

7. Encourage RCE technology cooperation amongst APEC economies with a view to contributing to sustainable and inclusive development; and

8. Engage the private sector and academia more deeply and frequently in RCE related policymaking to support APEC cooperation and create more cooperative opportunities for RCE industries among APEC economies.

We are committed to create an enabling environment for RCE trade and investment to contribute to sustainable development and common prosperity in the Asia Pacific region. We direct officials to develop knowledge sharing and capacity-building activities relevant to implementing these actions, including exchanging views, experiences, and best practices to promote RCE trade and investment."

VI. Highlights of the speakers' speeches at the PPPEGS

Opening Speeches

In the opening speeches by Mr. Zhang Shaogang, Mr. John Larkin from APEC CTI , Mr. Liang Zhipeng from China's National Development and Reform Commission and Professor Zhao Zhongxiu from the University of International Business and Economics, they all stress the importance of developing RCE in APEC economies which is the key to sustainable development, energy security and climate change mitigation. They all pointed out the importance of the liberalization of RCE trade and investment and the need to reduce trade barriers so as to further facilitate and promote the development of RCE in the region. They call all the participants to contribute to the output of the conference give their constructive proposals.

Voices from the public sector:

Mr. Ben Ben Jarvis from Australian Embassy in Beijing introduced Australian government's policies and targets on RCE. The Emissions Reductions Fund is the centerpiece of Australia's national program promoting RCE development.

Mr. Liang Zhipeng (NDRC, China) introduced China's government policy instruments to promote the development of renewable energy in China and also China's expectation of international collaboration on RCE. (China)

Mr. Liang summarizes China's key policies in promoting RCE development as follows: push forward the development of renewable energy in China?

1. Encourage the diversification of renewable energy applications to meet the purpose of synchronous development of concentrated and distributed renewable energy generation;

2. Promote the innovation of business models and financing mechanisms to support PV enterprises' transformation and upgrading;

3. Enhance the support for the development of distributed solar PV to realize national targets and energy transition;

4. Strengthen international exchanges and cooperation; optimize the industry's development environment

In the perspective of international collaboration, Mr. Liang points out:

1. Chinese renewable energy industry made great contribution for global economy and employment growth and environment improvement;

2. APEC should play a major platform to strengthen the lessons learning and experiences exchanges in RCE development among APEC member economies;

3. APEC members should strengthen communication and collaboration on technologies development and experiences sharing;

4. APEC members should reach a consensus on fair trade among APEC economies and therefore to avert trade frictions and protectionism and realize win-win among all participants in renewable and clean energy trade and investment.

Mr. Terry Collins, the Chair of APEC EGEE&C, New Zealand, shared the renewable energy strategy and the scenarios of New Zealand's renewable portfolio. New Zealand set the ambitious target of 90% of electricity generation from renewable sources by 2025. Mr Collins shared New Zealand's experience in renewable investment and development as follows:

- Renewables will thrive
- True electricity prices are visible
- Fossil fuel subsidy reform
- Long term hedge markets or PPA
- Political targets, e.g. 90% renewable electricity
- Price on carbon helps as does political leadership
- Renewables need government support to establish an industry

Mr. Jake Colvin from National Foreign Trade Council (USA) talked about how to create an enabling environment for RCE Trade and Investment from the three key motivations from the private sectors.

While the public sector focuses on the promotion of long range of R&D Investment in RCE the private sector is mainly motivated by 1) Reduction of tariffs and nontariff barriers; 2) Patent protection & legal certainty; 3)Integration into global supply chains.

Tariff and nontariff barriers are still significant on green (RCE) technologies. Within WTO members, over 60% members impose tariffs (with an average tariff of 7.4%) on wind power technologies while over 43% members impose tariffs (with an average tariff of 8.8%) on solar technologies. Among the nontariff barriers, Local content restrictions & procurement requirements product based standards are in the way of RCE trade and investment. Therefore, APEC should play an active role to reduce costs of goods & services, e.g. eliminating tariffs; increase fair competition by removing local content & procurement restrictions; and harmonize technology based standards.

Effective Intellectual Property Rights protection drives and supports international partnership on green/REC technology.

Globalization and externalization of R&D in green /RCE sector would enhance the global supply chains of RCE goods and services.

A well-defined action plan will enhance APEC's leading role in promoting RCE trade and investment: Continue to work on tariff liberalization and implement APEC leadership's EG tariff reduction commitment and update inventory of environmental goods and examine NTBs carry our fact based research and discussions to eencourage legal certainty and effective IP protection; build global supply and research chains and link RCE goods and services with data base.

Representatives from Thailand proposed the following points:

1. Conducting a cooperation scheme on harmonization of renewable and clean energy machinery and equipment standards. APEC could be able to use the same RCE certification such as solar panel, inverter etc. It could guarantee quality of goods and makes more confidence for investors to trade and invest of clean energy projects in the region.

2. The Study on intelligent monitoring system for RCE plant performance. It could cover the issues about standard practices, software to fully interpret operational data.

3. Pilot projects on small scale or community level RCE and capacity building activities. Small scale RCE is playing important roles in developing economies with plenty of energy

resources such as biogas system in animal farms, biomass gasification in agricultural field. It is very difficult to let people initiate RCE projects by themselves, so system installations is needed for this kind of area. Capacity building activities for local people is also needed to operate and maintenance RCE systems in long term.

4. Regional projects on RCE feasibility study in each APEC economies. Focusing on resource potential, capability for invest and laws and regulations in each economy could help APEC evaluate big picture of future plan and strategy.

Mr. John Larkin from APEC CTI commented on the role of PPPEGS in APEC:

Larkin Points out PPPEGS is a very good platform to discuss the frictions over RCE trade among public and private stakeholders and sometimes it is more effective than public to public approach. RCE services have yet to be fully discussed at the meeting and should be discussed in the future dialogue.

Mr. Chen Chao from the Ministry of Commerce gave a concluding speech. He summarized the conference with 3 key words: appreciation, passion and action. He appreciated all the speakers and active participants' passionate discussion about how to promote the environment of RCE trade and investment. He calls for actions from all stakeholders from all APEC economies to continue to communicate and contribute to the liberalization of the RCE trade and investment environment for a more sustainable APEC economic growth and prosperity.

Voices from trade associations and NGOs

Ms. Lisa Salley from UL LLC , USA, talked about how to create an Enabling Environment for Renewable/Clean Energy Trade and Investment.
International harmonization of standards is extremely beneficial for the renewable energy sector.
The International Electrotechnical Commission (IEC) Renewable Energy Scheme (IECRES) is developing harmonized standards in the fields of marine, solar and wind power. Organizations such as UL is one of the stakeholders that provide seed documents for the scheme. Harmonization of renewable and clean energy standards will enable stakeholders such as developers, financial institutions, and insurers understand better the technical aspects for the project and therefore to avert or minimize risks.

Mr. Qin Haiyan from Chinese Wind Energy Association introduced China's wind power status and prospects.

China has ambitious plan for wind power development. By 2015 the total wind power installed capacity will reach 100GW and the annual electricity generation will be more than 190TWh, which will be over 3% of the total power. By 2020, the total wind installed capacity will reach 200GW generating capacity will reach 390 TWh.

The fast growing demands for wind power equipment in Chinese market also benefit the wind turbine manufactures in China. The manufacturing capacity and technology innovation capacity in wind turbines allow wind turbine producers to export their wind turbines to 27 economies by 2013.

Keys to the success of China's wind development:
Government creates a better enabling environment for investment: the government made overall plan in the regions with rich wind resources to integrate different elements such as the wind energy resources, electric power market, regional power grid structure and interregional

power conditions into a coherent environment for wind power producers and other stakeholders.

The government policy incentivize both corporative and individual investors to invest in wind power distribution projects so as to create a favorable infrastructure for wind power production and distribution.

The local government provides financial incentives for the offshore wind power producers: The feed-in tariff subsidy for offshore wind power in Shanghai is 0.2 yuan/kWh.

Internationally, China seeks to participate in making international wind power technology standards, strengthen international exchanges and cooperation in wind turbine testing and certification system, and promote international mutual recognition of wind power unit testing and certification system in China.

Enterprises are also encouraged to participate in international collaboration with global partners to realize the internationalization of wind power value chain management includes different links of R&D design, production and application;

Mr. Peter Brun from SETI Alliance gives a speech titled with "Why do we need an international sustainable energy trade agreement (SETA)?"

Mr. Brun believes Trade barriers influence green industry's ability to optimise supply chains and lower cost of technology/energy. He demonstrated numerous disputes over RCE trade as follows to persuade the stakeholders that there is an imperative need for a trade agreement on RCE/green goods and services.

Mr. Brun believes that a Green Trade Agreement, from the policy perspective, will be able to support the formulation of policies addressing international markets for sustainable energy goods and services which will contribute to climate change mitigation, improve access to energy, enhance energy security and stimulate green growth; and from the business perspective ,will be able to secure open and stable trade and investment frameworks, and ensure a level playing field for sustainable technologies and related supply chains so as to combat climate change, lower the cost of technology and expand green jobs.

He listed 10 reasons for establishing a SETA

1. SETA will secure the scalability of clean technologies, allow economics of scale, and bring down the cost of energy for the benefit of consumers and climate change mitigation.
2. SETA will help both developed and developing economies reduce dependency on fossil fuel imports, and enhance their energy security with a switch to energy efficiency and renewable energy sources such as biofuels, hydro power, solar and wind power.
3. SETA will make clean technologies more affordable for consumers and developing economies, thus offering their populations climate friendly access to energy.
4. SETA will help reduce mortality from indoor air pollution caused by inefficient firewood or charcoal-based cooking, with better access to modern cook stoves such as solar or biomass fuels.
5. SETA will help rural children study at night without access to grid-based electricity with solar-lighting facilities.
6. SETA will accelerate the time until clean technologies will be cost-competitive without subsidies and replace fossil fuels.

7. SETA will bring welfare gains for all parts of the world, not least of which in employment for the establishment of plants and their annual service and maintenance structures.
8. SETA will speed up clean and green technology innovation due to increased growth in revenues and research and development.
9. SETA will help secure larger returns on investment flows to local economies as these technologies do not rely upon imported fuels.
10. SETA will establish a level playing field for global competition, and allow free sourcing and open supply chains securing the best price to quality ratio for customers and end consumers.

Mr. Li Junfeng from the Chinese Renewable Energy Industry Association gave a talk on "Promoting a Better Future for Renewable Energy Trade and Investment.

He proposed that APEC should: 1.Increase utilization of Renewable and Clean Energy (RCE) and enlarge RCE market through development of policies and regulations; 2.Promote market openness, eliminate trade barriers and avert trade disputes among APEC member economies;3. Strengthen the establishment and management of RCE industry standards; and 4. Encourage RCE technical know-how sharing and intellectual property rights protection.

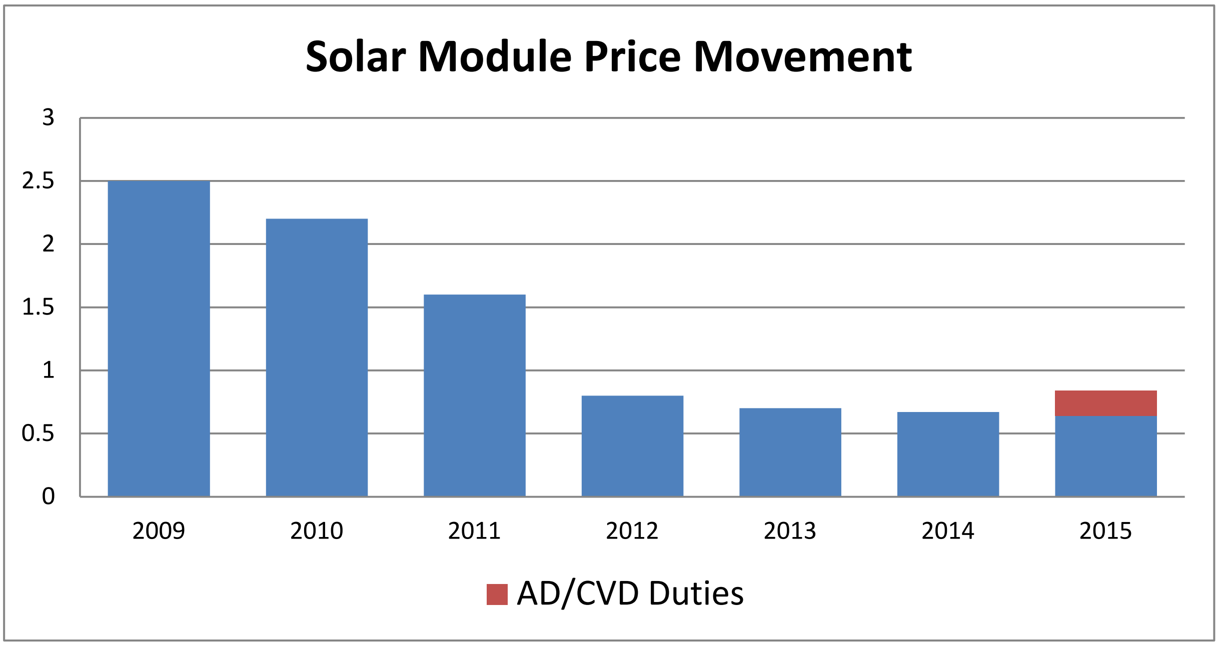
Mr John Smirnow from Solar Energy Industry Association, USA Highlighted 3 issues in his talk:

1. In order to facilitate RCE trade and investment in APEC region it is important to develop RCE products quality standards in the region. E.g. in Solar industry there is a need for the development of quality standards, solar products should be viewed as an investment rather than a consumable;
2. He calls for the APEC Secretariat to review the 2013 APEC leaders' Declaration regarding the collaboration on the development of RCE technology with APEC as a platform to find out what has been achieved and what is the gap between the objectives and reality and what needs to be done next;
3. The government has to play an important role to help to grow and nurture the RCE industries. Hope APEC Secretariat could continue to do work to identify the best practices and specifies of the government policies that facilitate the development of renewable energies. This is particularly important for the economies that are just starting to develop RCE.

Voices from Private sectors

Mr. Shawn Qu from Canadian Solar introduced the development road map of his company as an MNC in renewable energy as well as its social and environmental achievement. Mr. Qu emphasized his concern about the newly emerged tariff block solar goods is facing which will reverse the trend of the declining cost of solar goods in the past years.

Graph 1 Trade protectionism hinders the healthy development of solar market (Canadian Solar, APEC PPPEGS,11 August,2014)



Frank Zhu from Hanergy shared his company's successful experience in developing renewable energy, particularly solar energy.

Mr Zhu stated that the host economies' favorable tariff scheme for RCE producers and a decent standard infrastructure are critical external factors that affect the development of RCE. Meanwhile, Mr.Zhu believes the renewable (namely solar) energy technology revolution will be the driving power for the Third Industry Revolution. He shared Hanergy's successful experience in solar technology innovation. Hanergy realized solar energy technology leapfrogging by global integration and localization of solar technologies. By acquiring the overseas solar companies with strong R&D capacities, Hanergy strengthened its R&D team and developed the forefront technologies in thin film solar panel and other fields;

Henergy's story is a good example of the companies from emerging economies that is confidently integrating into the APEC and global market through doing and learning approach and begins to contribute positively in the upper stream of the value chain in renewable energy development.

Colin Yang from the Trina Solar talked about how to create a healthy environment for RCE growth from the perspective of solar sector. He is very optimistic about the potential competitiveness of solar energy from the past development and deployment of solar technology. However he is concerned about the trade barriers that solar products face will have adverse effect on the installment of solar energy worldwide. He calls for dialogue and consultation to solve the difference among stakeholders.

Mr Alex Lu from GE Renewable Energy China shared GE's success in renewable energy investment. According Mr Lu, GE's success in RE development lies in the support of sustainable infrastructure, technology advancement, customer orientation and long term partnership with stakeholders and business partners.

Dr Peng Ningke from Dow Chemical, China

1. RCE energy sector's weight in each APEC economy's energy portfolio varies. While some economies have a larger proportion of RCE in their energy mix, others have a much smaller share. Therefore, there is big potential for APEC economies to further increase the share of RCE in their energy sector. 2. The government should create a Level playing field for all players from both public and private , domestic or international enterprises so that the available clean energy technologies could be deployed in the industry; 3. A case of Win- win story between Chinese and US energy corporations China US energy collaboration program initiated by 50 American companies working with Chinese counterparts focusing on how to commercialize the mature clean energy technologies . The program facilitates investment and trade both ways between US and China; 4 harmonization of standards of RCE products and equipment will benefit all stakeholders in the region. RCE related regulations should be transparent among APEC members so as to avoid frictions; 5. RCE industry is just emerging. The conventional "unclean" energy could be made clean or cleaner energy via technology innovation and deployment.

Voices from the academics

Professor Li Shizhong from Tsinghua University talked about biofuels for economic transition and ending environment and energy stalemate. Due to the food security factor, some raw material for biomass energy production is constrained, such as corn which can be both used to produce diesel and as food for both humans and cattle. Professor Li demonstrated a new technology of biofuel: Advanced Solid State Fermentation developed by Tsinghua University: using sweet sorghum as the raw material to produce ethanol which is known for its wide geographical adaptability and high production. The application of this technology will ease the tension between food security and environmental security.

Professor XUAN Xiao Wei from the Development Research Center of the State Council, China, talked about the progress China's solar PV sector has made and the challenges it faces from the policy perspective.
China sets up ambitious target of solar power installation: from 2013 -2015, the annual new added solar power capacity is 10GW. A series of policies on tariff reduction, pricing instruction, subsidies, grid access, quality standard and market supervision have been issued. Meanwhile, there are challenges as well: There are gaps between national goals and business incentives. E.g. the capacity of the grid enterprise is yet to meet the demand of transport and distribute the solar power.

Dr. Hengwei Liu from Ha'erbin University of Technology talked about " APEC and the Sustainable Future: Towards a Low-Carbon Growth".

Dr. Liu listed Energy Security, Climate Change, Air Pollution and Energy Poverty as the five problems APEC community faces. To solve these problems requires policy innovation, technology innovation and infrastructure building. The challenges in solving the problems are: 1 developing economies lack the technology innovation capacity; Fossil fuel subsidies are still hindering the development of RCE; Policy uncertainties are affecting the investment on RCE; Trade barriers are affecting the RCE trade. Opportunities: APEC economies are maintaining a high economic growth; Renewable energy are "coming of age"; Significant reduction of cost of renewable energy, e.g. solar PV reduces by 80% since 2008,wind turbine reduces by 29% since 2008.

Dr. Liu calls for capacity building, eliminating trade barriers, end fossil fuel subsidies, and create expectable policy environment.

Dr. Chiharu Murakoshi from Jyukankyo Research Institute, Japan, shared his studies on Energy Saving Companies (ESCO) industry which is a critical area in clean energy management.

ESCO market is dependent on different public and private factors such as government's energy conservation policies, financial environment, and the target field for each ESCO, etc.

Both barriers ESCO faces and successful promotion programs of ESCO are introduced.

Key barriers range from Lack of recognition of ESCO by potential stakeholders, gap in capacity building for ESCOs, lack of support from industry associations, inadequate accreditation or certification system of ESCOs to inadequate financial support, difficulties to introduce ESCO to public facilities, lagged legal system, low energy price and lack of contract spirit.

Promotion programs such as feasibility investigations have been carried out in Japan, China and Thailand (a pilot program implemented). World Bank and the Global Environmental Facility have also carried out feasibility investigations.

Proposed actions to take: energy auditing, pilot programs, introduction ESCO into government facilities, capacity building(preparing guidelines for M&V and standard contract for ESCO projects, introductory manuals for ESCO in public facilities, bidding system adaptation to ESCO),capacity building for financial institutions in forms of training seminars, demonstrations of successful pilot programs, etc.

Keys to success: 1. set up ESCO associations by stakeholders: public sector, private sector, or international organizations; 2. set up accreditation systems; 3. third party evaluation system for energy saving performance;4 financial support from the government in forms of tax reduction/exemptions, low interest loans and loan guarantees; and 5 reinforcement of energy conservation regulations/laws.

VII Case Study

Analysis on Financing Efficiency of China's New Energy

WANG Bo[1] and YU Xiang[2]

Abstract This paper adopted DEA methods to conduct studies and overall assessment of financing efficiency based on financial data from 81 listed companies in China's New Energy Market. It also compared the differences of financing efficiency between different new energy industries and further explored impacting aspects of financing efficiency in these companies. Aimed to objectively reflect current financing efficiency of China's new energy market and to explore underlying reasons, and attempted to provide decision support for optimizing the financing efficiency of these agents, and intended to provide policy suggestion for new energy industry development in China. Research result revealed a dissatisfactory condition of financing efficiency of China's listed companies in new energy market. Under such circumstances, these companies are required to make adjustments on their internal management and to promote technical research and innovation in order to enhance financing efficiency.

Key words: Listed companies in China's new energy market, financing efficiency analysis, DEA method

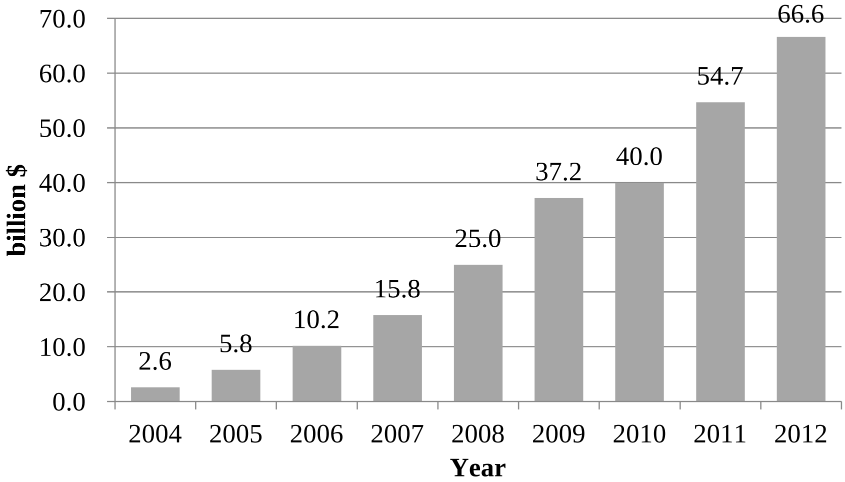
1 Introduction:

As one of the largest energy consumers and greenhouse gas emitters, China has made dedicated efforts to tackle climate change, and has been making efforts to develop the new energy market nationwide. The Chinese government promises to increase the ratio of non-fossil energy to total primary energy consumption to around 15% by 2020. In 12th Five-year Plan, the Chinese government indicates to increase the ratio of non-fossil energy to total primary energy consumption to around 11.4% by 2015.

[1] Dr WANG Bo, Associate Professor, University of International Business and Economics, Beijing
[2] Dr YU Xiang, Institute for Urban and Environmental Studies, Chinese Academy of Social Sciences, Beijing.

During the recent years, China became the dominant performer among the developing economies and shows the steepest and most consistent growth in renewable investment, overtook the U.S. in terms of total annual investment in renewable energy in 2009, and invested from just $2.6 billion in 2004 to $66.6 billion in 2012(show in Chart 1).

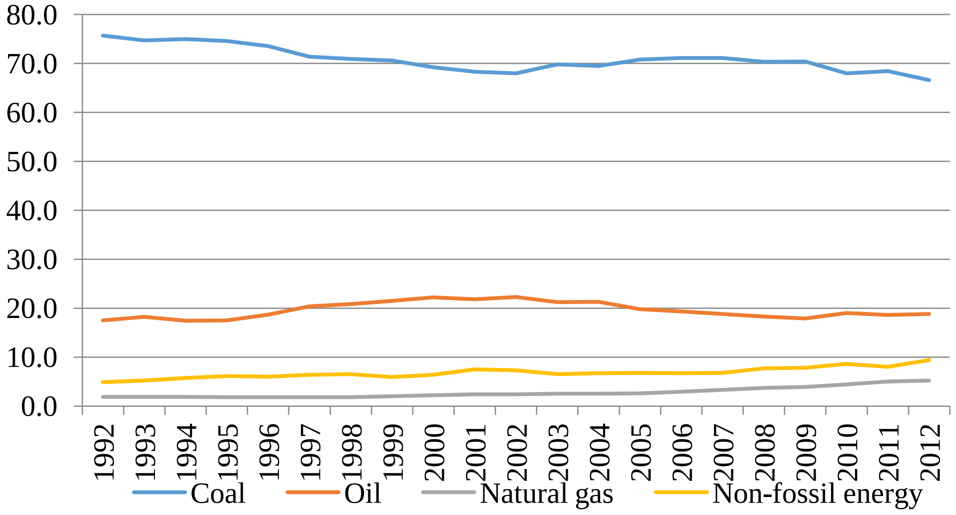
Chart 1. Data source UNEP 2013 Global trends in renewable energy investment



However, fossil energy including coal, petroleum and natural gas still dominates the structure of primary energy consumption at present due to such limitations as energy cost, technical dependence and consumption custom. Chart. 2 describes energy consumption structure in China during 1992–2012. It can be observed in Fig. 2 that fossil energy (including coal, oil and natural gas) is the main source of energy consumption in China, while non-fossil energy (including hydropower, nuclear power, wind power, solar power and others) accounts for a very low proportion of total energy consumption.

Chart.2. Energy consumption in China during 1992-2012.

Date source: Statistical Year Book of China in 2012



Various support policies on new energy development have been released successively. The National Renewable Energy Law, released in 2006 and further amended in 2009, first established the five core policy systems of the national new energy development: total consumption objective policy, Feed-in Law (FIL) policy, categorized electricity pricing policy, costs share policy, and special funds policy. After that, a series of laws, regulations, and implementing rules were published, including investment subsidies, preferential tax, preferential supply price, and R&D supports. In 2010, the first plenary session of the New Energy Commission of China was held in Beijing. It addressed the main tasks that accelerating energy structure adjustment and optimization, and encouraging the development and use of new energy; Later in the same year, the China's New Energy Industry Development Planning was initiated based on the agreements this session has reached. In 2014, Chinese government proposed that energy production and consumer revolution are crucial factors in the national energy system.

Renewable energy resources require substantial up-front capital costs, particularly for those technologies that are not yet commercially competitive, financing of initial capital costs is required. Financial demand will be very crucial during the process, however, How to enhance financing efficiency and optimize capital allocation efficiency are equally crucial for new energy industry.

The word efficiency as defined by the Oxford dictionary states that: 'Efficiency is the accomplishment of or the ability to accomplish a job with minimum expenditure of time and effort'.

Financial Efficiency refers to the efficiency with which scare resources are correctly allocated among competing uses at a period of time to minimize the costs and maximize the profit or use the lowest amount of inputs to create the greatest amount of outputs. Financial Efficiency is a measure of how well an organization has managed certain tradeoffs (risk and return, liquidity and profitability) in the use of its financial resources. (Moore and Jaedicke, 1980)

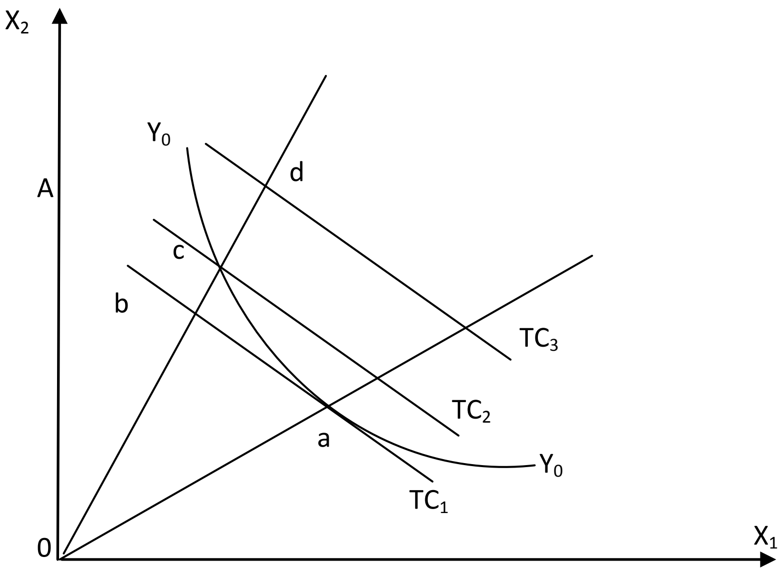
2 Methodology

Several Issues of Efficiency Evaluation

British economist Farrell believes that the efficiency of a company shall include two parts: one is the technical efficiency; the other is the allocation efficiency. The sum of the two efficiencies reflects an overall efficiency of the company(Farrell,1957)

To interpret the concept of the above-mentioned efficiency, we employ the diagram method of efficiency by Coelli, who uses the diagram combining two inputs and one output together to illustrate visually the basic concept of Farrell's efficiency(Coelli, Battese,1996)

Diagram 1: Technical Efficiency and Allocation Efficiency



Suppose the production function of a company is $f\ (X_1, X_2)$ and the Returns To Scale remains the same. In the diagram, X_1 and X_2 are the inputs of two elements. It is inefficient to use the input of the right side of Y_0Y_0 curve to produce Y_0 and impossible to use the input of the left side of Y_0 to produce Y_0 under current technical conditions. TC_1,TC_2 and TC_3 represent three budget constraint lines ($TC_1>TC_2>TC_3$). Therefore, the production on d point is lack of efficiency.

Inefficiency of d point can be divided into two elements: technical inefficiency and allocation inefficiency.

(1) Technical Efficiency (TE). C Point is located on the isoquant curve Y_0Y_0 (oc is the production cost at point c). That is, the input can be reduced during the production of Y0 by adopting the best production technology, improving management level and raising labor productivity. Thus, according to the definition of technical efficiency, the technology at point c is $TE = \frac{oc}{od}$.

(2) Allocation Efficiency (AE) In case of the production at Point c, though technical efficiency reaches 1, c Point will still not be the lowest cost due to the budget constraint lines TC2 which goes through c Point intersects the isoquant curve Y_0Y_0. TC is tangent to the isoquant Y_0Y_0 at Point a. Therefore, the allocation efficiency at Point c is $AE = \frac{oa}{oc}$

Supposing loosening returns to scale unchanged, the above-mentioned efficiency can be divided into Pure Technology Efficiency (PTE) and Scale Efficiency (SE). PTE measures the distance between the visited company and production frontier when Return to Scale is changeable. SE measures the distance between the production frontier with constant returns to scale and the production frontier with changeable returns to scale. For diagram illustration, only single input x and single output y is taken into consideration.

According to the Diagram 2, oc is the production frontier with constant returns to scale (CRS curve) while afegh is the production frontier with the changeable returns to scale (VRS curve). Supposing a company makes production at point i, its technical efficiency is $TE = \frac{bd}{bi}$ （1）

In order to measure the SE of a company's production, loosen the hypothesis of constant returns to scale and suppose the returns to scale is changeable. Then the production frontier is VRS. PTE considering changeable returns to scale:

$$PTE = \frac{bf}{bi} \quad (2)$$

SE:

$$SE = \frac{bd}{bf} \quad (3)$$

Drawing from formulation （1,2,3）: $TE = PTE \times SE$ （4）

Or:

$$SE = \frac{TE}{PTE} \quad (5)$$

Therefore, we can draw the following conclusions:

TE (Technology Efficiency) reflects the capability of obtaining the largest output by a company under the given input (from the angle of output), or the capability with the smallest input by a company under the given output (from the angle of input). TE measures the distance between the visited company and production frontier when Return to Scale is unchanged, and can be divided into PTE and SE. $\frac{OB}{A_4}$ In the model, symbol meaning is as same as the former. We can get PET and RS by model calculation, the relation between which is TE equals to PTE times RS. The paper analyses the TE,PTE and RS of China's new energy companies.

3 Positive Analysis of the financial efficiency of new energy companies

Sample selection and data resource

Sample selection means to determine decision-making units, which actually is to fix comparable reference sets. The paper selects the new energy companies listed from 2008 to 2012 as samples to discuss the financing efficiency of China's new energy companies. The data collection comes from companies listed web etc. Meanwhile, we obtain relative index from the balance sheet, profit and loss statement. According to the division of new energy industry, there are 7 wind power, 34 solar energy, 18 biomass power generation, 10 nuclear power and 12 hydroelectricity industries respectively. When using DEA model to measure efficiency, based on rule-of-thumb method, the number of DMU samples is at least twice as the total of input and output items. In the paper, the sample number 81 is bigger than twice of the total of input and output items, which is in line with the rule-of-thumb of DEA model.

Statistical description on samples

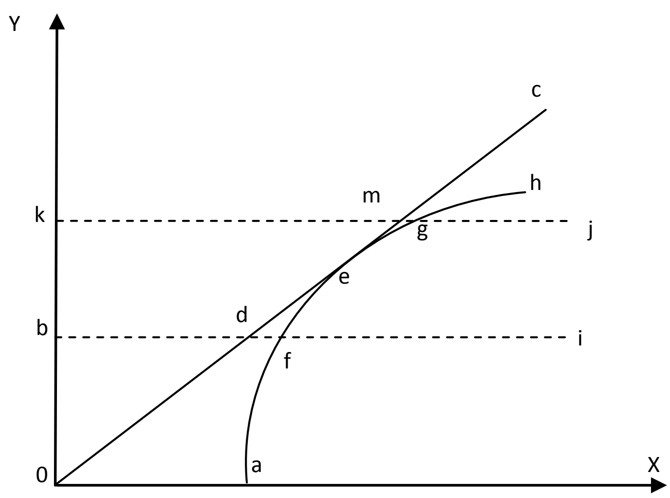
Obtain relative data of various index from the annual report of sample companies in 2012 to find the statistical results(see Table 1 and 2). From the input distribution of sample companies in Table 1, asset size of more than 50% companies is between 1-8 billion with an average debt asset ratio 52.47% and median 54.47%. Debt asset ratio of 50% companies is larger than 50% which means the ratio of new energy companies is high.

(1)AE (Allocation Efficiency) reflects a company's capability to use various inputs in appropriate proportion at the given price.

(2) PTE (Pure Technology Efficiency) measures the distance between the visited company and production frontier when Return to Scale is changeable.

(3) SE (Scale Efficiency) measures the relationship between the production frontier with constant Return to Scale and the production frontier with changeable Return to Scale.

Diagram 2: PTE and SE



Construction of DEA model of financing efficiency of new energy companies

Theoretical overview of DEA

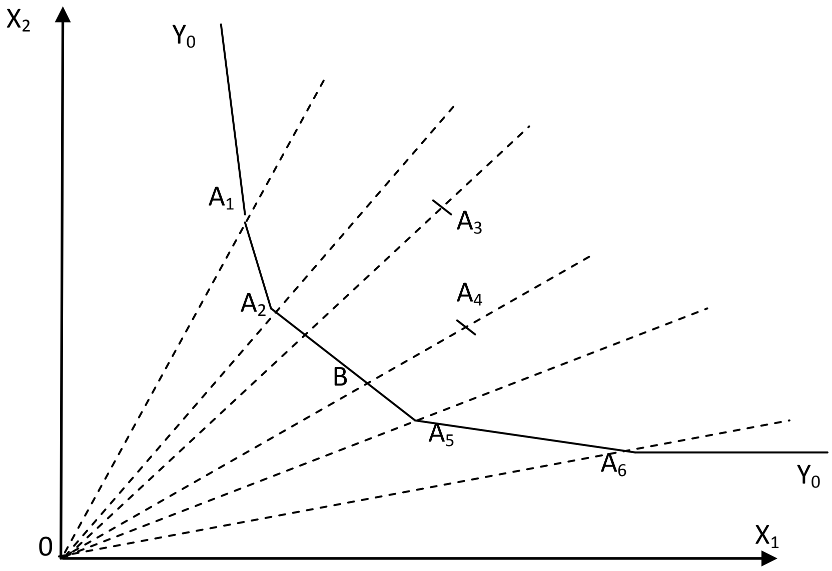
Data Envelopment Analysis (DEA) is a relatively new "data oriented" approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. Due to it requires very few assumptions and has opened up possibilities for use in cases which have been resistant to other approaches. A.Charnes, W.Cooper and E.Rhodes in 1978 there have been various DEA models as derivations which have been one of the most frequent used tools to measure efficiency and analyze system. The thoughts of DEA are expressed as Diagram 3.

Supposing there are six production units $A_i(i=1,2,...,6)$ make use of input factor X_1 and X_2 to produce output Y. Suppose they input different X_1 combinations which all reach the output Y0 (the production point when A_j reaches output Y0 is shown as Diagram 3). Link $A_j(j=1,3,5,6)$ and do vertical and horizontal extension line from A5, A6 which forms the fold line segment $Y_0 Y_0$ made up by part of Ai and all the Ai is located on the upper right of $Y_0 Y_0$.

Then we make a line from Ai and origin (cost of Ai)to find that OA4 and $Y_0 Y_0$ intersecting at point B, that is, A_4 can reduce both input X1 and X2 simultaneously to reach output Y_0 (A2 is the same case). That means the production at A4 and A2 is inefficient, that is, the production efficiency at point A_4 is $\frac{OB}{A.}$.

Meanwhile, it is impossible for the point at fold line segment Y0Y0 to reduce the input at X1 and X2 simultaneously to reach output Y_0.

Diagram 3: Basic Idea of DEA Model



According to Farrell's thoughts of frontier production function, when production unit is enough, fold line segment Y0Y0 turns to be a smooth curve, that is, production frontier. Drawing from the above-mentioned analysis, production frontier is made up based on the outer envelopment frontier of the actual observation sample. DEA is an analysis tool to estimate the production frontier by the method of linear programming to express the above-mentioned thoughts. Meanwhile, DEA is to analyze the relative effectiveness of the sample. Company financing efficiency is a typical multi-input and multi-output complex system with many evaluation factors. Traditional evaluation method is based on the optimization theory and satisfaction theory brought forward by famous American Management Scientist H.A. Simon, for example, fuzzy evaluation and level analysis methods etc. Traditional methods need to fix priority weights of every factor which may involve subjectivity. At the same time, difference on importance of different evaluation object factors may lead to injustice evaluation. DEA is an objective decision-making method based on the concept of relative efficiency, which is raised by American scholar Charnes in 1978. Now it has become an effective method to evaluate various decision making units of input and output of the same type and been used widely in military, manufacture, economy and management etc.(Chanes, Cooper, Rhodes, 1978). Based on the solid theorem form mathematically, DEA is proved to be in equal value with Pareto's effectiveness in economics and superior to production function in capability since DEA offers us relative efficient method by linear programming model. Compared with absolute effectiveness, relative effectiveness is of more practical significance. Actually, for certain system, research on numerous practical applications in managerial operations demonstrates that, production efficiency can by no means be optimal and the practical production can only pursue satisfying efficiency suitable for the manufacturing condition in the system. Otherwise, haste makes waste. At present, DEA offers the satisfying solution by providing the efficiency improvement target which is suitable for the direction of system development and possible to be achieved compared with the present development level of the system. Evaluating from the best angle for decision-making unit, DEA emphasizes the optimization of every decision-making unit and can point out the reorientation of relative index. Therefore, this paper, based on DEA theory, is to establish a model to evaluate financing efficiency of China's new energy companies and empirically analyze the financing efficiency of China's new energy to discuss the way to improve it.

Economic implication of CRS model and technical efficiency

DEA model of CRS is the basic DEA model raised by Chames, Cooper and Rhodes(1978), which is also called CCR model. Supposing N DMU employ K input to produce M outputs, use vectors x_i and y_i to dictate No. I DMU.:

$$x_i = (x_{1i}, x_{2i}, ..., x_{Ki})', y_i = (y_{1i}, y_{2i}, ..., y_{Mi})', i = 1, 2, ..., N \quad (6)$$

X and Y represents K * N -dimensional input matrix and M*N -dimensional output matrix. For each DMU, we intend to measure out the proportion of all inputs and all outputs, that is, $u'y_i/v'x_i$. *Here* u and v represent dimensional weight vector output M*1 and Victoria put weight vector input K*1 which is determined by the model. Supposing there is CRS, optimal weight can be obtained by solving the following mathematical programming problems:

$$\begin{aligned} &\max_{u,v}(u'y_i/v'x_i) \\ &s.t.\quad u'y_j/v'x_j \le 1\ j=1,2,\dots,N \\ &\qquad u,v\ge 0 \end{aligned} \qquad (7)$$

In fact, objective function is the weight ratio of the input and output of No. i DMU. In order to avoid infinite solutions, add constraints v'xi=1, the above-mentioned programming question becomes:

$$\begin{aligned} &\max_{u,v}(u'y_i/v'x_i) \\ &s.t.\quad u'y_j/v'x_j \le 1\ j=1,2,\dots,N \\ &\qquad v'x_i=1 \\ &\qquad u,v\ge 0 \end{aligned} \qquad (8)$$

Using the dual principle of linear programming, we can get the equivalent envelope form:

$$\begin{aligned} &\min_{\theta,\lambda}\theta \\ &s.t.\quad -y_i+Y\lambda\ge 0 \\ &\qquad \theta x_i - X\lambda \ge 0 \\ &\qquad \lambda\ge 0, i=1,2,\dots,N \end{aligned} \qquad (9)$$

θ is scalar, λ is dimensional vector of N*1. θ is the efficiency value of No.*i* DMU, meeting $0\le\theta\le 1$. When θ=1, the DMU is the point on efficiency frontier, technically effective.

Efficiency value from CRS model is TE. Its economic implication is when the output level of No. i DMU remains the same (input-oriented), take the DMU with the best performance (on efficiency frontier) in the sample as a standard and actual needed input proportion. 1-θ is the additional inputs proportion of No. i DMU and the largest proportion which can be reduced (also known as wasted) as well.

Calculation method of VRS model and scale efficiency

The assumption on CRS implies that DMU can expand output scale by increasing input proportionally, that is, the scale of DMU does not affect its efficiency. With this strict assumption, it does not meet the imperfectly competitive market under many conditions. Even policy constraints may make DMU fail to operate in an ideal scale. In that case, the hypothesis on CRS has a large difference with the actual situation, which cause TE mixes with SE in case of not all the DMU in perfect scale. In order to solve the problem, Banker, Chames and Cooper(1984) bring forward an improvement program of CRS model, which takes VRS (also known as BCC) into consideration. The assumption on VRS help the calculation on TE remove the effect of Returns to Scale, the efficiency from which is PTE.

By adding a convexity assumptions N'* λ =1, CRS model can be easily amended to VRS model:

$$\begin{aligned} & \min_{\theta,\lambda} \theta \\ & s.t. \quad -y_i + Y\lambda \geq 0 \\ & \qquad \theta x_i - X\lambda \geq 0 \\ & \qquad N'\lambda = 1 \\ & \qquad \lambda \geq 0, i = 1, 2, ..., N \end{aligned} \tag{10}$$

TE=PTE*RE, that is, $TE_{CRS} = TE_{VRS} * SE$. With CRS and VRS models, we can calculate the TE and PTE of one DMU to find the RS of it. From the definition of TE_{CRS} and TE_{VRS}, we can conclude $TE_{CRS} \leq TE_{VRS}$, which means the efficiency value of VRS model is larger than that of CRS and its observation point is closer to the efficiency frontier.

Assessment on NIRS and RS conditions

There is a defect in measuring SE, that is, invalid DMU will not tell us whether the evaluated DMU is in increasing area or decreasing area of RS, which reduces the effect of SE analysis. Coelli(1996) bring forward that, we can determine which area the evaluated DMU is in by solving the DEA of NIRS. We can get NIRS model by changing the constraint condition N'* λ =1 to N'* $\lambda \leq 1$, in VRS model:

$$\begin{aligned} & \min_{\theta,\lambda} \theta \\ & s.t. \quad -y_i + Y\lambda \geq 0 \\ & \qquad \theta x_i - X\lambda \geq 0 \\ & \qquad N'\lambda \leq 1 \\ & \qquad \lambda \geq 0, i = 1, 2, ..., N \end{aligned} \tag{11}$$

Compared the efficiency values from NIRS and VRS models, we can determine the area which the evaluated DMU is in. If $TE_{NIRS} \neq TE_{VRS}$, it means that the evaluated DMU is in RS increasing area. Too small scale leads to invalid scale, which can be improved by expanding scale. If $TE_{NIRS} = TE_{VRS}$, it means that the evaluated DMU is in RS decreasing area. Too large DMU leads to invalid efficiency, which can be improved by reducing scale. If TE, PTE and SE are 1, it means that DMU is in production frontier of the CRS area.

Evaluation model on financing efficiency of new energy companies

DEA model on financing efficiency of new energy companies is based on the basic theory of DEA. Supposing there is n decision-making unit, there are input vector $X = (x_1, x_2, ..., x_m)^T$ and output $Y = (y_1, y_2, ..., y_n)^T$ for each decision-making unit.

For any decision-making unit DUM, there is production set based on the hypothesis of convexity, minimum and ineffectiveness

$$T = \{(X, Y) \mid \sum_{j=1}^{n} \lambda_j X_j \le X, \sum_{j=1}^{n} \lambda_j Y_j \le Y, \lambda j \ge 0, j = 1, 2, ..., n\} \tag{12}$$

We can get the following DEA model(CCR):

$$\begin{aligned} &\min[\theta - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{w} s_r^+)] \\ &s.t. \quad \sum_{j=1}^{n} x_{ij}\lambda_j + s_i^- = \theta x_{ij0}, i \in (1, 2, ..., m) \\ &\qquad \sum_{j=1}^{n} y_{ij}\lambda_j - s_r^+ = \theta y_{rj0}, r \in (1, 2, ..., w) \\ &\qquad \theta, \lambda_j, s_i^-, s_r^+ \ge 0, \quad j = 1, 2, ..., n \end{aligned} \tag{13}$$

In the formulation, m and w represent the individual of the input and output index s_i^-, s_r^+ x_{ij0}, y_{rj0} are slack variables respectively while x_{ij0}, y_{rj0} are the No. i input and No.r output of No. j0 company, which can be expressed as （x0，y0）in short. ε is non- Archimedean infinitesimal which is used as positive infinitesimal in calculation, such as $\varepsilon = 10^{-7}$.

Through the above-mentioned model, we can get the TE value of new energy companies. The higher the value is, the better the company uses the capital invested. Therefore, we can assess whether the companies make full and effective use of the capital invested. As the assumption in the model is CRS, this actually does not match the fact. Therefore, based on DEA model, the paper tries to construct a BCC model of financing efficiency of new energy companies.For any decision-making unit DUM, there is production set only based on the assumption of convexity, minimum and ineffectiveness:

$$T = \{(X,Y) \mid \sum_{j=1}^{n} \lambda_j X_j \le X, \sum_{j=1}^{n} \lambda_j Y_j \le Y, \sum_{j=1}^{n} \lambda_j = 1, \lambda j \ge 0, j = 1,2,...,n\} \quad (14)$$

Therefore, we can get the BBC model of the financing efficiency of new energy companies:

$$\begin{aligned} & \min[\theta - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{w} s_r^+)] \\ & s.t. \quad \sum_{j=1}^{n} x_{ij}\lambda_j + s_i^- = \theta x_{ij0}, i \in (1,2,...,m) \\ & \qquad \sum_{j=1}^{n} y_{ij}\lambda_j - s_r^+ = \theta y_{rj0}, r \in (1,2,...,w) \\ & \qquad \sum_{j=1}^{n} \lambda_j = 1 \\ & \qquad \theta, \lambda_j, s_i^-, s_r^+ \ge 0, \quad j = 1,2,...,n \end{aligned} \quad (15)$$

In the model, symbol meaning is as same as the former. We can get PET and RS by model calculation, the relation between which is TE equals to PTE times RS. The paper analyses the TE,PTE and RS of China's new energy companies.

4 Positive Analysis of the financial efficiency of new energy companies

Sample selection and data resource

Sample selection means to determine decision-making units, which actually is to fix comparable reference sets. The paper selects the new energy companies listed from 2008 to 2012 as samples to discuss the financing efficiency of China's new energy companies. The data collection comes from companies listed web etc. Meanwhile, we obtain relative index from the balance sheet, profit and loss statement. According to the division of new energy industry, there are 7 wind power, 34 solar energy, 18 biomass power generation, 10 nuclear power and 12 hydroelectricity industries respectively. When using DEA model to measure efficiency, based on rule-of-thumb method, the number of DMU samples is at least twice as the total of input and output items. In the paper, the sample number 81 is bigger than twice of the total of input and output items, which is in line with the rule-of-thumb of DEA model.

Statistical description on samples

Obtain relative data of various index from the annual report of sample companies in 2012 to find the statistical results(see Table 1 and 2). From the input distribution of sample companies in Table 1, asset size of more than 50% companies is between 1-8 billion with an average debt asset ratio 52.47% and median 54.47%. Debt asset ratio of 50% companies is larger than 50% which means the ratio of new energy companies is high.

Table 1: Statistical distribution of the original data of input index

Capital scale(100 million Yuan)	<10	10-40	40-80	80-120	120-160	160-200	>200	average
Number of companies	4	35	14	5	10	1	12	172.83
cost of main business (100 million Yuan)	<10	10-20	20-40	40-60	60-80	80-100	>100	average
Number of companies (81)	33	15	12	8	2	2	9	59.12
debt asset ratio (%)	<10	10-30	30-40	40-50	50-60	>60		average
Number of companies (81)	4	11	11	8	13	34		52.47%

From the output index of the company in Table 1, return on equity of 50% new energy companies is lower than 4% with an average of -2.17% and median of 4.02%. Revenue growth of main business of 79% companies is smaller than 20% with an average of 0.4% and median of 2.04%. Therefore, earning capability of main business of most companies is higher than the average level with an average total assets turnover of 48.39% and median of 41.50%, which means total assets turnover of most companies are lower than the average level. Average growth rate of intangible assets is 19.46% and the median of 3.58%. That demonstrates only the intangible assets of individual company experiences substantial changes, that is, to form independent intellectual property rights, while most companies do not own new technical capability.

Table 2 Statistical distribution of the original data of output index

Return on equity (%)	<0	0-4	4-8	8-12	12-16	16-18	>18	average
Number of companies (81)	18	22	23	12	5	0	1	-2.17%
Revenue growth of main business(%)	<0	0-10	10-20	20-30	30-40	40-50	>50	average
Number of companies (81)	36	15	13	6	3	2	6	0.40%
Total asset turnover (%)	0-20	20-30	30-40	40-50	50-60	60-70	>70	average
Number of companies (81)	12	12	16	10	5	8	18	48.39%
growth rate of intangible assets (%)	<0	0-10	10-20	20-30	30-40	40-50	>50	average
Number of companies (81)	31	20	7	5	5	3	10	19.46%

Determination of evaluation index

Reasonable definition of input and output index is crucial to make proper use of DEA technology to measure efficiency. Therefore, we should first consider the property of new energy companies to determine the input and output index. The differences between new energy companies and general ones: strong technical innovation, high input, high risk, high profitability, knowledge-intensive and integration of R&D and operation. Based on these features of new energy companies, requirements on capital investment and the focus of this paper, we select the following measurement index of the financing efficiency for new energy companies.

Input index

(1) Total assets of companies: refers to all the assets owned or controlled by the company, including current assets, long-term investment, permanent assets, intangible and deferred assets, as well as other long-term investment etc, that is, total assets of the balance sheet of the company which reflects the financing scale of the new energy company. The index can reflect the financing situation of the new energy company in an overall way which consist the foundation of its capital management.

(2) Main business costs: refers to the direct costs which must be invested on the product or service related to the production and distribution of new energy companies' main business, including raw materials, labor cost (salary) and fixed assets depreciation etc. Main business costs are used for the actual costs caused by companies on distribution, labor or delivered right to use assets as so forth, which reflect the expenditure spent on main business by new energy companies. Cost determines profits and output as well. Its size shows the capability on capital operation.

(3) Debt Asset ratio: is also known as degree of financial leverage which reflects the effect of capital structure on financing efficiency, the rationality of the capital structure and its influence on company value. With good production and operation, we can make use of the positive effect of financial leverage to obtain more operating profit. If the company performs poorly, financing strength of company cannot guarantee the debt security; what's more, financial leverage will play a negative role to deteriorate financial situation. Due to the debt asset ratio is lack of the best standard, we select the absolute value of the difference between average debt asset ratio of new energy companies and this industry.

Output index

(1) Return on equity: is also known as Rate of Return on Common Stockholders' Equity which is the percentage of net profit and average stockholders' equity and of the profit after tax divided by net assets. The index reflects the income level of stockholders' equity, which is used to measure the efficiency of company's operation of its own capital. The higher the index value is, the higher the investment brings profits.

$$\text{Return on equity} = \frac{\text{net profit}}{\text{Net total capital}} \times 100\% \tag{16}$$

(2) Revenue growth of main business: is the ratio of the difference between the current main business income and the one of the last period divided by the former. The formulation is :

$$\text{Revenue growth of main business} = \frac{\begin{array}{c}\text{Current main business income minus the}\\ \text{one of the last period}\end{array}}{\text{The one of the last period}} \times 100\% \tag{17}$$

(3) Total assets turnover: reflects the operation speed of all assets. The ratio indicates the operation efficiency of the company's all assets. Any step in assets management will affect the index value. Generally speaking, as for the index, the bigger, the better. If the ratio is relatively low, it means the company is inefficient in using the money collected to operate and the operation speed is too low, which will directly affect the earning capability and development of the company. On the contrary, the higher the ratio, the faster the capital operation speed of the company, the higher the efficiency of the funds raised.

$$\text{Total assets turnover} = \frac{\text{Net main business income}}{\text{Average total asset}} \times 100\% \tag{18}$$

(4) Intangible asset growth: the index indicates the financial feature of the sustainable development and technological competitiveness of new energy companies. The most important feature of new energy company is taking technology innovation as core to obtain technical advantages and monopoly position. Large amount of capital will be invested during R&D stage. The proportion of R&D expenses to all the input is relative large. With successful technology, the highly-invested R&D expenses will be reflected in intangible assets of the companies to show the technology value owned. The technology value will increase as the growth of R&D investment and successful development.

$$\text{Intangible asset growth} = \frac{\begin{array}{c}\text{intangible asset of the current period -}\\ \text{intangible asset of the last period}\end{array}}{\text{Intangible asset of the last periodl}} \times 100\% \tag{19}$$

The above-mentioned indexes reflect the capital utilization efficiency of new energy companies in an overall way. Though more indexes can be introduced into the model, considering the effect of the cross and correlation of indexes on evaluation results, the paper select the ones which can fully show every aspect of the input and output of the capital.

Non-dimensional method of original index

In the practical application of DEA model, due to different dimension in the original input and output data, we will not get better model results when directly using original data. Besides, the application of DEA model requires the input and output index data is negative. However, the original data selected usually contain negative, like net profit, revenue increase, which is necessary for us to process original index data by certain method. Non-dimension of the index data is a method to standardize data. The paper will employ the following function relation to regulate the original index date to some positive space.

$$\begin{array}{l} y_{ij} = 0.1 + 0.9\dfrac{x_{ij} - m_j}{M_j - m_j} \\ {}_j \min\limits_i(x_{ij}), M_j = \max\limits_i(x_{ij}) \\ (i = 1, 2, ..., n), y_{ij} = [0,1] \end{array} \tag{20}$$

Analysis on empirical result

The paper employs DEAP software to find the solution of DEA model involved. Based on the original data of sample companies, we list input and output data of 81 new energy companies listed to establish 81 models. There are 3 different input indexes X_1,X_2,X_3 and 4 different output indexes Y_1,Y_2, Y_3 and Y_4in every DMU. Find the solution of model (14) and (20).

Analysis on empirical result

The paper employs DEAP software to find the solution of DEA model involved. Based on the original data of sample companies, we list input and output data of 81 new energy companies listed to establish 81 models. There are 3 different input indexes X1,X2,X3 and 4 different output indexes Y1,Y2, Y3 and Y4in every DMU. Find the solution of model (14) and (20)Calculate through DEAP to obtain the optimal solution and relative efficiency of every decision-making unit, that is TE, PTE and SE of China's new energy companies. See Table 3 for specific efficiency. We can thus conclude an overall situation of the financing efficiency of 81 new energy companies listed (see Table 4).

Table.3 81 DEA Efficiency Calculation Results of 81 Listed New Energy Companies

Listed company	TE	PTE	SE	S1-	S2-	S3-	S1+	S2+	S3+	S4+
CSG A	0.687	0.708	0.971	0.012	0	0.091	0	0.179	0	0
Into Shares	1	1	1	0	0	0	0	0	0	0
Anhui Electric Power	0.666	0.666	0.999	0	0	0.128	0	0	0	0
Shaoneng Shares	0.875	0.897	0.976	0.02	0	0.287	0	0.015	0	0.016
Tianmao Group	0.91	0.956	0.951	0.002	0	0	0.027	0.291	0	0
Yuan Xing Energy	0.882	0.883	0.998	0.019	0	0.361	0	0	0	0
Asia-Pacific Industry	0.969	1	0.969	0	0	0	0	0	0	0
Nuclear Sceince &Technology	0.948	0.976	0.972	0.002	0	0.165	0	0.044	0	0
Silver Star Energy	0.88	0.942	0.934	0.014	0	0.551	0.03	0.286	0.009	0.074
Hubei Energy	0.59	0.602	0.98	0.042	0	0.072	0	0.031	0	0
Lutianhua	0.759	0.79	0.961	0.021	0	0.322	0	0.059	0	0.008
Kaidi Electric Power	0.838	0.865	0.969	0.029	0	0.334	0	0.1	0	0
Buddha Plastic	0.838	0.864	0.969	0	0.005	0.236	0	0.137	0	0.048
Refinement Technology	0.811	0.962	0.843	0.004	0	0.101	0.015	0.413	0	0
Shield Security Environment	1	1	1	0	0	0	0	0	0	0
Qian Source of Power	1	1	1	0	0	0	0	0	0	0
Hengdian East Magnetic	0.788	0.875	0.901	0	0	0.022	0	0.195	0	0
Guangdong Hydropower	0.729	0.766	0.951	0.007	0	0.323	0	0.048	0	0.023
Jiangsu Dagang	0.871	0.891	0.977	0.006	0	0.492	0	0.175	0	0.057
Sinoma Science and Technology	0.858	0.872	0.984	0.004	0	0.339	0	0	0	0
Leo Shares	0.921	0.952	0.967	0	0	0.209	0	0	0	0.04
Stellar Technology	0.86	0.904	0.951	0	0	0.345	0	0.119	0	0.001
New Extension	0.931	0.97	0.959	0.005	0	0.048	0	0.026	0	0
Oriental Energy	1	1	1	0	0	0	0	0	0	0
Auto Motion	1	1	1	0	0	0	0	0	0	0
Hailu Heavy Industry	0.94	0.946	0.993	0.002	0	0.174	0	0.101	0	0.001

Zhe Fu Shares	0.993	1	0.993	0	0	0	0	0	0	0
Zhongli Technology	0.729	0.731	0.998	0.007	0	0.364	0	0	0	0
Seven Star Electronics	0.963	0.97	0.993	0.006	0	0.332	0	0	0.053	0
Dongshan Precision	0.938	0.957	0.981	0	0	0.176	0.072	0	0	0
Nanyang Technological	1	1	1	0	0	0	0	0	0	0
Dajin Heavy Industries	0.988	1	0.988	0	0	0	0	0	0	0
*ST Super Day	0.485	0.855	0.567	0.012	0	0.443	0.796	0.218	0	0
Kstar	0.952	0.976	0.975	0.001	0	0	0.011	0.109	0	0
Skyway Wind	1	1	1	0	0	0	0	0	0	0
SanYang Shares	1	1	1	0	0	0	0	0	0	0
Icahn Technology	0.85	0.922	0.922	0.004	0	0.287	0	0.147	0	0
Amalek Dayton	1	1	1	0	0	0	0	0	0	0
EVE Energy	1	1	1	0	0	0	0	0	0	0
Dragon Optical	0.553	0.986	0.56	0.003	0	0.033	0.393	0.476	0.055	0.056
New Daxin Materials	0.904	0.959	0.943	0.004	0	0.047	0	0.267	0	0
Oak Shares	0.896	0.905	0.99	0	0.001	0	0.041	0.183	0	0
Golden Glass	0.961	0.991	0.969	0.002	0	0	0.007	0.099	0	0
Sunflower	0.722	0.928	0.777	0.003	0	0.131	0.012	0.239	0	0
East Sunrise	0.88	0.969	0.908	0.005	0	0.43	0.165	0.22	0.029	0
Tatham Wind Power	0.962	0.979	0.982	0.001	0	0.094	0	0	0	0
Sunshine Power	0.936	0.96	0.974	0.005	0	0.075	0	0	0	0
Jingsheng Electrical	1	1	1	0	0	0	0	0	0	0
Huadian Power International	0.196	0.199	0.984	0.058	0	0	0	0.017	0	0
Gezhouba Hydropower	0.275	0.333	0.824	0.037	0.052	0	0	0.058	0	0
Harbin High-Tech	0.955	0.983	0.971	0.003	0	0.237	0	0.024	0	0
Huazi Industry	0.946	0.999	0.947	0.005	0	0	0.019	0.213	0.177	0.025
Harbin Air Conditioning	0.916	0.952	0.963	0.005	0	0.363	0	0.034	0	0
Qingdao Soda Ash Industrial	0.753	0.922	0.816	0	0.002	0.09	0	0.171	0	0

Laurel Power	0.787	0.789	0.997	0.045	0	0.431	0	0	0.176	0
Guanghui Energy	0.856	0.858	0.998	0.067	0	0.348	0	0.16	0.28	0
Huayi Electric	0.893	0.931	0.959	0.007	0	0.151	0	0.177	0	0.007
Jiulong Electric Power	0.82	0.841	0.975	0	0.01	0.16	0	0.028	0	0.065
Guidong Electric Power	1	1	1	0	0	0	0	0	0	0
Tianke Shares	0.987	0.995	0.992	0	0	0.215	0	0.083	0	0
Hareon Solar	0.697	0.741	0.941	0.014	0	0.284	0	0.235	0	0
Hunan Electric Shares	0.676	0.75	0.901	0.016	0	0.382	0	0.1	0	0
Wah Kwong Shares	0.838	0.865	0.968	0	0.003	0.402	0	0.166	0	0.016
Sailing Shares	1	1	1	0	0	0	0	0	0	0
EGing Photovoltaic	0.603	0.878	0.687	0.002	0	0.301	0.151	0.27	0	0
*ST National Development	0.807	1	0.807	0	0	0	0	0	0	0
Baoding Tianwei Baodian	0.658	0.822	0.801	0.035	0	0.222	0.171	0.297	0.022	0
Great Northern Wilderness	0.567	0.617	0.919	0	0.014	0.073	0	0.103	0	0.062
Shenergy	0.539	0.539	0.999	0.038	0.046	0	0.024	0.061	0	0.18
Sichuan Investment Energy	0.945	0.963	0.982	0.058	0	0.194	0	0	0.134	0
Arts Shares	0.945	0.97	0.974	0.021	0	0	0	0.332	0.107	0.002
GD Power	0.228	0.29	0.784	0.106	0.021	0	0	0.039	0.211	0
Hebei Veyong Bio-Chemical	0.963	0.969	0.993	0	0.002	0.167	0	0.113	0	0.218
North China Pharmaceutical	0.63	0.659	0.957	0	0.014	0.1	0	0.157	0	0.106
Shanghai Mechanical and Electrical	0.509	1	0.509	0	0	0	0	0	0	0
Shanghai Automation Instrument	0.927	0.964	0.962	0	0	0.685	0	0.113	0	0.011
Dongfang Electric	0.299	0.316	0.944	0.028	0	0.033	0	0.187	0.163	0
Yangtze Power	0.755	1	0.755	0	0	0	0	0	0	0
Sinovel	0.713	0.763	0.934	0.07	0	0.124	0.037	0.359	0.05	0
China’s Hydropower	0.243	0.259	0.938	0.127	0.155	0	0.001	0.073	0	0
Beijing Express	0.942	0.979	0.962	0.014	0	0	0.009	0.528	0.135	0

Note: TE is technical efficiency. PET is pure technical efficiency. Se is scale efficiency. S1- S2-、S3 -、S1+、 S2+、 S3+、 S4+ are slack variables.

Table 4 Overall situation of financing efficiency of 81 Listed New Energy Companies

New Energy Companies	TE_{CCR}		TE_{BCC}	
	Number of companies	percentage	Number of companies	percentage
efficient	13	16.05%	19	23.46%
inefficient	68	83.95%	62	76.54%

Note: TECCR is the comprehensive technical efficiency calculated by CCR model. TEBCC is the pure technical efficiency calculated by BBC

We can conclude that, in the 81 new energy companies listed, there are 13 with the relative effective value of financing efficiency of 1 and relative slack variables of 0, accounting about 16.05%, which means these companies are relative efficient, irredundant input (reached a minimum) and complete output (can no longer big) in this reference set. So, 16.05% companies' financing efficiency is not only scale effective but only technically effective. All the relative effective value of other 68 companies is smaller than 1 or equivalent to 1, but there exists input redundancy or output insufficiency to show its non-relative efficiency, which demonstrates both input and output need to be improved. With the 68 companies listed, there are 6 with only technically effective and not scale efficient. There are 62 companies are neither scale efficient nor technically effective, accounting for 76.54%. Therefore, generally speaking, the financing efficiency of new energy companies listed in China is low. This demonstrates the capital invested in new energy companies does not yield the maximum efficiency, nor get effective use. With the limited financial investment, companies' capital has not given full play to the best effect.

In models CCR and BCC, the distribution of financing efficiency value of new energy companies are as follows：(see Chart 3 and 4）

Chart 3 Distribution of TE in CCR Model

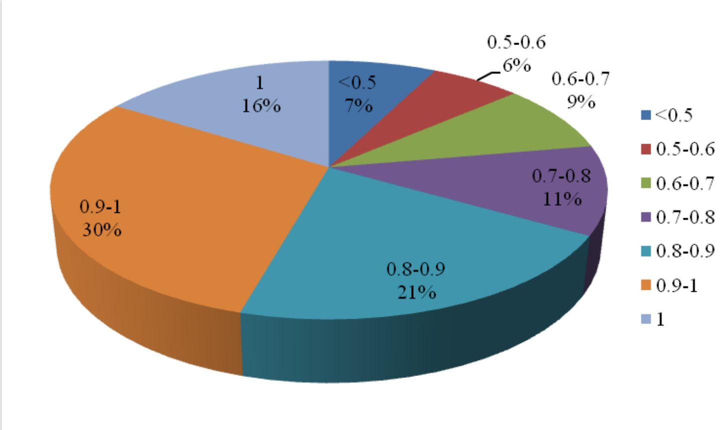
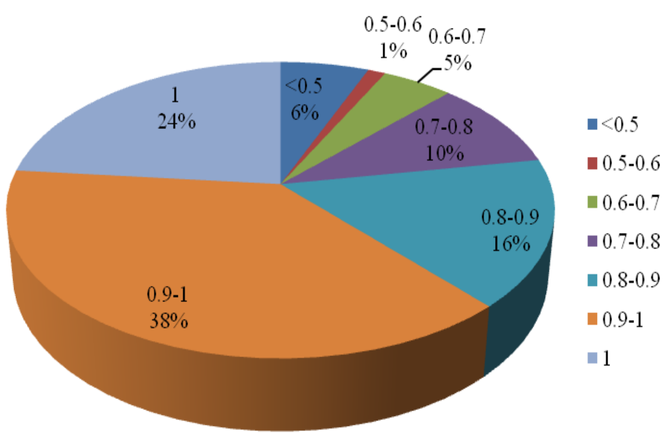


Chart4 Distribution of PTE in BCC model



From Chart 3 and 4, as for the financing efficiency of China's new energy companies, not only unit number of strong efficiency is on the low side, but also most are obvious non-efficient unit, that is, in CCR model, 54%TE is obvious non-efficient unit with efficiency value under 0.9.

Analysis on financing efficiency trends

In the 81 new energy companies, with the present technology and management level, in sample period from 2009-2012, there is 1 in technical efficiency frontier every year and 9 with PTE in most years (see Table 5). Financing efficiency of other companies fluctuates between 0.15~1 and efficiency value centers between 0.5~1. In year 2009, 2010, 2011 and 2012, there are 13,10,8 and 10 companies with technical efficiency in model CCR. There are 19, 11, 12 and 37 companies with above 0.9 efficiency value in each year. All shows there is a trend of efficiency improvement as a whole. See Chart 5 for the comparison of efficiency value in each year. However, from the trend development, the efficiency level of China's new energy companies in the 4 years is sufficiently improved.

Chart 5 Efficiency trend of 81 energy companies

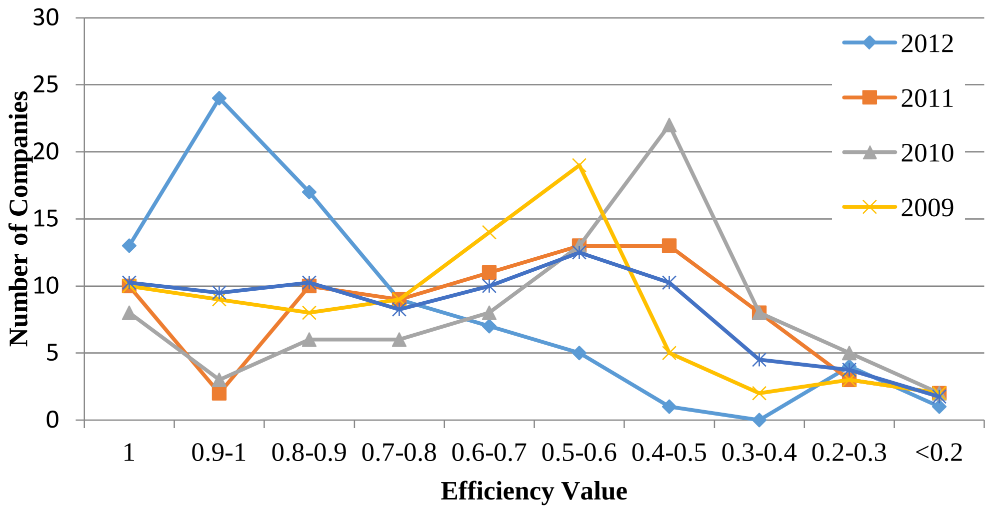


Table 5 2009-2012 Efficiency Measurement Results of CCR Model of 81 listed New Energy Companies

Listed companies	2009	2010	2011	2012
CSG A	0.584	0.431	0.53	0.687
Into Shares	0.958	0.742	0.891	1
Anhui Electric Power	0.504	0.338	0.343	0.666
Shaoneng Shares	0.525	0.408	0.422	0.875
Tianmao Group	0.749	0.62	0.688	0.91
Yuan Xing Energy	0.731	0.482	0.594	0.882
Asia-Pacific Industry	0.611	0.37	0.746	0.969
Nuclear Sceince &Technology	0.744	0.524	0.593	0.948
Silver Star Energy	0.613	0.485	0.55	0.88
Hubei Energy	0.619	0.454	0.322	0.59
Lutianhua	0.53	0.278	0.415	0.759
Kaidi Electric Power	0.563	0.481	0.568	0.838
Buddha Plastic	0.585	0.453	0.61	0.838
Refinement Technology	0.558	0.537	0.848	0.811
Shield Security Environment	0.76	0.49	0.568	1
Qian Source of Power	0.556	0.526	0.399	1
Hengdian East Magnetic	1	0.773	0.855	0.788
Guangdong Hydropower	0.576	0.913	0.436	0.729
Jiangsu Dagang	0.547	0.538	0.555	0.871
Sinoma Science and Technology	0.674	0.504	0.521	0.858
Leo Shares	1	0.853	0.798	0.921
Stellar Technology	0.706	0.508	0.573	0.86
New Extension	0.854	0.867	0.491	0.931
Oriental Energy	1	0.678	0.8	1
Auto Motion	0.964	0.863	0.728	1
Hailu Heavy Industry	0.7	0.432	0.657	0.94
Zhe Fu Shares	0.729	0.586	0.626	0.993

Zhongli Technology	1	0.713	0.588	0.729
Seven Star Electronics	0.693	0.486	1	0.963
Dongshan Precision	0.837	0.865	0.785	0.938
Nanyang Technological	0.971	1	1	1
Dajin Heavy Industries	0.968	1	1	0.988
*ST Super Day	0.93	0.671	0.841	0.485
Kstar	0.949	0.647	0.886	0.952
Skyway Wind	0.837	0.608	0.655	1
SanYang Shares	0.957	0.776	1	1
Icahn Technology	1	1	0.708	0.85
Amalek Dayton	1	1	1	1
EVE Energy	1	0.744	0.927	1
Dragon Optical	0.949	0.82	0.977	0.553
New Daxin Materials	1	1	0.768	0.904
Oak Shares	1	1	1	0.896
Golden Glass	0.865	0.605	0.816	0.961
Sunflower	0.629	0.909	0.521	0.722
East Sunrise	0.91	1	0.717	0.88
Tatham Wind Power	0.833	0.84	0.73	0.962
Sunshine Power	0.841	1	0.885	0.936
Jingsheng Electrical	1	0.918	1	1
Huadian Power International	0.179	0.208	0.151	0.196
Gezhouba Hydropower	0.283	0.208	0.258	0.275
Harbin High-Tech	0.514	0.492	0.45	0.955
Huazi Industry	0.832	0.602	0.651	0.946
Harbin Air Conditioning	0.614	0.447	0.338	0.916
Qingdao Soda Ash Industrial	0.522	0.454	0.615	0.753
Laurel Power	0.52	0.457	0.413	0.787
Guanghui Energy	0.598	0.385	0.523	0.856
Huayi Electric	0.695	0.512	0.481	0.893
Jiulong Electric Power	0.498	0.362	0.479	0.82
Guidong Electric Power	0.548	0.498	0.467	1
Tianke Shares	0.838	0.541	0.726	0.987
Hareon Solar	0.619	0.42	1	0.697
Hunan Electric Shares	0.55	0.353	0.379	0.676
Wah Kwong Shares	0.534	0.392	0.552	0.838
Sailing Shares	0.658	0.556	0.872	1
EGing Photovoltaic	0.667	0.467	1	0.603
*ST National Development	0.321	0.518	0.659	0.807
Baoding Tianwei Baodian	0.457	0.317	0.351	0.658
Great Northern Wilderness	0.468	0.319	0.426	0.567
Shenergy	0.37	0.29	0.426	0.539
Sichuan Investment Energy	0.656	0.46	0.488	0.945
Arts Shares	0.771	0.665	0.657	0.945

GD Power	0.276	0.236	0.189	0.228
Hebei Veyong Bio-Chemical	0.539	0.468	1	0.963
North China Pharmaceutical	0.405	0.534	0.614	0.63
Shanghai Mechanical and Electical	0.525	0.403	0.495	0.509
Shanghai Automation Instrument	0.696	0.468	0.631	0.927
Dongfang Electric	0.21	0.195	0.235	0.299
Yangtze Power	0.458	0.417	0.366	0.755
Sinovel	0.622	0.528	0.315	0.713
China's Hydropower	0.179	0.18	0.205	0.243
Beijing Express	0.799	0.777	0.841	0.942

From the 81 samples selected in the paper, in the 4 years, there is a substantial increase in intangible assets in some year. Growth rate of intangible assets of new energy companies exceed 100%: 12 in 2009, 10 in 2010; 13 in 2011 and 5 in 2012. In the 4 years, there are 60% companies with independent innovation to form intellectual property rights while 40% does not carry on technological innovation or has no successful technological innovation achievement. That indicates the consciousness or capability of overall technological innovation of China's new energy companies is not strong, which can explain the reason why financing efficiency of companies is not high.

Comparison on financing efficiency in the industry

According to the sample companies, the industry distribution of effective companies is shown in Table 6. From table 6, we can draw the conclusion that, wind power and nuclear power companies own the effective DEA with relative high proportion, especially the wind power. Except the company with the efficiency value of DEA equaling to 1, that of others basically near 1 while that of Biomass new energy companies is relatively low.

Table 6 Distribution of DEA effectiveness in 81 new energy companies listed

Sector	CCR effective			BCC effective		
	DEA effective		Non DEA effective	DEA effective		Non DEA effective
	No. of companies	percentage		No .of companies	percentage	
Wind	2	28.57%	5	3	42.86%	4
Nuclear	2	20.00%	8	3	30.00%	7
Biomass	1	5.56%	17	3	16.67%	15
Hydro	2	16.67%	10	4	33.33%	8
Solar	6	17.65%	28	6	17.65%	28

In order to make the evaluation result persuasive, change the number of objects of sample companies to analyze whether the alteration on objects will affect the shape or position of DEA efficiency frontier. The paper takes 18 Biomass new companies as samples to reconstruct production frontier and calculate DEA efficiency value to further introduce the financing efficiency of these companies (see Table 7). From the data in table 7, we can conclude that, DEA efficiency values of the 81 samples and 18 samples are close to each other. DEA efficiency of the sample with 18 companies and that of the 81's increase in the same direction, which means that, when production frontier changes, the measured DEA efficiency keep stable basically and evaluation results of financing efficiency stable which is convincing.

Table 7 DEA Efficiency Calculation Results of 18 Biomass businesses

NO.	Securities Code	Security Name	Efficiency Value of	Efficiency
1	000543.SZ	Anhui Electric Power	0.82	0.666
2	000601.SZ	Shaoneng Shares	0.891	0.875
3	000627.SZ	Tianmao group	1	0.91
4	000683.SZ	Yuan Xing Energy	1	0.882
5	000691.SZ	Asia-Pacific Industry	1	0.969
6	000912.SZ	Lutianhua	0.777	0.759
7	000939.SZ	Kaidi Electric Power	0.851	0.838
8	002221.SZ	Oriental Energy	1	1
9	600027.SH	Huadian Power International	0.352	0.196
10	600191.SH	Huazi Industry	1	0.946
11	600229.SH	Qingdao Soda Ash Industrial	0.824	0.753
12	600256.SH	Guanghui Energy	0.904	0.856
13	600378.SH	Tianke shares	1	0.987
14	600475.SH	Wah Kwong shares	0.863	0.838
15	600538.SH	* ST National Development	0.933	0.807
16	600598.SH	Great Northern Wilderness	0.696	0.567
17	600803.SH	Hebei Veyong Bio-chemical	1	0.963
18	600812.SH	North China Pharmaceutical	0.72	0.63

Explanation on the effective results effect of DEA by every input and output items

When using CCR model to calculate DEA efficiency, select the absolute value of debt asset ratio and industry average as input index. The larger the number is, the larger the distance between debt asset ratio and industry average of the company has. The smaller the number is, the closer the debt asset ratio and industry average are. That indicates the capital structure of the company in the industry turns to be rational. Capital structure plays a beneficial role in promoting DEA efficiency. We can find that the company with inefficient DEA will have a large distance between debt asset ratio and industry average. Debt asset ratio of a company may be either high or low. See Table 8 and 9 for specific data. Unreasonable capital structure of the company plays a negative role in company's financing efficiency.

Growth rates of main business and intangible assets of DEA effective companies have experienced steady or rapid increase, which means the financing efficiency of companies mainly comes from the main industry with good company growth and steady and advanced technical support. Among them, main business income of individual company grows fast or the intangible assets of some companies increase rapid. However, due to the debt asset ratio is relatively high or low, negative effects on company's financing efficiency from capital structure, or company's failing to make proper use of financial leverage, financing efficiency is relatively low. From another aspect, this reflects that companies are lack of a sound environment in free financing in capital market. Company financing has to make decision within its financing capability and less-developed capital market.

Table 8 DEA Comparison between input and output of DEA effective company projects

No	Stock code	Name	CCR model valid	BCC model valid	Net return on Assets	Main business income growth rate	Total assets turnover	Intangible assets growth rate
1	000151.SZ	Into Shares	√	√	4.86%	61.24%	117.45%	-2.49%
2	000691.SZ	Asia-Pacific Industry		√	1.83%	17.62%	19.55%	-2.58%
3	002011.SZ	Shield Security Environment	√	√	10.17%	50.46%	85.97%	299.94%
4	002039.SZ	Qian Source of Power	√	√	6.93%	81.34%	11.27%	13.10%
5	002221.SZ	Oriental Energy	√	√	5.58%	56.61%	125.07%	137.93%
6	002227.SZ	Auto Motion	√	√	3.86%	44.71%	34.64%	-2.04%
7	002266.SZ	Zhefu Shares		√	8.52%	-12.68%	39.81%	84.45%
8	002389.SZ	Nayang Technology	√	√	4.12%	-9.72%	26.48%	93.20%
9	002487.SZ	Daikin Heavy		√	2.06%	-11.04%	24.64%	30.57%
10	002531.SZ	Skyway Wind	√	√	9.62%	30.77%	52.63%	84.67%
11	002580.SZ	Shengyang Shares	√	√	6.60%	24.27%	100.36%	102.81%
12	002623.SZ	Amalek Dayton	√	√	3.63%	5.20%	28.32%	55.08%
13	300014.SZ	EVE Energy	√	√	13.35%	27.01%	71.11%	-1.60%
14	300316.SZ	Jing Sheng Electronical	√	√	10.34%	-38.98%	35.24%	-2.15%
15	600310.SH	Guidong Electric Power	√	√	3.35%	103.64%	66.59%	29.19%
16	600482.SH	Sailing Shares	√	√	5.88%	16.02%	141.04%	42.37%
17	600538.SH	*ST National Development		√	-114.00%	2.70%	82.87%	-2.85%
18	600835.SH	Shanghai Mechanical		√	18.44%	22.35%	81.29%	28.23%
19	600900.SH	Yangtze Power		√	13.82%	24.55%	16.44%	213.67%

Table 9 DEA Comparison Introduction of Invalid input-output projects

No	Security Code	Name	CCR model DEA valid	BCC model DEA valid	Net return on assess	Main business income growth rate	Total asset turn over	Intangible assets growth rate
1	000012.SZ	CSG A	0.687	0.708	5.09%	-15.43%	47.23%	1.75%
2	000543.SZ	Anhui Electric Power	0.666	0.666	6.62%	48.43%	47.77%	10.52%
3	000601.SZ	Shaoneng Shares	0.875	0.897	4.38%	1.86%	25.80%	-9.00%
4	000627.SZ	Tianmao Group	0.91	0.956	0.90%	-31.23%	39.50%	-2.10%
5	000683.SZ	Yuan Xing Energy Power	0.882	0.883	7.07%	16.81%	45.84%	73.93%
6	000777.SZ	SUFA Technology Industry	0.948	0.976	5.42%	11.57%	49.33%	4.60%
7	000862.SZ	Silver Star Energy	0.88	0.942	-3.66%	-40.51%	18.27%	-33.46%
8	000883.SZ	Hubei Energy	0.59	0.602	5.22%	7.17%	32.47%	0.71%
9	000912.SZ	Lutianhua	0.759	0.79	2.60%	8.41%	38.04%	-5.68%
10	000939.SZ	Kaidi Electric Power	0.838	0.865	2.47%	-1.77%	25.05%	-2.51%
11	000973.SZ	Buddha Plastic Technology	0.838	0.864	5.75%	-2.51%	76.81%	-3.61%
12	002006.SZ	Refinement Technology	0.811	0.962	-19.95%	-68.72%	29.98%	-2.50%
13	002056.SZ	Hengdian Group DMEGC Magnetics	0.788	0.875	-8.11%	-17.36%	69.61%	-1.11%
14	002060.SZ	GHEC	0.729	0.766	2.39%	12.13%	49.97%	-11.77%
15	002077.SZ	Dagang	0.871	0.891	6.71%	-13.11%	47.44%	-26.02%
16	002080.SZ	Sinoma Science and Technology	0.858	0.872	5.38%	10.74%	53.13%	45.80%
17	002131.SZ	Leo Shares	0.921	0.952	3.42%	25.66%	80.35%	7.48%
18	002132.SZ	Stellar Technology	0.86	0.904	3.10%	-0.68%	60.59%	-2.23%
19	002218.SZ	New Extension	0.931	0.97	0.37%	10.67%	24.49%	3.98%
20	002255.SZ	Hailu Heavy Industry	0.94	0.946	10.73%	2.18%	58.62%	-2.19%
21	002309.SZ	Zhongli Technology	0.729	0.731	10.10%	31.82%	64.59%	13.07%
22	002371.SZ	Seven Star Electronics	0.963	0.97	9.06%	-12.44%	31.47%	-1.94%
23	002384.SZ	Dongshan Precision	0.938	0.957	-8.67%	54.33%	77.75%	0.06%
24	002506.SZ	*ST Super Day	0.485	0.855	-146.48%	-31.39%	22.16%	12.67%
25	002518.SZ	Kstat	0.952	0.976	7.02%	-0.33%	59.13%	7.09%
26	002610.SZ	Icanhn Tehcnology	0.85	0.922	-4.21%	-10.61%	43.77%	-0.76%
27	300029.SZ	Dragon Optical	0.553	0.986	-70.26%	-79.09%	11.35%	-26.22%
28	300080.SZ	New Daxin Materials	0.904	0.959	-3.26%	-46.92%	31.84%	34.07%
29	300082.SZ	Oak Shares	0.896	0.905	3.27%	-19.29%	59.94%	13.11%
30	300093.SZ	Golden Glass	0.961	0.991	3.21%	2.64%	31.87%	-1.69%
31	300111.SZ	Sunflower	0.722	0.928	-31.67%	-36.76%	37.22%	3.95%

32	300118.SZ	East Sunrise	0.88	0.969	-25.76%	-51.77%	24.79%	102.10%
33	300129.SZ	Tatham Wind Power	0.962	0.979	4.02%	9.04%	37.84%	39.99%
34	300274.SZ	Sunshine Power	0.936	0.96	3.94%	24.00%	41.93%	3.58%
35	600027.SH	Huadian Power International	0.196	0.199	6.93%	9.17%	38.02%	1.05%
36	600068.SH	Gezhouba Hydropower	0.275	0.333	11.49%	15.03%	75.02%	47.24%
37	600095.SH	Harbin Heigh Tech	0.955	0.983	2.33%	11.63%	22.79%	2.70%
38	600191.SH	Huazi Industry	0.946	0.999	0.31%	1.23%	8.34%	-12.52%
39	600202.SH	Hardin Air Conditioning	0.916	0.952	2.27%	12.76%	33.86%	-2.49%
40	600229.SH	Qingdao Soda Ash Industrial	0.753	0.922	-24.54%	-17.12%	67.92%	20.66%
41	600236.SH	Laurel Power	0.787	0.789	8.82%	35.45%	24.33%	5.10%
42	600256.SH	Guanghui Energy	0.856	0.858	11.25%	-18.55%	17.66%	28.30%
43	600290.SH	Huayi Electric	0.893	0.931	1.77%	-16.42%	33.55%	-5.29%
44	600292.SH	Jiulong Electric Power	0.82	0.841	7.15%	19.87%	76.05%	-13.13%
45	600378.SH	Tianke Shares	0.987	0.995	10.82%	6.78%	66.40%	6.17%
46	600401.SH	Hareon Solar	0.697	0.741	-1.37%	-30.37%	41.50%	6.77%
47	600416.SH	Hunan Electric Shares	0.676	0.75	-10.04%	-13.17%	39.80%	33.93%
48	600475.SH	Wah Kwong Shares	0.838	0.865	6.71%	-8.00%	71.17%	-8.43%
49	600537.SH	EGing Photovoltaic	0.603	0.878	-56.90%	-51.77%	39.66%	33.79%
50	600550.SH	Baoding Tianwei Baodian	0.658	0.822	-29.08%	-47.07%	17.43%	12.92%
51	600598.SH	Great Northern Wilderness	0.567	0.617	-5.80%	2.04%	80.57%	0.14%
52	600642.SH	Shenergy	0.539	0.539	8.62%	5.61%	66.20%	-76.90%
53	600674.SH	Chuantou Energy	0.945	0.963	5.28%	-1.21%	7.79%	1.11%
54	600770.SH	Arts Shares	0.945	0.97	3.45%	-57.44%	7.61%	-3.50%
55	600795.SH	GD Power	0.228	0.29	13.00%	10.14%	28.57%	24.13%
56	600803.SH	Hebei Veyong Bio-Chemical	0.963	0.969	6.72%	1.49%	96.99%	-0.70%
57	600812.SH	North China Pharmaceutical	0.63	0.659	0.34%	-8.33%	89.70%	17.34%
58	600848.SH	Shanghai Automation Instrument	0.927	0.964	5.80%	1.64%	65.23%	-6.44%
59	600875.SH	Dongfang Electric	0.299	0.316	13.62%	-11.27%	47.37%	0.61%
60	601558.SH	Sinovel	0.713	0.763	-4.73%	-57.73%	12.80%	6.24%
61	601669.SH	China's Hydropower	0.243	0.259	12.51%	11.96%	73.70%	8.16%
62	601908.SH	Beijing Express	0.942	0.979	2.03%	-67.98%	12.62%	2.34%

In DEA effective companies, the distance between debt asset ratio of most companies and average level of the industry is relative small and main industry revenue keeps a large increase margin. In the 4 years, 60% companies have successful R&D programs and form independent intellectual property rights which is reflected in the substantial growth in intangible assets of companies. Most debt asset ratio of DEA inefficient companies financing is low which means the capital structure of companies is unreasonable. Majority of financing comes from equity financing which demonstrates the financing of new energy companies is limited and capital market is neither developed nor perfect. That affects the increase of company's overall value and improvement of financing efficiency. On the other hand, it shows that China's capital market is lack of institution building for new energy companies, which prevents the companies to make good use of the role and function of financial leverage.

There are 14 companies with intangible assets growth rate (4 years in average) bigger than 100%, 13 with the growth between 50%~100%, and 15 with almost no increase in 5 years, accounting for 18.52%. Most DEA effective companies grow rapidly. There are 32 companies with decrease in main business income and 30 in increase, in which 14 grows fast or keep the large increasing margin. Distribution of Rate on Equity, growth rate of main business revenue and growth rate of intangible assets are displayed in Table 8 and 9.

The analyze shows that, though individual output index of some company is relatively good, the input-output ratio is not high. Generally speaking, performance of China's new energy companies is relatively low from the angle of efficiency while its competitiveness does not play a decisive role in determining companies' performance and the foundation of its development is quite unstable. If the performance of new energy companies (measured by single index) is extraordinary good but its efficiency is on the average, the contrast will not last for a long time. Any performance without stable competitiveness will not be durable and stable. Sometimes, we may not exclude the phenomenon of manipulation on profit system. All demonstrate that the overall core competitiveness of China's new energy industry does not play an important role in the development strategy of companies.

Analysis on returns to scale

Changeable return to scale refers to, with the other conditions unchanged, the output change brought by the changes in the same proportion of the company's internal factors of production. Returns to scale includes increasing returns to scale, constant returns to scale and decreasing returns to scale. Increasing returns to scale means that the proportion of production increase is bigger than that of the increase of total production factors causing changes. Main reason for increasing returns to scale is the improvement of production efficiency due to companies' expanding its production scale. As a result, after enlarging its production scale, companies can employ more advanced technologies and production factors including machinery and equipment. However, it is impossible for the companies with smaller scale to use these technologies and production factors. In market competition, companies' financing efficiency and sustainable development will be affected if it does not form a certain scale and fail to obtain economics of scale profit due to its lack of capital, or the capital it financed at a higher price, even they have successful R&D programs. Constant returns to scale refers to the proportion of production increase equals to that of the increase of total production factors causing changes, which means the company is in the best station of constant returns to scale. Decreasing returns to scale refers to the proportion of production increase is smaller than that of the increase of total production factors causing changes. Main reason is too large production scale of companies makes it difficult for various production factors to realize coordinated development, which reduced the production efficiency. Combing the empirical data of 81 new energy companies, returns to scale situation of China's new energy companies is expressed in Table 10.

Table 10 Decision Table of Returns to Scale

Companies	Return to scale	Companies	Return to scale	companies	Return to scale
CSG A	irs	Zhongli Technology	irs	Laurel Poer	irs
Into Shares	crs	Seven Star Electronics	irs	Guanghui Energy	drs
Anhui Electric	drs	Dongshan Precision	irs	Huayi Electric	irs
Shaoneng Shares	irs	Nanyang Technological	crs	Jiulong Electric Power	irs
Tianmao Group	irs	Daikin Heavy Industries	irs	Guidong Electric Power	crs
Yuanxing Energy	irs	*ST Super Day	irs	Tianke Shares	irs
Asia-Pacific Industry	irs	Kstar	irs	Hareon Solar	irs
Nuclear Science and Technology	irs	Skyway Wind	crs	Hunan Electric Shares	irs
Silver Star Energy	irs	San Yang Share	crs	Wah Kwong Shares	irs
Hubei Energy	irs	Icahn dayton	irs	Sailing Shares	crs
Lutianhua	irs	Amalek Dayton	crs	EGing Photovoltaic	irs
Kaidi Electric Power	irs	EVE Energy	crs	*STnational Development	irs
Buddha Plastic Technology	irs	Dragon Optical	irs	Baoding Tianwei Baobian	irs
Refinement Technology	irs	New Daxin Materials	irs	Great Northern Wilderness	irs
Shield Security Environment	crs	Oak Shares	irs	Shenergy	crs
Qian Source of Power	crs	Golden Glass	irs	Sichuan Investment Energy	irs
Hengdian East Magnetic	irs	Sunflower	irs	Arts Shares	irs
Guangdong Hydropower	irs	East Sunrise	irs	GD Power	drs
Jiangsu Dagang	irs	Tatham Wind Power	irs	Hebei Veyong Bio-chemical	irs
Sinoma Science and Technology	irs	Sunshine Power	irs	North China Pharmaceutical	irs
Leo Shares	irs	Jing Sheng Electrical	crs	Shanghai mechanical and Electrical	drs
Stellar Technology	irs	Huadian Power International	irs	Shanghai Automation Instrument	irs
New Extension	irs	Gezhouba Hydropower	drs	Dongfang Electric	drs
Oriental Energy	crs	Harbin High-Tech	irs	Yangtze Power	drs
Auto Motion	crs	Huazi Industry	irs	Sinovel	irs
Hailu Heavy Industry	irs	Harbin Industry	irs	China’s Hydropower	drs
Zhe Fu Shares	drs	Qingdao Soda Ash Industrial	irs	Beijing Express	irs

Note: irs, crs and drs refer to increasing returns to scale, constant returns to scale and decreasing returns to scale.

According to efficiency strength, efficiency value of DMU is divided into: (1) Strong-Form Efficiency Units mean that the units appear quite a lot of times in the reference set of every business department with more than three times normally. Unless significant changes happening in the future, the units' efficiency can maintain an efficient level. (2) Marginal Efficient Units mean that the units appear only one or two times in the reference set of every business department. The overall efficiency will change in case of any change in input and output items. (3) Marginal In efficient Units refer to the overall efficiency value of the units is between 1-0.9, which means the efficiency value will be 1 as long as small adjustment in its input and output. (4) Distinctly in Efficient Units mean an overall efficiency of the units is obvious smaller than 0.9, which indicates the units are in poor operation efficiency. Therefore, in CCR model, for the energy companies with DEA efficiency smaller than 1 and bigger than 0.9, DEA will be effective in case of minor adjustment on the input and output items. As for the Distinctly in Efficient Units of DEA, effective operation will be achieved if the management is improved and promoted.

In Table 10, irs means returns to scale in increasing stage. drs means returns to scale in decreasing stage. crs refers to constant returns to scale with proper input and output scale. Distribution of financing efficiency in CCR model is shown in Table 11.

Table 11 TE of the companies with increasing returns to scale

TE scope in CCR model	1-0.9	0.9-0.8	0.8-0.7	0.7-0.6	<0.6
Number companies	34	12	8	3	1

From Table 11, as for the companies in increasing returns to scale, most DEA efficiency value is relatively low. May be due to their lack of development capital, further development of the companies and successful implementation of transformative projects are limited.

If the companies obtain more investment capital and strengthen its process management in transformative projects, larger proportion of output may be realized. If the companies increase R&D investment appropriately in strengthening its management, they may succeed in transforming scientific and technological achievements, which helps their products experience significant improvements in technology or production process. Products and competitiveness of companies are strengthened and operating results are improved substantially. As for the new energy companies in increasing returns to scale, new investors may be introduced to enlarge the capital investment or boost the transformation of R&D achievement as soon as possible with the support of government to improve output level and realize economics of scale. Based on practical situation, the companies in decreasing returns to scale can shrink capital to find new profit, carry on technical innovation to develop new products, adjust capital structure to strengthen internal management and improve output efficiency to reach the optimal station for production.

Bibliography:

[1] R.D. Banker, A. Charnes , W. W. Cooper. *Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis*[J]. Management Science, 1984, 26(3): 253~289

[2] A. Charnes, W. W. Cooper, E. Rhodes. Measuring the efficiency of decision making units. *European Journal of Operational Research*. 1978, 2(6): 429~444

[3] Coelli, Tim J. George E. Battese. Identification of Factors which Influence the Technical Inefficiency of India Farmers, *Australian Journal of Agricultural and Resource Economics,* 1996, 40(2): 103~128

[4] M.J Farrell, M.J. The Measurement of Productive Efficiency, *Journal of the Royal Statistical Society*, Series A (General), 1957, 120(3): 253~290

[5] Moore, Carl L; Jaedicke, Robert K., *Managerial Accounting* (London, E. Anold Publishers Ltd.), 1980: 11

Acknowledgements

This summary report is the final output of the project "The first Public Private Partnership on Environmental Goods and Services (PPPEGS) in APEC—*a Public Private Dialogue on Renewable and Clean Energy (RCE) Trade and Investment* (CTI 23 2013T:) which was approved by *APEC Committee on Trade and Investment and* funded by APEC Secretariat, Chinese Ministry of Commerce and the University of International Business and Economics. Mr John Larkin, Ms Mary Tan and her anonymous colleagues at APEC Secretariat have been providing consistent warm support for this program. Without them, this project is not possible.

The project is overseen By Mr. Chen Chao. Mr. Chen Chao and his colleagues: Ms Zhao Jie, Mr Wu Hao and Mr. Wang Chunyang have provided constructive criticism and most valuable labor from the beginning of this project to the communication with stakeholders and the final product of the seminar.

The project is cosponsored by Chile; Japan; New Zealand; Singapore; and US

The project has contacted numerous stakeholders in RCE investment. Their patient response and enthusiastic participation contribute to the most valuable content of the output of the project.

The project receives unreserved support from the University of International Business and Economics. Vice President and Professor Zhao Zhongxiu and other UIBE colleagues have been consistently supportive to this project. Numerous volunteers have participated in the event.

The project team has been working together coherently from the very beginning to date to make this project a successful one. They are Dr. Yu Xiang, Dr Wang Ran and Dr Guolin, Ms Chen Kexuan, Ms Wang Yu, Ms Zhu Xiaoting and other colleagues and students. Dr Han Qingna from Qingdao University also contributed her labor to the translation work of the project.

The project team expresses their sincere thanks to all the above stated people and institutions and numerous unanimous contributors to this project.

Appendix

of the **Public Private Dialogue on Renewable and Clean Energy Trade and Investment**

-The First Public Private Partnership on Environment Goods and Services (PPPEGS) in APEC

August11, 2014
Beijing, People's Republic of China

Appendix 1:
The Agenda of the Dialogue

Public Private Dialogue on Renewable and Clean Energy Trade and Investment

-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

August11, 2014

Beijing, People's Republic of China

Agenda

8.30 am – 9.00 am	**Arrival & Registration**
9:00 am – 9:20 am	**Opening Remarks** ● Zhang Shaogang ,Director General, Ministry of Commerce, China ● John Larkin, APEC CTI Chair ● Liang Zhipeng, Deputy Director General, China National Energy Administration ● Li Junfeng, President, Chinese Renewable Energy Industries Association ● Zhao Zhongxiu, Vice President of UIBE
Session 1: Overall Status and Recent Developments of RCE Trade & Investment in APEC Region	
9.20 am – 10:30 am	This session will have an overview of RCE trade and investment in APEC region, discuss the background, current development and trends of RCE trade and investment, and the roles of public and private sectors. The challenges and opportunities both developed and developing economies faced will be reviewed as well. **Moderator:** Mr. John Smirnow, Vice President ,Solar Energy Industries Association **Speakers**: ● Terry Collins, chair, APEC Energy Working Group Expert Group on Energy Efficiency ● Li Junfeng, President, Chinese Renewable Energy Industries Association ● Qin Haiyan, Secretary General ,Chinese Wind Energy Association ● Peter C. Brun, Managing Director, the SETI-alliance ● Liu Hengwei, Professor, Harbin University of Technology **Discussion (Questions & Answers)**
10:30 am – 10:50 am	**Coffee Break**
Session 2:Perspectives from Public and Private Sectors: How to Create an Enabling Environment for RCE Trade and Investment	

10:50am – 12.30 am	In this session, public and private sector representatives will discuss how government policies can promote RCE trade and investment and the dissemination of RCE technologies, how the use of international standards in APEC economies can contribute to increased trade and investment in RCE, how APEC can promote existing international standards or greater alignment of standards in this sector, and how APEC can strengthen cooperation on designing and implementing RCE related policies to avoid trade frictions. **Moderator:** Qin Haiyan, Secretary General, China Wind Energy Association **Speakers:** ● Liang Zhipeng, Deputy Director General, China National Energy Administration ● Zhu Chenyang, Vice President, Hanergy Holding Group Ltd. ● Xuan Xiaowei, Development Research Center of the State Council, China ● Jake Colvin, Vice President,， Global Trade Issues ● Wu Gang, Chairman, Xinjiang Goldwind Science & Technology Co.,Ltd **Discussion (Questions & Answers)**
12.30 am – 2.00 pm	**Lunch**
2.00 pm – 4.00 pm	**Moderator:** Li Junfeng, President, Chinese Renewable Energy Industries Association **Speakers:** ● Lisa Salley, VP & GM of Energy & Power Technologies, Underwriters' Laboratories ● Qu Xiaohua, President & CEO, Canadian Solar Inc. ● Li Shizhong, Professor, Tsinghua University ● Yang Xiaozhong, Vice President, Trina Solar ● Alex Lu, Sales General Manager, GE Greater China ● Chiharu Murakoshi, Executive Research Adviser, Jyukankyo Research Institute Inc. **Discussion (Questions & Answers)**
4.00 pm – 4.20 pm	**Coffee Break**
Session 3: Open Floor Discussion: Way Forward - Recommendations for Future APEC Work	

4.20 pm – 5.40 pm	In this open discussion session, representatives from both public and private sectors will share their views on what APEC should do to 1) facilitate RCE trade and investment in this region, 2) assist economies in designing and implementing policies, strategies and actions to promote RCE trade and investment, 3) avoid trade frictions, and 4) improve the business climate for RCE for the economic benefit of all APEC economies **Moderator:** Peng Ningke, Vice President, Greater China, Dow Chemical (China) Investment Company Limited **Speakers:** ● Mr. John Smirnow,Vice President of Trade & Competitiveness, Solar Energy Industries Association ● Dr. Bo Wang, University of International Business and Economics ● Active participants from APEC economies **Open Floor Discussion**
5.40 pm – 6.00 pm	**Closing**

Appendix 2: Name List of the Speakers and Active Participants

Participant contact list

Public Private Dialogue on Renewable and Clean Energy Trade and Investment

-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

August11, 2014

Economy	Name	Gender	Job Title	Contact
APEC Secretaria t	Mary Tan	Female	Program Executive, APEC Secretariat	mt@apec.org
Australia	Ben Jarvis	Male	Counsellor, Australian Embassy Beijing	ben.jarvis@dfat.gov.au
Australia/ APEC	John Larkin	Male	APEC CTI Chair, Assistant Secretary of Department of Foreign Affairs and Trade	John.Larkin@dfat.gov.au
Canada	Shawn Qu	Male	President & CEO, Canadian Solar	shawn.qu@canadiansolar.com
Canada	Tu Wuyi	Male	Manager, Canadian Solar	Wuyi.tu@canadiansolar.com
Chile	Ninel Calisto Santana	Female	Advisor	ncalisto@direcon.gob.cl
Chile	Claudia AYALA	Female	Advisor	cayala@direcon.gob.cl
China	Wu Gang	Male	Chairman Gold Wind Science & Technology Co., Ltd	86-10-67511888
China	Zhang Shaogang	Male	Director General, Ministry of Commerce(MOC)	86-13801167582
China	Liang Zhipeng	Male	Deputy Director General ,NDRC	liangzp@ndrc.gov.cn
China	Zhao Zhongxiu	Male	Vice President, the University of International Business and Economics	zhxzhao@uibe.edu.cn
China	Li Shizhong	Male	Professor, Tsing Hua University	8613910097598
China	Yang Xiaozhong	Male	Vice President,Trina Solar	colin.yang@trinasolar.com
China	Lu Xi	Male	GE Sales General Manager	MingMing.Ma@ge.com
China	Wang Bo	Male	Associate Professor, UIBE	bowang@uibe.edu.cn ;
China	Chen Chao	Male	Office Director, MOC	chenchao@mofcom.gov.cn
China	Zhao Jie	Female	Deputy Director, MOC	zhaojie_gj@mofcom.gov.cn
China	Wu Hao	Male	Officer，MOC,	wuhao_gj@mofcom.gov.cn
China	WANG Chunyang	Male	Officer，MOC,	wangchunyang@mofcom.gov.cn

China	Ma Mingming	Female	Manager, GE	MingMing.Ma@ge.com
China	Li Junfeng	Male	President, Chinese Renewable Energy Industries Association(CREIA)	lijunfeng@creia.net
China	Qin Haiyan	Male	Secretary General China Wind Power Association	qinhy@cgc.rog.cn;
China	Liu Hengwei	Male	Professor, Ha'rBin University of Technology	liu.aramco@gmail.com
China	Zhu Chenyang	Male	Vice President , Hanergy	delialiao@hanergy.com
China	Xuan Xiaowei	Male	Professor National Development and Reform Research Center	xxw@drc.gov.cn
China	Liao Dishan	Female	Assistant Manager, Hanergy	delialiao@hanergy.com
China	Liu Zhigang	Male	Manager, Siemens Ltd.,	zg.liu@siemens.com
China	Tang Wenqian	Female	Manager, CREIA	86 10 6800 2618-106
China	Geng Dan	Female	Manager, CREIA	geng.d@creia.net
China	Sun Lei	Female	Manager, CREIA	86 10 6800 2618-106
China	Zhang Miao	Female	Manager,CREIA	zhangmiao@creia.net
China	Li Li	Female	Lecturer ,UIBE	86-18610167976
China	Lin Zhiqin	Male	Professor ,UIBE	010-64492361，13691301593
China	Men Ming	Male	Professor , UIBE	86-13911620389
China	Xiaoting Zhu	Female	Manager, UIBE	sallyzhu2003@sina.com
China	Xiangfeng Zhu	Male	Manager UIBE	175207004@qq.com
China	Kexuan Chen	Female	Office Assistant, UIBE	ckx_999@126.com
China	Yu Wang	Female	Office Assistant, UIBE	cynthia635401428@163.com
China	Ran Wang	Female	Post Doc Research Fellow, China Social Sciences Academy	ranran06117@126.com
China	Lin Guo	Femail	PHD researcher, Nagoya University	icecream_linlin@163.com
China	Chang Cheng	Female	Manager China Guodian Corporation	changcheng@cgdc.com.cn
China	Li Gengda	Male	Manager China Guodian Corporation	ligd05@163.com
China	Hanzhi Xu	Mr	Manager , Trina Solar	hanzhi.xu@trinasolar.com
EU	Wang Jue	Female	Trade official	Jue.wang@eeas.europa.eu
Indonesia	Satrio Nugroho	Male	International Trade Policy Analyst	satrio.nugroho@kemendag.go.id
Indonesia	Michael Fernando Ginting	Male	International Trade Policy Analyst	michael.fernando@kemendag.go.id
Malaysia	Nor Hayati	Female	Senior Principal	nhy@doe.gov.my

	Yahaya		Assistant Director	
Malaysia	Nor Azaliza Damiri	Female	Senior Assistant Director	azaliza@seda.gov.my
New Zealand	Terry Collins	Male	Chair, APEC EGEE&C	Terry.Collins@eeca.govt.nz
NGO based in Geneva	Peter C. Brun,	Male	Managing Director, SETI Alliance, ICTSD	PBrun@ictsd.ch
Philippines	Nestor P. Arcansalin	Male	Director	nparcansalin@boi.gov.ph
Chinese Taipei	Feng-Chi Yen	Mr	Section Chief	fcyan@moeaidb.gov.tw
Chinese Taipei	Shih-Fang LO	Female	Associate Research Fellow	shihfang.lo@cier.edu.tw
Chinese Taipei	Che-Ming CHANG	Male	Project Manager	tom6251@mail.sinotech.com.tw
Thailand	Krittiya Petsee	Female	Plan and Policy Analyst	krittiya_p@dede.go.th
Thailand	Thanyalak Meesap	Female	Engineer	thanyalak_m@dede.go.th
Japan	Chiharu Murakoshi	Male	Executive Research Adviser, Jukankyo Research institute Inc.	murakoshi@jyuri.co.jp
USA	Robert Jake Colvin	Male	Vice President, National Foreign Trade Council	jcolvin@gmail.com
USA	William Mceleana	Male	Director for Environment and Natural Resources, Office of the ***United States Trade Representative***	William_K_McElnea@ustr.eop.gov
USA	***Ed Brzytwa***	Male	Director for APEC Affairs at Office of the ***United States Trade Representative***	Edward_Brzytwa@ustr.eop.gov
USA	Ningke Peng	Male	Vice President, Dow Chemical ,China	npeng@dow.com
USA	Lisa Salley	Female	Vice President and General Manager,UL LLC	Lisa.Salley@ul.com
USA	John P. Smirnow	Male	Vice President ,Trade & Competitiveness at the Solar Energy Industries Association (SEIA)	JSmirnow@seia.org
USA	Bian Yanan	Female	Manager, OGIN Wind Turbine	MichelleBian@oginenergy.com
Viet Nam	Nguyen Thanh Long	Male	Official in charge of renewable and clean energy.	nguyenthanhlong.2010@gmail.com
Viet Nam	Nguren Minh Tri	Male	Official in charge of FTAs negotiations on environmental goods and services.	nmtri1987@yahoo.com

Experts / Consultants list

Economy	Name	Gender	Job Title	Contact
Australia/ APEC	John Larkin	Male	APEC CTI Chair, Assistant Secretary of Department of Foreign Affairs and Trade	John.Larkin@dfat.gov.au
Australia	Ben Jarvis	Male	Counsellor, Australian Embassy Beijing	ben.jarvis@dfat.gov.au
Canada	Shawn Qu	Male	President & CEO, Canadian Solar	shawn.qu@canadiansolar.com
China	Wang Bo	Male	Associate Professor, UIBE	bowang@uibe.edu.cn;
China	Liu Hengwei	Male	Professor, Ha'rBin University of Technology	liu.aramco@gmail.com
China	Zhu Chenyang	Male	Vice President , Hanergy	delialiao@hanergy.com
China	Xuan Xiaowei	Male	Professor National Development and Reform Research Center	xxw@drc.gov.cn
China	Li Junfeng	Male	President, Chinese Renewable Energy Industries Association(CREIA)	lijunfeng@creia.net
China	Qin Haiyan	Male	Secretary General China Wind Power Association	qinhy@cgc.rog.cn;
China	Li Shizhong	Male	Professor, Tsing Hua University	8613910097598
China	Yang Xiaozhong	Male	Vice President,Trina Solar	colin.yang@trinasolar.com
China	Lu Xi	Male	GE Sales General Manager	MingMing.Ma@ge.com
China	Zhang Shaogang	Male	Director General, Ministry of Commerce(MOC)	86-13801167582
China	Liang Zhipeng	Male	Deputy Director General ,NDRC	liangzp@ndrc.gov.cn
China	Zhao Zhongxiu	Male	Vice President, the University of International Business and Economics	zhxzhao@uibe.edu.cn
Japan	Chiharu Murakoshi	Male	Executive Research Adviser, Jukankyo Research institute Inc.	murakoshi@jyuri.co.jp
NGO based in Geneva	Peter C. Brun,	Male	Managing Director, SETI Alliance, ICTSD	PBrun@ictsd.ch
New Zealand	Terry Collins	Male	Chair, APEC EGEE&C	Terry.Collins@eeca.govt.nz
USA	Robert Jake Colvin	Male	Vice President, National Foreign Trade Council	jcolvin@gmail.com
USA	Ningke Peng	Male	Vice President, Dow Chemical ,China	npeng@dow.com
USA	Lisa Salley	Female	Vice President and General Manager,UL LLC	Lisa.Salley@ul.com
USA	John P. Smirnow	Male	Vice President ,Trade & Competitiveness at the Solar Energy Industries Association (SEIA)	JSmirnow@seia.org

Appendix 3: Presentation Slides of the Speakers

Public Private Dialogue on Renewable and Clean Energy Trade and Investment

Terry Collins New Zealand
Chair APEC EGEE&C

New Zealand Electricity Sector

- Generation
- Transmission
- Distribution
- Retail
- Consumption
- Regulation

The New Zealand Energy Strategy

Sets the strategic direction for the energy sector and the role energy will play in the New Zealand economy over the period 2011-2021

Goal: for New Zealand to make the most of its abundant energy potential for the benefit of all New Zealanders

Includes the Energy Efficiency and Conservation Strategy 2011-2016

3

The New Zealand Energy Strategy

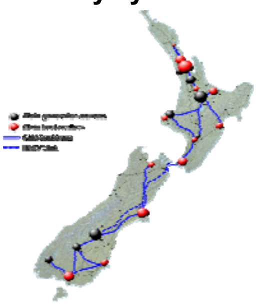
AREAS OF FOCUS	PRIORITIES	GOAL
Develop renewable energy resources Develop petroleum and mineral fuel resources Embrace new energy technologies	Diverse resource development	Make the most of our energy potential
Best practice in environmental management for energy projects Reduce energy-related greenhouse gas emissions	Environmental responsibility	
Warm, dry, energy efficient homes An energy efficient transport system Enhance business competitiveness through energy efficiency Better consumer information to inform energy choices	Efficient use of energy	
Competitive energy markets Reliable electricity supply Oil security and transport	Secure and affordable energy	

4

New Zealand's Achievements

- First major HVDC link (1965)
- Pioneered locational marginal pricing electricity market, later adopted by others
- Largely unsubsidised electricity system
- 75% renewable and increasing again, but 90% renewable in 1990

Experience operating an amazing electricity system

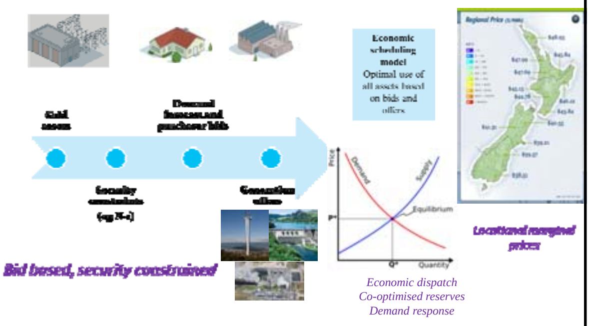


- Isolated island system
- Two AC island power systems
- 1,200MW HVDC link
- Peak demand, 7,040MW
- Installed generation, 9,751MW
- Total energy, 43,138 GWhr

We are just big enough to be internationally relevant

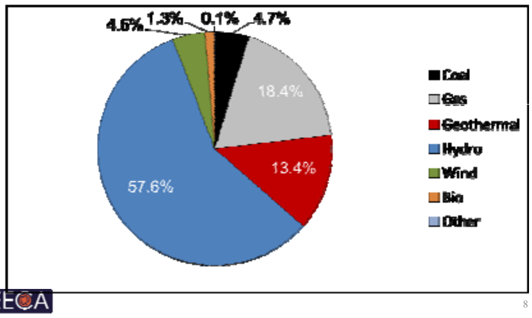
6

The Wholesale Market Model



EECA 7

Renewable energy's contribution to New Zealand's energy supply



EECA 8

Strategy Targets for Renewable Energy

- NZES and NZEECS include the following targets
- 90% of electricity generation from renewable sources by 2025 (in an average hydrological year), providing this does not affect security of supply
- By 2025: utilise up to 9.5 PJ per year of energy from woody biomass or direct use geothermal additional to that used in 2025

EECA 9

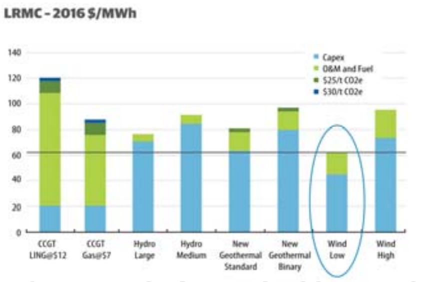
Government policy and activities related to geothermal energy

Government's focus is on:

- Ensuring there are no unnecessary regulatory barriers, while managing environmental and sustainability issues
- Investing in scientific research
- Learning from other economies and sharing our own experience (e.g. IPGT, Geothermal NZ, scholarships)
- Market development and investment promotion (e.g. industrial fuel switching)

EECA 10

Real understanding of the true costs of generation



Low-cost option for new electricity generation

EECA 11

We have insights for building a thriving renewable industry

- NZ experience is that renewables will thrive:
- True electricity prices are visible
- Fossil fuel subsidy reform
- Long term hedge markets or PPA
- Political targets, e.g. 90% renewable electricity
- Price on carbon helps as does political leadership
- Renewables need government support to establish an industry

EECA 12

Market Potential

- Geothermal only 12,000 MW globally
- Wind already at some 250,000 MW globally
- Wind competitively priced
- Wind development cycle relatively short (compared to Geothermal)
- Small scale opportunities can provide entry point
- Low cost hybrid developments practical and cost effective


EECA

13

Experience in helping an industry develop

A wind farm is a:

- Roading project
- Exercise in transport logistics
- Cabling project
- Grid connection project
- Weather dependent project
- Crane project
- Planning/legal project

Build an ecosystem of companies that understand each other and work together well

EECA

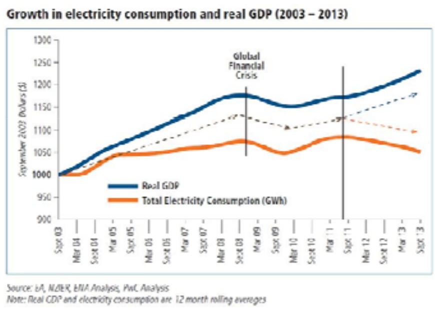
14

Solar Energy- in New Zealand

- Just beginning to emerge as option in New Zealand
- Use in New Zealand very dependent on net metering – not particularly attractive unless utility allows this
- Uptake being driven by long term price certainty
- Providers offering long term financing
- Lines companies encouraging growth – not subject to loss of generation sales but do need to resolve payment for "fixed costs" of providing interconnection to end user


EECA

Impact of Well Managed Network and Energy Efficiency Measures



EECA

16

Understanding & Capacity

Renewable generation needs to be understood:

- Politicians
- Communities
- Industrial sector
- Business sector
- Electricity sector
- Landowners

An education/promotion programme is important

EECA

17

Summary

- New Zealand has a long history using renewable resources for power generation
- Partnerships with land owners is a key to future growth
- We are proud to share our experience internationally
- Renewables are a key part of the new global development framework post 2015
- Much is happening but accelerating future growth requires pragmatic approaches and realistic targets
- Collaboration at all levels will be a key element in this acceleration
- It will take innovation, commitment finance and people

EECA

18

PROMOTE A BETTER FUTURE FOR RENEWABLE ENERGY TRADE & INVESTMENT

Li Junfeng

August 11, 2014

Chinese Renewable Energy Industries Association

Sustainable Development Requires Further Deployment of Renewable Energy Resources

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

Positive Environment Impact

- Reduce the use of fossil fuels and greenhouse gas emissions
- Contribute to deal with climate change

Economic Benefits

- Create new jobs
- Reduce poverty

Energy Security

- Secure energy services
- Diversify power supply

Exploration of Renewable Energy Transition is a Global Energy Mega Trend

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

Renewable Energy in the World in 2013

- Renewable energy provided approximately **19%** of global final energy consumption
- Renewable energy comprise **26.4%** of global power generation capacity
- **22.1%** of global electricity was produced from renewable energy
- Renewables accounted for **56%** of new installed power capacity in 2013
- Total renewable energy power capacity: **1,560 GW**

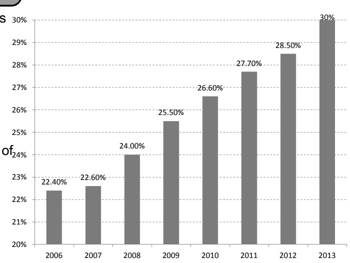
Data Source: REN21 GSR 2014

China's Achievements in the Renewable Energy Arena

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

- China's renewable energy market has experienced rapid growth due to continuously **growing demand** and effective **policy support**.
- In 2013, China's renewable power accumulated installed capacity reached **378GW**, accounted for **30%** of total power capacity.
- In 2013, electricity generated by renewables exceeded **1 trillion kwh**, made up **over 20%** of total electric power generated from all sources.

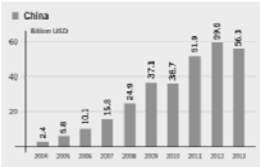
2006-2013 China's renewable energy share of total power installed capacity



China's Contribution to Fostering the Development of Renewable Energy in the World

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

2004-2013 China's New Investment in Renewable Energy



ANNUAL INVESTMENT / NET CAPACITY ADDITIONS / PRODUCTION IN 2013

	1	2	3
Investment in renewable power and fuels	China	United States	Japan
Share of GDP 2012 (USD) invested	Uruguay	Mauritius	Costa Rica
Geothermal power capacity	New Zealand	Turkey	United States
Hydropower capacity	China	Turkey	Brazil
Solar PV capacity	China	Japan	United States
CSP capacity	United States	Spain	United Arab Emirates
Wind power capacity	China	Germany	United Kingdom
Solar water heating capacity[3]	China	Turkey	India
Biodiesel production	United States	Germany	Brazil
Fuel ethanol production	United States	Brazil	China

Source: REN21 GSR 2014

Cooperation and Elimination of Trade Barriers are Bases of Large-scale Deployment of Renewables

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

- Increase utilization of Renewable and Clean Energy (RCE) and enlarge RCE market through development of policies and regulations
- Promote market openness, eliminate trade barriers and avert trade disputes among APEC member economies
- Strengthen the establishment and management of RCE industry standards
- Encourage RCE technical know-how sharing and intellectual property rights protection

CREIA CHINESE RENEWABLE ENERGY INDUSTRIES ASSOCIATION

THANK YOU!

Li Junfeng

Chinese Renewable Energy Industries Association

中国风电产业现状及展望

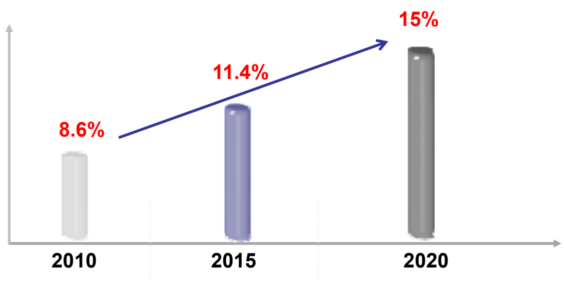
China Wind Status & Prospects

Qin Haiyan 秦海岩
Chinese Wind Energy Association
Aug. 11th, 2014

Contents

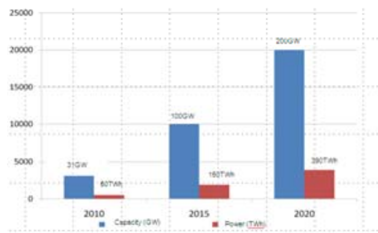
- Wind energy roadmap of China
- Wind development status in China
- The challenges and prospects

中央政府确定2020年非化石能源发展目标
The government sets the non-fossil energy development goals for 2020



Wind —"12th FYP "

- By 2015, the total wind power installed capacity will reach 100GW and the annual electricity generation will be more than 190TWh, which will be over 3% of the total power.
- By 2020, the total wind installed capacity will reach 200GW, the offshore wind power capacity will reach 30GW, generating capacity will reach 390 TWh.



Wind —"13th FYP "

十三五规划前期研究全面启动，已经开展相关课题调研研究
13th FYP early study has been fully started up, the research study has been carried out on this subject.

非化石能源发展的重大矛盾和问题
The major contradictions and problems of non-fossil energy development

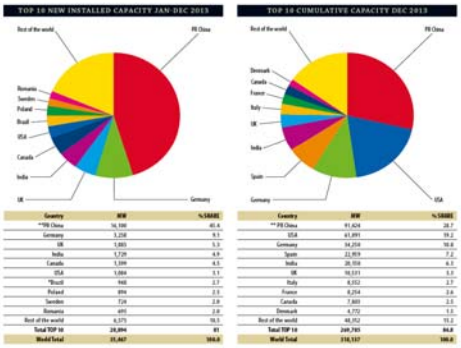
测算各类非化石能源的可行发展规模
Measure and calculate feasible development scale of all kinds of non-fossil energy

制定各类政策和保障措施
Formulate all kinds of policies and measurements

Contents

- Wind energy roadmap of China
- Wind development Status in China
- Challenges and prospects

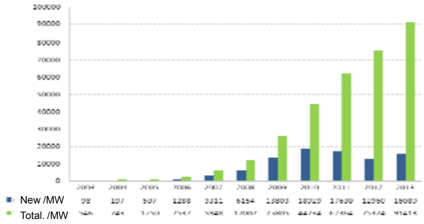
China is the global leading market of wind installed capacity



Source: GWEC

2013年中国风电新增及累计装机容量
Wind power Installed Capacity, China: 2013

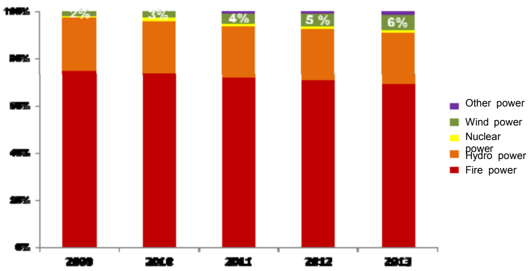
2013年，中国风电新增装机1608.9万千瓦，同比增长24.1%；
In 2013, wind power new installed capacity in China has reached 16089MW , with a year-on-year growth of 24%.
累计装机达到9141.3万千瓦，同比增长21.4%。
Total capacity has reached 91413MW, up 21.4% from a year earlier.



Source:CWEA

中国风电市场回暖
Chinese wind power market recovery

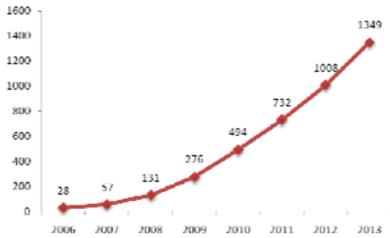
风电装机在电力装机总量中的比重逐年提高，2013年达到6%。
The proportion of the newly installed wind power capacity among the total power installation capacity increases year by year, reach 6% in 2013



Source: NEA

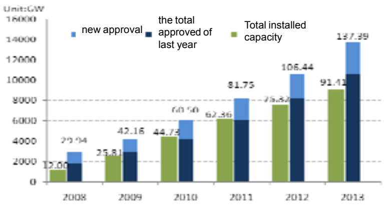
中国风电发电量逐年提高
Wind power electricity production in China increases year by year

2013年中国风电发电量超1300亿千瓦时,保持37%的增长率；连续2年成为中国第三大电源。
In 2013, the wind power generation capacity in China exceeded 130 billion kWh, maintaining a growth rate of 37%;become the third largest power supply in China for two consecutive years .



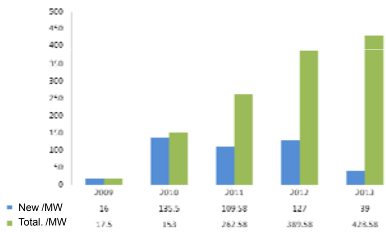
中国风电项目核准与实际装机情况
The wind power project approval and the real installed capacity

国家能源局印发的《2014年能源工作指导意见》，提出2014年实现新增装机1800万千瓦的目标，从能源局提出的目标来看，现有核准项目完全能满足市场的装机要求。
National Energy Administration(NEA) issued *the Guidance of the 2014 Energy Work*, which puts forward the goal of realizing newly installed capacity of 18 GW in 2014. From the targets put forwarded by NEA, the existing approved projects can fully satisfy the installation requirements of the market.



2013中国海上风电发展情况
The Status of Offshore Wind Development in China in 2013

截止2013年底，中国已建成海上风电项目共428.6MW，当年新增全部为潮间带项目。
By the end of 2013, China has built a total of 428.6 MW offshore wind projects, the new ones are all intertidal zone projects.



Source:CWEA

全球主要风电企业
The global leading manufactures

More than half of the global top15 are Chinese companies

2013 全球新增装机容量TOP15**制造企业**
2013 global top 15 manufactures of new installation

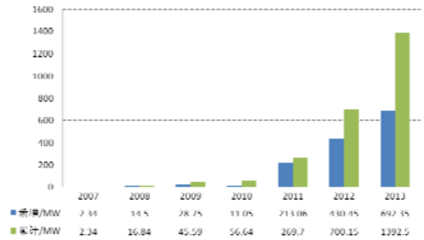
No.	Economy	Manufacture
1	Denmark	VESTAS
2	China	Goldwind
3	Germany	ENERCON
4	Denmark	Simens
5	U.S.	GE
6	Spain	Gamesa
7	India	Suzlon
8	China	United Power
9	China	Ming Yang
10	Germany	Nordex
11	China	Envision
12	China	XEMC-Wind
13	China	SEWIND
14	China	Sinovel
15	China	CSIC-Haizhuang

2013全球累计装机容量TOP15**开发企业**
2013 global top 15 developers of cumulative installation

No.	Economy	Developer
1	Spain	Lberdrola Renovables
2	China	China Guodian Co.
3	U.S.	NextEra
4	Portugal	EDP
5	Spain	Acciona
6	China	China Huaneng
7	China	China Datang
8	China	China Huadian
9	Italy	Enel
10	China	China Power Investment Co.
11	Germany	E.ON Climate and Renewables
12	China	China Guangdong Nuclear Co.
13	France	EDF
14	France	GDF Suez法国燃气苏伊士集团
15	China	China Guohua

中国风电设备出口情况
Chinese wind turbines exports during 2007-2013

Distributed in 27economies and regions, including the U. S., Australia, Britain, Denmark, Sweden, Finland, Italy and Spain.



Source: CWEA

14

Contents

15

未来发展思路-风电规划与区域布局合理化
Future development ideas - Wind power planning and the rationalization of regional layout

- 综合风能资源、电力市场、区域电网结构和跨区电力外送条件，统筹协调资源丰富地区风电规模化开发。
  Integrated the wind energy resources, electric power market, regional power grid structure and interregional power conditions, make overall plans and coordinate the scale development of wind power in the area of rich resources .
- 协调风能资源与海域综合利用，积极稳妥推进海上风电项目开发建设。
  Coordinate the comprehensive utilization of wind energy resources and offshore resources, actively and prudently push the development and construction of offshore wind project.
- 鼓励企业和个人等各类投资主体按照"分散开发、就近接入、当地利用"的原则，加快建设分散式风电项目。
  Encourage all kinds of investment main bodies such as the enterprises and the individuals to speed up the construction of distributed wind power projects according to the principle of " dispersed development use local, access to the nearest, local use".

16

未来发展思路-着力保障重点地区风电并网和消纳问题
Future development ideas -Focus on the issues of grid integration and wind power consumption in key areas

因地制宜采取措施

Take measures according to local conditions

- 蒙东地区采用过渡方案，将风电分别接入开鲁220千伏变电站和科尔沁500千伏变电站，保障了开鲁风电基地的风电接入。
  The transition plan in Mongolian East area is adapted, which transits the wind power to the 220kV transformer substation in Kailu and 500 kV transformer substation in Khorchin, ensures the wind power connection in Kailu wind power base .
- 东北地区则较好地利用了风电供暖，支持利用风电清洁供暖技术替代已有的燃煤锅炉供热技术。
  Wind power heating system is well applied in the Northeast China. The wind power clean heating technology already could be supported to replace the existing coal-fired boiler heating technology in this area.

17

未来发展思路-着力保障重点地区风电并网和消纳问题
Future development ideas - Focus on the issues of wind power grid integration and consumption in key areas

风电基地配套送出通道建设加快

Speed up construction of transmission lines for wind power bases

- 2013年6月投运的新疆—西北750千伏联网工程，这个通道投运以后，对释放酒泉风电出力起到了很关键的作用。
  Xinjiang - northwest 750kV network program operated in June of 2013: Its operation plays a critical role to releasing wind power output of Jiuquan region.
- 哈密—郑州±800千伏特高压直流工程，该工程于2014年1月11日完成机组调试，1月25日投入商业运行，具备输送800万千瓦风电的能力。
  The ±800kV UHV DC transmission project from Hami of Xinjiang Autonomous Region to Zhengzhou of Henan Province: the project completed the unit commissioning in January 11 of 2014 , used for commercial operation in January 25, it has the capacity of transiting wind power of 8 GW .
- 2014年，国家能源局将重点保障哈密风电基地二期、酒泉风电基地二期第一批项目、张家口风电基地二期、承德风电基地二期以及内蒙古自治区乌兰察布市风电基地、锡林郭勒盟风电基地等项目的配套送出通道的规划和建设，以更好的送出当地的富余风电。
  In 2014, the National Energy Administration will mainly focus on the planning and construction of supporting delivery channel of the projects of the wind power bases such as Hami wind power base phase II, the first project of the Jiuquan wind power base phase II, Zhangjiakou wind power base phase II, Chengde wind power base phase II, and Wulanchabu wind power base of Inner Mongolia Autonomous Region, Xilin Gol League wind power base so that to better transit the local surplus wind power .

18

未来发展思路-政策体系不断完善
Future development ideas - the policy system improvement

海上风电电价政策支撑海上风电产业发展

The policy of offshore wind power feed-in tariff is a key incentive for offshore wind development in China

- 2014年6月，国家发改委发布《海上风电上网电价政策》：2017年前投运的
  ——近海风电项目，上网电价0.85元/千瓦时；
  ——潮间带风电项目，上网电价0.75元/千瓦时。
  June, 2014, NDRC released *Offshore Wind Power Feed-in-tariff:*
  ——*for near offshore, 0.85 yuan/kWh;*
  ——*for the inter tidal, 0.75 yuan/kWh.*
- 已有地区制定海上风电补贴措施：上海对海上风电提供0.2元/千瓦时的补贴。
  Offshore wind power subsidy measurement are conducted in existing areas: The subsidy for offshore wind power in Shanghai is 0.2 yuan/kWh.
- 欧洲国家：德国、丹麦、英国、意大利海上风电上网电价在1.14元/千瓦时~1.6元/千瓦时。中国海上风电电价低于欧洲各国水平，未来还需进一步调整和优化。
  In European economies, the feed-in tariff of Germany, Denmark, U.K, and Italy rang from 1.14 yuan/kWh to 1.6 yuan/kWh. The offshore wind power price in China is still lower than those in Europe, and needs further optimization.

19

未来发展思路-建立完整的风电技术创新体系
Future development ideas– Build complete innovation system of wind power technology

定制化 Customization

根据不同的环境条件、不同客户需求，对机组进行差异化、精细化配置，最大限度地提高风电场的发电效率。

On basis of different environmental conditions and the different needs of customers, differentiation and fine configuration should be made on wind turbine so as to maximize power generating efficiency of the wind farm.

20

未来发展思路-建立完整的风电技术创新体系
Future development ideas– Build complete innovation system of wind power technology

智能化 Intelligentization

利用现代通信与信息技术、智能控制技术以及更先进的信号采集技术来提升机组的性能和效率。机组智能化控制具备自我感知、自我修正和动态调节功能，实现一定的自适应以提高效率。

By using modern communication and information technology, intelligent control technology and more advanced signal acquisition techniques to improve performance and efficiency of the wind turbine. Intelligent control of wind turbine has self awareness, self correction and dynamic adjustment function, finally achieve a certain self-adaption to improve efficiency.

21

未来发展思路-建立完整的风电技术创新体系
Future development ideas– Build complete innovation system of wind power technology

互联化 Interconnection

通过互联网实现风电物与物、物与人的互联，有效推动产品的监控、反馈与完善，为风电产业大数据分析做好准备。

Through the interconnections to realize the interaction between object and object, object and human and to effectively promote the product monitoring , feedback and improvement so that to make well preparation for the big data analysis in the wind power industry.

22

未来发展思路-鼓励开展国际合作
Future development ideas – encourage carrying out globalization and international cooperation

全球化 **Globalization**

融入全球风电技术创新体系
Integrate into global wind power technology innovation system

风电价值链国际化管理，包括研发设计、生产制造、应用各个环节;

Internationalized management of wind power value chain includes different links of R&D design, production and application;

参与国际性的技术发展计划，与国外企业合作开展前沿技术和共性技术研究

Participate in the international technological development plan, cooperate with foreign enterprises to carry out the research of frontier technology and common technology.

23

未来发展思路-鼓励开展国际合作
Future development ideas – encourage carrying out globalization and international cooperation

积极参与全球风电市场
Actively participate in the global wind power market

提高企业国际化经营能力，积极参与国际风电项目投资建设;

Improve the international operation ability of the enterprise, actively participate in the investment and construction of international wind power projects;
中国风电企业走出国门，金风、明阳等企业已经取得很好成绩。
The Chinese wind power enterprises go abroad, such as Goldwind, MingYang have achieved very good results.

24

未来发展思路-鼓励开展国际合作
Future development ideas – encourage carrying out globalization and international cooperation

积极参与国际标准和规则制定
Actively participate in making international standards and rules

积极参与国际风电技术标准的制定，加强风电机组检测和认证体系的国际交流与合作，促进中国风电机组检测、认证体系的国际互认，提高中国在风电标准制定方面的影响力。

It is necessary to actively participate in making international wind power technology standards, strengthen international exchanges and cooperation in wind turbine testing and certification system , and promote international mutual recognition of Chinese wind power unit testing and certification system , so as to increase the China's influence in the aspect of wind power standards formulation.

25

未来发展思路-鼓励开展国际合作
Future development ideas – encourage carrying out globalization and international cooperation

加强区域合作
Strengthening regional Cooperation

在亚太地区新能源合作的整体框架下，明确优先和深度合作领域，制定风能合作机制，建立长效稳定、互惠共荣的合作关系。

Formulate wind energy cooperation mechanism under the framework of Asia-Pacific new energy cooperation, and establish a long-acting, multi-beneficial cooperative relationship.

26

Thank you 谢谢！

北京国际风能大会暨展览会

China wind Power 2014

时　间/Time：2014.10.22-2014.10.24

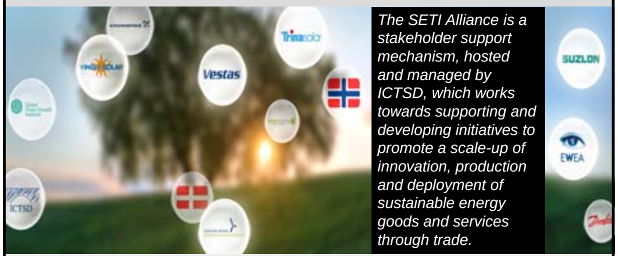
网 址/Website：www.chinawind.org.cn

Why do we need an international Sustainable Energy Trade Agreement ?

Peter C. Brun
Managing Director, SETI Alliance
Senior Fellow at International Centre of Sustainable Trade and Development

---

What is the SETI Alliance?



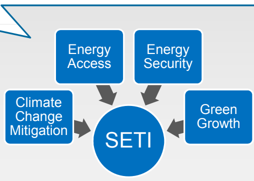
The SETI Alliance is a stakeholder support mechanism, hosted and managed by ICTSD, which works towards supporting and developing initiatives to promote a scale-up of innovation, production and deployment of sustainable energy goods and services through trade.

With the integration of the AFASE Campaign and the Trade Associations in the Wind Industry the SETI Alliance represents more than 1800 European solar and wind companies

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Policy perspective for a Green Trade Agreement

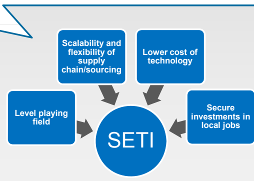
To support the formulation of policies addressing international markets for sustainable energy goods and services which will contribute to **climate change mitigation**, improve **access to energy**, enhance **energy security** and stimulate **green growth**.



ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Business perspective of Green Trade Agreement

To **secure open** and **stable trade and investment frameworks**, and ensure a level playing field for sustainable technologies and related supply chains so as to **combat climate change, lower the cost of technology and expand green jobs.**



ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

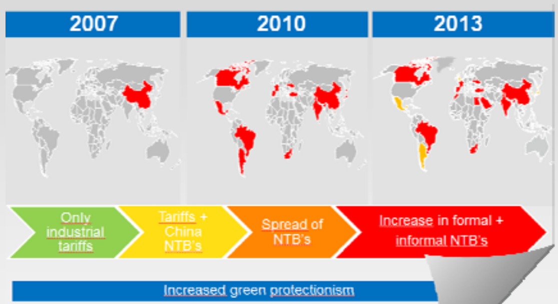
---

10 reasons for establishing a SETA

- ✓ SETA will **secure the scalability of clean technologies**, allow economics of scale, and bring down the cost of energy for the benefit of consumers and climate change mitigation.
- ✓ SETA will help both developed and developing economies **reduce dependency on fossil fuel imports**, and enhance their energy security with a switch to energy efficiency and renewable energy sources such as biofuels, hydro power, solar and wind power.
- ✓ SETA will make clean technologies **more affordable for consumers and developing economies**, thus offering their populations climate friendly access to energy.
- ✓ SETA will help **reduce mortality from indoor air pollution caused by inefficient firewood** or charcoal-based cooking, with better access to modern cook stoves such as solar or biomass fuels.
- ✓ SETA will **help rural children study at night** without access to grid-based electricity with solar-lighting facilities.
- ✓ SETA will **accelerate the time until clean technologies will be cost-competitive** without subsidies and replace fossil fuels.
- ✓ SETA will **bring welfare gains for all parts of the world**, not least of which in employment for the establishment of plants and their annual service and maintenance structures.
- ✓ SETA will **speed up clean and green technology innovation** due to increased growth in revenues and research and development.
- ✓ SETA will help **secure larger returns on investment flows to local economies** as these technologies do not rely upon imported fuels.
- ✓ SETA will **establish a level playing field for global competition**, and allow free sourcing and open supply chains securing the best price to quality ratio for customers and end consumers.

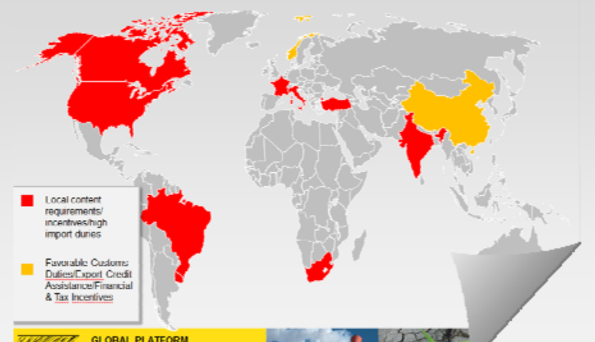
ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Why the SETI-Alliance – Case from Wind Industry



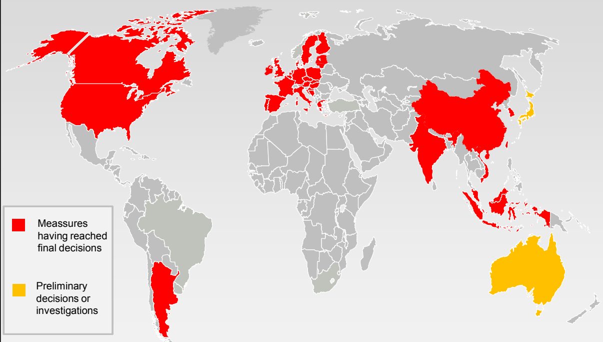
ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Why the SETI-Alliance – Case from Solar Industry



GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY
ICTSD

AD & CVD measures in Renewables



GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY
ICTSD

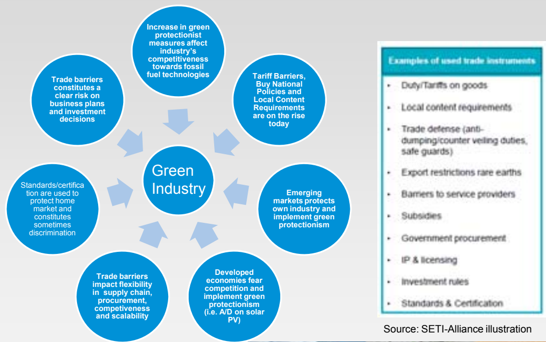
Disputes in WTO – panel cases

- *13 Sep 2010-6 May 2013*, **Japan and EU vs Canada, FITs and LCRs in RE Sector Ontario** (DS 412). AB ruling issued.
- *22 Dec 2010-present*, **China vs US, Chinese subsidies for Wind Power Equipment** (DS 419). In consultations. China ended the challenged subsidies, so the case didn't proceed further.
- *25 May 2012-present*, **China vs US, US imposition of CVDs on several products from China including solar panels and wind towers** (DS 437). Panel composed on 26 Nov 2012.
- 17 Aug,2012-present. **Argentina vs EU (Spain), Discriminatory and de-facto restrictive measures against biodiesel imports from Argentina**. (DS 443). In consultations.
- 5 Nov 2012-present, **China vs EU, FiTs and LCRs in Italy and Greece** (DS 452). In consultations.
- 6Feb 2013-present, **US vs India, LCRs for Solar Cells and Modules in India** (DS 456). In consultations. In Feb 2014, the US filed an addendum to these consultations, as a result to India starting the next phase of its NSM.

Other Disputes – Trade defense meassures

- 2011, **US anti-dumping and countervailing duties imposed on China** – (solar panels and wind towers) and anti-dumping duties Vietnam (Wind Towers) over the period March 2012 to January 2013.

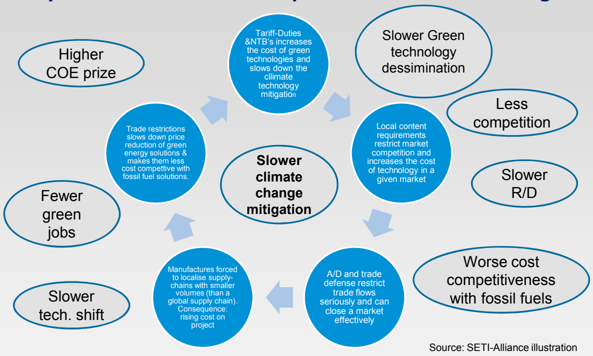
Trade barriers influence green industry's ability to optimise supply chains and lower cost of technology/energy



Source: SETI-Alliance illustration

GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY
ICTSD

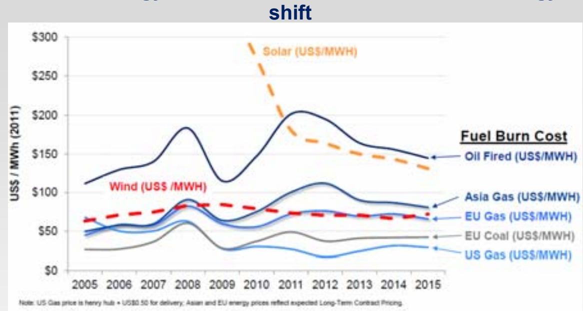
Why are trade restrictions a problem for climate change?



Source: SETI-Alliance illustration

GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY
ICTSD

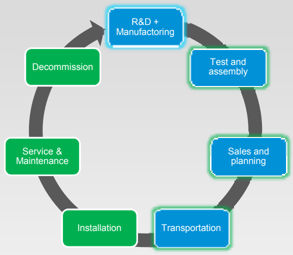
Cost of energy will be decisive for the clean technology shift



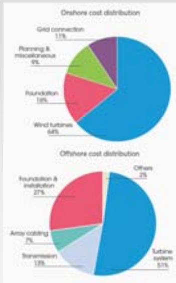
Source: IHS Emerging Energy Research, 2012

GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY
ICTSD

Renewables delivers lots of *natural* local content – "Case of Wind"



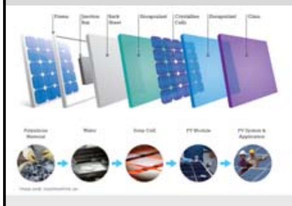
Capex cost – without service and maintanaince cost (opex)



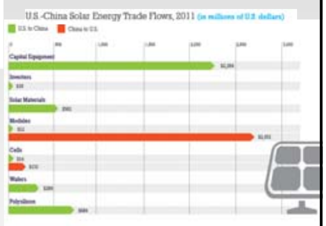
- Imported and/or local
- Naturally local

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

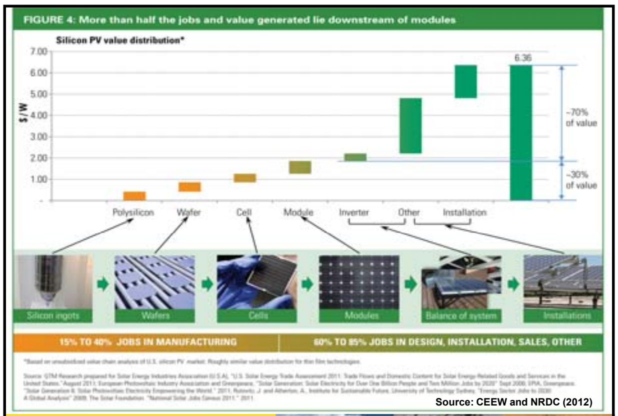
Success of renewables so far has been global supply chains



Source: The Pew Charitable trust: The US-China Clean Energy Technology Trade 2013



ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY



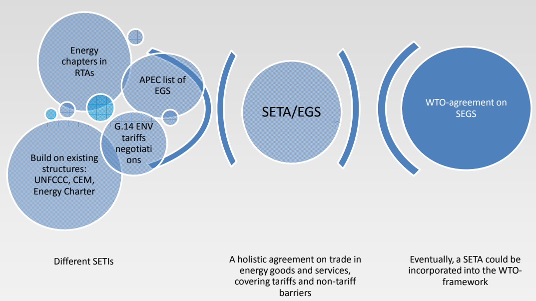
Source: CEEW and NRDC (2012)

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Sustainable Energy Trade Initiatives – Approach towards political process

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

SETI/SETA in the broader trade governance landscape

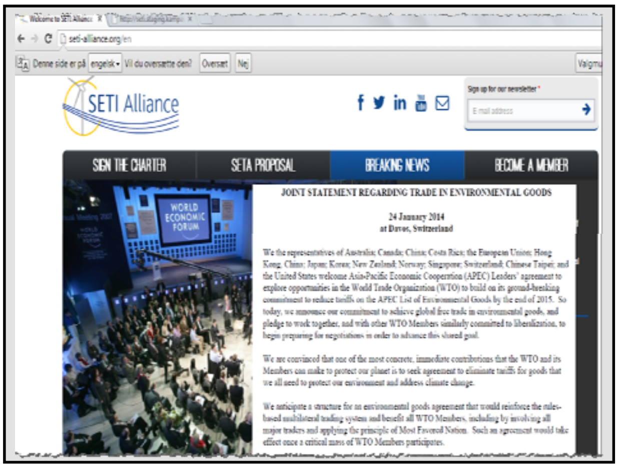


Different SETIs

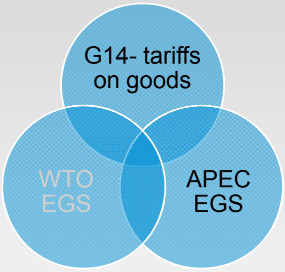
A holistic agreement on trade in energy goods and services, covering tariffs and non-tariff barriers

Eventually, a SETA could be incorporated into the WTO-framework

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY



Scope for trade negotiations



G-14 Members, MFN-applied and bound tariffs of 54 APEC subheadings

Economy	MFN-applied tariffs (2011) HS2007			Bound tariffs HS1996 or HS2002		
	Simple average	Minimum	Maximum	Simple average	Minimum	Maximum
Australia	2.6	0	5	6.4	0	23
Canada	0.4	0	7.5	3.6	0	11.3
China	4.8	0	35	5.2	0	35
Costa Rica	0.5	0	14	30.8	0	45
European Union	1.8	0	4.7	1.5	0	4.7
Hong Kong, China	0.0	0	0	0.0	0	0
Japan	0.0	0	0	0.1	0	0
Korea, Republic of	5.4	0	8	7.4	0	16
New Zealand	2.9	0	5	10.9	0	30
Norway	0.0	0	0	2.1	0	5
Singapore	0.0	0	0	4.8	0	10
Switzerland 1/	0.0	0	0	0.0	0	0
Chinese Taipei	2.2	0	10	2.1	0	10
United States	1.5	0	16	1.3	0	16
Total G14	1.65	0	35	5.9	0	45

1/ Ad valorem duties only (19 subheadings).Note: simple-average MFN rates can be higher than simple-average bound rates, as the former refer to HS07 whereas the latter refer to HS96 or HS02 (this may affect the averaging process)
Source: WTO Tariff Download Facility.

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Non Participants G14 Initiative. MFN-applied and bound tariffs (APEC List)

Economy	MFN-applied tariffs (2011)			Bound tariffs		
	Simple average	Minimum	Maximum	Simple average	Minimum	Maximum
Brazil	11.5	0	20	31.6	0	35
India	6.3	0	10	20.9	0	40
Indonesia	5.3	0	10	25.5	0	40
Malaysia	1.9	0	30	5.7	0	40
Mexico	2.3	0	15	34.8	10	50
Russia Federation	1.7	0	20	3.7	0	12
Saudi Arabia	2.3	0	5	5.4	0	15
South Africa	1.1	0	15	10.3	0	30
Thailand	3.4	0	20	15.2	0	30
Turkey	1.7	0	4.7	8.4	0	31.8
Subgroup	3.8	0	30	16.7	0	50

Source: WTO Tariff Download Facility.

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Tariffs still matter in many economies for certain products in the APEC-54 List

Examples:

G-14 economies (Average applied tariffs)

Solar water-heaters (ex-HS 841919): China (35 percent)

Wind-powered generating sets (HS 850231): China (8 percent); Korea (8 percent)

A/c generators (alternators) of an output exceeding 750kva (HS 850164): Chinese Taipei (9.6 percent)

Parts of resistance-heated furnaces and ovens (HS 851410): Australia and New-Zeland (5 percent)

Condensors for steam or other vapor-powered units (HS 840420): United States (5.6 percent)

Non-G14

Static convertors (HS 850440): Brazil (16.5 percent); India (8.3 percent)
Machines and apparatus for the manufacture of boules or wafers (HS 848610): Brazil (14 percent); India (7.5 percent)
A/c generators (alternators) of an output exceeding 750kva (HS 850164): Indonesia (10 percent)

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

Considering Trade Dynamism of Sectors: *Growth* of sub-headings in the APEC List

	Imports (USD b)		Annual growth (%)	Exports (USD b)		Annual growth (%)
	2002	2011		2002	2011	
APEC List (53 Sub-headings*)	83.7	321.6	16.1	70.5	336.1	19.0
- Of which RE products	29.7	129.0	17.7	24.6	182.4	24.9
- Of which other products	54.1	192.6	15.2	45.8	153.7	14.4
Manufactured products	2404.7	5922.8	10.5	2053.1	5759.8	12.1

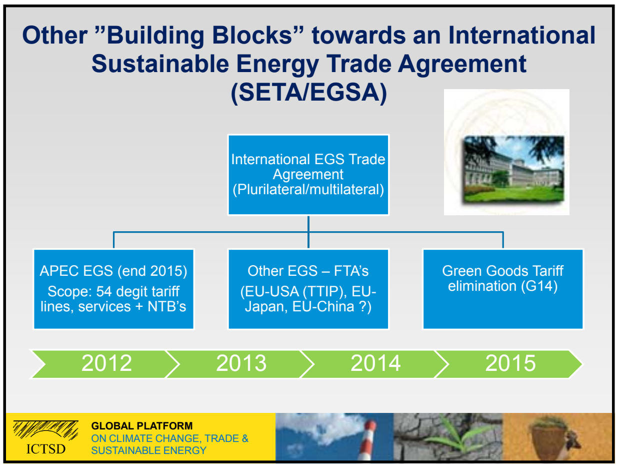
Source: COMTRADE using WITS, December 2012.
** Excluding assembled flooring panels, multilayer of bamboo*

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

3. important Elements to Consider in the APEC EGS negotiations – now…..

- *Tariffs on Goods:* Continue the identification for ZERO-tariffs (ceiling of 5% is in many cases NOT significant/ambitious).
- *Non-tariff-barriers:* Important that APEC EGS qualifies NTB provisions – f.x. moratorium of Local Content Requirements, notification procedures on standards and certification.
- *Services:* Further qualify the EGS services provisions – as these can play a role for the further G14 negotiations

ICTSD GLOBAL PLATFORM ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY


Other "Building Blocks" towards an International Sustainable Energy Trade Agreement (SETA/EGSA)
International EGS Trade Agreement (Plurilateral/multilateral)
APEC EGS (end 2015) Scope: 54 degit tariff lines, services + NTB's
Other EGS – FTA's (EU-USA (TTIP), EU-Japan, EU-China ?)
Green Goods Tariff elimination (G14)
2012
2013
2014
2015
ICTSD
GLOBAL PLATFORM
ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY


Green Trade Initiatives engagement forecast
2009
Launch of APEC EGS negotiations
2013
Establishment of APEC-PPPEGS
2013
Launch of EU-US TTIP negotiations + EU-Japan FTA
2014
Launch of Green Goods tariff negotiations (G.14)
2015
Final delivery of an international Green Trade Agreement at WTO Ministerial, 2015
ICTSD
GLOBAL PLATFORM
ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY


Go visit - www.seti-alliance.org
SETI Alliance
SIGN THE CHARTER
QUESTIONNAIRE
SOLAR PV ADVISORY
BECOME A MEMBER
Support SETI - Sign the SETI-Charter!
About the Alliance of the Sustainable Energy Trade Initiative (SETI)
ICTSD
GLOBAL PLATFORM
ON CLIMATE CHANGE, TRADE & SUSTAINABLE ENERGY

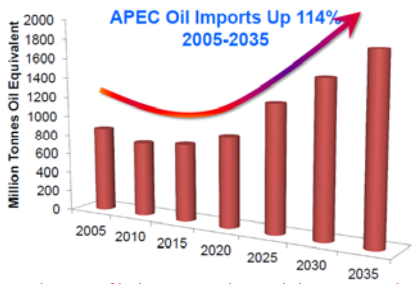
APEC and a Sustainable Future: Towards a Low-Carbon Growth

Dr. LIU Hengwei (刘恒伟）
Beijing, 11 August 2014

Public Private Dialogue on Renewable and Clean Energy Trade and Investment-The First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC. Beijing, China, 11 August 2014.

Outline

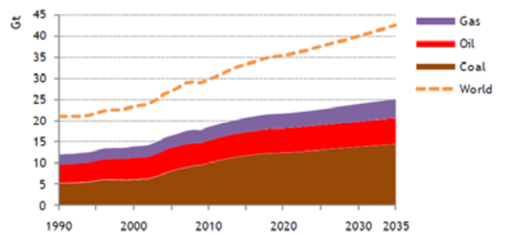
The Problems (1): Energy Security



The combination of higher prices and expanded imports translates to a growing import bill for the region, which can be a heavy burden on economic growth.

Source: IEA

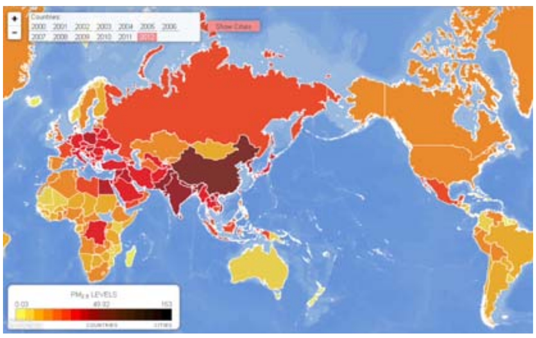
The Problems (2): Climate Change



APEC's share of global CO2emissions increases slightly to 59% in 2035, highlighting that the region will have to play a key part if climate objectives are to be met.

Source: IEA

The Problems (3): Air Pollution



Source: http://epi.yale.edu/pollution-map/

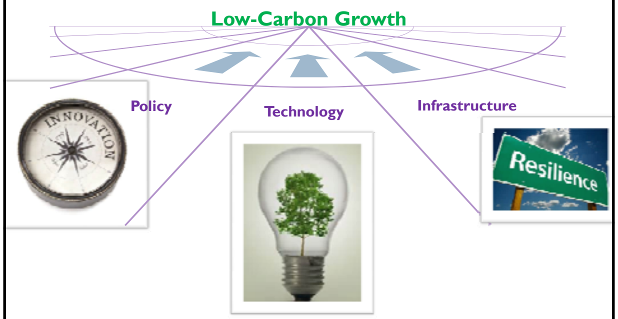
The Problems (4): Energy Poverty

	Population without electricity (million)	Population relying on traditional use of biomass (million)
World	**1258**	**2642**
China	3	446
Indonesia	66	103
Peru	3	
The Philippines	28	
Thailand	1	
Viet Nam	4	
APEC (6)	**105**	**549**

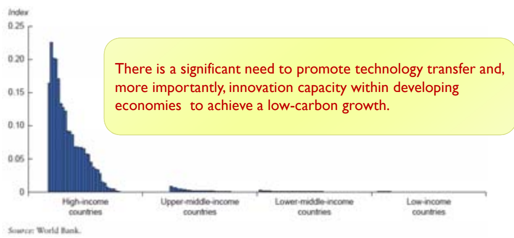
18%of global population lack access to electricity, and 38%of global population lack clean cooking facilities.

Data Source: IEA

The Solutions



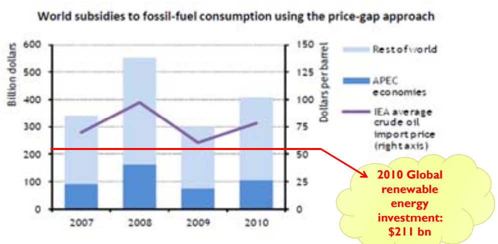
The Challenges (1): Innovation Capacity



Scientific innovation is almost exclusively a high-income activity.

Source: World Bank

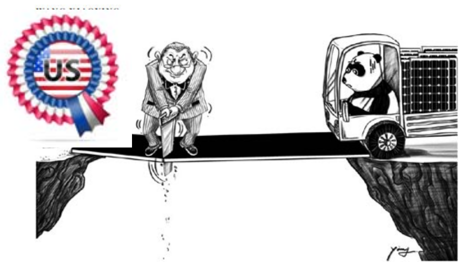
The Challenges (2): Fossil-Fuel Subsides



Fossil-fuel subsidies result in market distortions and an economically inefficient allocation of resources, while often failing to meet their intended objectives.

Source: IEA

The Challenges (3): Trade Barriers



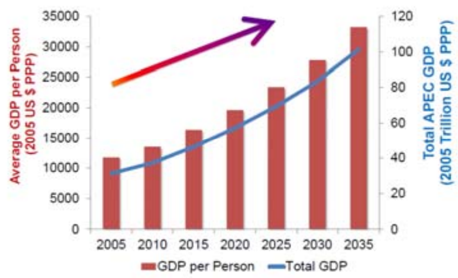
Source: Internet

The Challenges (3): Policy Uncertainties

Clean energy investment in Asia grows, falls in Europe and the Americas.

Source: PRNewsFoto/The Pew Charitable Trusts

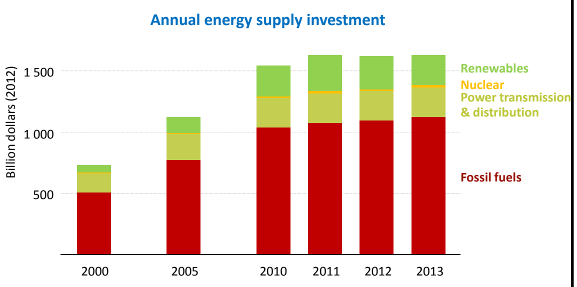
The Opportunities (1): Sustained Economic Growth



Despite recent economic turbulence, APEC is expected to achieve fairly high economic growth in the long run.

Source: APERC

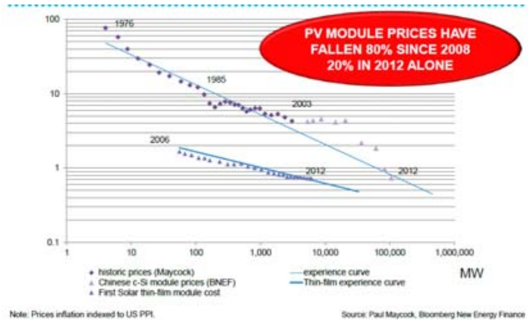
The Opportunities (2): Renewables are "coming of Age"

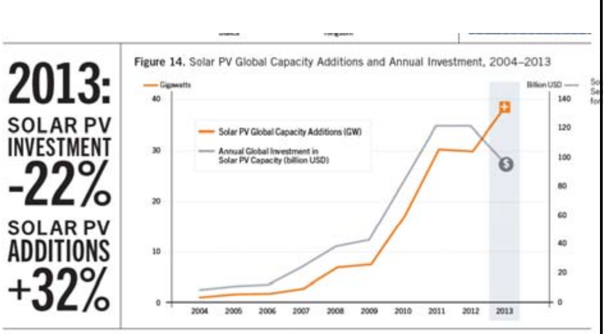


Investment in renewables rose from $60 billion in 2000 to a high point approaching $300 billion in 2011, before falling back since.

Source: IEA

The Opportunities (3): Significant Cost Reductions-PV Module

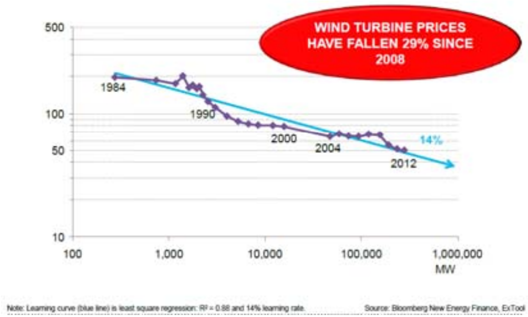




Solar PV installations reached record high in 2013, despite a 22% decline in dollars invested.

Source: REN21

The Opportunities (3): Significant Cost Reductions-Wind Turbine



Onshore wind power is now cost competitive, or nearly so, on a per kWh basis with new coal- or gas-fired plants, even without compensatory support schemes, in several markets (including Australia, Brazil, Chile, Mexico, New Zealand, South Africa, Turkey, much of the EU, and some locations in India and the United States)

Reference: BNEF/REN21

The Call to Action

Source: Internet

Frank Zhu's Speech on APEC

2014.8.8

Good morning Ladies and Gentlemen,

Thanks for the great opening made by Secretary General Qin, and my name is Frank Zhu, the vice president of Hanergy Holding Group, also the Chairman and CEO of Hanergy Asia Pacific region.

First of all, I really appreciate APEC giving me the opportunity to be here and to speak to you about the important issue of the renewable and clean energy (RCE), which is an increasing sector of the growing economy.

Meanwhile, I would also like to thank the efforts and accomplishments that all the APEC economies has achieved, which brought increased investment in the renewable and clean energy business and the acceleration of development and exploration plans on private sectors. I believe that's why we've seen the stronger first quarter for global investment in the clean energy.

However, we still have a seriously challenge in dealing with the energy crisis and pollution, which all economies need work together, in order to collaborate on developing technologies and finding alternative solutions to tackle energy problems and climate change.

As we known, if any economy's Feed-in tariff cannot offer a strong long-term contracts to renewable energy producers, or fails to provide a decent standard Infrastructure for sustainable development;
I have to say that today's talk about the development of clean energy is just empty talk.

Dear Ladies and Gentlemen, the global Transition Energy Revolution Tipping Point has arrived. In Hanergy's view, at this moment, we are facing a revolution that will change the whole energy landscape, the PV Revolution.

Hanergy deeply convinced that the core of new energy competition is the competition of technology. Whoever owns the core technology in this industry becomes the leader of this revolution.

The American economic and social theorist Mr. Jeremy Rifkin in his best seller, *The Third Industrial Revolution,* pointed out that the great economic revolutions in history occur when new communication technologies converge with new energy systems. The first industrial revolution in the 19th century and the second industrial revolution in the 20th century already created a new world for us. Today, Internet technology and renewable energies are beginning to merge to usher a Third Industrial Revolution.

We believe the core of the third industrial revolution is new energy revolution. The core of new energy revolution is PV revolution. And the core of the PV revolution is thin-film revolution. Therefore, thin film, as we believe, will bring dramatic changes to people’s way of work and way of life.

Since we are talking about the Thin-film technologies, I’m glad to briefly introduce Hanergy to you, share with you our views, and more importantly, what Hanergy can do for the energy shortage faced by developing economies and the world today.

Hanergy is a multinational clean energy power generation company and the world's largest thin-film solar manufacturer. Established in 1994, headquartered in Beijing and has more than 10,000 employees. Our businesses cover hydropower, wind power, and solar PV power generation. We have branches across China and in North America, Europe, Asia-Pacific, Africa and other regions.

In the past 20 years, Hanergy has been committed to "changing the world by clean power.” At present, the total installed capacity of our hydropower projects exceeds 6 gigawatt (GW), and wind power projects is 131 megawatt (MW). In solar energy, Hanergy has invested in and built up 8 thin-film solar R&D and manufacturing bases in China, with a total production capacity of 3GW. Through global technological integration and independent innovation, Hanergy’s thin-film PV technology has taken a leading place globally. We have 7 technological routes including amorphous silicon and CIGS. The highest conversion efficiency of our CIGS modules is 15.7%, and the lab result reaches 19.6%.

Hanergy’s total installed capacity of clean power can help reduce carbon dioxide emissions by 17.3 million tons annually. We also help to support the development of 1,026 small and medium enterprises in 85 industries, creating over 20 million employment opportunities directly and indirectly.

In the field of thin-film solar technology, CIGS (i.e. copper indium gallium selenide) represents the highest level of current commercial thin-film technology. It is also Hanergy’s prioritized technology for development.

Thin film solar PV has many advantages. First, zero pollution. Second, low energy consumption. Third, wide applications. The semi-transparent and flexible feature of thin film panel makes it applicable not only to ground-mounted solar project, but also building integrated PV (BIPV) and even in everyday’s life.

Here’s a simple from our US factory, I’d like to show you this CIGS solar cell with higher efficiency and flexible.

Thin film is also advantageous in terms of temperature coefficient and weak light performance. According to a test result of an international authoritative institution, thin-film panels, compared with crystalline silicon panels, can generate up to 30% more power in high temperature regions such as the American West and the Middle East. Even in higher-latitude zones such as northwestern Germany, it can generate 10-15% more power on average annually.

Ladies and gentlemen, we want to bring to all APEC economies our thin film solar technology that will lead the PV revolution and the third industrial revolution.

Looking into the future, as the Chairman and CEO of Hanergy Asia Pacific Region, I'm very confident in doing solar business in APAC region. We plan to launch at least 500MW project pipeline in APAC in the coming two years. Depending on the future project development status, Hanergy may even consider establishing a manufacturing base in several economies for further localization.

At present, we welcome all the institutions, associations, companies and government agencies from both public and private sectors to be our strategic partners. With our know-how and abilities put together, we can address the increasing energy demand and power shortage in this region.

Finally, I want to share with you a favorite saying from Hanergy's Chairman and CEO Mr. Li Hejun. He said, People tend to overestimate the changes in one to two years, but underestimate the changes in five to ten years. The former usually lets us down, while the latter often surprises us.

Ladies and Gentlemen, let’s look forward to the surprises in the solar power industry in the APEC!

Thank you very much.

SOME PROGRESS OF SOLAR PV POWER GENERATION DEVELOPMENT IN CHINA

Xiaowei XUAN
Development Research Center of the State Council

Aug. 11, 2014

Contents

- Progress
- Obstacles
- Next steps

Progress

- Ambitious goals in solar PV power generation development in China
  - 2013~2015, 10GW per year (new added capacity)
  - To 2015: 35GW (Total capacity)

    ("Some instructions to promote solar PV development from the State Council",《国务院关于促进光伏产业健康发展的若干意见)
  - 2014 target: 14GW new added capacity (National Bureau of Energy :国家能源局)
    - 6 GW: large on-grid PV power stations ;
    - 8 GW: distributed solar PV power generation;

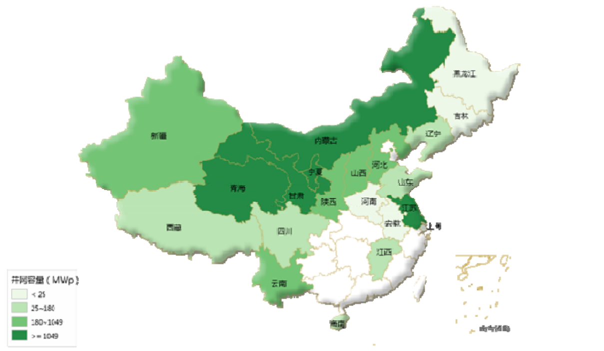
Progress

- Significant Capacity has established:
  - To 2013: 19.4 GW (Total capacity)
    - 16.3GW (large on-grid PV power stations)
    - 3.1GW (distributed solar PV power generation)
  - In 2013: 12.9 GW (new added capacity)
    - 12.1 GW (large on-grid PV power stations)
    - 0.8 GW (distributed solar PV power generation)
  - To 2013:
    - Large on-grid PV power stations
      - GanSu(甘肃) 4317MW, 26.5%
      - QinHai(青海) 3103MW, 19.0%
      - XinJiang(新疆) 2570MW, 15.8%
    - Distributed solar PV power generation
      - Zhejiang(浙江) 425MW, 13.7%
      - HuNan(湖南) 300MW, 9.7%
      - GuangDong(广东) 300MW, 9.7%

(Source: National Bureau of Energy)

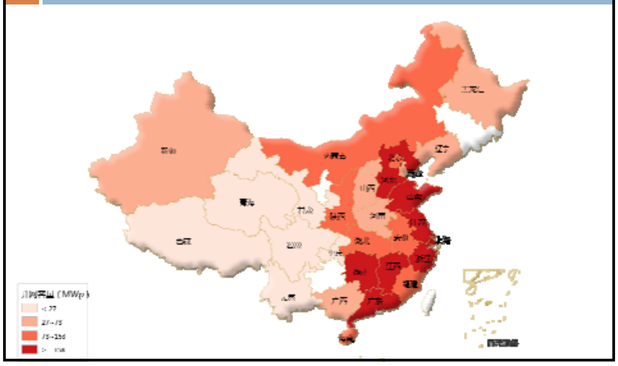
Large on-grid PV power stations in Provinces

5



Distributed solar PV power generation in Provinces

6



Progress

7

- **Important polices have been released**
  - **Comprehensive Policies**
    - **"Some instructions to promote solar PV development from the State Council" (《国务院关于促进光伏产业健康发展的若干意见》,July 4th, 2013)**
    - **Policies of fiscal, financial, industry, market supervision, on-grid, etc**
  - **Specific Polices**
    - **"Announcement of price policy to promote solar PV development "**

      (NDRC: National Development and Research Committee《国家发改委关于发挥价格杠杆作用、促进光伏产业健康发展的通知》Aug. 26th, 2013)
      - **The standard electricity price of Large on-grid PV power stations: 0.9、0.95、1.0 yuan /KWH (20years)**
      - **Subsidy for Distributed solar PV power generation: 0.42 yuan/KWH (**
  - **Regional Polices:**
    - **"Fiscal policy to support renewable energy development of Shanghai"《上海市可再生能源和新能源发展专项资金扶持办法》**
    - **Subsidy for Distributed solar PV power generation: 0.4 yuan/KWH for individual, 025 yuan/KWH for enterprise (five years)**
    - **Jiangxi(江西): 0.2 yuan/KWh (20 years), HeFei(合肥): 0.25 yuan/kwh(local parts needed)**

Obstacles

8

- **Solar PV power generation development have a big opportunity in China, but it also faced lots of obstacles and uncertainties.**
  - 2014 Target: 14GW (6GW: large station; 8GW distribution)
  - The first half of the year: Large Station: about 3GW, Distribution Generation: less than 1GW(only 6 provinces achieved their goals)
- **The bottleneck of transport(output) capacity of grid:**

  (National Bureau of Energy allocated the on-grid quotas to each provinces:集中并网光伏发电容量指标)
- **The Quality issues of large stations:**
  - Too high construction speed (To get the fiscal subsidy, Gold Solar PV Project:金太阳工程)
  - Lack of quality control system (standard , verification, supervision)
- **Distributed solar PV power generation:**
  - Grid company lack of incentives
  - Complicated situation: Lots of owners, no proper law, small company lack of support

Next steps

- "Announcement of further polices to promote distributed solar PV power generation" (National Bureau of Energy, July 2014)
  - 《关于进一步落实分布式光伏发电有关政策的通知》
  - Emphasis on the enterprise project, not only individual
- "Techniques Standards of quality evaluation and performance test of solar PV station"
  - 《光伏电站性能检测与质量评估技术规范》
  - 19 technical standards of Performance Ratio.
- Financial: China Development Bank, other policy
- Fiscal: "Announcement of invoice policy for distributed solar PV power generation" (National Bureau of Tax, July 2014)
  - 《关于国家电网公司购买分布式光伏发电项目电力产品发票开具等有关问题的公告》
- Grid Company:
- Law:

Thanks!

How to create an enabling environment for RCE Trade and Investment

Jake Colvin
jcolvin@nftc.org

National Foreign Trade Council
www.nftc.org

Global Innovation Forum
www.globalinnovationforum.com

11 August 2014

NFTC

OVERVIEW

- About NFTC
- What motivates the private sector?
- Market Access
- IPRs and legal certainty
- Global value chains
- Where can APEC play a leading role?

About NFTC

Mission

To advance global commerce by:

1. Advocating public policies to foster open trade and investment;
2. Mobilizing expertise on trade and tax issues;
3. Influencing public debate through interaction with policy makers and opinion leaders and by convening government/private sector discussions.

Founded 1914

Active in WTO, WIPO, APEC, UNFCCC, TPP

Members Include
ExxonMobil, eBay, General Electric, Google, J&J, P&G, Microsoft, Siemens, United Technologies, Visa, Wal-Mart

Global Innovation Forum

MOTIVATING
Green Technology Trade and Investment

How do you FACILITATE private sector trade and investment?

Understand the private sector's MOTIVATION

THE RIGHT POLICIES TO DRIVE FOCUS

Government	Long Range R&D Investment
Academia	Prizes
Private Sector	Absolute return & predictability

MOTIVATING THE PRIVATE SECTOR

- Reduction of tariffs and NTBs
- Patent protection & legal certainty
- Integration into global supply chains

Improving Market Access

SIGNIFICANT TARIFF BARRIERS ON GREEN TECH

Among WTO member economies

~60% impose tariffs on wind, with a mean tariff of 7.4%

~43% impose tariffs on solar, with a mean tariff of 8.8%

OTHER FACTORS INHIBITING ACCESS

- Local content restrictions & procurement requirements
- Product based standards

Tools to *enhance access* to green technology

- Reduce costs of goods & services, e.g. eliminating tariffs
- Increase fair competition by removing local content & procurement restrictions
- Harmonize technology based standards

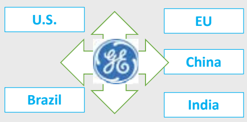
Effective IP Protection

IP drives & supports partnerships

Helps find new partners	Clear contribution to partnership
Reviewing patent literature can uncover parties having complementary solutions or synergies	Identifies what each party brings to the venture and what is new
Predictable IPR encourages sharing	Provides a construct to build on success
Enables disclosure of trade secrets to speed up and enhance innovation	New inventions can be patented to be exported, licensed, etc.

Global Research and Supply Chains

GLOBALIZATION
Of R&D



EXTERNALIZATION
Of R&D

P&G | connect + develop

Global Supply Chains in the Digital Age

Goods
+
Services
+

A leading role for APEC

THE IMPORTANCE OF
Well-defined action plans

Tariff Liberalization Implement EG Commitment	**Encourage Legal Certainty and Effective IP Protection** Fact-based research and discussions
Non-Tariff Barriers Building from EG tariff liberalization to inventory and examine NTBs	**Global Supply and Research Chains** Linking Goods+Services+Data

Thank You

Jake Colvin
jcolvin@nftc.org

National Foreign Trade Council
www.nftc.org

Global Innovation Forum
www.globalinnovationforum.com

Enabling Environment for Renewable/Clean Energy Trade and Investment

Lisa Salley
Vice President & General Manager
Energy & Power Technologies
UL LLC

Standards

Good standards serve as the foundation for successful technology deployment

They can enable:
- Sustainable deployment based on common approaches to critical issues like safety
- Common market expectations about critical issues like performance
- Effective trade across geographies
- Conformity assessment to be adequately addressed

International Harmonization

International harmonization is extremely beneficial for the renewable energy sector

Intense activity in renewable energy continues to occur in the International Electrotechnical Commission (IEC)

While IEC standard development takes several years, UL has been active in quickly developing national standards that serve as seed documents for the IEC

Conformity Assessment

Conformity assessment is a critical aspect for supporting confidence and sustainable deployment of renewable energy technologies

UL believes that effective conformity assessment:
- Allows for evidence to be established in various locations to meet the needs of the global market
- Recognizes the value of independent third-party certification for critical aspects such as safety

IEC Renewable Energy Scheme

The new IEC Renewable Energy Scheme (IECRE) has been developed to support global use of clean energy

Three key sectors are being addressed: marine, solar and wind power

The Scheme will address conformity assessment of renewable energy equipment plus system aspects of operational plants

Technical Services for Energy Stakeholders

Distilling and sharing technical information in formats for that can help key stakeholders understand and address risk is increasingly critical for renewable energy

Developers, financial institutions, and insurers are among the many parties that need to understand the technical aspects of renewable energy projects

Services to address siting, energy production forecasts, equipment and system reliability, and other critical aspects will be increasingly important for the energy sector

August 11, 2014

CSIQ NASDAQ LISTED

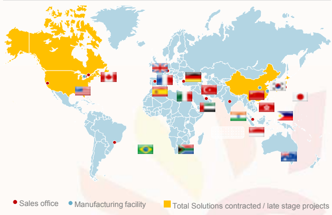
CanadianSolar Make The Difference

Canadian Solar – A Company with Global Footprint

A rapidly growing solar total solution provider with one of the largest global project development pipelines

- Founded in Canada in 2001
- Listed on NASDAQ in 2006
- Manufacturing plants in Canada and China
- Business subsidiaries in 20 economies
- More than 7 GW cumulative modules sold to date
- Customers in over 70 economies

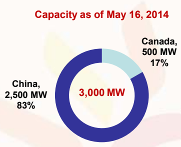
Global Footprint



CanadianSolar 2

Canadian Solar in China – A Localized Multinational Company

- 3 Manufacturing plants
- More than 6000 employees
- 83% of company's total solar module capacity
- Significant project pipeline and strong partnership



CanadianSolar 3

Example of Solar Adaptations in APEC Economies

Utility Scale Solar Projects

Hamamatsu City, Shizuoka Prefecture, Japan

Falls Mill, CA, USA

CanadianSolar 4

Example of Solar Adaptations in APEC Economies

Micro-grid Applications with Solar

Deer Lake First Nation Ontario, Canada

CanadianSolar 5

Example of Solar Adaptations in APEC Economies

Solar Home Systems

Philippines

CanadianSolar 6

Example of Solar Adaptations in APEC Economies

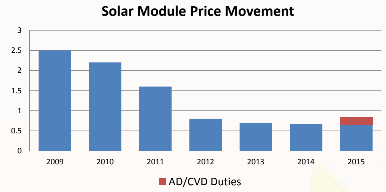
Street Lamps Powered with Solar

Jakarta, Indonesia

CanadianSolar 7

Roadblock of Globalization – Trade Protectionism

- Trade protectionism hinders the healthy development of solar market



- Environmental Goods Agreement will help the industry advancement
  - Utilize comparative advantages
  - Fight against climate change
  - Maximize total benefits of all human beings

CanadianSolar 8

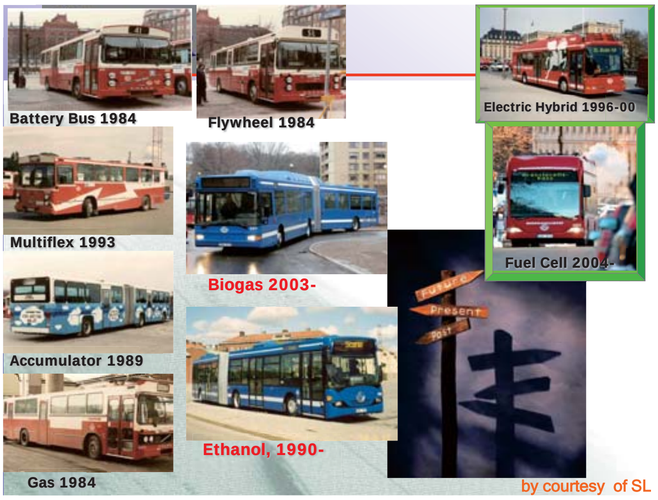
CanadianSolar

Biofuels for economic transition and ending environment and energy stalemate

Shi-Zhong Li
MOST-USDA Joint Research Center for Biofuels
Beijing Engineering Research Center for Biofules
Institute of New Energy Technology, Tsinghua University, China
Email:szli@tsinghua.edu.cn
+86 10 62772123

In 2013, China became the second oil importer, 60% of oil was imported. Vehicle emission becomes major source of China's air pollution, and smog threatens people's health seriously. The replacement of oil by biofuels is the high priority.

On 10 Sept. 2013, State Council issued Action Plan for Air Pollution Control.



by courtesy of SL

Exhaust emissions from comparable engines

Emission factors (g/litre fuel)

Engine / Fuel	NOx (Nitrous Oxides)	PM (Particles)	Net CO_2*
ED95 Ethanol	4	0.02	460
Diesel fuel (Euro 5)	7	0.05	2 700
RME / Biodiesel	9	0.05	1 600

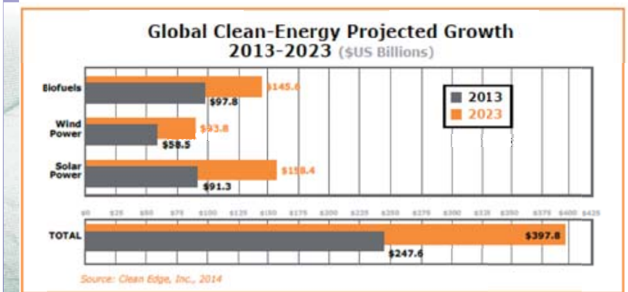
*) Net CO_2-emission depends on fuel source. Values calculated acc. default values in RES directive. ED95 of Brazilian origin. Tailpipe emission is 1440 g
Diesel fuel: European certification fuel, RME of European origin. All engines DC 9.

by courtesy of Scania

Net gain in Stockholm using ethanol and biogas in buses

- All inner city bus lines run on renewable fuels
- A total of 600 ethanol and 160 biogas buses in operation in 2011
- Reduced diesel use by > 20 million litres / year
- Reduced fossil CO_2 by > 60 000 t / year
- Reduced PM 12 tons and NOx 120 tons

by courtesy of SL



- Biofules are today the practically direct substitute for fossil fuels, and can benefit environment and rural development
- According to OECD-FAO Agriculture Outlook 2014, ethanol and biodiesel output is expected to reach 125.6 million tons (158 billion litres) and 34 million tons (40 billion litres)respectively by 2023.

Bioethanol in the US

- According to the Renewable Fuels Association, at year's end the ethanol industry comprised approximately 210 plants in 28 states with nameplate capacity of 14.7 billion gallons to produce 13.3 billion gallon
- The production of 13.3 billion gallons of ethanol means that the U.S. needed to import 476 million fewer barrels of oil in 2013 to refine gasoline. This is roughly the equivalent of 13 percent of total U.S. crude oil imports. The value of the crude oil displaced by ethanol amounted to $48.2 billion in 2013.
- Contributed more than $44 billion to the nation's GDP in 2013

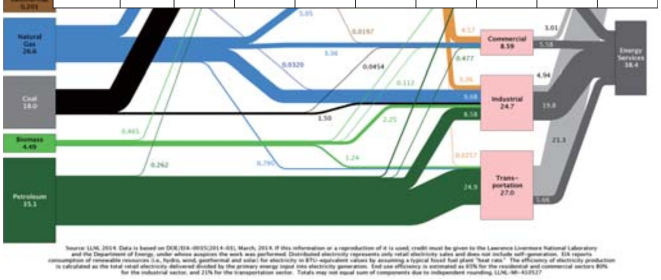
Ethanol contribution to the US economy in 2013

	GDP (Mil 2013$)	Employment (Jobs)	Income (Mil 2013$)
Ethanol Production	$11,212	104,555	$7,010
Direct	$2,185	13,108	$1,857
Indirect	$4,839	40,769	$2,611
Induced	$4,188	50,678	$2,542
Construction	$600	8,020	$439
Direct	$247	4,077	$232
Indirect	$115	1,135	$73
Induced	$238	2,808	$134
Agriculture	$29,340	242,348	$21,174
Direct	$1,445	59,822	$1,123
Indirect	$14,804	38,192	$12,734
Induced	$13,091	144,334	$7,317
R&D	$2,885	31,858	$2,086
Direct	$991	9,496	$990.15
Indirect	$609	7,069	$377.20
Induced	$1,285	15,293	$718.53
Total	$44,037	386,781	$30,709
Direct	$4,867	86,503	$4,203
Indirect	$20,367	87,164	$15,795
Induced	$18,803	213,113	$10,712

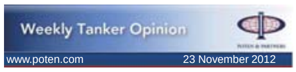
The US energy consumption in 2013

Lawrence Livermore National Laboratory

	石油	天然气	煤	核电	生物质	水电	风电	太阳能	地热
消耗量 Quads	35.1	26.6	18.0	8.27	4.49	2.56	1.6	0.32	0.201
比例%	36.13	27.38	18.53	8.51	4.62	2.64	1.65	0.33	0.21



A Pause in Ethanol Contribution to US Energy Independence

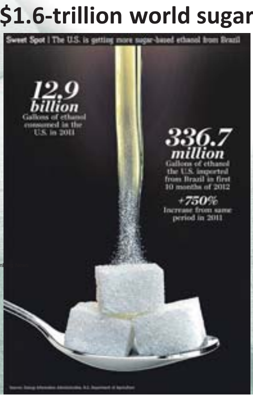


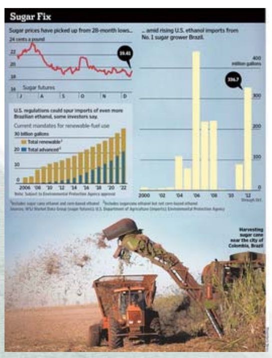
- In Aug. 2012, UN urges US to cut ethanol production as the worst US drought in 50 years pushes up the prices of staple commodities.

http://www.ft.com/intl/cms/s/0/8808b144-e240-11e1-8e9d-00144feab49a.html#axzz2364BfU9i

- In Sept. 2012, the European Commission proposed major changes to their existing biofuels policy. Under the new proposals, the EC will limit edible feedstock-based biofuels to just 5%.

A resurgence of U.S. ethanol imports is shaking up the $1.6-trillion world sugar market. 17 Dec. 2012, *Wall Street Journal*



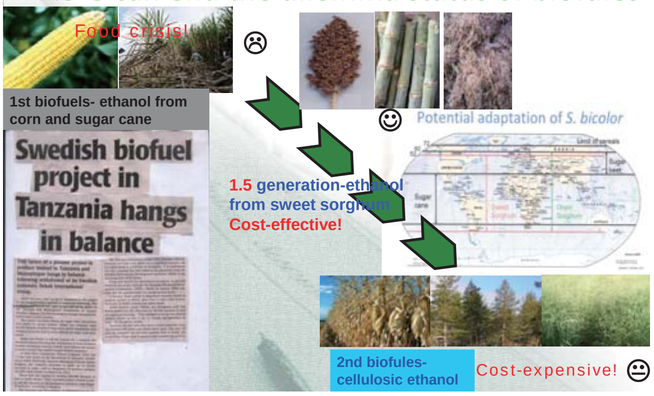


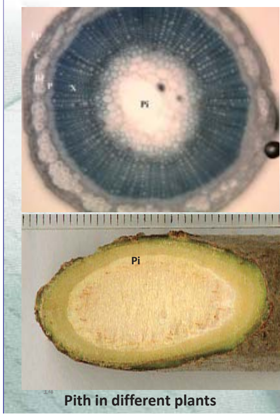
Current status of cellulosic ethanol

- In January 2012, the Range Fuel wood-to-ethanol facility in Georgia sold for just over $5 million costing taxpayers around $65 million. Local press has compared the disaster to the Solyndra collapse in California.
- In May 2012, Shell and Iogen canceled their long-contemplated Canadian cellulosic ethanol project, and announce 150 layoffs.
- In October 2012, BP canceled their project of expensive ethanol plant near Lake Okeechbee, FL.

- Dupont will complete the construction of one of the world's largest commercial-scale cellulosic ethanol biorefineries (30 million gallons of cellulosic ethanol per year) in Nevada, Iowa, later 2014.
- Chemtex's plant (20 MMgy) in Clinton, North Carolina is expected to be at capacity by the end of 2016.

1.5 G can end the dilemma status of biofules





Pith in different plants

Compositions of sweet sorghum stalk

	whole sorghum	pith	bark
cellulose	12.4	8.7	19.2
hemicellulose	10.2	6.3	17.5
lignin	4.8	0.6	8.8
sucrose	55.0	67.4	32.2
glucose	3.2	3.7	2.4
ash	0.3	0.2	0.5

Source: *Billa E, et al . Ind. Crop. Prod.,1997 , 6: 297-302*

- ✓ Huge energy cost is required for juice squeezing (around 400kwh/t ethanol)
- ✓ 5% sugar remained in bagasse.
- ✓ Working time is 30-40 days per year.

Solid-state fermentation is much more suitable for sweet sorghum ethanol production.

Advantages of Advanced Solid State Fermentation (ASSF)

- Short process
  - Directly ferment stalks to ethanol, 2/3 equipment compare to liquid state fermentation process (LSF)
- Less fermentation time
  - 24hr vs 30 hr for liquid process, and 50 hr for corn ethanol
- Less water consumption and less waste water
  - 1 ton water required vs 5+ ton for liquid process
- Less energy consumption
  - About 300kwh/ton ethanol vs 800kwh/ton ethanol for liquid process
- Less total investment cost
  - About 75% investment vs liquid process
- Simple operation
  - Low educated labor for operation

Scale up of solid state fermentor

Zhang, et al, Scale-up of ethanol production from sweet sorghum using advanced solid state fermentation. AIChE Annual Meeting, Pittsburgh, PA. Nov. 2012

Li, et al. A techno-economic study of ethanol production from sweet sorghum stems with advanced solid state fermentation technology. Applied Energy, 2013, 102: 260–265
Wang, et al. Modeling of rotating drum bioreactor for anaerobic solid state fermentation. Applied Energy, 2010, 87: 2839-2845.

50 % of fibrous residues (1.3t) for boiler fuel, 50% (1.3t) to feed 1 cattle, and nutrition report is as the following

Raw material	Dry matter	Crude Protein content	Crude fiber	Neutral detergent fiber	Acid detergent fiber	Crude ash	Calcium	Phosphate	Total energy MJ/kg
Corn silage	24	1.47	4.59	9.89	5.76	1.34	0.06	0.06	16.44
Fermented bagasse (dry sample)	94.22	7.26	30.12	63.75	40.62	22.5	0.32	0.13	11.91

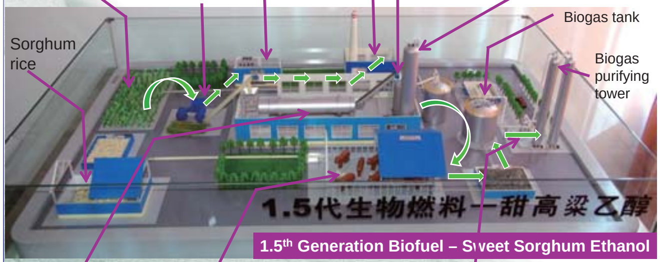
Energy balance of the whole process

(based on 1 ton of fuel ethanol)

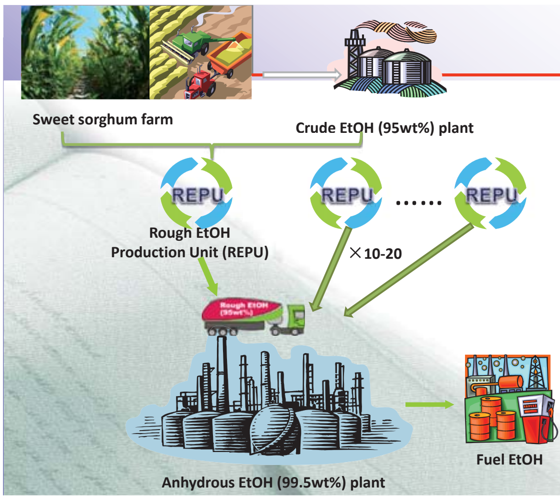
Energy input		Energy output	
Electricity: 373 Kwh (GJ) ethanol producing 230 Kwh (GJ) distiller pelletizing 143 Kwh (GJ)	1.343 0.828 0.515	1.18t pellets (GJ)	17.31
4.52 t steam for distillation (GJ)	11.92	1t ethanol (GJ)	29.30
5.0 t hot air for drying distiller (GJ)	0.50		
Total (GJ)	13.85	Total (GJ)	46.61

The energy input/output ratio during ethanol production process is 1 : 22, hence ethanol produced from sugar crops by ASSF can be regarded as ADVANCED BIOFUEL defined by U.S.A." Energy Independence and Security Act of 2007"

Sweet sorghum to fuel & feed module



A 'closed loop'/'zero waste' system is established in China



TEA study of ASSF

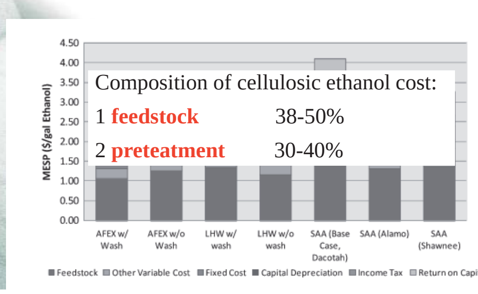
No.	Item	Cost (USD)		Remarks
1	Feedstock	stalks	30x16 =480	16t Sweet sorghum stems at price $30/t
		Other materials	26.5	Enzymes+yeast
2	Utility	water	2.4	2.4t water at price $1/t
		electricity	0.1×332=33.2	332 Kwh electricity at price $0.1/Kwh
		steam	10	Fermented bagasse as boiler fuel
3	Labor	90		30 people
4	Maintenance	20		
5	Depreciation	64.3		Capital $900/t, 14 years
6	Admin/Mgmt	18		
7	Finance	30		
	Total		775.4	
8	Feed credit	20×6=120		6t fermented bagasse as cattle feed at the price $20/t
	production cost	775.4 -120=655.4	$1.95/gal	

Current corn ethanol production cost: $2.72/gal

Sweet sorghum ethanol production potential in China

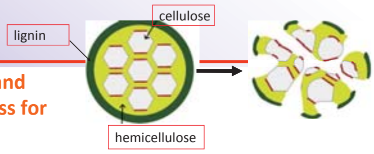
- **With high level of stress resistance, sweet sorghum can be planted in almost everywhere in China, from north (Heilongjiang) to south (Hainan), it can grow three seasons in tropic area, compared with sugarcane and cassava, sweet sorghum can increase land use efficiency.**
- **In China, besides the 15 million ha marginal lands, there are 20 million ha of heavy metal polluted croplands, which can be used for energy crop production.**
- **The cultivated area of sorghum is about 0.6 million ha, when replant sweet sorghum, without affect the grain supply for alcohol making and forage, sweet sorghum stem can produce 3 million tons of ethanol.**
- **Coastal regions such as Liaoning, Hebei, Tianjin,Shandong and Jiangsu provinces have 1.2 million ha of mud flat land and salty land, these lands are suitable for planting sweet sorghum, with conservative estimate of 5 million tons of ethanol fuel and 2.2 million tones of sorghum rice.**
- **Beijing, Tianjin, Hebei and northeast three provinces have 4 million cows that feed with corn silage, with the need of 0.8 million ha of cropland to plant, if replaced with sweet sorghum, it can not only fulfils the need of forage supply for the 4 million cows, but also provides 4 million tons of ethanol fuel and 2 million tons of sorghum grain, and will increase the farmers' income and improve the land use efficiency.**

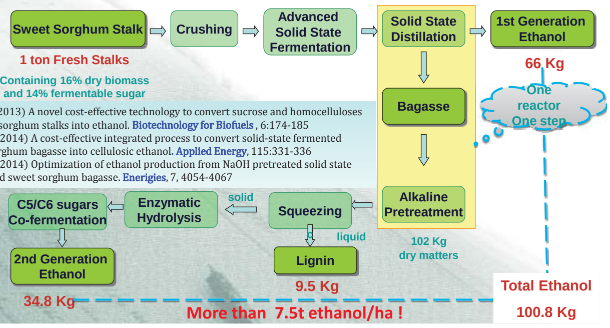
TEA study of cellulosic ethanol conducted by NREL



Tao Ling et al, Process and technoeconomic analysis of leading pretreatment technologies for lignocellulosic ethanol production using switchgrass. Bioresource Technology, 2011, 102.24: 11105

The combination of ASSF and Alkaline pretreatment process for ethanol production





Li, et al.(2013) A novel cost-effective technology to convert sucrose and homocelluloses in sweet sorghum stalks into ethanol. Biotechnology for Biofuels , 6:174-185
Yu, et al (2014) A cost-effective integrated process to convert solid-state fermented sweet sorghum bagasse into cellulosic ethanol. Applied Energy, 115:331-336
Yu, et al (2014) Optimization of ethanol production from NaOH pretreated solid state fermented sweet sorghum bagasse. Energies, 7, 4054-4067

Heavy metal absorbing capacities of sweet sorghum

		unit	Zn	Cs	As	Cu	Cd
Heavy metal content		mg/kg	500.0	400.0	50.0	400.0	15.0
Ⅲ grade soil quality standard		mg/kg	500	--	30	400	1
Heavy metal contents in different parts of sweet soghum	stalks	mg/kg	210.24	80.04	44.66	19.84	11.24
	leaves		68.88	7.38	6.36	2.37	0.42
	grains		60.76	23.13	12.91	5.73	3.24
Control	stalks	mg/kg	18.62	0.21	0.64	3.22	0.16
	leaves		8.71	0.06	0.14	0.49	0.02
	grains		11.20	-	-	1.92	0.088

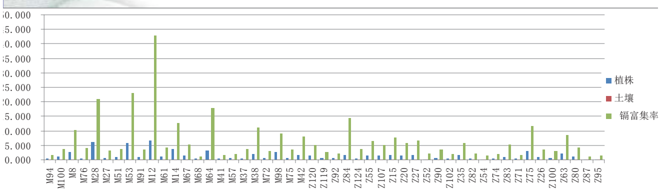
Production yield:
75t fresh stalks, 1.2t leaves, 180kg grain per hectares

Sweet sorghum plantation trial in Hunan

Sweet sorghum trial places

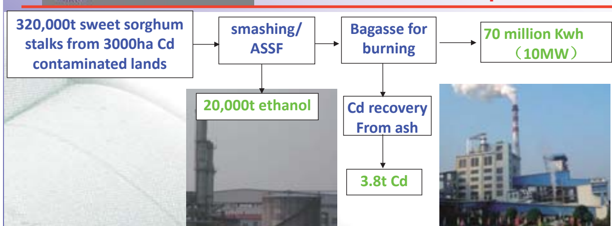
Cd contamination caused peasant unrest in 2006， in Xinma village, Zhuzhou city Hunan province, the factory was shut down, however the abandoned field （Cd>15mg/kg） is full of weeds. Sweet sorghum was planted in 2 Aug. 2013, harvested on 26 Dec. 2013, the highest stalk yield was more than 150t/ha.

9 varieties with high Cd accumulating capacity are selected from 229 sweet sorghum varieties



- ✓ 19 of 100 varieties from USDA with high production yield of more than 75t fresh stalk/ha, the highest is 150t/ha
- ✓ 46 0f 129 varieties from Institute of Botany CAS with high production yield of more than 75t fresh stalk/ha, the highest is 1136.5t/ha

Sweet sorghum to fuel & power module



- ✓ It's reported that there are 1/6-1/5 arable lands are contaminated by heavy metals in China now. There is no available technology to remediate these lands cost-effectively.
- ✓ Sweet sorghum can absorb heavy metals, and can be proceeded into ethanol and electricity cost-effectively, and the heavy metals, such as Cd, will be concentrated and recovered from ash simultaneously.
- ✓ Sweet sorghum for fuel & power production is the unique practical and cost-competitive technology to treat heavy metal contaminated croplands.

Income of US farmers

	Grain/acre	Stalks/acre	USD	remarks
Grain sorghum	150 bu (4.2t on)	-	1050	$7/bu grain
Sweet sorghum	35.7 bu (1ton)	40 tons	1450 (250+1200)	$30/ton stalk

Sweet sorghum can be planted all over the US, and help the US to realize the goal of 35 billion gallons of ethanol by 2022.

- ✓ The South African government has introduced ASSF technology from Tsinghua University to establish of sweet sorghum ethanol industry of $12.25 billion/a in 5-10 years, including agriculture of $2.25 billion and industry of $ 10 billion
- ✓ Dr. Li met with ministers of Department of Energy, Department of Social development, and vice minister of Department of Finance in Johnnesburg.

Bioethanol potential in Ethiopia

- ✓ Ethiopia is rich of land and water resources
- ✓ If 1.6 million ha grain sorghum is replaced by sweet sorghum, 10 million tons of ethanol can be produced per year.
- ✓ 2 million ha are available to be used to produce 15 million tons of ethanol competitively to supply the domestic need, 10 million tons of sorghum grain, and 20 billion Kwh electricity annually.
- ✓ A new industry of more than $15 billion/a will be built in 3-5 years in Ethiopia.

Dr Li met with Mr. Ato Girma, President of Ethiopia

Dr Li met with Mr. Hailemariam, PM of Ethiopia.

Global sweet sorghum ethanol potential

✓ There are total 43m ha of sorghum in 99 economies in the world. If sweet sorghum is planted, 200 million tonnes of ethanol will be produced simultaneously, account for 5% of oil production.
✓ The global sweet sorghum suitability area is around 100 million ha (e.g., 69.4 million ha in Tanzania), sweet sorghum ethanol potential will be 500 million tonnes per year.

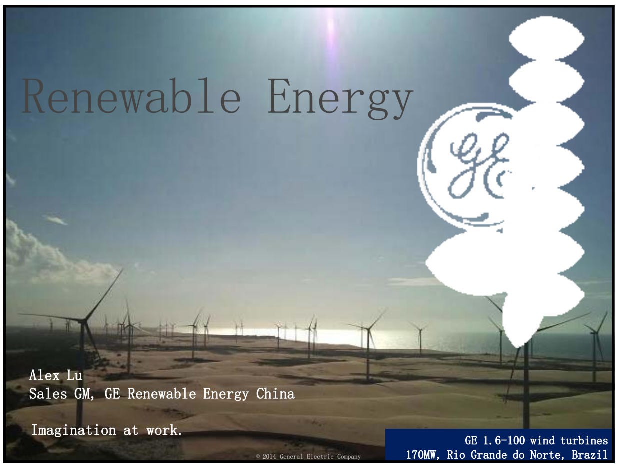
sweet sorghum varieties with 90 days growing time developed in Texas A & M Uni.

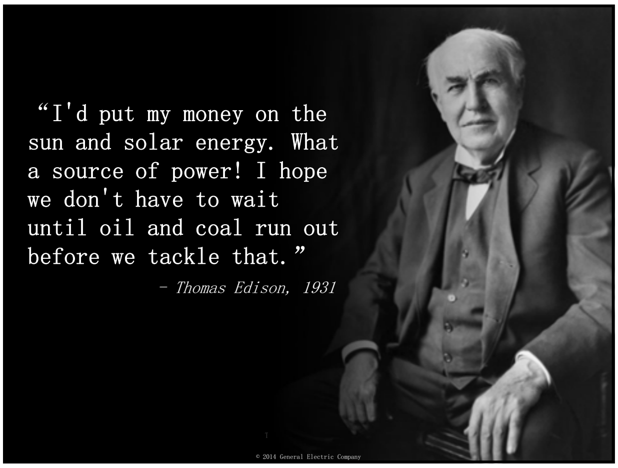
Sweet sorghum in Kenya

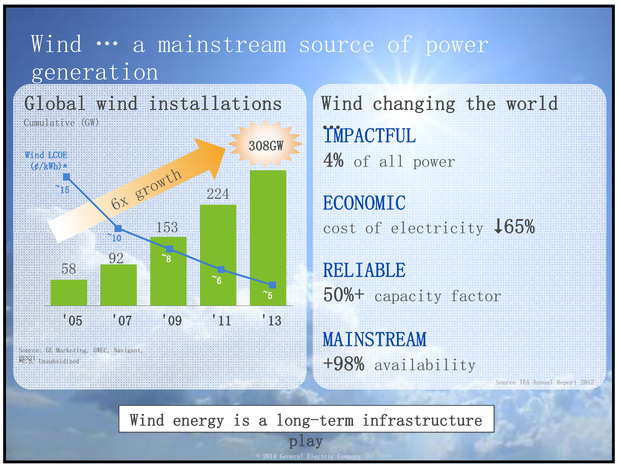
Sweet sorghum in Zhuhai, China

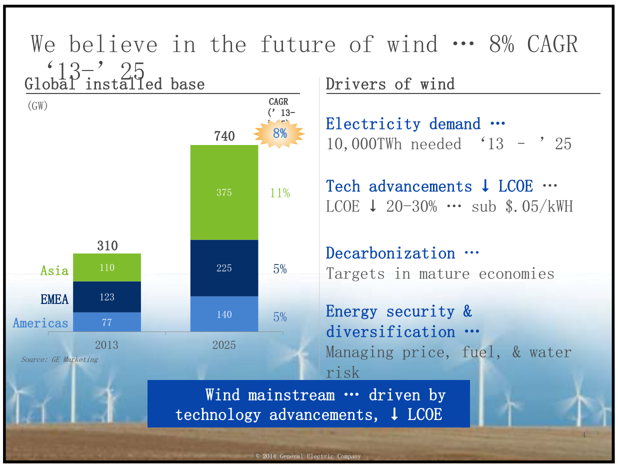
"It always seems impossible until it's done".

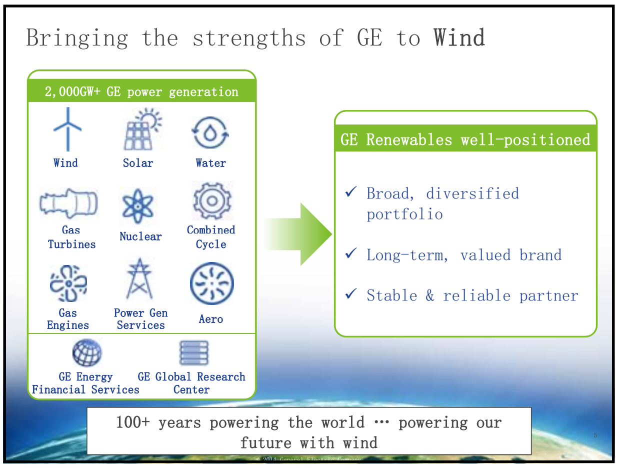
Thank You


Renewable Energy
Alex Lu
Sales GM, GE Renewable Energy China
Imagination at work.
GE 1.6-100 wind turbines
170MW, Rio Grande do Norte, Brazil
© 2014 General Electric Company

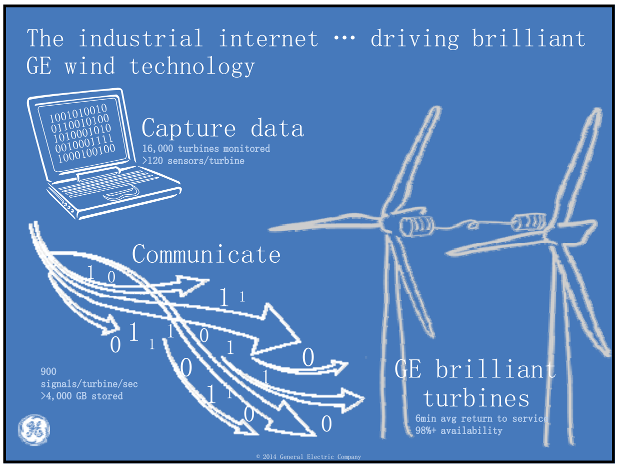

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that."
- Thomas Edison, 1931
© 2014 General Electric Company


Wind … a mainstream source of power generation
Global wind installations
Cumulative (GW)
Wind LCOE (¢/kWh)*
6x growth
308GW
58
92
153
224
~15
~10
~8
~6
~5
'05
'07
'09
'11
'13
Wind changing the world
IMPACTFUL
4% of all power
ECONOMIC
cost of electricity ↓65%
RELIABLE
50%+ capacity factor
MAINSTREAM
+98% availability
Wind energy is a long-term infrastructure play
© 2014 General Electric Company


We believe in the future of wind … 8% CAGR '13-'25
Global installed base
(GW)
CAGR ('13-'25)
740
8%
375
11%
310
Asia
110
EMEA
123
225
5%
Americas
77
140
5%
2013
2025
Source: GE Marketing
Drivers of wind
Electricity demand …
10,000TWh needed '13 - '25
Tech advancements ↓ LCOE …
LCOE ↓ 20-30% … sub $.05/kWH
Decarbonization …
Targets in mature economies
Energy security & diversification …
Managing price, fuel, & water risk
Wind mainstream … driven by technology advancements, ↓ LCOE
© 2014 General Electric Company


Bringing the strengths of GE to Wind
2,000GW+ GE power generation
Wind
Solar
Water
Gas Turbines
Nuclear
Combined Cycle
Gas Engines
Power Gen Services
Aero
GE Energy Financial Services
GE Global Research Center
GE Renewables well-positioned
✓ Broad, diversified portfolio
✓ Long-term, valued brand
✓ Stable & reliable partner
100+ years powering the world … powering our future with wind


GE is committed to our customers' success
Enhancing customer plant economics with:
The right products for customers
Service solutions to run wind plants more efficiently
Technology investments to position wind as a mainstream power source
31
economies
36GW
installed
22,000
wind turbines
98%+
availability
$2B
R&D invested
GE supporting customers today … and for the life of their wind plants
© 2014 General Electric Company

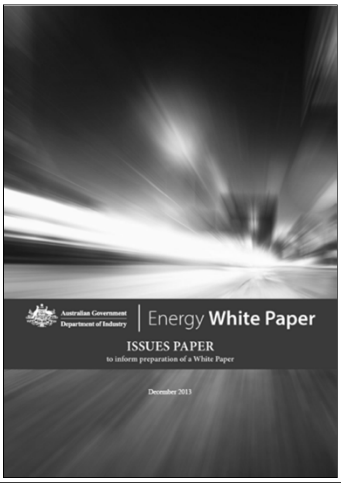

The industrial internet … driving brilliant GE wind technology
Capture data
16,000 turbines monitored
>120 sensors/turbine
Communicate
900
signals/turbine/sec
>4,000 GB stored
GE brilliant turbines
6min avg return to service
98%+ availability
© 2014 General Electric Company

Australian Government
Department of Industry

Australia's renewable and clean energy policies

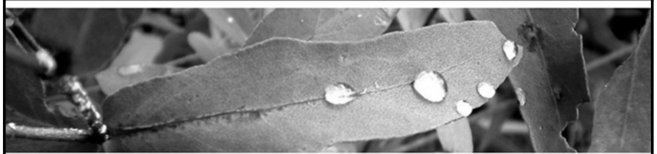
Ben Jarvis, Counsellor (Resources & Energy)

11 August 2014



Australian Government
Department of Industry

| industry.gov.au |



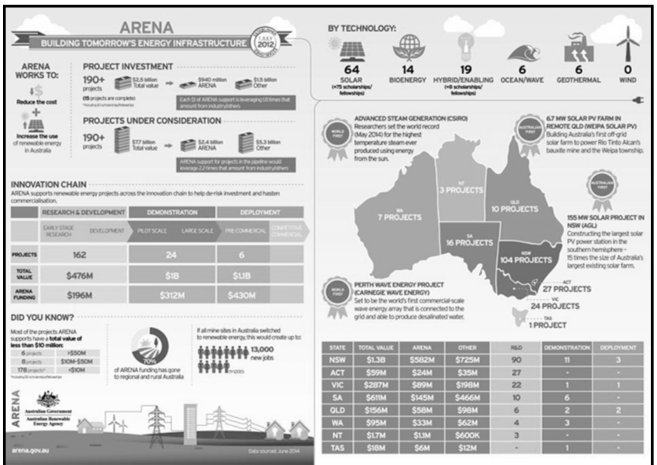
Emissions Reduction Fund

The Emissions Reduction Fund is the centrepiece of the Australian Government's Direct Action Plan. It will operate alongside existing programmes already working to reduce Australia's emissions such as the Renewable Energy Target and energy efficiency standards on appliances, equipment and buildings. The Emissions Reduction Fund will provide incentives for emissions reduction activities across the Australian economy.

Australian Government
Department of Industry

| industry.gov.au |

Renewable Energy Target (RET)



Australian Government
Department of Industry

| industry.gov.au |

Thank you

The First Public Private Partnership on Environment Goods and Services (PPPEGS) in APEC

Development programs and recent activities of ESCO industry

11 August, 2014

Chiharu Murakoshi, Ph.D.

Jyukankyo Research Institute

Japan Association of Energy Service Companies

Overview of presentation

- Common barrier to promote ESCO industry
- Successful promotion programs for ESCO industry mainly in Asian economies
- Trend of ESCO market in Japan

Reference

- Features of ESCO Industry
- Typical business model of the energy conservation market
- Detailed survey result by type in commercial sector
- Activities of JAESCO
- Overview of the activities which JAESCO has implemented in the past

1

World ESCO Market

JYUKANKYO RESEARCH INSTITUTE INC.

2

JYUKANKYO RESEARCH INSTITUTE INC.

Common barrier to promote ESCO industry

3

Common barrier to promote ESCO industry

JYUKANKYO RESEARCH INSTITUTE INC.

Hurdle: Lower → Higher

- Lack of recognition of ESCO
- Delay in capacity building of ESCOs especially M&V, technical knowhow
- Lack of support to ESCO association
- Lack of accreditation or certification system of ESCOs
- Lack of financial scheme
  - ✓ Lack of financial institutions' understanding toward ESCO industry
  - ✓ Delay in capacity building of financial institutions
- Difficulty in introducing ESCO to government buildings
- Undeveloped legal framework of energy conservation
- Low energy price
- Gap between contract society and real business custom
- Lack of recognition of ESCO

4

JYUKANKYO RESEARCH INSTITUTE INC.

Successful promotion programs for ESCO industry mainly in Asian economies

5

Promotion programs for ESCO industry

JYUKANKYO RESEARCH INSTITUTE INC.

Promotion programs for ESCO industry are as shown as below, and similar programs are implemented in most economies.

- **Preliminary review**
- **Development of business**
- **Development of capability (Capacity building)**
- **Propagation and enlightenment**
- **Establishment of project body/operation support**
- **Financial support**
- **Reinforcement of policy/system reformation**

6

Preliminary review

JYUKANKYO RESEARCH INSTITUTE INC.

- Its carried out in the early stages of ESCO implementation.
- **Examine such as definition of ESCO, standard contract, overview of M&V, energy saving potential, and market barrier and the breakthrough.**
- In response to the examinations, pilot project, capacity building, support measures and establishment of ESCO association are often performed.
- ***In Japan***, various programs have been deployed for nearly 10 years since FS carried out supported by METI in 1996.
- ***In China***, the facts that there was a large potential on energy savings and at the same time there was a market barrier were identified by the investigation carried out from 1992 to 1994, therefore a supporting program was performed for 10 years since 1998.
- ***In Thailand***, a feasibility study by GEF was carried out and a pilot project of ESCO was implemented.
- ***In Asia***, the World Bank and Global Environment Facility (GEF) have been investigated in several economies in the early 1990s.

7

Development of business

JYUKANKYO RESEARCH INSTITUTE INC.

Following the initial feasibility studies, energy audit and pilot projects should be performed.

- Implementation of energy audit (corresponding to FS research)
  - Although it is difficult to say that free energy audit directly helps the development of ESCO industry because not all facilities which received energy audit take in ESCO project, making energy audit to define the energy consumption and issues contributes to the promotion of the overall energy savings.
- Implementation of pilot projects
- Introduction of ESCO business into governmental facilities
  - Implementation of ESCO projects to government facilities enhances the credibility of the entire ESCO industry
- Implementation of IRP/DSM programs
  - Contributes to the development and promotion of ESCO project

8

Development of capability (Capacity building) 1

JYUKANKYO RESEARCH INSTITUTE INC.

Preparation of technical guidelines:

- Develop guidelines for M&V and Standard Contract which are important to perform ESCO project.

Preparation of ESCO introduction manuals for public facilities:

- The potential of public sector is huge.
- Bidding procedure differing from the usual construction is needed for implementing ESCO project to public facilities.

↓

Plan A: Reform the bidding system like U.S. and Canada

Plan B: Make a manual for bidding system which can make use of the characteristics of ESCO as much as possible under the current bidding system.

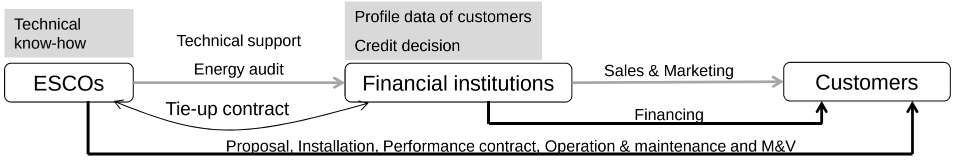
9

Development of capability (Capacity building) 2

JYUKANKYO RESEARCH INSTITUTE INC.

➢**Performance development for financial institutes:**

- Involvement of financial institutions is essential on ESCO project.
- Guideline for financial institutions which showing the overview of ESCO project should be created.
- Seminar should be held in order to help financial institutions to understand ESCO model.
- Promote tie-ups and cooperative work between financial institutions and ESCOs.



➢**Performance development for ESCO enterprisers:**

- Carry out capacity building in order to bring up good ESCOs quickly.

10

Propagation and enlightenment

JYUKANKYO RESEARCH INSTITUTE INC.

In order to bring up ESCO industry, it is necessary to promote it continuously, not only in the beginning of implementation.

➢Compile and issue of successful models

➢Seminar, conference, exhibition: opening of various seminars and conferences for propagation and enlightenment of ESCO business

➢Provision of information such as newsletters, websites etc.

➢Commendation system for excellent ESCO projects

11

Establishment of project body/operation support

JYUKANKYO RESEARCH INSTITUTE INC.

- Set up of ESCO association/operation support
  - ESCO association is active in many economies to participate in dissemination and public awareness activities.
  - Private sector set up it in U.S., Japan and Australia
  - Government and private sector set up it in Thailand and Korea
  - International organization supported to set up it in China, Malaysia and Philippines
- Support to set up ESCOs
  - Establishment of Pilot ESCOs, which was supported by an international organization in the beginning of implementation, was successfully performed in China.
- Accreditation system for ESCOs
  - Preliminary accreditation system to simplify government procurement procedure (Super ESPC in U.S., Australia, Thailand and Korea)
  - Accreditation system (NAESCO etc.) for nurturing excellent ESCOs
- Evaluation of energy savings performance and impartiality 3rd party mechanism

12

Financial support

JYUKANKYO RESEARCH INSTITUTE INC.

Financial support by government is extremely important. While the main support is subsidies in Japan, other Asian economies often implement low-interest loans and Tax incentives. Additionally, loan guarantee helps the promotion of ESCO industry in China.

- Develop financial scheme
- Implementation of low interest finance (performance based incentive)
  - ESCO assume an obligation to reduce fixed amount CO_2 reduction such as 100-200 UDS/ton-CO_2 which we would like to propose
- Offer of subsidies
- Implementation of loan guarantee programs
  - Insurance to reduce investment risks of financial institutions
- Tax incentive system
  - exempts taxation for utility costs reduced by implementation of ESCO project
  - deducts a certain percentage of the cost for introducing high-efficiency equipment

13

Reinforcement of policy/system reformation

JYUKANKYO RESEARCH INSTITUTE INC.

- Reinforcement of regulations for energy conservation
  - Japan: Energy Conservation Law
  - China: Energy Conservation Law
  - Thailand: Energy Conservation Promotion Act
  - India: Energy Conservation Act

  Energy-saving standard has been established basing on the development of these laws, regulation was started, and support program for energy-saving promotion was carried out. Most of them closely relate to the business growth of ESCO industry.
- Reformation of procurement regulations to introduce ESCO in governmental facilities
  - Super ESPC in U.S.

14

Typical success factor

JYUKANKYO RESEARCH INSTITUTE INC.

- **Japan**: Strengthening the Energy Conservation Law, capacity building supported by Government and activities of Association of ESCO
- **The United States**: Reform of procurement rules for ESCO at government facilities and DSM programs
- **China**: Large financial support by international organizations on the early stage of ESCO introduction
- **Thailand**: Financial support such as low-interest loans and tax incentives
- **India**: Initiative by government agencies and the enactment of Energy Conservation Act.
- **Europe**: Regulation by Cap & Trade and White Certificate or Energy Company Obligation

15

Brief roadmap to develop & promote ESCO industry in initial introduction economies

JYUKANKYO RESEARCH INSTITUTE INC.

	Programs	1st year	2nd year	3rd year	4th year	5th year
Feasibility study	Standard contract	✓				
	Guideline of M&V		✓	✓	✓	
	Estimate potential of energy savings	✓				
	Free energy audit	✓	✓	✓	✓	✓
Capacity Building and raise awareness	Pilot projects (public & private)		✓			
	Seminar, exhibition and business matching meeting		✓	✓	✓	✓
	Case study of successful ESCO projects			✓	✓	✓
	Commendation program for excellent ESCO projects				✓	✓
	Training of M&V			✓	✓	✓
	Capacity building of financial organizations				✓	✓
Development of financial scheme						✓
Establish ESCO association			✓			
International relationship		✓	✓	✓	✓	✓
Government initiative	Financial incentive			✓	✓	✓
	Reformation of procurement system of Government's buildings				✓	✓
	Reinforcement of regulation for energy efficiency				✓	✓

16

JYUKANKYO RESEARCH INSTITUTE INC.

Trend of ESCO market in Japan

- ✓ Macro survey result
- ✓ Cost of CO_2 reduction and amount of CO_2 reduction by ESCO projects in Japan

17

Overview of JAESCO market survey

JYUKANKYO RESEARCH INSTITUTE INC.

Macro survey : Survey for activities of member companies

Items of survey : total number of project and the revenue by type of contract, type of customer, size of customer, amount of subsidy

Detailed survey : Survey for performance of each project

Items of survey : type of facility, type of customer, floor area of facility, type of contract, contract period, investment cost, pre and post energy consumption by type of energy, energy saving ratio, installed measures, prime contractor or subcontractor, amount of subsidy etc

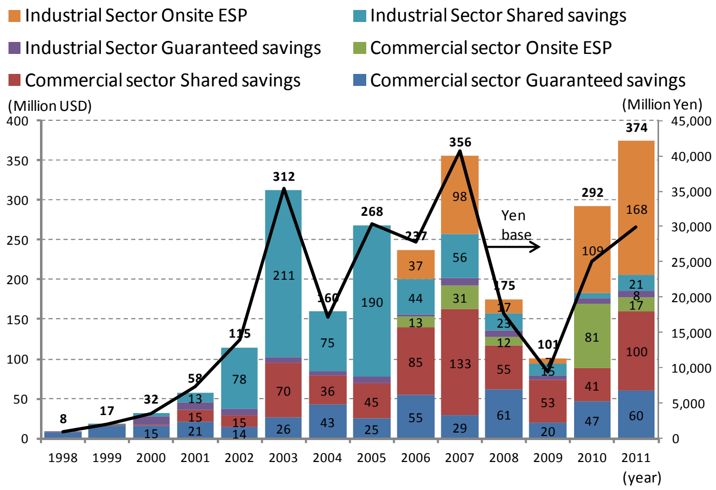
Number of samples of ESCO projects by detailed survey from 2002-2011

	Private sector	Public sector	Total
Commercial Sector	456	207	669
Industrial Sector	252	0	252
Total	708	207	921

18

Market size of ESCO industry in Japan

JYUKANKYO RESEARCH INSTITUTE INC.

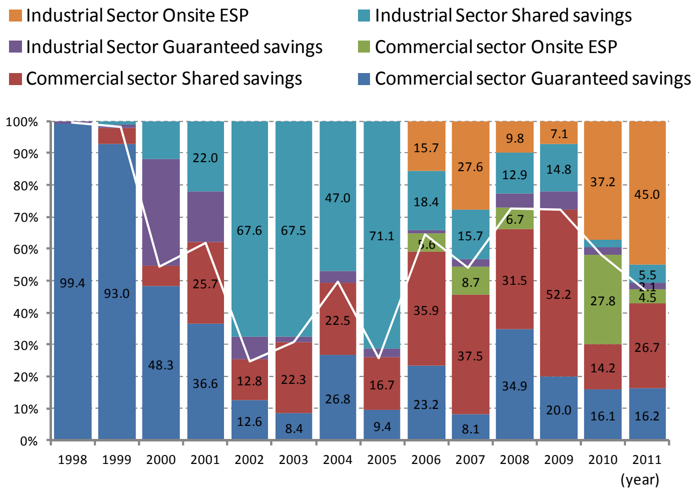


Source: JAESCO survey, 2012

19

Market share by type of contract in Japan

JYUKANKYO RESEARCH INSTITUTE INC.

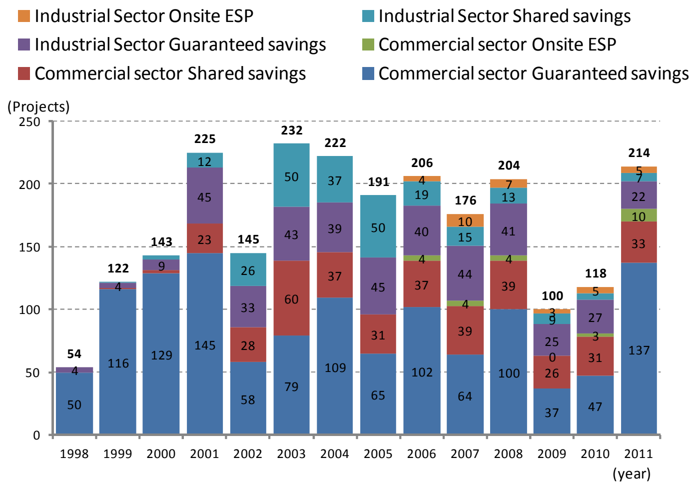


Source: JAESCO survey, 2012

20

Number of ESCO projects in Japan

JYUKANKYO RESEARCH INSTITUTE INC.

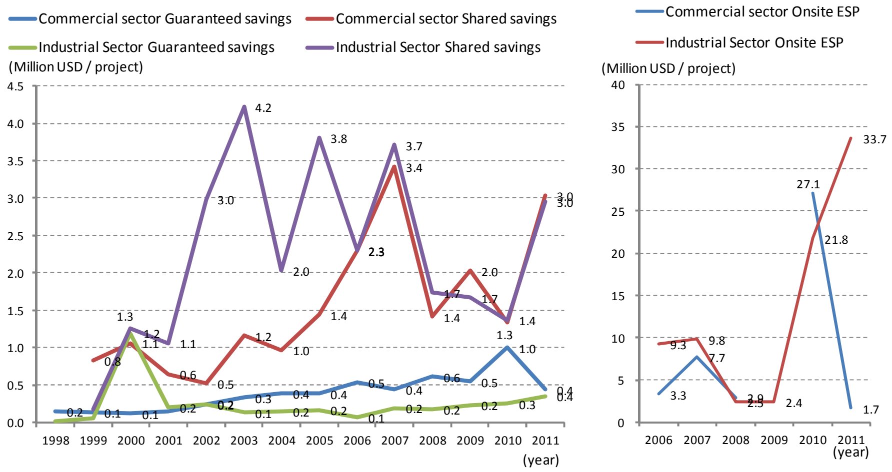


Source: JAESCO survey, 2012

21

Investment size of ESCO projects in Japan

JYUKANKYO RESEARCH INSTITUTE INC.



Source: JAESCO survey, 2012

Cost of CO_2 reduction by ESCO projects

JYUKANKYO RESEARCH INSTITUTE INC.

			Number of sample	Amount of investment	Amount of CO_2 reduction	Cost of CO_2 reduction
			samples	Million USD	ton-CO_2/year	USD/ton-CO_2/15years
Commercial Sector	ESCO projects		181	259.4	119,761	144.4
		GSC	103	95.6	49,396	129.1
		SSC	78	163.8	70,365	155.2
	ESP projects		2	16.7	7,382	151.1
Industrial Sector	ESCO projects		43	68.3	85,811	53.0
		GSC	9	3.8	2,083	121.6
		SSC	34	64.5	83,728	51.3
	ESP projects		4	50.6	17,269	195.4
Total / Average			230	395.1	230,223	114.4

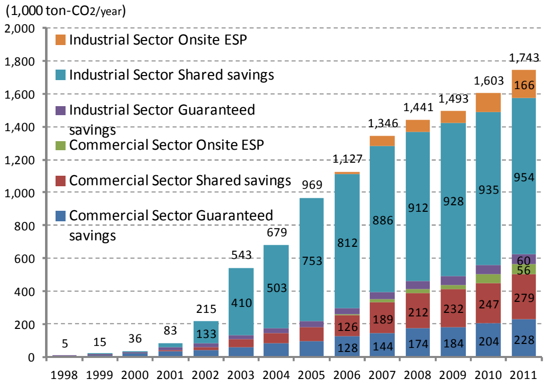
Source: JAESCO survey, 2002-2012

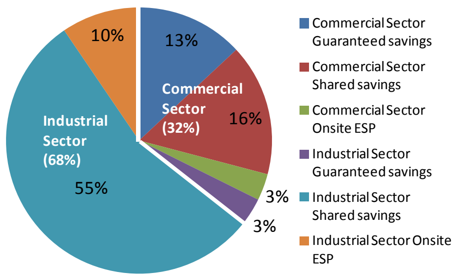
$$\text{Cost of CO2 reduction} = \sum_{i=1}^{n}(\text{amount of investment})i \div \left(\sum_{i=1}^{n}(\text{amount of CO2 reduction})i \times 15\text{years}\right)$$

Cost of CO_2 reduction (USD/ton-CO_2/15years)
Amount of investment (USD) of each project
Amount of CO_2 reduction (ton-CO_2/year) of each project
n= number of sample

CO_2 reduction by ESCO projects in Japan

JYUKANKYO RESEARCH INSTITUTE INC.





Amount of CO_2 reduction = total amount of investment in Japan(USD) / cost of CO_2 reduction (USD/ton-CO_2) / 15 years

Cost of energy savings by ESCO projects

JYUKANKYO RESEARCH INSTITUTE INC.

			Number of sample	Amount of investment	Amount of energy savings	Cost of energy savings
			samples	Million USD	TJ/year	¢/MJ/15yeras
Commercial Sector	ESCO projects		181	259.4	1,960	0.88
		GSC	103	95.6	805	0.79
		SSC	78	163.8	1,155	0.95
	ESP projects		2	16.7	85	1.31
Industrial Sector	ESCO projects		43	68.3	1,275	0.36
		GSC	9	3.8	36	0.71
		SSC	34	64.5	1,240	0.35
	ESP projects		4	50.6	173	1.95
Total / Average			230	395.1	3,493	0.75

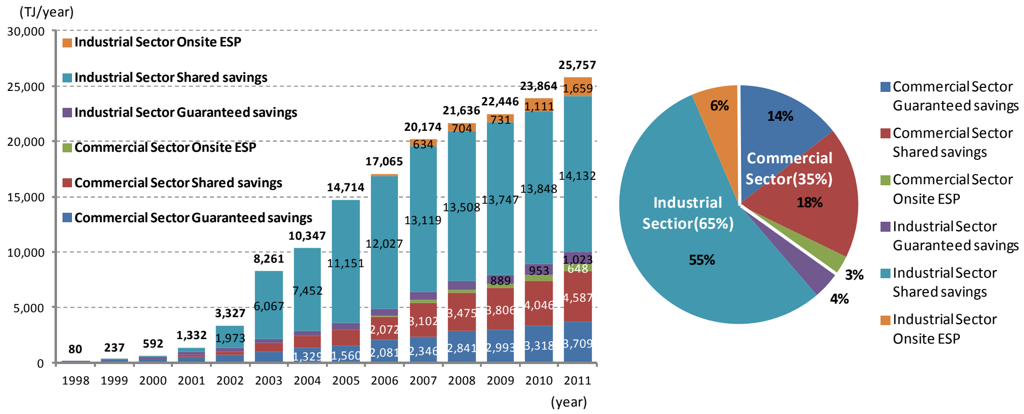
Source: JAESCO survey, 2002-2012

$$\text{Cost of energy savings} = \sum_{i=1}^{n}(\text{amount of investment})_i \div \left(\sum_{i=1}^{n}(\text{amount of energy savings})_i \times 15\text{years}\right)$$

Cost of energy savings (¢/MJ/15years)
Amount of investment (USD) of each project
Amount of energy savings (MJ/year) of each project
n= number of sample

Energy savings by ESCO projects in Japan

JYUKANKYO RESEARCH INSTITUTE INC.



Amount of energy savings= total amount of investment in Japan(USD) / cost of energy savings (USD/MJ) / 15 years

26

JYUKANKYO RESEARCH INSTITUTE INC.

Thank you for your attention !!

There is a never-ending stream of energy efficiency.

murakoshi@jyuri.co.jp

Jyukankyo Research Institute

Japan Association of Energy Service Companies

27

JYUKANKYO RESEARCH INSTITUTE INC.

Reference

28

JYUKANKYO RESEARCH INSTITUTE INC.

Features of ESCO Industry

29

Features of ESCO

JYUKANKYO RESEARCH INSTITUTE INC.

- ESCO guarantees the energy savings.
- ESCO makes a reliable proposal which is based on energy audit.
- ESCO can sustain the energy-saving performance over a long period of time by providing Measurement and Verification (M&V)
- ESCO makes a financial arrangement, and sometime it provides funding.
- Although energy services have been traditionally provided by the supply side, ESCO represents the interests of customers by providing a service from the demand side.

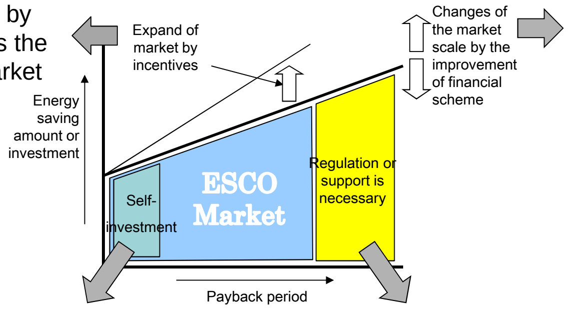
- ☐ The basis of these features is the **guarantee of energy savings** realized by **performance contracts**.
- ☐ **Performance contract** is a business model to maximize the benefits of both customers and ESCO, at the same time as it wins a customer trust.

30

Position of ESCO market and changing factor

JYUKANKYO RESEARCH INSTITUTE INC.

Financial support by government helps the overall ESCO market to be expanded.



Developing finance scheme makes an important role to the expansion of ESCO market. Promoting to introduce ESCO project to public facilities also helps the market expansion.

● Short Payback Period

The need to provide know-how of ESCOs is small in this area therefore is possible to invest by their own fund.

● Long payback Period

promoting energy conservation by regulation or requiring incentives such as subsidies

- ☐ **ESCO market varies depending on government's energy conservation policies, financial environment, and the target field for each ESCO.**
- ☐ **Therefore, the relationship between government and private sector is important.**

31

JYUKANKYO RESEARCH INSTITUTE INC.

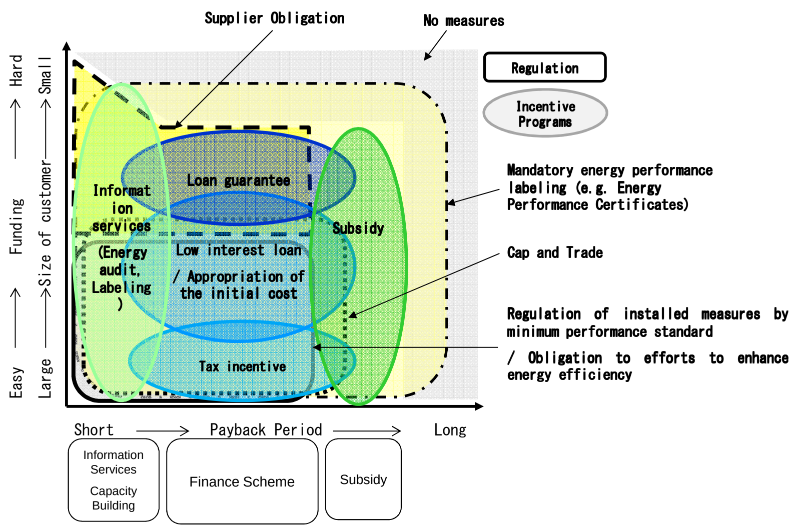
Typical business model of the energy conservation market

32

EE Policy Map:

Area of energy efficiency market which corresponding energy efficiency policies

JYUKANKYO RESEARCH INSTITUTE INC.



Typical business models of the energy conservation market

JYUKANKYO RESEARCH INSTITUTE INC.

➢ Regulatory model	Significant impact on ESCO market
➢ Incentive model	
➢ Engineering model	
➢ Value-added service model	Main solution of ESCO model
➢ Financing model	
➢ Improving market value model	Sub solution of ESCO model
➢ Utility DSM model	Significant impact on ESCO market
➢ Government facilities model	
➢ CSR (Corporate Social Responsibility) model	Additional impact on ESCO market

Note: Underline indicate the model by Government EE policy

34

Solution of ESCO business model

JYUKANKYO RESEARCH INSTITUTE INC.

➢**Engineering model**

- Service that provides the technical know-how of energy audit, energy saving design, construction, and operation management, etc.

➢**Value-added service model**

- Propose added values such as performance contract and M&V provided by ESCO and turnkey contract.

➢**Financing model**

Revitalize businesses by preparing financial scheme, such as project finance and leasing.

  - Loan guarantee for revitalizing by risk hedge for financial institutions has been implemented in China and other economies. Its targeted large commercial and industrial projects.
  - "On Bill Finance" becoming popular in the United States and "Green Deal" of the UK to provide funds for the upfront cost, collecting funds in accordance with utility charges. Its targeted residential and small & medium commercial buildings.

➢**Improving market value model**

- A model to improve the market value by evaluating the energy performance of buildings and equipment by rating and labeling and so on.

35

Significant impact on ESCO market by Government EE policy

JYUKANKYO RESEARCH INSTITUTE INC.

➢**Regulatory model**

✓ A regulation for energy demand, which is targeting at customers.

- Mandatory regulation of installed EE measures by minimum performance standard. (targeted new buildings and new equipments)
- Obligation to efforts to enhance energy efficiency to large customers.
- Cap and Trade.

✓A regulation for energy demand, which is targeting at Utilities.

- White certificate or Energy Company Obligation in Europe.

The target customers and Utilities would promote energy conservation business since they would be forced to invest.

➢**Incentive model**

- There are subsidies, low-interest loans, tax incentive and credit trading and so on, and they contribute to the expansion of energy conservation market directly.

36

Model that affect ESCO market

JYUKANKYO RESEARCH INSTITUTE INC.

➢**Utilities model**

- This model includes programs like DSM biding program, feedback program, and demand response program, etc. provided by Utilities, which drive energy conservation market due to Utilities' investment.

➢**Government facilities model *(Strong Impact)***

- A model to improve energy efficiency in government facilities, in order to expand the overall energy conservation market.

➢**CSR (Corporate Social Responsibility) model**

- A model to achieve energy savings as a service which helps company's social contribution.

37

Comprehensive Life Cycle Energy Service

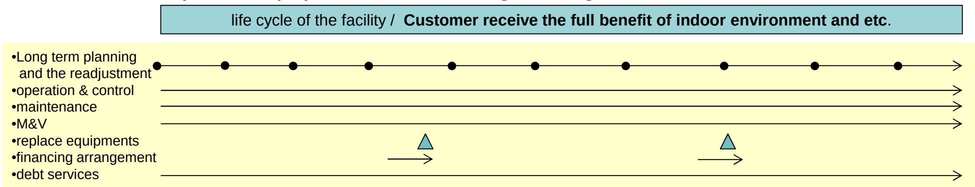
JYUKANKYO RESEARCH INSTITUTE INC.

I would like to propose developing CLCES

- ESCO provide comfortable indoor environment, hot water supply, lighting, security and debt service for the long term.
- Life cycle of equipment is 10 or 15 years
- Technology improve year by year
- Relevant timing to replace equipment is different

□Long term planning

operation & control, maintenance, payment of energy bill, measurement & verification, replace equipments, financing arrangement & debt services



38

JYUKANKYO RESEARCH INSTITUTE INC.

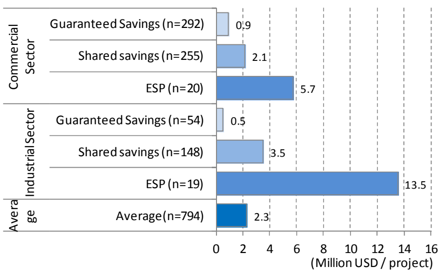
Detailed survey result by type in commercial sector

39

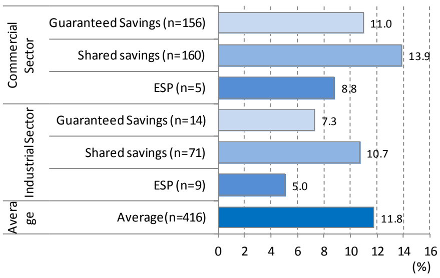
Investment size and energy saving ratio

JYUKANKYO RESEARCH INSTITUTE INC.

<Investment size of ESCO project>



<Energy saving ratio of ESCO project>



ESP in industrial sector is the largest, 13.5 Million per project, and Guaranteed savings in the same sector is the smallest, USD 0.5 Million per project. The market size of industrial sector is larger than commercial facilities.

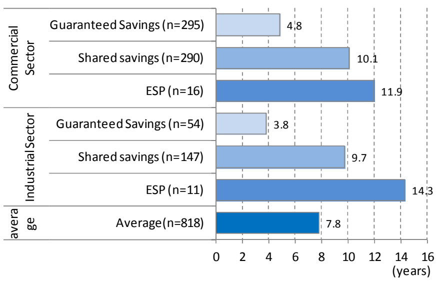
Shared savings is higher than Guaranteed savings in both commercial and industrial sector. And ESP is the lowest. Compare of Shared savings and Guaranteed savings, installed measures are not so different, but guaranteed savings is small market size

40

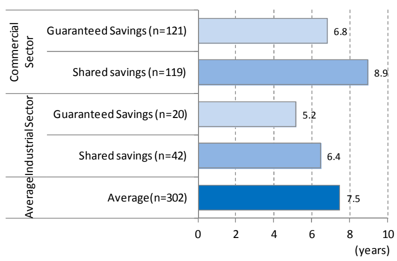
Contract period and simple payback period

JYUKANKYO RESEARCH INSTITUTE INC.

< Contract period of ESCO project >



< Simple payback period of ESCO project >



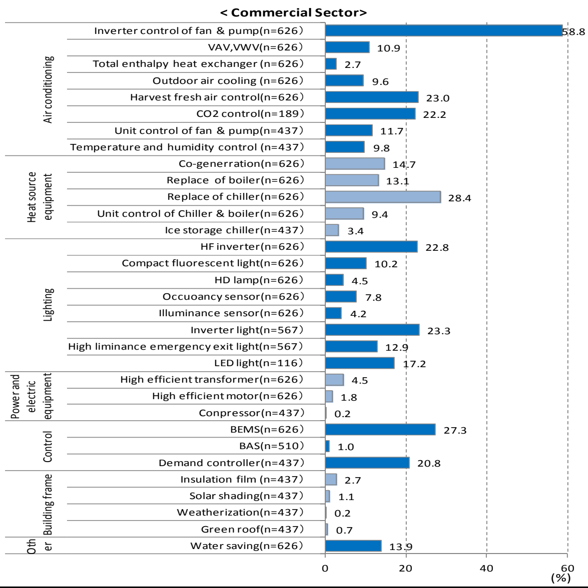
ESP's contract period is long and Guaranteed savings' period is short both in commercial and industrial sector. However, simple payback period shows a different trend from contract period.

Shared savings' simple payback period is nearly average and slightly shorter than contract period. On the other hand, the simple payback period of Guaranteed savings is longer than contract period. It is because that there are cases where they make a shorter contract than payback period on the contract of Guaranteed savings.

41

Installed countermeasures of ESCO project in Commercial sector

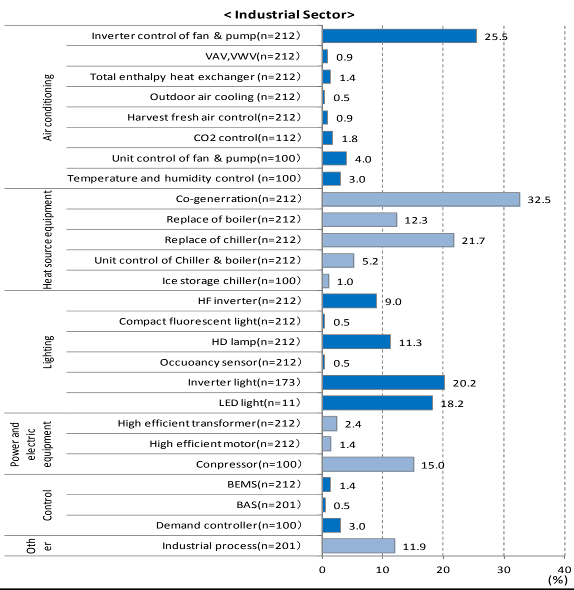
JYUKANKYO RESEARCH INSTITUTE INC.



42

Installed countermeasures of ESCO project in Industrial sector

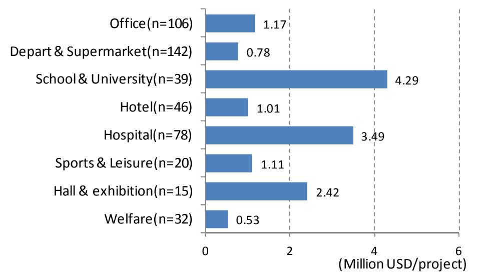
JYUKANKYO RESEARCH INSTITUTE INC.

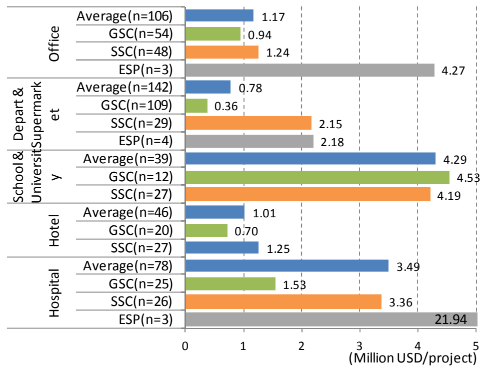


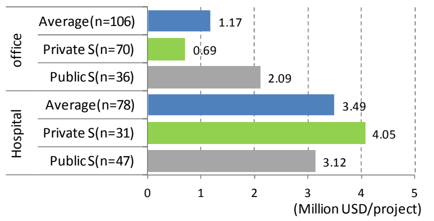
43

Investment size by type in commercial sector

JYUKANKYO RESEARCH INSTITUTE INC.



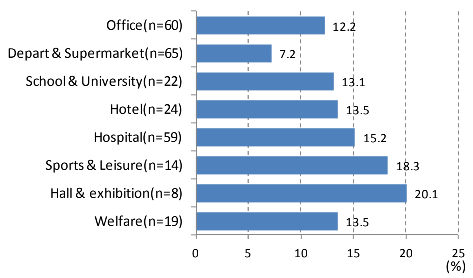


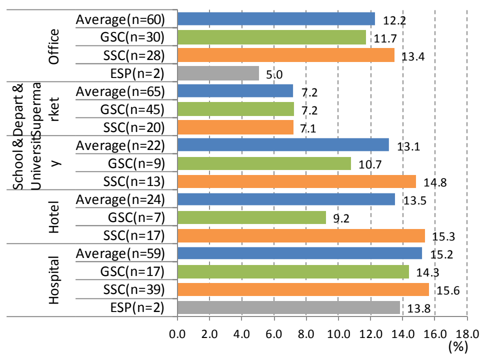


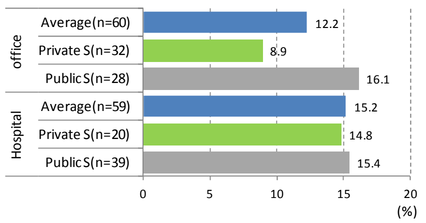
44

Energy savings ratio by type in commercial sector

JYUKANKYO RESEARCH INSTITUTE INC.



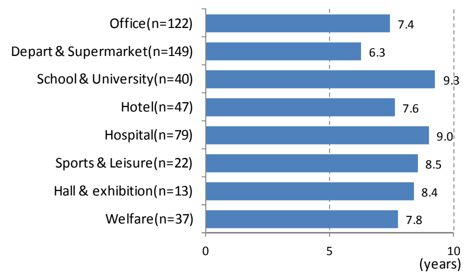


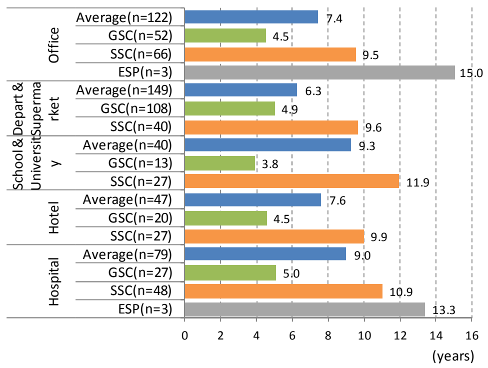


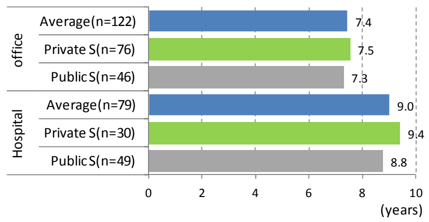
45

Contract period by type in commercial sector

JYUKANKYO RESEARCH INSTITUTE INC.

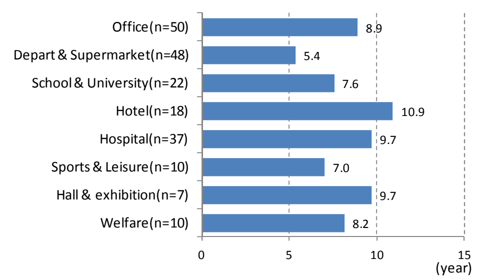


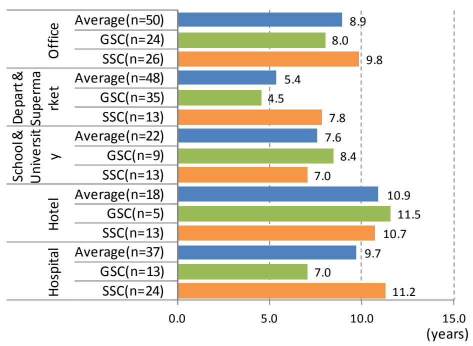


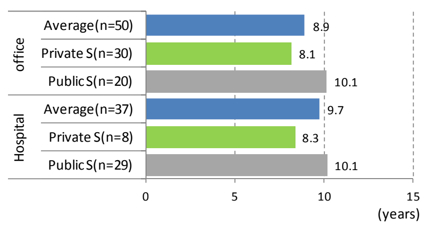


Simple payback period by type in commercial sector

JYUKANKYO RESEARCH INSTITUTE INC.







JYUKANKYO RESEARCH INSTITUTE INC.

Activities of JAESCO

- ✓Objectives of JAESCO
- ✓Organization of JAESCO
- ✓Activities of each committees of JAESCO
- ✓Feature of JAESCO Members

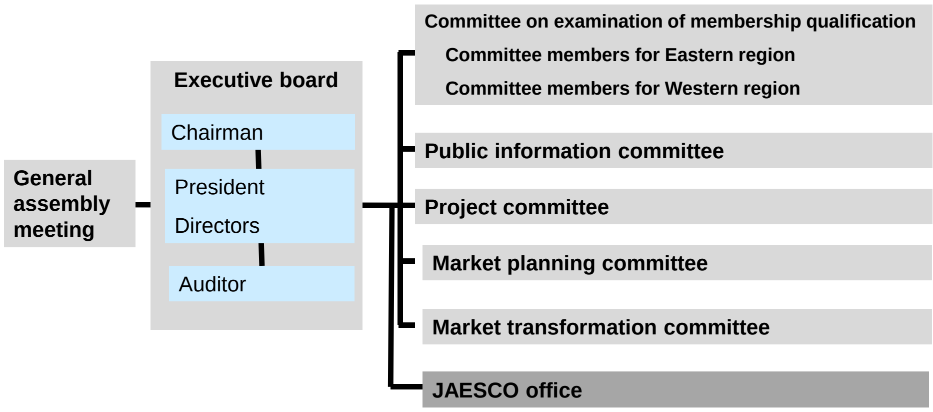
Objectives of JAESCO

JYUKANKYO RESEARCH INSTITUTE INC.

- ➢ JAESCO was established to support development of ESCO market
- ➢ as well as ensure sound evolution of ESCO industry
- ➢ to provide customers energy efficiency with comprehensive services of high cost-performance
- ➢ thereby, resulting in progress of energy conservation and global environment protection.

Organization of JAESCO

JYUKANKYO RESEARCH INSTITUTE INC.



50

Activities of Public information committee

JYUKANKYO RESEARCH INSTITUTE INC.

Carrying out plans to popularize ESCO industry such as holding conference, advertising via mass media, cooperating to news reporters and taking part in various related projects.

Conference WG

- Holding annual conference on the latest activity surrounding ESCO industry.
- Lectures and panel discussion are held with leader of each business world and professionals.
- Wide-ranging discussion is extended together with 500 participants on topics directly linked to business including governmental policies & programs, technology, finance and contracts.

News letter & Home page WG

- Publish news latter for members.
- Maintenance home page.

51

Activities of Project committee

JYUKANKYO RESEARCH INSTITUTE INC.

Seminar WG

- Holding seminars for members on the latest activity close about ESCOs three or four times annually, taken part by 100-200 members.

Exhibition WG

- Holding ESCO exhibition and provide members with opportunities to exchange information among members and with parties concerned.
- Set up ESCO booth to exhibitions relevant to energy efficiency such as ECO-Manufacture held by JETRO.

Energy business fair WG

- Running booths at Energy Business Fair held by the Kanto Bureau of Economy, Trade and Industry.

52

Activities of Market planning committee

JYUKANKYO RESEARCH INSTITUTE INC.

- Fulfilling data based on a in-depth market survey and collecting actual performance data of member's ESCO projects.
- Analyze market barrier and making policy proposals for encourage ESCO industry.
- Public relations campaign to industry groups.
- Arrange seminar and dispatch lecturers upon request of local authorities or industry groups.
- Entertain foreign guests and exchange information which contribute business evolution.
- Reviewing how to manage the association and discuss strategy on next step.

53

Activities of Market transformation committee

JYUKANKYO RESEARCH INSTITUTE INC.

- Lobbying for revitalize ESCO industry.
  - ✓ Propose to set up a new official fund.
- Field survey on detailed performance of both ESCO projects and general EE retrofit projects for analyze the superiority of ESCO projects.
- Computer simulation analysis on ESCO projects.
  - ✓ Analyze energy saving effect by continued control tuning.
  - ✓ Analyze energy saving effect by downsizing of heat/cool source equipments.

54

Feature of JAESCO Members

JYUKANKYO RESEARCH INSTITUTE INC.

- ESCO study committee formed with 233 members supported by METI in 1997.
- JAESCO established with 16 members in 1999 as economic association.
- Reorganized incorporated association in 2009.
- 117 members are participating in 2013.
- Most members are large companies and all most major utilities are participating JAESCO.
- Members of JAESCO has implemented 2,352 ESCO projects since 1998, it's energy-saving effect is 25,757 TJ/year, the CO_2 reduction is 1,743,000 ton-CO_2/year.

55

JYUKANKYO RESEARCH INSTITUTE INC.

Overview of the activities which JAESCO has implemented in the past

56

Overview of the activities which JAESCO has implemented in the past

JYUKANKYO RESEARCH INSTITUTE INC.

◆Before established JAESCO

- Initiation of ESCO introductory study in1996. : METI & Jyukankyo Research Institute(JYURI)
- Implementation of feasibility study in 1997. : METI, ECCJ & JYURI
- Implementation of demonstration projects and preparation of a standard contract form in 1998. : METI, NEDO & JYURI
- Development of Measurement & Verification Protocol guideline from1999 to 2002. : METI, ECCJ & JYURI

◆JAESCO established in 1999

- Hold annual conference from 2000 to present (conference & exhibition).
- Publish News letter from 2000 to present.
- Holed seminar for JAESCO members from 2000 to present.

57

JYUKANKYO RESEARCH INSTITUTE INC.

- **Dispatch ESCO study delegation to U.S.A in 2000, 2004 and 2014.**
- Support to adoption of ESCO projects to local authorities from 2000 to present.
- Dispatch lecturers upon request of local authorities or industry groups from 2000 to present.
- Implement ESCO market survey from 2001 to present.
- Exhibit ESCO booth to exhibitions relevant to energy efficiency from 2001 to present.
- Publish guidebook for adopt ESCO projects from 2001 to 2007.
- Advertising via mass media and journals for popularize ESCO concept from 2001 to 2004.
- Support ESCO business briefing by METI from 2001 to 2008.
- **Dispatch ESCO study delegation to Europe in 2002 and 2004.**
- Reviewing of risk sharing between ESCOs and local authorities in 2002.

58

JYUKANKYO RESEARCH INSTITUTE INC.

- Reviewing spread of BEMS and the cost in 2002.
- Support to make guideline for ESCO bidding system of local authorities in 2003.
- Hold ESCO business matching meeting & exhibition in 2003, 2004 and 2007.
- Preparation of guideline to introduce ESCO projects to local authorities in 2004.
- **Hold the First Asia ESCO Conference in Bangkok in 2005. :ECCJ**
- Superior ESCO Project Commendation from 2005 to 2007.
- Hold ESCO training seminar in 2006, 2007, 2008 and 2011.
- **Hold the Second Asia ESCO Conference in Beijing in 2007. :METI**
- Publish case study on successful ESCO projects in 2007.
- **Support Asia ESCO symposium in Tokyo in 2007. :NEDO**

59

- **Support ESCO capacity building seminar in Bangkok in 2008. : NEDO**
- Reorganized incorporated association in 2009.
- Public relation campaign to industry groups from 2009 to present.
- **Support Asia ESCO Conference in New Delhi in 2010. : NEDO**
- Study on potential market size of ESCO industry in Japan in 2013.

Forging Consensus on RCE Trade & Investment, Moving to a sustainable future in Asia Pacific Community

Public Private Dialogue on Renewable and Clean Energy Trade and Investment
-The First Public Private Partnership on Environment Goods and Services (PPPEGS) in APEC

Bo Wang
University of International Business and Economics
Beijing, China

Beijing Accord-1

- Promote market openness by further reducing tariff and non-tariff barriers on RCE products among APEC member economies.

- Work together to fight against all forms of trade protectionism in the RCE sector and deepen our cooperation on monitoring and resisting protectionist measures.

Beijing Accord-2

- Prevent trade frictions in cross border RCE trade and investment by strengthening coordination and cooperation among APEC economies.
  - including by holding public private dialogues regularly and building broader understanding and trust among APEC economies.

Beijing Accord-3

- Promote regulatory coherence and cooperation in areas affecting RCE trade and investment.
  - including by exploring the harmonization of quality standards and certification systems in the RCE industry to ensure the supply of high quality RCE products in this region.

Beijing Accord-4

- Recognize the importance of public sector support for the development of the RCE sector.
- Make efforts to identify and deploy appropriate measures to further the utilization and deployment of RCE.
- Ensure that all government support and incentive programs aimed at promoting RCE trade and investment are transparent and consistent with WTO rules.

Beijing Accord-5

- Strengthen the protection and enforcement of intellectual property rights and recognize the importance of comprehensive and balanced intellectual property systems that provide for and protect the incentives that encourage creativity and innovation, and provide substantial support to RCE research and development.

Beijing Accord-6

- Encourage RCE technology collaboration and dissemination amongst APEC economies.
  - including by enhancing capacities of APEC economies to attract, utilize, absorb and develop RCE technologies and related industries, with a view to narrowing the development gap and contributing to inclusive development.

Beijing Accord-7

- Engage the private sector and academia more deeply and frequently in RCE related policymaking.
- Establish an APEC Alliance of RCE Associations and Chambers to support APEC cooperation and create more cooperative opportunities for RCE industries among APEC economies.

Key points of the proposal on promoting
RCE Trade and Investment in APEC Economies

Proposed by Thailand

1. Conducting a cooperation scheme on harmonization of renewable and clean energy machinery and equipment standards. APEC could be able to use the same RCE certification such as solar panel, inverter etc. It could guarantee quality of goods and makes more confidence for investors to trade and invest of clean energy projects in the region.

2. The Study on intelligent monitoring system for RCE plant performance. It could cover the issues about standard practices, software to fully interpret operational data.

3. Pilot projects on small scale or community level RCE and capacity building activities. Small scale RCE is playing important roles in developing economies with plenty of energy resources such as biogas system in animal farms, biomass gasification in agricultural field. It is very difficult to let people initiate RCE projects by themselves, so system installations is needed for this kind of area. Capacity building activities for local people is also needed to operate and maintenance RCE systems in long term.

4. Regional projects on RCE feasibility study in each APEC economies. Focusing on resource potential, capability for invest and laws and regulations in each economy could help APEC evaluate big picture of future plan and strategy.

The report is written by

WANG Bo, YU Xiang, WANG Ran and GUO Lin

University of International Business and Economics, Beijing

Institute for Urban and Environmental Studies, Chinese Academy of Social Sciences, Beijing

Produced for

the Asia-Pacific Economic Cooperation (APEC) Secretariat

35, Heng Mui Keng Terrace Singapore 119616

Tel: (65) 6775 6012   Fax: (65) 6775 6013

E-mail:info@apec.org

Website: www.apec.org

Publication Number : **APEC#215-CT-01.7**