Asia-Pacific Economic Cooperation

Report on Seminar on Successful Cases of Renewable and Clean Energy Investment in APEC, November 2012

Investment Experts' Group

APEC Committee on Trade and Investment

28-29 June 2012

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Economic Cooperation

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Abbreviations

APEC	Asia-Pacific Economic Cooperation
CATF	Clean Air Task Force
CCS	CO2 Capture and Storage
CCUS	Carbon Capture, Utilization and Sequestration
CDM	Clean Development Mechanism
CFIUS	the Committee on Foreign Investment in the United States
CHP	Combined Heat and Power
CNOOC	China National Offshore Oil Corporation
CWHR	Cement Waste Heat Recovery
DOE	Department of Energy
ENN	Energy Innovation Group
EOR	Enhanced Oil Recovery
FDI	Foreign Direct Investment
FIT	Feed-in-tariff
GCS	Geological Carbon Sequestration
GEI	Global Environmental Institution
HEC	Harbin Electric Corporation
IEA	International Energy Agency
IGCC	Integrated Gasification Combined Cycle
IGO	Inter Governmental Organization
IPO	Initial Public Offering
ITC	Investment Tax Credit
MARD	Ministry of Agriculture and Rural Development
MFI	Micro Finance Institution
NBIP	Non-Binding Investment Principle
NDRC	National Development and Reform Commission
NPO	Nonprofit Organization
NGO	Nongovernmental Organization
PE	Private Equity
PHC	Pacific Hydro Chile
PTC	Production Tax Credit
PCC	Post-combustion Capture
RCE	Renewable and Clean Energy
SNV	Netherlands Development Organization
SC	Super-critical Combustion
TD	Technology Diffusion
TPRI	Thermal Power Research Institute
TRIG	Transport Integrated Gasification Technology

TT	Technology Transfer
USC	Ultra-super-critical Combustion
NGO	Nongovernmental Organization
UCG	Underground Coal Gasification
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
VC	Venture Capital

1. Background introduction

1.1 Background

APEC has put climate mitigation and sustainable development as top priorities in the APEC Leaders and Ministerial Statements. The 2011 APEC Leaders' Declaration: "We are committed to advancing our shared green growth objectives. We can and must address both the region's economic and environmental challenges by speeding the transition toward a global low-carbon economy in a way that enhances energy security and creates new sources of economic growth and employment." The 2011 Declaration set a target of a reduction of energy intensity by 45% by 2035 in the region. The APEC Strategy for Investment states, "APEC will strengthen its activities to increase member economies' ability to create investment opportunities through information sharing on investment opportunities regarding particular sectors…" Cross border investment is an important way to facilitate the diffusion and dissemination of low carbon technologies.

As a concrete action to cater to the above stated APEC strategies, China proposed a project, "*Seminar on Successful Cases of Renewable and Clean Energy (RCE) Investment in APEC*", approved by the Investment Experts' Group(IEG) and the APEC Committee on Trade and Investment (CTI) in the fall of 2011. This project is designed to explore effective policy instruments to facilitate RCE investment and technology diffusion in APEC via information exchange among stakeholders and surveys and analyses. As a core component of the project, a one-and-half-day seminar on Successful Cases of Renewable and Clean Energy Investment in APEC was held in June in Beijing.

1.2. Objectives

The seminar aims at the following objectives:

- Increase understanding and raise awareness of opportunities for investment within APEC economies in RCE through holding an information exchange seminar on successful cases of RCE investment;
- Share experiences, lessons and opinions on the role of cross-border investment in increasing utilization of RCE and dissemination of RCE technologies; and share experiences on facilitation and promotion of cross-border RCE investment.

1.3 Methodology and Definitions

The term "clean energy" in this report refers to the energy forms that are developed and exploited in environmentally friendly approaches. Two clean forms of clean energies are examined in this program, namely, clean coal and waste heat recovered and used in power generation from cement production

Renewable energy involved in this program mainly concern biomass/biogas, solar and wind. As this seminar is based on some successful cases of RCE investment recommended by different APEC economies, we do not have equal coverage on each form of renewable energy and do not cover all forms of renewable energy, which does not mean that there is a preference for any particular form of renewable energy.

This report is based on the presentations of the participants at the seminar and the project team's literature review and communications with stakeholders.

This report does not reflect APEC official positions. All responsibilities are solely the author's.

1.4 Who Participated?

This workshop had 53 invited participants. They included senior government officials, Mr. Sun Yuanjiang, Mr. Zhu Guangyao, Mr. Chen Chao, Mr.Wu Guoliang from Ministry of commerce and Mr. Liu Pengcheng from Ministry of Foreign Affairs and Professor Zhao Zhongxiu from University of International Business and Economics.

The speakers included Dr. Mark Gabriel Little from Kenan Institute for Private Enterprise, Dr. Melanie Hart from Center for American Progress, Mr. Asfaazam Kasbani from UNDP Malaysia, Mr. Nguyen Sy Linh from Institute of Strategy and Policy on Natural Resources and Environment, Mr. Kenji Takayama from Plant & Infrastructure Company Kawasaki Heavy Industries, Ms. Shirona D. Partem from Camco, Mr. José Antonio Valdés Carmona from Pacific Hydro company, Dr. Liu Hengwei from King Abdullah Petroleum Studies and Research Center, Dr. S. Ming Sung from The Clean Air Task Force, Ms. Cheng Chongying from Global Environmental Institute, Mr. Luo Xiang from Investment and Technology Promotion Office, Professor Wang Yi from China Academy of Science, Mr. Zhao Yongqiang from China National Renewable Energy Center.

In addition to this, 40 representatives from 9 economies also participated in this workshop. They are from Chile, China, Indonesia, Japan, Malaysia, Mexico, Philippines，Thailand and Viet Nam.

We also had representatives from IGO and NGOs, including United Nations Development Program, United Nations Industrial Development Organization and Global Environmental Institute.

Among the participants and speakers, 14 are women. 7 of the 10 working staff are women.

2. Executive Summery

Seminar on Successful Investment of Renewable and Clean Energy investment in APEC was hosted in Beijing on 28-29 June 2012. Over 50 participants attended the seminar and exchanged their experience and findings of successful cases of RCE investment. The participants identify some valuable experiences and models of RCE investment as well as barriers in RCE investment. Proposals for APEC future actions were given by the RCE investment stakeholders.

Participants and researchers understand that clean coal investment remains critical for future energy security and environmental integrity for APEC economies. Chinese local innovation strategy plus international technology transfer successfully lowered the cost of clean coal technology deployment(SC and USC). Pre-commercialized clean coal technologies that will lead to substantial reduction of CO2 have seen pilot cross border investment programs. The incremental costs out of the climate mitigation objective are beyond the private sector's financial capacity. More substantial incentives need to be provided by the government and more international collaboration and cross border investment should be facilitated.

Kawasaki Heavy Industries, a Japanese manufacture, shared its case of joint investment with Chinese counterpart in cement waste heat recovery system which provides one third of the energy for cement production. The Sino-Japanese joint venture successfully localized the Japanese technology and diffused it in both Chinese market and other developing economies. The trust between the investment partners set an example for technology providers and local enterprise.

A Chinese solar company ENN successfully secured a solar farm investment in USA with their understanding of the local politics and public relations which set a good example for an enterprise from emerging economies to invest in advanced economy. The different legal and political system of the advanced economies from the emerging ones remain a challenge for investors, particularly for small and medium sized enterprises, in their cross border investment in RCE.

Hydropower investment has been mature in technology with lower financial risk. However, it faces new problem of counterbalancing its negative environmental impact, particularly for the local communities. Pacific Hydro Chile shared its experience in realizing environmental integration and harmony with the local community. Global Environment Institute (GEI) also shared their experience in investing biogas project for the local community that is affected by the Chinese hydropower project.

Bio-fuels, though take a small share of the energy portfolio, is critical for local energy supply, particularly for rural areas. It has multi-implications for the rural habitants: eliminate energy poverty for remote off grid areas, improve the local environment with clean energy and promote the crop harvest. In advanced economies, bio-fuels production also creates significant number of employment. Bio-fuels investment in USA, biogas investment in Viet Nam and bio-fuel investment in China other non-APEC economies were shared at the seminar. Governmental support and international capacity building support are critical to the developing economies in promoting clean bio-fuel investment.

Intergovernmental organizations, nongovernmental organizations and nonprofit organizations are playing important roles in promoting RCE investment in APEC.

The United National Development Program, the United Nations Industrial Development Organization, Global Environment Institute, Clean Air Task Force shared their experience in promoting cross border RCE investment. They assist the host national and local government to formulate policies and instruments to incentive stakeholders in RCE investment, particularly in developing economies which lack the understanding and expertise in RCE investment policy formulation. They also provide capacity training for RCE investment stakeholders for financial management and technology management. They also serve as brokers to bridge the gap between investors (or technology owners) and project owners. Finally they also provide a portion of financial assistance in pilot investment programs.

The speakers and participants proposed several actions for APEC economies, among them are as follows:

A public-private dialogue between RCE investment policymakers and RCE investors could be carried out for the stakeholders to communicate on the best policy options and instruments to facilitate RCE investment, to identify the barriers that RCE investors encounter.

Capacity building on RCE investment policy formulation and project management could be enhanced.

An APEC RCE investment fund should be set to facilitate the RCE investment in the APEC region.

Work out a list of RCE products and technologies that could be given preferential treatment in trade and cross border investment among APEC members.

A data base of RCE investment in APEC could be established to solve the asymmetry of RCE information distribution.

3. Cases and Topics discussed at the Seminar:

3.1. Case I Clean Coal Investment Situation in APEC and Experiences and Lessons in China for APEC Economies

3.1.1. Global energy will remain dominated by fossil fuels in the coming decades with a majority of the energy-demand growth in developing economies.

Today fossil sources account for 81% of energy demand: Coal (25%), natural gas (21%), petroleum (34%), nuclear (6.5%), hydro (2.2%), and biomass and waste (11%). Only 0.4% of global energy demand is met by geothermal, solar and wind. In the long term, the share of fossil fuels in global primary energy consumption falls from around 81% today to 75% in 2035. Renewables increase from 13% of the mix today to 18% in 2035.According to the International Energy Agency (IEA)'s New Policies Scenario, which assumes that recent government commitments are implemented in a cautious manner, global primary energy demand will increase by one-third between 2010 and 2035, with 90% of the growth in non-Organization for Economic Co-operation and Development (OECD) countries.

3.1.2 Speakers pointed out that coal will continue to dominate some major APEC economies for decades to come. Coal is the most abundant and widely distributed fossil fuel in the world. About 70% of world's proved reserves are located in APEC economies, namely: US (28%) Russia: 18%; China: 13%; Australia: 9% and other APEC economies: 11%. APEC coal production takes even larger share of the world: 81%, namely China: 48%; US 15%; Australia: 6% and other APEC economies: 12% (Figure 1). APEC also consumes most of the coal in the world: 77%, namely: China: 48%; USA: 15%; Japan: 4% and other APEC economies: 10%.(Figure 2 ,BP, 2012).

Figure 1.APEC Coal Production, 2010

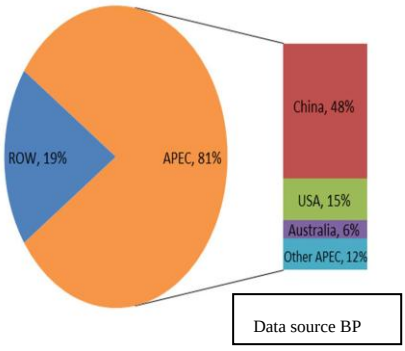
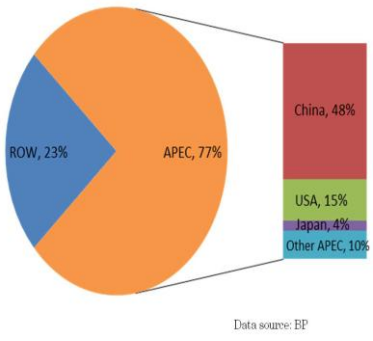


Figure 2.APEC Coal consumption, 2010



According to IEA projection, APEC energy demand expands by 44% between now and 2035, with coal remaining dominant in the energy mix.

Coal use in its current form is environmentally unacceptable, but that APEC economies will use its economically recoverable coal reserve is virtually inevitable because of the need for energy security and the relatively low cost of producing coal.
Based on the reality of the world energy demand and structure of energy supply, to satisfy both energy security and environmental integrity, it is wise to invest more in cleaner coal while we increase the share of renewables in the energy mix.

3.1.3. How can APEC economies use coal in a carbon-constrained future?

The speed and scale of the expanding coal use emphasize the urgency to deploy the full range of clean coal technologies, from those that reduce conventional pollutants such as SOx and NOx, to more advanced technologies with higher efficiency and the potential to substantially reduce CO2 emissions: Supercritical combustion(SC), ultra-supercritical combustion (USC), integrated gasification combined cycle (IGCC), CO2 capture and storage (CCS) or carbon capture, utilization and sequestration (CCUS). [1]Faster and broader innovation is critical for addressing the twin challenges of energy security and environment protection.

3.1.4. Localization and technology transfer: China's experience in SC and USC investment

China deploys the largest capacity of clean coal with SC and USC technologies.
The majority of coal-fired generation capacity in China is less than 10 years old, while in the United States and Europe, most of the fleet is between 31 to 40 years old (IEA CCC,2011). China has been routinely closing down old, inefficient coal-fired plants (less than 200 GW capacities with subcritical technologies) and replacing them with modern, efficient technologies (SC/USC), for example, in 2010, more than 11 GW of small plants were taken out of operation. Between 2006 and 2010, 100GW capacity with SC and USC technologies was installed. Between 2011and 2015, over 320 GW capacity SC and USC will be deployed and subcritical technology will be phased out of the new capacity.

[1] SC and USC has much higher thermal efficiency (45% or above) than subcritical, technologies (36%); IGCC also has higher efficiency (currently at 42-44%, with technology improvement it has the potential to crease efficiency to over 57%!) than subcritical technologies. CCS and CCUS are mostly for the capturing and storage for climate mitigation purpose which is more a public goods issue. SC, USC and IGCC are the prerequisite technologies for CCS deployment.

China's experience in large deployment of clean coal technologies can be attributed to her policies encouraging localization of the SC and USC technologies which brings down dramatically the cost of deployment. China manufactured equipment is about 40% lower than the cost in OECD countries. The comparatively low costs make SC/USC technologies more affordable and have consequently assisted with accelerated diffusion in China.

China now is the largest thermal power equipment manufacturer in the world. Shanghai Electric Group (SEG), Harbin Electric Corporation (HEC), and Dongfang Electric Corporation (DEC) have emerged as three key manufacturers in China. Their annual outputs all exceeded 35 GW in 2007, higher than any other major manufacturer around the world. All three manufacturers have the capacity to design and manufacture SC/USC equipment.

China obtained the SC and USC technologies through both technology transfer schemes and self-innovation approaches.

Chinese manufactures acquires the designs for turbines, boilers, and generators from industry leaders in other economies through joint ventures, purchasing licenses or joint design. The three key manufacturers are able to produce SC/USC equipment. HEC, for example, pays Mitsui Babcock over ten million Yuan (US$1.5 million) in licensing fees for every 600 MW boiler it produces (Tsinghua Study 2009). In addition to sourcing some core technology designs internationally, China still largely depends on imports to obtain alloys that can sustain high pressure and high temperature for the USC boiler. The foreign companies due to fear of losing IPR and lack of trust, is reluctant to transfer the key technologies of USC. Therefore, Chinese manufactures have to import the key component or innovate on their own R&D efforts.

Chinese government's strategic targets of innovation and portfolio policy of support is another key source for the leapfrogging of SC/USC technologies. Chinese National Basic Research Program, National Key Technology R&D Program, and National High-Tech R&D Program all engaged in the SC and USC technology innovation programs.

Their collaboration with the manufactures and power generators also provide convenient laboratory for the application of their research.
Chinese government's ambitious plan to phase out old power plants and the vigorous demand for power provides large potentials for the deployment of such technologies which serve as strong incentives for the manufactures in the investment in technology innovation.

Highlights of Chinese domestic policies

China's experience highlights the important role of effective domestic policy in stimulating clean technology. Chinese government took different approaches for its building blocks for technology deployment infrastructure include:
i). Making a deliberate, holistic plan and long-term commitment to the localization of SC and USC technology.
ii). Establishing R&D funding programs to support the launch and scale-up of low-carbon technology innovation. This approach is especially prominent in the case of SC/USC coal-fired power generation technology.
iii) Improving businesses' technological absorptive capacity through supporting their technology learning.
iv) Capitalizing on public-private and industry-academia synergies to bring together multi-sector expertise. The success of the localization of SC/ USC in particular is built on such multi-sector synergies.
v). Designing national-level and sector-wide laws, policies, and regulations to scale-up deployment of SC and USC, create domestic markets, and drive down the costs.

3.1.5. International collaboration featured: China's experience in IGCC and CCS RD&D

IGCC is a technically proven and near-commercial technology for higher thermal efficiency and an enabling technology for CCS at lower cost. However, its deployment currently is hindered by its higher upfront capital investment, poorer reliability and availability, and inflexibility of operation.

China deployed her first 3 IGCC demonstration projects in Yankuang(60WM, 2005), Fujian (200WM, 2009) and Huangneng GreenGen(250WM, 2012) respectively. There are 10 projects with capacities ranging from 250WM to 400WM are under construction or planned in China. Among the above stated projects, some will have CCS functions (e.g. GreenGen Project) and some others undergoing that will be elaborated on include CCS demonstrations.

Due to the high cost of IGCC and risks in deployment, and the substantial extra cost of CCS for CO2 reduction functions, there is more consensus on international collaboration in the investment of IGCC and CCS RD&D. The collaborations are mainly introduced and financed by governments with energy enterprises as the key players.

Chinese IGCC and CCS projects are featured with international collaborations. China is engaged in several bilateral cooperation programs concerning IGCC and CCS , such as China-Japan co-operation on CCS and enhanced oil recovery technology, Australia-China Joint Coordination Group on Clean Coal Technology, China-US Working Group on Climate Change, EU-China Partnership on Climate Change, China-UK Cleaner Coal Technology Transfer Program, Germany-China Environmental Cooperation, Canada-China Working Group on Climate Change .

In the above listed programs, mostly the foreign governments provide funding for the RD&D programs in China aiming to promote the demonstration of IGCC and CCS in China and share technologies gained from the RD&D experiences.

Also the most relative multilateral partnership on IGCC and CCS are FutureGen initiative(located in US) and GreenGen initiative (located in China) in which Chinese coal enterprises and US Coal enterprises cross-invest in each project and share the technology from their collaboration in demonstrations.

Speakers find complementary interests in IGCC and CCS technology investment between China and the advanced economies.

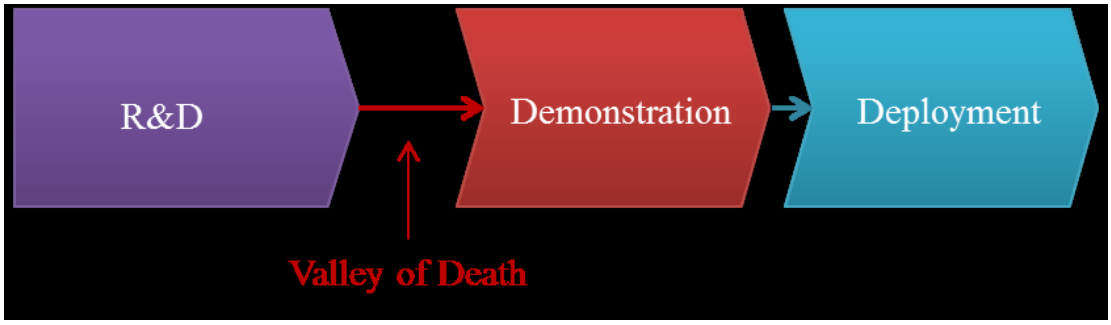
In the Advanced economies, e.g. the US, they face such challenges as:

- Lack of real markets (slow demand growth)
- Limits to available government financial support for innovative technology
- High capital costs and long timeframes (five-plus years) for major projects
- Sparse large energy project construction management experience (due to construction lull)

While in China, advantages are:

- Dynamic, rapidly expanding economy
- Government interest / support
- Project development can be quick & inexpensive
- Relatively scare oil, thus demand for Enhanced Oil Recovery (EOR)
- Utilization of captured CO2 in EOR and other revenue-generating activities could significantly drive down costs

Figure 3.Technology Innovation Process



Liu, 2012

Speakers emphasize *Clean energy innovation is constrained not by a lack of new ideas, but by the absence of early examples of successful implementation.(Liu, 2012) Investments by one country can reduce the cost of a technology worldwide, increasing the likelihood that CCUS will be widely deployed in time to help avert the worst consequences of climate change.*

Speakers propose *to foster clean energy innovation in APEC member economies, particularly in developing economies, APEC would increase access to capital for clean-energy innovation performers (especially young startup companies with promising innovations) and help get innovative technologies through the so-called "valley of death"(See figure3); include and retool existing small grant programs under this fund to focus on clean energy innovation capacity building in developing economies.*

3.2. Case II : Technology Investment: Interaction between Technology Transfer (TT) and Technology Diffusion (TD): A Successful Case---- Conch Cement's Cement Waste Heat Recovery (CWHR) Projects

Technology investment has different forms: such as selling equipment accompanied with basic know-how(operating skills)/ selling production license, forming joint ventures with local companies(joint manufacturing and research team), foreign investment, etc.

Selling equipment and basic operating know-how does not naturally lead to technology diffusion. The diffusion has to be accompanied by a series of other factors such as innovation ability in the technology host, the lowering of the learning curve in cost reduction, favorable policy incentives and the like. The Japanese company Kawasaki's Heavy Industries' investment in the CWHR system in China successfully involves both TT and TD in China. The large scale deployment of the CWHR system also rewards the Japanese investor a large share of in Chinese market and spillover to other foreign economies.

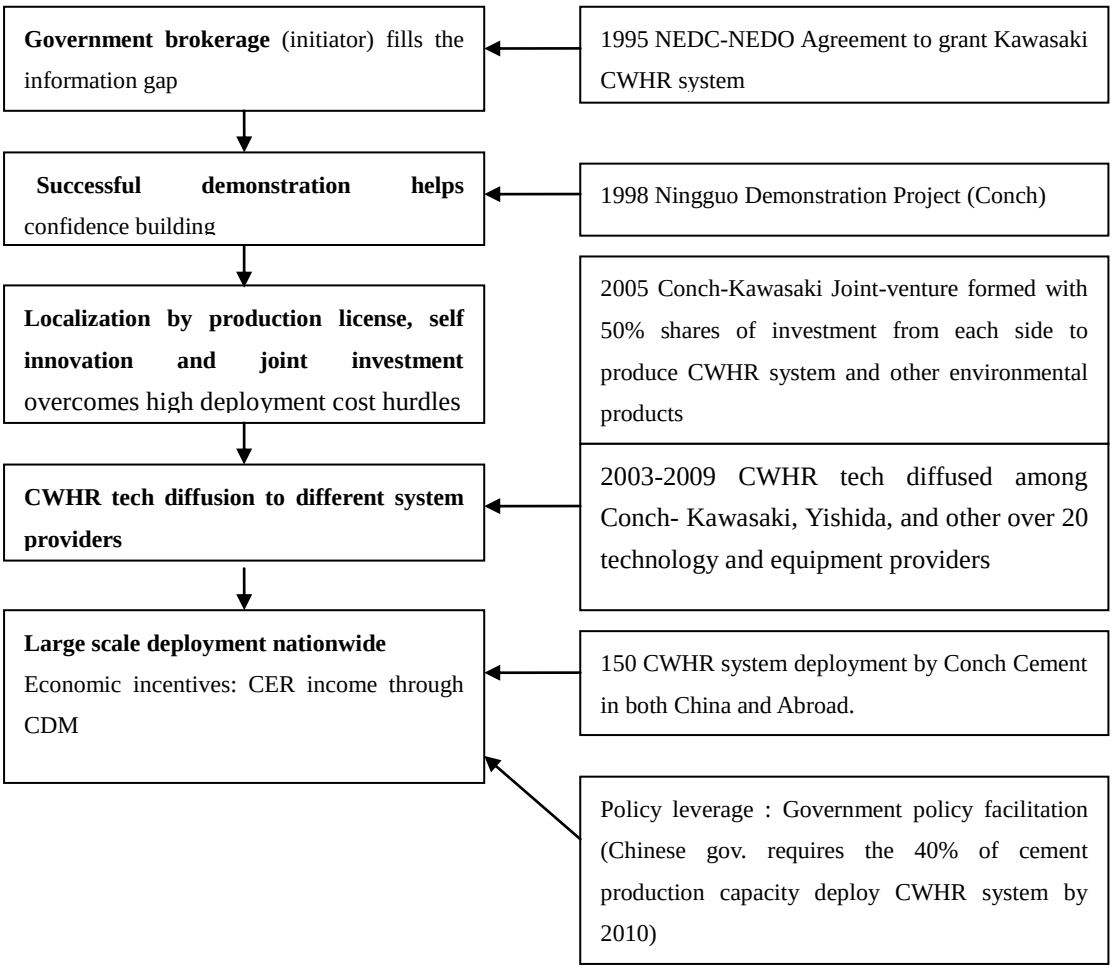
There was no CWHR in China until the introduction of the first Japanese system in 1998. With the successful demonstration project in China, the Chinese host made innovations to the Japanese system and produced a system more efficient than the original Japanese technology. Presently CWHR projects save one-third of the electricity consumed by cement production and have reduced costs by over 100%. More than three key technology providers are providing similar technology to domestic customers. As Figure 4 shows, a set of factors including CDM incentives contributed to the process (Chao Dong Cement Factory Engineers, 2009).

One factor that is important for early deployment and development is that the government serves as a broker and initiator of TT. For the technology recipient, this not only solved the asymmetrical disadvantage the host company faced in adopting novel foreign technology, but also reduced the risk of investment in the new technology to the lowest possible level by using granted foreign equipment and technology (Anhui Ningguo Cement Plant, 2002).[2] For the technology

2 In 1995, the New Energy and Industrial Technology Development Organization of Japan, Chinese National

provider and potential investor, the government guarantees the credibility of the partner.

Figure 4. Model of Technology investment: from TT to TD in CWHR system in China (Anhui Provincial Economic Commission official, 2011)



The recipient company has the technology potential not only to operate the system efficiently but also to independently adapt the foreign technology to local conditions and undertake incrementally minor adjustments, modifications, improvements and optimization.

The successful demonstration of the first project eventually encouraged the company to deploy another ten lines of this technology in seven of its subsidiary companies in spite of its high cost. In this process, the cooperation between the

Development and Planning Commission and China National Building Materials Administration jointly signed an agreement to build a Cement Waste Recovery demonstration project. With the assistance of the Japanese company Kawasaki, Ningguo Cement Plant, one of the chief components of the later Conch Cement Group in Anhui Province, installed the first waste heat recovery system in China. The project began its operation in October 1998. The project was very successful both in its economic and technological benefits. The local plant adopted know-how and also leaned to improve the system by adapting it to local conditions (Anhui Ningguo Cement Plant, 2002).

investor and the recipient company helps build the confidence between them which is vital to their cooperation.

Confidence building proves to be critical in the process of cross border investment and technology dissemination. For investors, they are concerned about protection of intellectual property rights. Therefore, they expect reliable partners. For recipient companies, they are concerned about the reliability of the foreign technologies and whether they could be successfully adapted to the local conditions and whether the local technicians can timely master the operating skills.

The financial ability of the recipient company is also important in cross border investment and technology dissemination. Analysis of the Chinese CWHR CDM projects' project description documents suggests that the project owner who excluded the choice of domestic substitute technology on efficiency grounds.[3] The high cost of the Japanese equipment and technology was identified as the chief hurdle of the project. The 20 to 30% higher efficiency advantage of the technology was cited as the chief argument for using Japanese technology. Considering the motivations of similar CDM projects deploying domestic technology because of high cost hurdles of foreign technology, one can assume that the better than average financial ability of the host projects was also a very important factor. [4]

The special nature of the diffusion of CWHR technology is that the recipient was a large entity, which provided both the incentives and potential to localize the technology. By the end of 2008, Conch Cement had more than 59 subsidiaries and branches and 2 associated companies. Its total annual capacity was 70 million tons, and its total assets were 19.2 billion Chinese Yuan. For ten years, Conch Cement has been the top cement and clinker manufacturer and seller in China, as well as the largest in Asia at present. All production lines within the group are fit to install new efficient systems. With a self-sufficient market for such a technology, Conch Cement is well incentivized to obtain the production license. Thus through the joint venture business form, Conch obtained the production license from Kawasaki and transformed itself from a recipient to a domestic technology provider. The advantage of being both a technology provider and applicant allowed Conch to reduce technology costs and optimize efficiency simultaneously, which eventually contributed to its large scale of technology diffusion. By July of 2011, the number of projects in China that deployed Conch technology had reached 145, which comprehended approximately one-third of China's market. CER income through CDM provides

3 One of the 7 projects was rejected by the CDM EB.

4 But the successful implementation of the project did not lead to large scale diffusion of the technology because the expensive equipment from Japan was beyond the financial ability of most cement plants to purchase.

economic incentives in facilitating the diffusion of waste heat recovery technology. With the support of CER income ($10/t CO2), the projects could generally increase their IRR by 5-7% (Anhui Conch Cement Co. Ltd, 2012).

National policy promoted the diffusion of this technology. Under the national strategic aim to reduce China's energy intensity by 20% in its Eleventh Five-Year Plan, promoting the deployment of the Cement Waste Heat generation system satisfies one of the government's objectives. China's NDRC issued "Some Opinions on Speeding up the Restructuring of the Cement Industry" in April 2006 in which it recommended that 40% of the existing cement production line would have to be equipped with waste heat generation systems by 2010, and the cement industry energy consumption intensity reduced by 25% (NDRC et al., 2006). CWHR projects also fall into one of the ten national energy conservation and efficiency categories (NDRC et al., 2006). This stimulated the local government to urge cement companies to install such technology. In some provinces such as Anhui and Henan, the local companies even signed a "*Jun Ling Zhuang"* (meaning: a solemn commitment) to fulfill 100% of the target instead of 40% (Anhui Provincial Economic Commission officials, 2009).

Benefits for the foreign technology provider/investor:
Though the first CWHR system was provided by the Japanese Kawasaki in the form of grants, it helped build the confidence between the investor and the recipient company. The successful demonstration of the first CWHR system lead to the deal of 10 CWHR system purchase from Kawasaki. More importantly, The Conch group, as the largest cement producer and cement production equipment producer, later proves to be the tech provider's ideal investment partner which was embodied by the Conch-Kawasaki Joint Cement Equipment Co.Ltd (formed in 2006). The joint technology investment lead to the deployment of 150 CWHR system in both China and southeast Asian and South Asian Countries by July 6th, 2011, which is self-evident a successful investment strategy for the technology provider.[5] The Japanese investment in China with Chinese partner not only opens a huge Chinese market but other foreign market mainly due to the local procurement which reduces the deployment cost and the local innovation of the technology which adapts to the local demands.

Environmental (climate) benefits: as energy consumption absorbs half of the cost in cement production, the CWHR technology diffusion in China has led to a one-third reduction in electricity used for cement production, and thus a significant reduction of CO2 in this sector across the country. CDM income facilitated both the TT stage and the diffusion stage. Successful diffusion by definition means that TT has become unnecessary. As the technology develops even further, with higher efficiency, lower costs and higher IRR, the additionality

[5] The Conch- Kawasaki's cooperation is not only on the CWHR equipment manufacturing and engineering but also on the cement production equipment manufacturing and engineering.

in the projects will gradually fade away. There will be no more such CDM projects. If that happens eventually in this sector, it will demonstrate the success of TT and CDM facilitation. This will also achieve the goal of emission reduction through not only the hotly discussed sectoral approach, but also by means of more market-oriented and voluntary methods.

Stakeholders recommend:
i) Enhancing mutual trust ("信赖") and ensuring business predictability
Building mutual trust and cooperation between foreign investors and their local business partners is the key factor to success in RCE investment. Successful RCE investments should be based on the rule of law and open, transparent and predictable business environment such as ensuring reliable intellectual property right systems. As in the case, the government as broker's role helped to build confidence between a foreign company and a Chinese local company in the initial phase. The subsequent cooperation between the businesses builds up confidence in each other. Chinese regulations and policies require the deployment of the CWHR system also provide predictability for the foreign investment.

ii) APEC Non-Binding Investment Principle (NBIP) should be reaffirmed to promote RCE investment.
Investment principles have provided predictability and stability to investors. The APEC Non-binding Investment Principles (NBIP) provide a common basis for the entire APEC region's international commitments, since they cover the key elements for International Investment Agreements and regulatory principles regarding economy-wide policies. While NBIP is "non-binding", the seminar can urge APEC member economies to adopt them into their investment policy. Promotion and Facilitation of RCE investment would accelerate technology dissemination too.

3.3. Case III Renewable Energy Investment in an Advanced Economy from an Emerging Economy: Chinese ENN's Solar Project in Nevada, US.

ENN Mojave Energy, a unit of Chinese energy ENN Group, is building a thin-film PV manufacturing plant and 720MW generation project on 22 sq km of public land at the southern tip of Nevada, US, which has been approved by The Clark County Board of Commissioners unanimous vote on July 5, 2011.

3.3.1. Investment environment
Though US is known for its transparency in investment, investors sometimes face hurdles in terms of renewable and clean energy investment.

The Committee on Foreign Investment in the United States, CFIUS, is tasked

with reviewing foreign business acquisitions in the United States to determine if those acquisitions create any national security risks. This review process has created uncertainties for some foreign investors in the United States. It is difficult to predict what CFIUS will consider to be a national security threat.

Another risk is that the US does not a have a consistent long term federal strategy in promoting clean and renewable energy. The incentives provided by the current administration might change due to the party and interest group politics. The federal policies they do have depend primarily on short-term tax rebates that do not always apply to foreign investors.

The three main national-level US clean energy incentives are the Department of Energy loan guarantee program, the production tax credit and the investment tax credit. The US Department of Energy loan guarantee program (section 1703 loan program) supports pre-commercial clean energy technologies by guaranteeing bank loans issued to companies pursuing those technology development projects.[6] DOE loan guarantees lower the otherwise high investment risks associated with those companies and make them more attractive to private lenders. Chinese and other foreign enterprises are eligible to receive DOE clean energy loan guarantees if they apply through a subsidiary located in the United States or through a US partner. Unfortunately, the loan guarantee program depends on appropriations from Congress to the DOE, and that can fluctuate. The US House of Representatives has to allocate enough funds to cover that program on an annual basis, and that program is currently under political attack in Washington (Issa, 2012).[7] *In the current US political climate, it would be a serious liability for the DOE to lend to a foreign company, so it would likely be very difficult for a Chinese firm to qualify for one of those loans.*

In addition to the loan guarantee program, the United States also has two renewable energy tax credits: a production tax credit (PTC) and an investment tax credit (ITC). The production tax credit provides a per-kilowatt-hour tax refund for companies that generate electricity using wind, biomass, hydropower, and other renewable sources. That tax credit can substantially reduce the costs of some renewable generation projects, particularly for wind, closed-loop biomass and geothermal projects, which can receive a tax credit of 2.2 cents per kilowatt hour. Problem is, the PTC is a temporary incentive program. The US Congress is currently in a pattern of only extending the program for a few years at a time, and at the end of that period, it is always uncertain whether they will extend it again. The production tax credit is currently set to expire again in December 2012, and US policymakers have so far failed to issue a post-2012 extension. Unfortunately, this repeated expiration/renewal pattern creates a

[6] US Department of Energy 1703 Loan Program: https://lpo.energy.gov/?page_id=39.
[7] Those attacks come primarily from the Republican-controlled US House of Representatives.

boom/bust cycle in US renewable energy markets that can increase longer-term investment risks for domestic and foreign investors alike.

The US federal investment tax credit (ITC) is a longer-term policy incentive for renewable energy capital investments. Unlike the two-year PTC, the ITC is currently set to expire at year-end 2016.[8] The investment tax credit is substantial: it provides a 30 percent tax credit for residential solar systems, commercial solar systems, fuel cells and small wind, and a 10 percent credit for geothermal, small wind turbines (below 2 MW) and combined heat and power (CHP) systems.

The problem with these federal tax incentives is that even when they are current and working as directed, they only reward companies with relatively large tax bills. That is not always useful for foreign firms, because foreign firms often do not fall in that category.

Foreign direct investment projects are most likely to succeed when the investors study their target market, figure out what domestic investors do to succeed in that country, and then follow the same model. In the United States, that model is to hire good local representation and to build broad political support early on in the process to avoid roadblocks and to obtain favorable policy incentives.

Learning Points:
It is critical for companies to understand the local market, understand local politics, and find good allies. Foreign companies cannot penetrate the US market alone. Even US companies do not operate alone. They hire good legal, lobbying, consulting, and public relations companies to negotiate the red tape, anticipate problems, and build political consensus at multiple government levels. In the US market, at least, that is a recipe for success that potential foreign investors should study very closely.

Policy recommendations:

i) Some type of framework is needed to direct foreign investors toward the clean energy sectors where their contributions are most welcome and least likely to encounter major political obstacles.

One step APEC could take is to initiate a deep multilateral discussion on which sectors of the clean energy economy can legitimately be closed off for security concerns and which sectors should not. We need to agree on a set of mutually-acceptable principles for how economies can address security concerns in clean energy sectors, particularly sectors involving the electric grid.

[8] There is a possibility that the ITC could be revoked or altered before 2016 if the US Congress launches major tax reforms.

In the current era where cyber security (particularly critical network infrastructure security) is a growing concern, FDI security fears and associated market barriers are only going to increase.

ii). APEC could play a role in building trust between the APEC economies by providing new frameworks for sharing and verifying information about the policy support companies receive at home.

The APEC should develop new frameworks for improving mutual trust in clean energy trade and cross-border FDI among member economies. It is also critical for the largest energy consumers in APEC to find more win-win ways to work together in the clean energy sector.

3.4. Case IV. Hydropower Investment Case Study

Hydro energy has been a conventional renewable energy and takes the largest share of renewable energy among other renewable energy forms. Clean and low carbon from the climate change mitigation aspect, it faces growing controversy for its negative environmental impact. The Pacific Hydro Chile's Case illustrates a successful investment in Hydro power. PHC won prizes for their Excellency in environmental performance and social responsibilities in Chile. The PHC investment in Chile adopted a "**sustainability framework"** which is built on four pillars: community, environment, workplace and business partners.

PHC has set up Sustainable Community Funds to support over 100 community projects and train local community members for employment capacity enhancement.

Apart from its climate mitigation benefits, PHC invested in environmental purposes to accouter balance and minimize the environmental effects caused by the construction of the reservoirs, among which, including the protection of the local species and communities. José Antonio Valdés, 2012)

Another Case is the community development project in Lao PDR as part of Sinohydro's Nam Ngum Company's contribution to the communities affected by the reservoir of Nam Ngum No.5 hydropower station.

The project was implemented by GEI to build biogas digestors to help the local households effectively utilize animal manure and apply renewable energy in various areas such as livestock raising, crop farming and residential consumption. This provides a model of collaboration between hydro power investor who provides project finance and Environmental NGO who plans and implements the biogas digester project. The project does not only construct biogas digesters but also train local technicians for maintenance and repairs.

In these cases we see how different forms of RCE complement each other to achieve comprehensive sustainable development targets.

3.5. Case V. Biomass/Biogas Investment

3.5.1. Cases in USA

i) Case study in North Carolina bio-fuels investment finds that: Investment in bio-fuels could create significant economic impact: job opportunities, (production of 600MGY bio-fuels could create 3864 jobs based on the annual activities of 7 bio-fuel facilities in NC , direct and indirect jobs are both included) (Little,2012)

ii) Case Study in Idaho finds that foreign investment in biogas is profitable on the condition that the government provides such incentives as investment tax credit, renewable energy certificates. Climate Action Reserve (CAR) and ITC grant are the key incentives for foreign investors to invest in biogas project in USA. (Partem, 2012)

3.5. 2. Biogas Investment in Viet Nam

Biogas occupies a small portion of total renewable energy in Viet Nam but it is critical to meet the requirement of energy and environmental protection in rural areas.

A successful case is the "Domestic Biogas Program for the Animal Husbandry Sector " in Viet Nam. The program is implemented by Vietnamese Livestock Production Department (under Vietnamese Ministry of Agriculture and Rural Development /MARD) in cooperation with Netherlands Development Organization – SNV. The program was launched in 2003, since when it has supported the construction of over 164,000 biogas digesters in more than 58 of Viet Nam's 63 provinces and municipalities. The program targets low-income, rural livestock farmers and has created employment for more than 5,700 masons(1200 mason teams established) and improved the lives of more than 700,000 people through enabling access to clean, safe and sustainable energy. It is now extended to 2014.

Its comprehensive multi-social impact includes:

i) *Energy:* reduces fuel expenses for cooking and lighting (household expenditure reduced by 65%)

ii) *Environment:* improves soil fertility and plant nutrition; reduces the rate of deforestation; reduces green house gas emissions (1.5-3 ton CO2 reduction per plant)

iii) *Agriculture:* reduces the costs on chemical fertilizers; improves crop yields (crop increase 5-20%); supports animal husbandry (67% livestock increase)
iv) *Sanitation:* improves hygiene through toilet attachment; reduces bad odors of manure; decreases environmental pollution
v) *Health:* is smoke- and soot less, reducing (especially for women): respiratory health problems; and eye problems
vi) *Gender:* saves time and reduces the workload especially for women on collecting traditional cooking fuels; cooking process; and cleaning of cooking pots(109 million work hours reduced for women).

The program was awarded the Humanitarian Award in 2012. Previously the project was awarded 2010 Ashden Award for sustainable energy and Energy Globe Award in 2006.

Keys to the success:
i) The commercial viability is the key incentives for the households to construct biogas digesters. Local ownership of the digester provides sustainable incentives for the households to maintain the assets. The comprehensive social economic impacts provide the most incentives. Surveys find that 78% of the households raise 4 pigs or more would construct a digester. Surveys find that although biogas users, participating in BPI, obtained a flat subsidy of ～€60 to cover part of the construction costs (an average cost of a 8㎥ digester is ～€250), The households take up the major share of the construction cost. Very insignificant number of households borrowed from financial institutions to carry out expenses. Though inaccessibility to the credit resources is one of the factors, the rationality of cost-benefit calculation of the household to invest in biogas plays the most important role in their investment decision.

ii) *National and local government serve as an efficient facilitator and investor*
National and provincial government provide round €3.5 million and €10.2 million respectively among the total investment of €64.4 million.
The government also is responsible for:
• *Promotion and marketing*: to enhance awareness of the benefits of domestic biogas as a proper livestock's waste treatment solution.
• *Training*: to provide knowledge on biogas technology and skill on biogas plant construction & management for all related project counterparts.
• *Support to Construction and Quality Managemen*t: to provide technical support to biogas plant construction to reach the target of 180,000 plants.
• *Bio‐slurry application*: to improve the process of bio slurry application.
• *Research and Development:* to increase knowledge about domestic biogas issues to maximize effectiveness, quality and service delivery of the biogas program.
• *Credit*, accessing facilitation to financial sources: to facilitate easier access to domestic biogas for all potential clients with emphasis on the poor, women and other disadvantaged groups.

• *Enterprise development*: to support to upgrade mason teams and to establish one to two enterprises doing biogas technical services.
• *Monitoring and evaluation, institutional support:* Project carries out the Biogas User Survey and Project Evaluation every year.

iii) International stakeholders also play instrumental role in the biogas plant investment: The Netherlands government provides funding for the program as a source of subsidy to cover the part of the construction cost. In Phase I (2003-2006), Netherlands provides € 2.5 million. The Dutch Development organization (SNV) strengthens the domestic organizational and institutional capacities in biogas investment.
SNV services include:
• feasibility studies assessing market potential, proper technical design, institutional set-up and required implementation modalities;
• design of quality standards procedures for construction of biogas plants;
• support in design of policies and mechanisms (subsidies) to facilitate access of rural farming households to biogas technology;
• capacity development of local public and private stakeholders.

Challenges: Money is still a problem for the lower income households. Surveys find that demand for bio-digesters is greater among the households earning annual income over 30 million VND (USD1500)compared to households earning less.[9] Therefore easier access to credit and more subsidies for lower income households would be needed. More funding should be channeled through national scheme and international donors.

Difficulties to access formal credit through banks and MFIs are the following:
• Strict regulations on purpose of its loans (not for biogas construction).
• Relatively high interest rates.
• Require membership as the precondition to access to loans.
• Low loan amount (mostly less than USD 250) with repayments to be made every week, two weeks or month.
• Limited financial resources at the banks and MFIs.

3.6. Case VI. Role of Intergovernmental Organizations (IGO), Nongovernmental Organizations(NGO) and Nonprofit Organizations (NPO) in RCE Investment

3.6.1. UNDP RCE projects in Malaysia

Official from UNDP Malaysia residence shared UNDP RCE investment experience.

[9] From the surveyed households, 96% of households with annual income more than 30 million have indicated interest in building bio-digester, while only 60% of households with less income have demand for bio-digester.

UNDP in Malaysia serves mainly as RCE investment policy designer and facilitator, capacity builder, financial provider and project facilitator.
UNDP helps to map policy, regulatory and legal instruments for the local government which lacks sufficient policy instruments on RCE (e.g. regulatory, fiscal, financial, buy-back tariff etc..)

UNDP helps to train the local financial institutions and enterprises in RCE investment project as they lack experience in RE project evaluation and the skill in financial structuring & packaging respectively. UNDP also trains the management of RCE projects (e.g. training the capacity of the use of renewable energy in palm oil mills –more 400 mills participated).

UNDP also serves as financial provider through the scheme of Green Energy Fund by providing soft loans for the RCE investment (e.g. UNDP provides 30% soft loan for Renewable Energy Business Facility program.)

3.6.2. UNIDO RCE investment in China

UNIDO representative shared its Sustainable Value-Adding Plan for Small and Medium-sized Enterprises (SME) RCE Technology Investment.

i) Challenges RCE SMEs face:

Business development model is not sustainable, profitable but no value precipitation.
There is no replicable business model for enterprises.
Enterprises are lack of core competitiveness.
They face harsh capital environment of the enterprises.
Financing Problems RCE technology SMEs face internally: Insufficient equity, flow capital chain ruptured, lack of management team, low technology valuation, equity financing over diluting and debt financing lack of credit guarantee .
ii) Financing Problems RCE technology SMEs face externally: government policies, bank discrimination, market factor, commercial environment, venture capital(VC) availability and mechanism.

ii) Main investment risks in RCE technology industry

Risk in the communication between enterprises and VC and private equity (PE);
Risk in investment bubble & no technology breakthrough point;
Risk on government policy (e.g. rely excessively on government subsidy while some key segments absent);
Risk of homogeneous cut throat competition;
Distinctive management risk of low carbon technology enterprises.

iii) UNIDO SME Value-added Program

Creative financing model & entity in low-carbon technology chain

UNIDO as a one-stop resources integration platform provider:

- **Industrial development strategy & planning:** Low-carbon technology value chain analysis for local government; Value chain location carding for local enterprises; Provide strategic suggestions and planning for low-carbon technology development. *Advantages and resources:* Technical expert resources in low-carbon tech. industry ;Wide-ranged industrial consulting and think tank institutes
- **Provide low-carbon technology linkage** :Introduce advanced technologies in the field of low-carbon technology & environment protection from developed countries, through cooperation, purchasing, etc, *Advantages and resources:* UNIDO has resident missions in 33 countries; Long-term resource accumulation of advanced tech. partners and technology transfer institutions
- **Provide financing solutions**: Provide various approaches to support financing for local low-carbon technology development; *Advantages and resources:* Extensive domestic & foreign equity fund and venture capital resources.

Local government's role

- Public platform establishment, financial aid to talent training, subsidy to certification etc. for low-carbon technology project
- Quality low-carbon technology project evaluation and certification Quality: projects selected from local low-carbon technology industry;
- Examination and verification on related project qualifications, e.g. low-carbon technology project examination and verification
- Special project funding program: Provide special financial aid for companies and projects fulfilling the criteria of supporting preferential policies
- supporting preferential policies and its implementation: Provide other non-financial aid supports for quality projects, e.g. land, taxes, etc.

Low-carbon technology enterprise's role

- Project value realization and entity updating
- Project financing beneficiary
- Low-carbon technology transfer receiver
- IPO entity
- Government tax supplier

Equity fund's role

- Direct equity financing: Long and medium-term equity financing for quality projects
- Technical support to IPO Technical supports in listing process for qualified enterprises, including choosing stock exchange, partners and strategy making, etc.
- Improvement of corporate governance structure: Optimize the

organization structure, human resources, corporate culture etc. of target company and raise its value

- Combination of various strategic resources: Provide national & international resources for the improvement of financing, purchasing, production, sales and marketing of target company

Commercial bank's role

- Early stage preferential bond financing for Special low-carbon technology project(interest rate, approval, etc.) :Provide bond financing for qualified low-carbon technology enterprises and special projects, including preferential interest rates, loan approval process optimization and so on
- High-quality project recommendation: Recommend high quality low-carbon technology project resources to government and equity fund
- Provide other types of bond financing, which are necessary to enterprises' development, such as late-stage trade financing and other forms of debt financing, etc.
-

Enterprises' role : Main party of Low carbon technology development

- Main party of project's value implementation and ascension

Enterprise is the actual project carrying body, with purpose of value enhancing, specifically in charge of enterprise operation and development

- Enforcing party of project financing: Obtain further development capital from equity funds or bank
- Undertaking party of Technology transfer Obtain related domestic and foreign technology from technology owner or technology transfer institutions or UNIDO
- Listing party: Raise funds for further development through issuing shares to public in the stock exchange
- Provider of government tax: Offer a variety of tax revenue sources for local and central government

Investment disciplines：Investment scale

- Early stage：no more than 5 million RMB per project
- Medium and growing stage: no more than 10 million RMB per project
- Pre IPO stage: no more than 20 million RMB per project

Investment orientation:

- Focus on clean technology, new energy enterprises with core technologies and teams, innovation capacity, and high growth. Great attention will be paid on brand and channel when seeking for potential target companies.

3.6.3. Global Environmental Institute (GEI) as a bridging institution in

biogas and biomass investment in China and other economies. GEI as a Chinese NGO has successfully implemented /facilitated several biomass and biogas projects in both China and other peer developing economies, namely, the biogas projects in Sri Lanka, Laos, Biomass project in Shanxi Province China. In the Sir Lanka and Laos project, GEI's role is mainly as project designer, capacity builder, technology provider and financial supporter. In Chinese domestic biomass stove project, GEI's role is mainly as a technology screener, identifying appropriate technologies that fit the local household demand, proposing stove design improvements to the stove producers based on the collection of feedback from households.

3.6.4 Clean Air Task Force (CATF) as a Business to Business (B2B) Cooperation Facilitator

CATF as an NPO is engaged in environmental protection and clean energy development. One of the key objectives is to facilitate cross-border clean coal and other renewable energy investment and technology cooperation and technology diffusion.

It has taken advantage of its expertise in energy technology and policy formulation and network resources in international RCE enterprises to bridge the communication gap between enterprises and promote trust and confidence among enterprises and eventually help the forging of partnership between enterprises cross border. The most notable is the joint investment between Chinese and US energy enterprises on clean coal projects (See Figure 5).

Figure 5 Select Partnerships Facilitated by CATF

Joint Agreements	Scope of Agreement
ZEEP-ENN Group	Deployment of P&W Rocketdyne gasification system
Southern Company/KBR-Dongguan Tiaming Electric Power Company	Deployment of Transport Integrated Gasification Technology (TRIG) gasifier
Duke Energy-ENN Group	Joint work on a range of climate technologies including underground coal gasification (UCG), CCS, solar, and algae bio-fuels; ENN investment in Duke solar-PV projects
BrightSource-Thermal Power Research Institute(TPRI)	Solar-thermal technology development and application in China
Duke Energy-China Huaneng Power/TPRI	Advanced coal generation, CCS including post combustion capture ,GCS/EOR, and renewable energy-including wind, biomass and solar

Future Fuels- TPRI	North American licensee for TPRI gasifiers, application of TPRI-designed gasifier at proposed IGCC projects in US and EU
Others parties under discussion including CNOOC, GreatPoint Energy, General Compression, etc	

Sung, 2012

4. Way Forward: Proposals for APEC in Catering the Need for RCE Investment[10]

4.1. A public- private dialogue between RCE investment policymakers and RCE investors could be carried out for the stakeholders to communicate on the best policy options and instruments to facilitate RCE investment, to identify the barriers that RCE investors encounter. Due to the multi-facial nature of RCE investment, which has economic, social and environmental implications, market alone cannot solve all the problems. A close collaboration between government and business will optimize the models of RCE investment and speed up the development of sustainable energy. The dialogue would help forge policy consensus among APEC members on RCE investment. A network of RCE investors and stakeholders would also be set formed through dialogues. Dialogues also will enhance the confidence and trust among stakeholders and partners which are essential for RCE cross border investment.

4.2. Capacity training on RCE investment policy formulation and project management could be enhanced. Experts in RCE investment, policymakers from leading RCE investment economies and management from successful RCE enterprises should be invited to train RCE investment policy makers, RCE enterprise management, particularly for the developing economies.

4.3. An APEC RCE investment fund could be set to facilitate the RCE investment in the APEC region. Priorities of the fund should be on :i) facilitation of the RDD of future RCE technologies which have significant environmental public goods nature , require large external assistance and have high risk for private sectors to carry on alone, such as clean coal technologies. ii) Small scale RCE technology diffusion and investment in developing economies to eliminate energy poverty and achieve environmental sustainability. iii) Capacity building for the small scale RCE project management and operation in developing economies and particularly the rural communities where such expertise is scarce.

4.4. Work out a list of RCE products and technologies that could be given preferential treatment in trade and cross border investment among APEC members. Create standards for RCE products and applications among APEC economies so as to incentivize enterprises to utilize RCE products and technologies.

[10] The following proposals are based on the Seminar participants' proposals for APEC in RCE investment.

4.5. A data base of RCE investment in APEC could be established to solve the asymmetry of RCE information distribution. The data base should provide the latest information regarding APEC members' policies (incentives and restrictions) in RCE investment as to help the investors get easy access to investment information and avoid unnecessary risks. The data base also could provide opportunities for RCE investment and technologies available for deployment. SMEs are most badly in need of such information as they do not have the adequate resources that big enterprises have in cross border investment. A department in charge of energy policies from each APEC should be responsible for the supply and update of the verified information.

5. Annexes

Annex I

Key Factors of RE Development in APEC Economies

APEC economies	RE capacity	RE development goals	RE laws	Measures to incentivize RE investment
Australia	12 057 GWh	20% (or around 60 000 GWh) of electricity supply to be provided By renewable energy sources by 2020.	The Renewable Energy (Electricity) Amendment Act 2009	1. The Australian Centre for Renewable Energy (ACRE) to promote the development, commercialization and deployment of renewable energy and enabling technologies, October 2009; 2. No feed-in tariffs schemes at national level but at local levels; Program: National Solar Schools; Solar Cities.
Brunei Darussalam	NA	NA	NA	1. Assessing the viability of large-scale photovoltaic electricity generation;

				2. Tenaga Suria Brunei solar-energy demonstration Project in 2008; 3. And other feasibility studies to identify the potential of alternative energies.
Canada	382580 GWh	Reducing Canada's total GHG emissions by 17% from 2005 levels by 2020.	The Energy Efficiency Act of 1992	1. Providing almost CAD 4 billion in funding to assist the development of a more sustainable energy system. Program: 2. Deployment incentive programs and RD&D activities. RETScreen International Clean Energy Project.
Chile	24292 GWh	By 2024, the level of non-conventional sources rises to 10% of total energy production (around 3410 MW).This results in nearly 1600 MW of additional power from NCRE sources	Law 20.257 (the Law of Non-Conventional Renewable Energy)	Financing through CORFO of feasibility studies for projects

		by 2035.		
China	585 187 GWh	Reaching a 15% share for non-fossil fuels in its primary energy consumption by 2020. Promoting the development of renewable energy technologies and industries so that essential renewable energy equipment can be produced domestically by 2010, and local manufacture can be based mainly on home-grown intellectual property rights by 2020.	Related Regulation on Power Generation from Renewable Energy; Trial Procedures for Power Pricing and the Cost-sharing Management of RE; Interim Measures for Allocation of Additional Revenue from Power Tariffs for RE; Catalogue for the Development of the Renewable Energy Industry	Introducing a series of financial and tax policies to boost the development of renewable energy power projects: 1. The Interim Measures for the Administration of the Special Funds for the Industrialization of Wind Power Generation Equipment; 2. The Measures for the Administration of the Subsidy Funds for the Utilization of Straw for Energy; The Interim Measures for the Administration of the Subsidy Funds from Public Finance for the

				Application of Photovoltaic Solar Energy in Buildings; 3. The Interim Measures for the Administration of the Financial Subsidy Funds to the 'Gold Sun' Exemplary Projects; The Notice on Perfecting the Policy on the On-grid Prices of Wind-generated Power; 4. The Interim Measures for Management of Special Funds for Architectural Applications of Renewable Energy
Hong Kong, China	NA	NA	NA	1. Encouraging the two power companies in Hong Kong,

				China to use RE and to invest in RE facilities by providing them with incentives; 2. Providing tax incentives for RE installations since 2008. 3. Government taking the lead in installing RE facilities in Government buildings and facilities. 4. Encouraging the use and development of RE through public education and publicity.
Indonesia	11528 GWh	Achieve energy elasticity to GDP of less than one by year 2025. Realize an optimum primary energy consumption mix in 2025. The combined share of renewable energy and nuclear in the	National Energy Policy of 2006	1. Emphasis on enhancing the share of bio-fuels. 2. Enhancing the share of bio-fuels.

		overall energy mix in 2025 to have exceeded 17%.		
Japan	81 595 GWh	Raise the share of renewable energy in its energy mix to 10% by 2020. Promote environment-related industries. Increase the share of bio-fuels to 3% of gasoline-equivalent sold in Japan by 2020.	NA	1. Introducing sustainable standards for bio-fuels to reduce greenhouse gases. 2. Implementing a system of feed-in tariffs. 3. Implementing measures for stabilizing the power grid.
Korea	5 563 GWh	Increasing share of the energy mix to 2030 (MKE 2009g) Renewable energy sources will account for 4.3%, 6.1% and 11% of the energy mix in 2015, 2020 and 2030.	Renewable energy plan,	1. Allocating funds and attract investment to increase the use of renewable energy sources. 2. Support the development of green technologies to make renewable energy more cost effective. 3. Improve infrastructure

				for renewable energy.
Malaysia	7 460 GWh	985 MW by 2015 for grid-connected generation from renewable sources, which would contribute 5.5% to Malaysia's total electricity generation mix.	The Tenth Malaysia Plan; The Five-Fuel Policy;	1. Introducing feed-in-tariff (FiT) for power generated from renewable energy resources to support the plan target. 2. Establishing a special agency, the Sustainable Energy Development Authority to manage the FiT fund as well as to support development of renewable energy in the economy.
Mexico	46234 GWh	Introduction of clean technologies as key factors for energy security and a sustainable energy environment. Encourage the development of a renewable energy industry in Mexico	Special Program for the Use of Renewable Energy; The Law for the Promotion and Development of Bio-fuels;	1. Implement mechanisms for the development of clean technologies 2. Recognizing the

		Expand the energy portfolio and energy security of the economy by encouraging the Diversification of fuels so as not to rely on one fuel Expand the electricity supply in rural communities using renewable energies where grid connection is not technically and economically feasible. The potential for bio-energy use in the energy sector could be as high as 16% by 2030		environmental impacts and indirect benefits of applying the energy 3. Supplying cost (for the short term and long term) to all technologies and fuels 4. Establishing a program for updating the inventory of the economy's renewable energy resources 5. Provide profit opportunities through the generation of carbon credits 6. Evaluating the alternatives for the development of a bio-energy market for its introduction

				in the fuel transportation mix 7. Promote biogas recovery and its use in anaerobic processes by the development of feasible economic opportunities.
New Zealand	26066 GWh	90% of electricity to be generated from renewable sources by 2025; A NZD 36 million grant program for biodiesel production;	New Zealand Energy Strategy; Emissions Trading Scheme; 10-year moratorium on new fossil-fuelled electricity generation; Electricity generation Act 1991	Setting a variety of laws such as 10-year moratorium on new fossil-fuelled electricity generation and Electricity generation Act 1991.
Papua New Guinea	855 GWh	Promoting green energy and reducing dependency on fuel oil for electricity generation.	NA	A company commissioned a 20 MW geothermal power plant;
Peru	19 040 GWh	increase renewable energy use	Law No. 28054; Supreme Decree No. 013–2005 EM; Supreme Decree No. 021–2007 EM; The Law on Promotion of Investment for	Setting a variety of laws such as Law No. 28054,Supreme Decree No. 013–2005 EM, Supreme Decree No. 021–2007 EM;

			Electricity Generation with Renewable Energies	
The philipines	9843 GWh	Over the next 10 years, the development of proven reserve areas will make available a maximum 1200 MW of this estimated potential.	Renewable Energy Act of 2008 (RA9513); Rules and Regulations (IRR); National Renewable Energy Board (NREB)	1. Further developing hydropower as the mainstay of the economy's power-generating options; 2. Promoting the use of other RE sources;
The Russia Federation	169070 GWh	Creating the mechanism of guaranteed supply, available to all economies that strictly follow the principle of the non-proliferation of nuclear weapons.	NA	The Russian Federation and the IAEA reached an agreement in March 2010 to set up a guaranteed reserve of 120 tones of LEU in Russia and to supply IAEA's member states
Singapore	NA	Pursuing its biodiesel production to reach 3 million tons by 2015.	NA	Pursuing growth opportunities in clean and renewable energy, including bio-fuels and solar
Chinese Taipei	4 257 GWh	Renewable resources will account for 8% of total electricity generation by 2025.	Renewable Energy Development Bill	1. Increasing the share of domestically produced energy and lead the

				development of local industry; 2. Emphasizing wind power, solar photovoltaic and bio-fuels, and also promotes other renewable energies as auxiliary means.
Thailand	7113 GWh	The percentage share of clean energy will increase from 8% in 2009 to 20% by 2022; Attracting more than USD 15 billion in 'green investment' and to cut down CO2 emissions by 42 million tons per annum by 2022.	The 15-year Renewable Energy Development Plan	1. Adjusting the current plan by type of renewable energy, e.g. increasing the goals of solar energy from 400 MW to 2000 MW and wind energy from 800 MW to 1900 MW due to the private sector's interest, and reducing the goal of biomass from 2600 MW to 1600 MW due

				to the public's protest; 2. Setting up incentive programs and mechanisms to encourage investment; 3. Revising legislation and setting up guidelines and standards;
United States	281 995 GWh	NA	Federal Renewable Energy Production Tax Credit (PTC)	1. Taking financial measures that complement federal incentives for NRE investment; 2. Providing significant indirect incentives for NRE development through the establishment of policy frameworks such as renewable portfolio

				standards (RPS),
Viet Nam	25 986 GWh	NA	NA	Setting some programs on wind power plant.

Asia Pacific Energy Research Centre, 2011

Annex II

AGENDA

Seminar on Successful Cases of Renewable and Clean Energy Investment in APEC

Date: 28-29 June 2012

Venue: Administrative Building 222, The University of International Business and Economics, Huixin Dongjie 10# ,Chaoyang District , Beijing, 100029

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DAY ONE

08:30 – 09:00 **Registration**

09:00 – 09:20 **Welcome and Opening Remarks**

Mr. Sun Yuanjiang, *Deputy Director General, International Trade and Economic Affairs Department , Ministry of Commerce, China*

Professor Zhao Zhongxiu, *Vice President of the University of International Business and Economics, Director of Institute of Global Low Carbon Economy*

9:20-9:30 **Group Photo**

09:30 – 10:30 **Session I RCE Investment Policies in APEC Economies**

Chair: Professor Zhao Zhongxiu

9:30-9:50 **● China's RCE Investment Situation and Policies**

Mr. Zhao Yongqiang, Assistant Director of China National Renewable Energy Center, NDRC, China

9:50-10:10 **● US RCE Investment Policies**

Dr. Melanie Hart, Policy Analyst, Center for American Progress

10:10-10:30 **Q&A**

10:30 – 10:50 **Coffee Break**

11:00 – 12:20 **Session II the Roles of International Partners in RCE investment: Models and cases**

Chair: Dr. Melanie Hart, *Policy Analyst, Center for American Progress*

11:00-11:20 **● SME Sustainable Value- Adding Plan of UNIDO**
Mr. Luo Xiang, the National Program Director, Investment and Technology Promotion Office (ITPO) in China, the United Nations Industrial Development Organization

11:20-11:40 **● Case study on Malaysia's RE & EE Projects and Investment**
Mr. Asfaazam Kasbani, Assistant Resident Representative (Environment and Energy) of UNDP Malaysia.

11:40-12:00 **● CAMCO's Successful Investment Cases in APEC**
Ms Shirona Partem, CAMCO, UK

12:00-12:20 **Q&A**

12:30 – 14:00 **Lunch (Jiangnanchun Restaurant)**

14:00 – 15:30 **Session III Successful Cases on RCE Investment in Asia Pacific Region (Part I)**

Chair: Dr. Hu Yuandong *Chief Representative ,United Nations Industrial Development Organization, China*
and Dr. Wang Bo

14:00-14:20 **● Clean Coal Investment and Technology Diffusion in APEC**
Dr. Liu Hengwei, Senior Researcher, Energy and Environmental Technology Program at the King Abdullah Petroleum Studies and Research Center, Saudi Arabia

14:20- 14:40 **● Accelerating Clean Energy Deployment through B-B Collaborations**
Dr. S. Ming Sung, the Clean Air Task Force's Chief Representative for Asia-Pacific and Chairman for the Asia Clean Energy Innovation

Initiative advisor to Duke, World Bank and others

14:40-15:00 **● Establishment of a Joint Venture for Manufacturing Boilers for Waste Heat Power Generation for Cement Plants**

Mr. Kenji TAKAYAMA, Associate Officer, Plant & Infrastructure Company, Kawasaki Heavy Industries (KHI), Japan

15:00-15:20 **Q&A**

15:20 – 15:40 **Coffee Break**

15:40 – 17:20 **Session IV Successful Cases on RCE Investment in Asia Pacific Region (Part II)**

Chair: Dr. Hu Yuandong and Dr. Mark G. Little

15:40-16:00 **● Pacific Hydro: a Successful Case of RCE Investment in Chile**

Mr. José Antonio Valdés Carmona , General Manager Pacific Hydro Chile

16:00-16:20 **● A Case of Renewable and Clean Energy Investment in Viet Nam**

Mr. Nguyen Sy Linh, Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)

16:20:16:40 **● Successful Investment on Biogas in China , Sri Lanka and Laos and Implications for APEC Members**

Ms Cheng Chongying, Global Environmental Institute, China

16:40-17:00 **● Rural RCE Strategy**

Dr. Mark G. Little, Frank Hawkins Kenan Institute of Private Enterprise, University of North Carolina at Chapel Hill, USA

17:00-17:20 **Q&A**

17:00 – 19:30 **Dinner (Taishuxi Restaurant)**

DAY TWO

09:00-10:00 **Session V: Way Forward**

Chair: Mr. Asfaazam Kasbani

9:00-9:30 **●Practices and Challenges to Sustainable Development in China**

Dr. Wang Yi, Professor and Deputy Director, Institute of Science and Technology Policy Planning, China Academy of Science

9:30-9:50 **● Cross border RCE Investment with US: Challenges**

Dr. Mark G. Little Frank Hawkins Kenan Institute of Private Enterprise, University of North Carolina at Chapel Hill

9:50-10:10 **Q&A**

10:10-10:30 **Coffee Break**

10:30-11:00 **Free Discussions to Stimulate Ideas for Future Actions**

All speakers and participants (3-5 minutes each)

Chair: *Dr. Liu Hengwei*

11:00-11:30 **Recommendations for APEC Future Cooperation**

Dr. Wang Bo, Associate Professor and Deputy Director, Institute of Global Low-carbon Economy, University of International Business and Economics

11:30-13:30 **Lunch (Jiangnanchun Restaurant)**

Annex III

APEC Seminar Participant list
CTI(IEG)34/2011T
Project No.: CTI(IEG)34/2011T
Project Title: Seminar on Successful cases of Renewable and clean energy investment in APEC
Venue: The University of International Business and Economics , Beijing Event Date: 28-29, June ,2012

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7.Acknowledgements

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