Voluntary energy efficiency agreements in China: history, impact, and future

Jiang Yun
China Energy Conservation Association
No. 18, Bei San Huan Dong Lu
Beijing 100013
People's Republic of China
CECA@263.net.cn

Lynn Price
China Energy Group, Energy Analysis Department
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
One Cyclotron Road, MS 90R4000
Berkeley, CA 94720-8136
United States of America
LKPrice@lbl.gov

Keywords

agreements, energy efficiency agreements, industrial energy saving, policy instruments, CO_2 abatement, China

Abstract

The first Voluntary Energy Efficiency Agreements in China – modeled after voluntary or negotiated agreements in Europe – were initiated through a pilot program with two steel mills in Shandong Province in 2002. Following the pilot program, the Chinese government initiated the Top-1000 Energy-Consuming Enterprises Program in 2006, in which the 1000 largest energy-using enterprises were assigned mandatory 2010 energy-saving targets. Also following the pilot program, nearly 300 voluntary energy efficiency agreements have been signed in China. Many of these agreements are between city-level governments and local enterprises, but agreements between national-level government agencies and large enterprises are also beginning to be seen. These agreements are voluntary and typically proposed by the enterprises, not mandatorily imposed by the government as is the case with the Top-1000 program. They are used to engage enterprises that are either not included in the mandatory agreements or that want to commit to energy savings beyond their mandatory targets. The China Energy Conservation Association has made a concerted effort to disseminate information regarding the use of such agreements throughout China in order to engage these enterprises. This paper will describe the history of the adoption of this policy mechanism in China and provide information on a number of agreements that have been signed, including their actual or expected energy savings. The paper will also discuss the prospects for continued adoption of voluntary energy efficiency agreements under China's 12th Five Year Plan, which covers the period 2011–2015, making recommendations for improving the use of this policy mechanism in China.

Introduction

After three decades of rapid growth in energy supply, supported by subsidized energy prices and a central allocation system that provided energy primarily to the industrial sector, China became aware of the need to promote energy efficiency in the early 1980s. At that time, the Central government announced that it would place equal emphasis on development of energy supply and energy conservation in order to ensure an adequate supply of energy, emphasizing energy conservation in the near term (Lu, 1993). Many energy-efficiency policies and programs were developed and implemented by the central government and most of these programs were directed toward the industrial sector.

During the 1980s, energy management offices, departments, and agencies were established at all levels of government to implement, manage, monitor, and enforce the numerous rules, standards, and programs related to energy conservation. Energy efficiency and energy conservation management for the industrial sector during this period involved controlling energy intensity and energy supply through the use of quotas. Energy conservation goals were set in the form of physical energy intensity standards for various manufacturing processes. Other standards addressed industrial equipment such as boilers and motors. Success in attainment of the standards was considered when allocating energy supply quotas for industrial enterprises (Sinton et al., 1998; Liu et al., 1994). Other energy management efforts included dissemination of energy-efficient technologies and products, retiring energy-intensive mechanical and elec-

trical devices, restricting energy-wasting production practices, and monitoring enterprise energy conservation. Low interest loans for energy conservation projects, tax breaks for energy-efficient products, and monetary energy conservation awards for enterprises were all used to encourage investment in energy efficiency (Sinton et al., 1998). National, local, and sectoral energy conservation technology service centers were also established. Over 200 energy conservation centers were established during this period to provide energy monitoring and efficiency services, develop and promote energy-saving technologies, and perform feasibility studies (Liu et al., 1994).

In 1993, the Chinese government enacted a number of significant financial reforms, initiating China's transition to a market-based economy in which there was less direct government management of energy efficiency. Energy price reforms included deregulation of coal prices, increases in oil prices, and partial deregulation of electricity prices. A simplified tax code introduced in 1994 eliminated tax rate reductions and tax breaks on energy-efficiency technology development and investment projects. Banks also began to reduce low-interest lending for efficiency projects. During the 1990s, energy quotas were eliminated and monitoring of energy intensity levels declined. In 1998, most industrial ministries were demoted to the bureau level and placed under the authority of the State Economic and Trade Commission (SETC)[1] where their level of authority was reduced. Industrial bureaus were merged into a single Industrial Management Department within SETC in 2000. The quality of statistical collection diminished as state control over enterprises weakened.

Even with the reduced government support for energy efficiency during the later portion of the 1990s, China's energy efficiency policies resulted in a decoupling of the traditionally linked relationship between energy use and gross domestic product (GDP) growth between 1980 and 2000, realizing a four-fold increase in GDP with only a doubling of energy use. With the goal of again quadrupling GDP with only a doubling of energy use between 2000 and 2020, China would need to reinvigorate its energy efficiency efforts.

In 1997, the Chinese government passed the Energy Conservation Law (ECL) which provides broad guidance for the establishment of energy-efficiency policies in China. In 1999, SETC issued a catalogue of "Outdated Technology Processes and Products" initiating an effort to phase out non-competitive processes or products that consume too much energy or are polluting (China Environmental Review, 2000). SETC also mandated closure of some inefficient petrochemical plants as well as hundreds of small cement and glass plants, mainly in northern China, small refineries, coal mines, sugar mills, and paper mills for financial, energy efficiency and environmental reasons (China Daily, 2000a and 2000b; Nengyuan, 2000). The 10th Five-Year Plan, which became effective in March 2001, included a renewed focus on energy end-use efficiency and productivity improvement, development of supporting regulations for the ECL at the local and sectoral levels, formulation of annual energy conservation plans to improve energy utilization efficiency and productivity, formulation of preferential economic policies to support energy conservation demonstration and dissemination projects, and enhanced energy management of key energy-using enterprises.

It is against this backdrop that the effort to introduce voluntary energy efficiency agreements in China was initiated. Voluntary agreements to meet specific energy-use or energy-efficiency targets are used in the industrial sector in many countries around the world (Bertoldi, 1999; Chidiak, 1999; Hansen and Larsen, 1999; Mazurek and Lehman, 1999; Newman, 1998; Paton, 2002; Price, 2005). Such agreements can be viewed as a tool for developing a long-term strategic plan for increasing industrial energy efficiency that often fully engages not only the engineers and management at industrial facilities, but also includes government, industry associations, financial institutions, and others. An agreement or target can be formulated in various ways. Two common methods are those based on specified energy-efficiency (or energy intensity) improvement targets and those based on absolute energy use or greenhouse gas emissions reduction commitments. Either an individual company or an industrial subsector, as represented by a party such as an industry association, can enter into such agreements. Voluntary agreements typically have a long-term outlook, covering a period of five to ten years. The agreements focus the attention of all actors on energy efficiency or greenhouse gas emissions reduction goals. The key elements of voluntary agreement programs are the assessment of energy-efficiency potential of the participants as well as target-setting through a negotiated process with all parties. Supporting programs and policies, such as audits, assessments, benchmarking, monitoring, information dissemination, and financial incentives, all play roles in assisting the participants in meeting the target goals.

Introduction of Voluntary Energy Efficiency Agreements in China

In 1999, the China Energy Conservation Association (CECA) and Lawrence Berkeley National Laboratory (LBNL) initiated a research project on "Chinese Energy Conservation Regulations Framework Infrastructure" conducted under the former State Economic and Trade Commission (SETC, now NDRC) and funded by the China Sustainable Energy Program of the Energy Foundation. This research project proposed to introduce the concept of voluntary agreements to China based on experience with this policy mechanism in countries in Europe and elsewhere.

CECA and LBNL provided policy recommendations for a pilot voluntary agreement project (CECA, 2002; Price et al., 2003) and the project partners, which included representatives from SETC, CECA, the Energy Research Institute (ERI), the Beijing Energy Conservation Center (BeCon), Tsinghua University, Energy Office of the (former) Ministry of Metallurgy, Nanyang Energy Conservation Monitoring Center, Policy Research Center for Environment and Economy of the China Environmental Protection Administration, and the Energy Conservation Information Dissemination Center, initiated a pilot project. Based on selection criteria developed by the project partners, the team selected the steel industry in Shandong Province to launch the pilot policy of voluntary energy efficiency agree-

1. In 2003, SETC merged with the National Development and Planning Commission (formerly the National Planning Commission) to form the current National Development and Reform Commission (NDRC). NDRC is considered a "Super-Ministry", which is a half-step above other Ministries due to its authority over economic planning, pricing, and approval of investment.

Table 1. Participants of 2003 Voluntary Energy Conservation Agreements in Shandong Province.

Participants		Responsibilities
Government	The Economic and Trade Commission of Shandong Province	Introduced incentives and provided industry participants with policy support.
Industry	Jinan Steel Corporation, Laiwu Steel Corporation	Implemented energy-saving measures and achieved the committed energy saving target specified in the agreements
Evaluation Team	Team of Supervision and Evaluation for Shandong Province's Voluntary Energy Conservation Agreements	Inspected onsite and audited the progress made by industry participants in attaining the energy-saving target
Third Party	China Energy Conservation Association, Lawrence Berkeley National Laboratory, Industries Association of Shandong Province	Provided technical support and consulting

ments and drafted a sample implementation contract for the voluntary agreement based on contracts used in the Long-Term Agreements in the Netherlands adapted to the Chinese situation. The team also drafted a series of proposed corresponding policy measures. CECA and a "Technical Team" comprised of Chinese and international energy-efficiency experts, were responsible for evaluating the results of enterprise assessments of energy-efficiency improvement potential to determine if the assessment has been done correctly and adequately, evaluate the proposed energy-efficiency targets to determine if they are realistic, yet ambitious, and beyond business-as-usual, and report to SETC regarding these evaluations. The targets were then set through a collaborative process involving CECA, the enterprises, and the local government (Price et al., 2003).

The project directly led to the signing of the first voluntary agreement in China on April 22, 2003 between Shandong's Economic and Trade Commission, Jinan Steel Corporation (Jigang Steel), and Laiwu Steel Corporation (Laigang Steel). In addition to the government and industry participants, an evaluation team was established which consisted of ten experts from Tsinghua University, Beijing University, NDRC's Energy Research Institute, CECA and BaoGang Steel Corporation. The evaluation team conducted onsite inspections and audited progress made in attaining the energy-saving targets. In addition, a number of third parties, including CECA, LBNL, and the Industries Association of Shandong Province, provided technical assistance and consulting during the project pilot (Wang, 2009). Table 1 outlines the pilot project participants and their roles.

The Shandong pilot voluntary energy efficiency agreements had a base year of 2002 and set performance targets for 2005 (Price et al., 2003). The two companies received policy support in five areas, including being awarded the honorary title of "a pilot enterprise of the voluntary agreements", given priority for existing energy-saving incentives (such as eligibility for applying for a bond discount[2]), being exempt from energy inspections, having government assistance related to the warrant of collateral when applying for loans to finance energy conservation projects, and receiving technical and information support (CECA, 2004).

The two steel mills both established organizational leadership in energy conservation and had established systems for energy monitoring and management as well as a set of energy indicators. Both companies also retooled and upgraded their technologies for energy efficiency, leading to more energy savings. At the end of 2005 when the pilot project was completed, both companies reported that they achieved the committed targets specified in the voluntary agreement, for a total energy savings of 361,900 tons of coal equivalent (tce)[3] or 11 petajoules (PJ), which was 204,900 tce (6 PJ) more than would have been achieved without the voluntary agreements (e.g. the business-as-usual or autonomous energy efficiency improvement during this period was 157,000 tce or 5 PJ) based on the business-as-usual energy use calculated as part of each enterprise long-term development plan. These savings were about 2 % and 3 % of total energy consumption at Laigang and Jigang steel enterprises, respectively. The realized energy cost savings were 200 million RMB (24 million USD)[4] (Beijing Municipal DRC, 2009).

For the Economic and Trade Commission of Shandong Province, the experience from the pilot voluntary energy conservation agreements transformed the way it dealt with energy conservation. The ETC moved away from the use of executive orders it relied upon in the past and redirected its efforts to policy guidance, supervision, and performance services. This enriched the government's management experience and enhanced its role in energy conservation. The Shandong voluntary energy efficiency agreement pilot was considered a success due to the achievement of the targets along with the knowledge gained related to establishing targets, implementing energy management within the companies, making energy-efficiency investments, and establishing energy efficiency policies at the provincial level (Hu, 2007). The pilot was used as a model for the Top-1000 Energy-Consuming Enterprises program that was initiated in China in 2006 as a mandatory energy efficiency agreement program in support of the 11th Five-Year Plan as well as a model for voluntary energy efficiency agreements.

2. Since the 1980s, China has provided support for the key technical renovation programs of enterprises through a Special Fund for Treasury Bond. The support is either through giving the enterprises a subsidy for project investment or providing subsidized interest for enterprise loans. SETC (now NDRC) was in charge of the work of approval.

3. 1 tce = 29270×10^3 Joules.

4. 1 RMB = 0.1219 USD (average 2005 exchange rate). Source: http://www.oanda.com/currency/historical-rates/

Current Status of Voluntary Energy Efficiency Agreements in China

Following Shandong's successful pilot project, additional voluntary energy efficiency agreement pilot projects with various scopes have been launched throughout China. These voluntary energy efficiency agreements are different from the mandatory agreements of the Top-1000 program in that they do not involve the signing of a mandatory "responsibility contract" with the government, but rather represent an agreement that reflects the enterprise's willingness to take on a voluntary target. Enterprises that sign such voluntary agreements can be, for example, enterprises that are not included in the Top-1000 program or other efforts that require the signing of a responsibility contract, foreign-owned enterprises, township and village enterprises, and enterprises that have signed responsibility contracts but that wish to voluntarily commit to even larger energy-savings targets. In addition, the voluntary energy efficiency agreements can be signed not only with industrial enterprises (similar to the Top-1000 program agreements), but also with enterprises related to the buildings, transport, and services sectors. In this way, the voluntary energy efficiency agreements include enterprises that fall outside of mandatory government programs and also provide a platform for enterprises that wish to set even more ambitious targets.

Since 2005, CECA has made a concerted effort to disseminate information and implement voluntary energy-efficiency pilots throughout China. CECA has provided assistance to central government departments such as NDRC and the new Ministry of Industry and Information Technology (MIIT)[5] to develop related policies to help voluntary energy-efficiency agreements to become a key measure used by governments to intensify the management of energy conservation. NDRC is the lead government agency for the Top-1000 Enterprise agreement program and MIIT is the lead government agency for the voluntary energy-efficiency agreements. Energy-saving voluntary agreements have been listed as one of the key work tasks for MIIT in 2010. MIIT believes that energy-saving voluntary agreements are an important means to encourage enterprises in the industry and communications industries to save energy in the 12th Five-Year Plan period and beyond.

CECA has also been active in promoting and implementing voluntary energy efficiency agreements within enterprises of various ownership structures. To date, CECA has assisted central and local governments to develop 8 policies or national standards related to voluntary agreements, organized or attended around 60 workshops and conferences related to voluntary energy efficiency agreements, made numerous presentations on voluntary energy-efficiency agreements, provided technical support for enterprises regarding the design and implementation of voluntary energy efficiency agreements, provided assistance to provinces that implemented such agreements, and edited and delivered 28,000 copies of 23 issues of the *China Energy Efficiency Agreement Briefing*.

Currently there is no consistent incentive policy that is applied to encourage enterprises to establish a voluntary energy efficiency agreement. Instead, when signing each voluntary agreement, the government and the enterprises undertake detailed negotiations and design incentive policies that can be realized by the government and also are attractive to the enterprises. Examples of these incentive policies include enterprise participation in development of technical standards, information and technology assistance for the enterprises, financial assistance, and positive publicity through government channels.

Table 2 provides a summary of the agreements that have been signed in China to date and provides information on either the energy savings realized or the energy savings targets associated with each agreement. Information regarding the number of enterprises, types of enterprises, and the enterprise targets is readily available. Information regarding the actual implementation of some of the agreements, as well as documentation of the claimed energy savings is much more difficult to identify.

Shandong Province

Following the initial pilot project, Shandong Province has continued to be active in the use of energy efficiency agreements, further expanding to other areas in the province. In 2003, 15 enterprises in Qingdao, representing over 72 % of the energy consumption of the city's major energy-consuming enterprises, signed agreements with the city's Municipal Economic Committee. The VAs were signed with power plants, a petrochemical plant, an iron and steel company, chemical companies, Haier Group, and the Tsingdao Beer plant, among others. These 15 enterprises committed to saving 285,000 tce (8.4 PJ) within 3 years of signing the agreements.[6]

Additional agreements were signed with 138 enterprises throughout Shandong Province between 2005 and 2008. Three enterprises in Jinan, 4 enterprises in Zibo, and 4 enterprises in Jining signed one-year agreements in 2005 and achieved combined savings of 280,000 tce (8 PJ), 127,800 tce (3.7 PJ), and 62,500 tce (1.8 PJ), respectively. These energy-savings values were verified by the local city government. An additional 38 enterprises in Shandong Province signed one-year voluntary energy efficiency agreements in 2006 and achieved a combined savings of 513,000 tce (15 PJ) that year.

In 2008, 89 enterprises throughout Shandong Province signed energy efficiency agreements and committed to savings of 1.848 million tce (54 PJ) annually between 2008 and 2010. Some of these companies have also signed agreements as part of the national Top-1000 program or the provincial level extension of the Top-1000 program. In these cases, the voluntary energy efficiency agreements outline energy-saving targets that are more difficult to achieve than their mandatory targets (CECA, 2009). In the document *2010 Provincial Wide Energy Conservation Work Highlights* released in 2009, Shandong Province proposed to have up to 500 enterprises sign voluntary agreements by the end of 2010, indicating its determination and perseverance to promote the voluntary agreement model (SARCU, 2008).

5. MIIT was established in 2008, as a result of mergers of the former Ministry of Information Industry, former State Council Information Office, former National Defense Science and Industrial Technology Committee (except for nuclear power management) and NDRC's responsibilities related to industrial management and information.

6. It has not been possible, however, to obtain information on the results of these agreements since the government person responsible for this program in Qingdao was transferred to another department.

Table 2. Voluntary Energy Efficiency Agreements in China.

Local or Central Government(s)	Signing Year	Enterprise(s)	Energy Conservation Results or Energy Conservation Targets (tce and PJ)
Shandong			
Pilot Project	2003	Laigang, Jigang	Achieved savings of 362,000 tce (11 PJ) in 2005
Qingdao	2003	15 enterprises	Committed to savings of 285,000 tce (8.4 PJ) within 3 years
Jinan	2005	3 enterprises	Achieved savings of 280,000 tce (8 PJ) in 2005
Zibo	2005	4 enterprises	Achieved savings of 127,800 tce (3.7 PJ) in 2005
Jining	2005	4 enterprises	Achieved savings of 62,500 tce (1.8 PJ) in 2005
Yantai, Weifang, Taian, Zaozhuang Dongying, Heze, Binzhou	2006	38 enterprises	Achieved savings of 513,000 tce (15 PJ) in 2007
16 new cities joined, including Weihai, Rizhao, Laiwu, Liaocheng, Dezhou, Linyi	2008	89 enterprises	Committed to energy savings of 1.848 million tce (54 PJ) annually between 2008 and 2010
Jiangsu			
Nanjing	2006	10 enterprises	N/A
Yangzhou	2006	10 enterprises	Committed to savings of 800,000 tce (23 PJ) in 11th FYP
Suzhou	2009	24 enterprises	Committed to savings of 825,000 tce (24 PJ) savings
Jiangxi			
Jiujiang	2010	3 enterprises	Committed to achieve energy intensity of 0.225 tce per 10,000 RMB (0.005 GJ/USD) and 12% energy reduction in terms of industrial value added
Jingdezhen	2010	16 enterprises	Achieved savings of 37,400 tce (1 PJ) in 2010
Yingtan	2010	10 enterprises	Committed to achieve 30,000 tce (879 TJ) by the end of 2010
Various Locations			
Energy Conservation and GHG Emissions Reductions in China's Township and Village Enterprises (TVEs) Project	2006	43 enterprises	Achieved annual savings of 81,000 tce (2.4 PJ) from 2002 to 2006
Pilot Action – Implementing Voluntary Approaches for Urban Environmental Management in China under the European Commission Asia Pro Eco Programme(2nd Phase)	2007	13 enterprises	Achieved annual energy savings of 27 PJ in 2009 compared to the reference year of 2007 and CO_2 emissions were reduced by almost 3 $MtCO_2$ per year
Ministry of Industry and Information Technology	2009	China Mobile Group	Committed to reducing 20% of electricity consumption per unit traffic (11.8 billion kWh) by December 2012
Ministry of Industry and Information Technology	2010	Huawei Corporation	Committed to reducing average energy consumption per product unit shipped by 35%

N/A = not available

Other Provinces

Twenty enterprises in two cities (Nanjing and Yangzhou) in Jiangsu Province signed voluntary energy-efficiency agreements in 2006. While there is no additional information available regarding the agreements in Nanjing, the enterprises in Yangzhou committed to energy savings of 800,000 tce (23 PJ) during the 11th Five Year Plan, which ended at the end of 2010. Another 24 enterprises in Suzhou, Jiangsu Province signed agreements in 2009 and committed to energy savings of 825,000 tce (24 PJ) that year (Jiangsu DRC, 2009). The savings will be verified by the Suzhou Energy Conservation Center.

Similarly, voluntary agreements were signed with 29 enterprises in Jiangxi Province in 2010. These included agreements with 3 enterprises in Jiujiang in which the enterprises committed to achieve an energy intensity level of 0.225 tce per 10,000 RMB (0.005 GJ/USD) and a 12 % energy reduction in

terms of industrial value added (CECA, 2010). Sixteen enterprises in Jiangdezhen signed agreements committing to achieve energy savings of 37,400 tce (1 PJ) in 2010 and 10 enterprises in Yingtan signed agreements committing to achieve energy savings of 30,000 tce (879 TJ) by the end of 2010 (Chemical Industry News, 2010). These savings will be verified by the local government. In April 2010, the Jiangxi Provincial Industry and Information Technology Committee issued *Notice on Print and Distribution of Pilot Voluntary Energy Conservation Agreements Among Industrial Enterprises in Jiangxi Province*, demonstrating its determination to launch a provincial-wide pilot voluntary agreement among industrial enterprises (Commission of Industry and Information Technology of Jiangxi Province, 2010).

National-Level

In November 2009, through the coordination of CECA and the China Association of Communication Enterprises, China's Ministry of Industry and Information Technology (MIIT) signed a voluntary energy-efficiency agreement with the China Mobile Group, in which the Group committed to reducing electricity consumption by 20 % per unit of traffic volume by the end of December 2012 from the level of 2008. It is estimated that this will save 11.8 billion kWh of electricity (China CSR, 2009). This was the first effort by the Central government to sign a voluntary agreement with a large, nation-wide corporation and thus signified a milestone in the use of voluntary energy efficiency agreements in China.

In early 2010, MIIT promulgated the *2010 Job Outline on Industrial Energy Conservation and Comprehensive Utilization*, including developing and issuing a "*Management Guidelines on Energy Conservation Voluntary Agreement in Manufacturing Industry and the Communication Industry*" to further promote energy-efficiency agreements mode in manufacturing industry and the communication industry.

In 2010, MIIT signed a voluntary agreement with Huawei Corporation, a large telecommunications company, in which the enterprise committed to reduction average energy consumption per product unit shipped by 35 % at the end of 2012 compared with 2009 (MIIT, 2010). MIIT will provide support to Huawei in achieving its goals through research related to energy saving and emission reduction standards and promotion of new telecommunications technologies (Xinhua, 2010).

For both energy efficiency agreements that MIIT signed with China Mobile and Huawei, MIIT committed to provide the enterprises with several targeted support measures such as participation in the development of energy-saving and emission-reduction standards for the communications industry as well as research and development policy measures for promoting energy conservation and emission reduction through information technology.

International Efforts to Promote Voluntary Energy-Efficiency Agreements

Along with the efforts of local governments to promote voluntary energy efficiency agreements, a number of international organizations have also provided China with expertise and funding to develop pilot projects (in addition to the Energy Foundation funded voluntary agreement pilot project described above). For example, between 2001 and 2006, the project "Energy Conservation and GHG Emissions Reductions in China's Township and Village Enterprises (TVEs)", sponsored by the Global Environment Facility and implemented jointly by the United Nations Development Program (UNDP), the United Nations Industrial Development Organization (UNIDO) and the Ministry of Agriculture of China, introduced the voluntary agreement mechanism to 43 township and village enterprises (TVEs) in four sectors (metal casting, cement, coking and brick-making), resulting in energy savings of 81,000 tce (2.4 PJ) and CO_2 emissions reduction of 203,000 tonnes during the project period (2002 to 2006) (CECA, 2006).

The European Commission Asia Pro Eco Programme project on "Pilot Action – Implementing Voluntary Approaches for Urban Environmental Management in China" worked with 6 large companies (petrochemical, power, steel, cement and car manufacturing) and one local NGO in Nanjing; 4 large companies (power, beer, paper and compressor manufacturing) and one local NGO in Xian, and 3 large companies (all petrochemical) and one local NGO in Kelamayi to promote the use of voluntary agreements. While the overall objective of the project was to improve industrial energy efficiency and reduce industrial emissions and waste in China by 3-5 % annually through the use of voluntary agreements, the enterprises committed to achieve high environmental standards aiming at annual energy saving of 18 PJ in 2009. An evaluation of this program found that actual energy savings of 27 PJ per year were achieved in 2009 compared to the reference year of 2007, while CO_2 emissions were reduced by almost 3 $MtCO_2$ per year (Zhang Tiehan, 2010; Asia Pro Eco II, n.d.).

Prospects for Continued Adoption of Energy-Efficiency Agreements in China

The use of voluntary energy efficiency agreements in China remains in the developmental phase. As described above, a number of agreements have been signed at the provincial level and two national-level voluntary agreements were signed in 2010. The importance of using such voluntary energy efficiency agreements is to include enterprises that fall outside of government programs and also to provide a platform for enterprises that wish to set even more ambitious targets. Even so, voluntary agreements overall have not gained enough momentum to spread nationwide, and most agreements have been limited to individual enterprises in individual provinces, not the whole industry. This is because it takes time to develop and perfect new mechanisms as well as to educate governments, enterprises and the public about the use of such mechanisms.

At the Central government level, some supporting guidance has been issued to promote the use of voluntary energy efficiency agreements. In 2006, eight ministries including NDRC jointly issued *Views on Ten Key Energy Conservation Projects in the 11th FYP.* One of the ten key energy conservation projects is Energy Conservation Monitoring and Technical Service System Project. In this project, as a supporting measure, developing *Technical Standards for the Voluntary Energy Conservation Agreements* and *Inspection and Evalu-*

ation method for Voluntary Energy Conservation Agreements was established. In early 2010, a national standard on *General Technical Rules for Voluntary Agreement of Energy Conservation* passed the review of China National Standard Committee and will be issued soon (CNIS, 2010). These technical rules apply to all voluntary agreements signed in China and provide guidance on implementation procedures including benchmarking, energy potential evaluation, target setting, monitoring, and evaluation. In June 2010, in order to promote energy efficiency agreements and regulate the implementation of energy-efficiency agreements in manufacturing industry and the communication industry, with the technical support of CECA, MIIT launched the development of *Management Guidelines on Energy Conservation Voluntary Agreement in Manufacturing Industry and the Communication Industry.* These guidelines apply to enterprises that sign voluntary agreements with MIIT and they cover the application process, approval procedures, and the implementation and supervision procedures for the agreements.

Observations and Conclusions

Voluntary energy efficiency agreements are one mechanism to encourage more enterprises to commit to emissions reductions and to provide incentives to achieve greater energy savings. These agreements can also help the government to change its management approach and to create an energy conservation mechanism that is more adaptable to a market economy, in line with the goals of the 12th Five Year Plan. In contrast with the mandatory responsibility contracts, voluntary energy efficiency agreements represent a move away from strong administrative control towards a system in which the enterprises themselves comprehend the advantages of energy-savings and are internally motivated to achieve energy savings.

These agreements can be an effective compliment to the current mandatory responsibility contract system that is used for the Top-1000 Energy-Consuming Enterprises Program. Currently, there are three categories of industrial enterprises that are ideal candidates for the use of voluntary energy-efficiency agreements: 1) large state-owned groups that have not signed the mandatory contracts; 2) foreign-owned enterprises, township and village enterprises as well as small-to-mid sized enterprises that are willing to save energy but that are excluded from the policy scope specified in the mandatory programs; and 3) enterprises that have signed the mandatory responsibility contracts but that are also willing to voluntarily assume higher energy-savings targets.

There are a number of weaknesses with the current use of voluntary energy-efficiency agreements as a policy mechanism in China. As described above, most of the experience to-date is based on pilot-level experience, where individual agreements are signed with enterprises on an ad hoc basis at the provincial level, and is not the result of a concerted national effort. As such, supporting policies and standardize guidance on how to implement this program are weak or missing completely. In addition, reporting and verification of the savings is similarly weak for most agreements. However, recent developments regarding the adoption of energy-efficiency agreements at the national level as well as efforts to develop standardized guidelines for energy-efficiency agreements show that this mechanism is moving from the pilot phase and gaining more attention at the Central level, especially with the relatively new MIIT.

If voluntary energy efficiency agreements are to be more widely adopted and promoted as a complimentary mechanism during the 12th Five-Year Plan, then it will be important to further develop this mechanism into a robust program that includes guidance on how to implement an agreement, including setting energy-saving targets, supporting policies to assist enterprises in reaching their targets including financial and technical support, guidelines or standards for reporting energy-savings, monitoring guidelines, and program evaluation procedures. A voluntary agreement policy, announced at the national level, would provide the impetus needed to more widely promote the use of this mechanism. Even better would be to integrate the use of voluntary energy-efficiency agreements within current existing policies such as the new policy on energy performance contracting, energy-saving incentives, carbon emissions trading programs, etc.

As with any other policy, voluntary energy-efficiency agreements are not a silver bullet to address all energy efficiency goals. They do, however, appear to be a useful complimentary policy to engage enterprises that are not included in China's mandatory agreements or enterprises that would like to achieve even greater energy savings than outlined in their mandatory agreements. As such, additional research on the lessons learned from the voluntary agreements that have been implemented to-date in China, along with additional policy support at the Central government level, could help to ensure that the use of such agreements is done in a manner that promotes achievement of robust energy savings.

References

Asia Pro Eco II, n.d. Case Study: Voluntary Agreements – Supporting the realisation of industrial energy savings and environmental enforcement experiences from an EC Asia Pro Eco project in China. http://www.wupperinst.org/uploads/tx_wiprojekt/Case_Study_VolunAgreem.pdf

Beijing Municipal Development and Reform Commission (DRC), 2009, "Energy Saving Training Materials: Energy Management and the New Mechanism," Chapter 10, Energy Conservation Voluntary Agreements.

Bertoldi, P., 1999. "The Use of Long-Term Agreements to Improve Energy Efficiency in the Industrial Sector: Overview of the European Experiences and Proposal for a Common Framework," Proceedings of the 1999 American Council for an Energy-Efficient Economy Summer Study on Energy Efficiency in Industry. Washington, DC: ACEEE.

Chemical Industry News, 2010. 16 Industrial Enterprises in Jingdezhen City Signed the Energy Conservation Voluntary Agreement. http://www.cheminfo.gov.cn/zxzx/page_info.aspx?id=278265&tname=hgyw

Chidiak, M., 1999. "Voluntary Agreements for Energy Efficiency in Five EU Countries," in Energy Efficiency and CO_2 Reduction: The Dimensions of Social Change: 1999 European Council for an Energy-Efficient Economy Summer Study, May 31-June 4, Mandelieu, France.

China Corporate Social Responsibility (CSR), 2009. China Mobile Commits To Energy Conservation. November 16, 2009. http://www.chinacsr.com/en/2009/11/16/6576-china-mobile-commits-to-energy-conservation/

China Energy Conservation Association (CECA), 2002 "Establishment of Energy Conservation Targets in Industries (voluntary agreement)."

China Energy Conservation Association (CECA), 2004. "Assessment Meeting of Shandong Province's Voluntary Energy Conservation Agreement", http://www.cecaweb.org.cn/CN/News/2004-08/EnableSite_ReadNews7371131093881600.html

China Energy Conservation Association (CECA), 2006. "Significant Results Attained in UNDP/GEF China TVE Energy Conservation Project,"http://www.cecaweb.org.cn/CN/News/2006-08/EnableSite_ReadNews733911156953600.html.

China Energy Conservation Association (CECA), 2009. Shandong Province's Expansion of Energy Conservation Voluntary Agreement Project in Full Swing. 山东省节能自愿协议扩大试点工作全面展开 http://www.cecaweb.org.cn/CN/News/2009-12/EnableSite_ReadNews7969061260288000.html

China Energy Conservation Association (CECA), 2010. First Energy Conservation Voluntary Agreement in Jiangxi Province signed in Jiujiang City. 江西首个节能自愿协议在九江市签 http://www.cecaweb.org.cn/CN/News/2010-08/EnableSite_ReadNews710814281281369600.html

China Daily. 2000a. "China to Close Down 50 Small Steelworks." 29 June. http://www.chinadaily.com.cn.

China Daily. 2000b. "Polluting Firms to be Closed Down." 9 May. http://www.chinadaily.com.cn.

China Environmental Review, 2000. Legislation on Redundant Technology in China, Summer 2000.

China National Institute of Standardization (CNIS), 2010. National Standards on "Technical Guidelines for Energy Conservation Voluntary Agreements" has Passed the Review. 《节能自愿协议技术通则》国家标准通过审查

Commission of Industry and Information Technology of Jiangxi Province,2010. Notice of Issuance of Work Program for Industrial Enterprises Signing Up the Pilot Energy Conservation Voluntary Agreement 关于印发江西省工业企业节能自愿协议试点工作方案的通知 http://www.jxdii.gov.cn/Item/2635.aspx

Hansen, K, and Larsen, A., 1999. "Voluntary Agreements in Industry: A Comparative Description of the Process and a Normative Analysis," Proceedings of the 1999 American Council for an Energy-Efficient Economy Summer Study on Energy Efficiency in Industry. Washington, DC: ACEEE.

Hu, Yuan, 2007. "Implementation of Voluntary Agreements for Energy Efficiency in China," Energy Policy 35 (2007): 5541-5548.

Jiangsu DRC, 2009. Twenty-four Largest Enterprises in Suzhou Compete to Gain "Energy Efficiency Star" (苏州24家用能大户争创"能效之星"). http://www.jsdpc.gov.cn/pub/jsdpc/jyxsh/jnjp/200909/t20090911_156576.htm.

Kelamayi Daily, 2009. Three Central Enterprises of Kelamayi Joined Voluntary Agreements of Environmental Management Projects（克拉玛依三家央企加入环境管理自愿协议试点项目）.

Liu, Z.P., Sinton, J.E., Yang, F.Q., Levine, M.D., and Ting, M.K., 1994. Industrial Sector Energy Conservation Programs in the People's Republic of China during the Seventh Five-Year Plan (1986-1990). Berkeley, CA: Lawrence Berkeley National Laboratory (LBL-36395).

Lu, Y., 1993. Fueling One Billion: An Insider's Story of Chinese Energy Policy Development. Washington, DC: Washington Institute Press.

Mazurek, J. and Lehman, B., 1999. "Monitoring and Verification of Long-Term Voluntary Approaches in the Industrial Sector: An Initial Survey," Proceedings of the 1999 American Council for an Energy-Efficient Economy Summer Study on Energy Efficiency in Industry. Washington, DC: ACEEE.

Ministry of Industry and Information Technology (MIIT), 2010. Huawei Technologies is Committed to Reducing Average Energy Conservation of Per Unit of Delivered Goods by 35% Compared to 2009 in Three Years. (华为技术有限公司承诺未来三年内实现发货产品单位业务量的平均能耗比2009年下降35%) http://jns.miit.gov.cn/n11293472/n11295091/n11299485/13487674.html

Nengyuan. 2000. Goals for the Reduction in Production and Mine Closures for the Coal Industry in 2000. Nengyuan 2000(3):14. March.

Newman, J., 1998. "Evaluation of Energy-Related Voluntary Agreements," in Martin et al., (eds.) Industrial Energy Efficiency Policies: Understanding Success and Failure: Proceedings of a Workshop Organized by the International Network for Energy Demand Analysis in the Industrial Sector. Utrecht, The Netherlands, June 11-12, 1998 (LBNL-42368).

Paton, B., 2002. "Voluntary Environmental Initiatives and Sustainable Industry," in ten Brink, P., ed., 2002. Voluntary Environmental Agreements: Process, Practice and Future Use. Sheffield, UK: Greenleaf Publishing Ltd.

Price, L. Jiang, Y., Worrell, E., Du, W., Sinton, J.E, 2003. Development of an Energy Conservation Voluntary Agreement Pilot Project in the Steel Sector in Shandong Province: Report to the State Economic and Trade Commission, People's Republic of China. Berkeley, CA: Lawrence Berkeley National Laboratory (LBNL-51608). http://china.lbl.gov/sites/china.lbl.gov/files/LBNL51608.2003.English.pdf

http://china.lbl.gov/sites/china.lbl.gov/files/LBNL51608.2003.Chinese.pdf

Price, L., 2005. "Voluntary Agreements for Energy Efficiency or Greenhouse Gas Emissions Reduction in Industry: An Assessment of Programs Around the World," Proceedings of the 2005 ACEEE Summer Study on Energy Efficiency in Industry. Washington, DC: American Council for An Energy-Efficient Economy.

Shangdong Association of Resources Comprehensive Utilization (SARCU), 2010. *The Notice on Key Points of Energy Conservation Work in Shandong Province in 2010* (《关于印发2010年全省节能工作要点的通知》) 。Shangdong Economic and Information Committeee. Document of Energy Conservation Office of Shandong Province. http://wenku.baidu.com/view/0ebe681b6bd97f192279e9bd.html

Sinton, J.E., Levine, M.D., and Wang, Q., 1998. "Energy Efficiency in China: Accomplishments and Challenges," Energy Policy 26(11):813-829.

Wang L., 2007. Shandong Economic and Trade Commission, Energy Saving Office of Shandong Provincial Government. Implementation of Energy-Saving Agreements in Shandong Province. Presentation at the Benchmarking Workshop, Jinan, September 7. http://ies.lbl.gov/iespubs/Wang_Liting_Presentation_VAs_Jinan.ppt

Wang, L., 2009. Guidelines for Energy Conservation Voluntary Agreements in Shandong Province.《山东省节能自愿协议指南》

Xinhua, 2010. MIIT and Huawei Signed Voluntary Energy Saving Agreement. November 12, 2010. http://money.163.com/10/1112/19/6LAJ3RHR00253B0H.html

Yingtan Daily, June 18, 2010. Ten Industrial Enterprises Signed the Energy Efficiency Voluntary Agreement. http://www.ytnews.cn/Article/news/shishi/201006/50355.html)

Zhang Tiehan, 2010. Final External Evaluation Report of the EC Asia Pro Eco II project "Pilot action – Implementing Voluntary Approaches for Urban Environmental Management in China". Beijing EU-China New Resource Centre for Environmental Science and Technology.

Acknowledgements

This work was supported by the China Sustainable Energy Program of the Energy Foundation through the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.