New Mechanism Feasibility Study 2011 – Final Report

New Mechanism Feasibility Study on Energy Efficiency Improvement by Introducing Energy Management and Control Systems at Factories in Shaanxi Province, China

By YASKAWA Electric Corporation

| FS Partner(s) | Shaanxi Province Development and Reform Commission  
|              | Shaanxi Province Economy and Information Commission  
|              | Smart Energy Co., Ltd. |
| Location of Project Activity | Shaanxi Province, China |
| Category of Project Activity | Energy saving |
| Description of Project/Activity | This project assumes the implementation of efforts to reduce greenhouse gas emissions through the introduction of a Energy Management and Control Systems (EMCS), with the target of this effort being a group of large-scale factories in China’s Shaanxi Province. A survey concerning the feasibility of a bilateral offset credit mechanism (BOCM) for the project is to be carried out.  

The sites where this project is to be implemented are Iron and Steel Manufacturing Enterprise A (a blast furnace steelworks) and Nonferrous Metals Enterprise B (coke and zinc manufacturing and processing), both in Shaanxi Province. Both companies belong to business groups representative of Shaanxi Province, and consume particularly high energy.  

With regards to the targets for introduction and application, the hypothesized introduction of EMCS by this project is to be to non-manufacturing facilities powered and operated by incoming electricity (these facilities are to include ancillary equipment that supplies air and cool water to production facilities as well as air conditioning and lighting for employee benefit as opposed to for immediate manufacturing purposes). In order to reduce the waste resulting from electricity supply and demand mismatches and as well as from between multiple supply facilities at the point of application in these plants, both supply- and demand-side facilities are to be made to cooperate with each other with energy conservation accomplished by optimum control of the entire process. This EMCS consists of measurement functions for related information and data, acquired information, database and calculator functions, control functions that carry out command-based controls, dashboard functions that carry out visualization and application management of information collected en masse, and other functions. The EMCS is a technique for implementing optimization by repairing or otherwise upgrading existing facilities; it thus differs from individual measures to update to new, highly efficient facilities.  

With the introduction of EMCS, load-following becomes feasible for the electricity consumption of the targeted facilities, while standby electricity requirements are also reduced, resulting in an anticipated electricity savings for each factory of about 10%. |

<1>
This in turn would result in a reduction in greenhouse gas emissions related to grid power.

In China, the individual facilities measures mentioned above are becoming more widespread. However, because repair and instrumentation engineering technology hasn’t improved, the EMCS introduction has not become prevalent. However, there has been a shift towards introducing information and data measuring functions as well as dashboard functions that carry out visualization and application management of collected information and control status to local production facilities. This is the place where Japan’s signature technologies, such as engineering technology for repairs and instrumentation, as well as related products, are to join together in a collaborative effort to create a model for energy conservation by means of EMCS, thus serving as a blueprint for the implementation of pertinent projects and activities.

| Reference Scenario and Project/Activity Boundary | Referring to data that the National Development and Reform Commission – which has jurisdiction over China’s energy policies – presented, the reference scenarios for the applicable projects and activities are felt to be as follows. China will improve its energy efficiency by 1% every three years over the 45-year period stretching from 2005 to 2050. The efficiency standards/status of all applicable facilities involves the continued use of the existing applicable facilities without the introduction of EMCS”
The target of introduction of EMCS via the applicable projects and activities is non-production facilities powered and operated by electrical power inputs (ancillary equipment that supplies air, cold and warm water and other inputs to plant and equipment, as well as equipment not directly related to production). With regards to the energy-saving effects of introduction aimed at these targets, these are derived from the energy differences before and after measure enactment. Furthermore, with regards to the results of individual measures that do not include energy conservation by means of controls, these will be removed from the overall results. |
| Monitoring Methods and Plan | Monitoring target includes power consumption within the project boundary, a factor referred for specific energy consumption (e.g. production amount), operation hours, and grid electricity carbon emission rate. They are monitored and recorded manually or electronically. |
| GHG Emissions and Reductions | GHG emission reduction of 80,213t-CO2 is estimated if the reduction measures are installed to the enterprise A, which basically emits 466,333t-CO2 for grid power consumption.
GHG emission reduction of 9,671t-CO2 is estimated if the reduction measures are installed to the enterprise B, which basically emits 48,028t-CO2 for grid power consumption. |
| MRV System for GHG Reductions | Reference emission amount: Energy consumption of the boundary is changing every time in response to another factor (e.g. production amount). Looking at specific power consumption rate (power consumption / the factor), we assume in the reference scenario, the rate keep certain value. The rate is calculated by monitoring in a certain period. The calculated formula gives reference energy consumption when the amount of the factor in the project is specified. When reference energy consumption is calculated, we can specify reference emission amount.
Project emission amount: Project power consumption amount is
specified by project monitoring, then project emission amount is to be calculated. Reduction amount is calculated by the difference between the reference emission amount and the project emission amount.

| Analysis of Environmental, Socioeconomic and other Impacts (including Securement of Environmental Integrity) | No significant impact is to be occurred in the relevant activities and projects. |
| Financial Planning | Cost/benefit level for installing the EMCS energy saving measures to a targeted factory without carbon credit income is 3 to 4 years. If the carbon credit income for the installation is realized, cost is reduced by 20%. The additional income is quite helpful for the installation related vendors. Another option of a financial support for the project is ESCO scheme, which allows a user avoid initial investment. |
| Introduction of Japanese Technology | Control equipment and measuring instruments are Japanese technologies central to this project. Retaining quality in local energy conservation projects and strategic system solutions are important to maintaining and popularizing the competitiveness of these technologies in energy conservation. |
| “Co-benefits” (i.e. Improvement of Local Environmental Problems) | In regard to the effects the implementation of this project will have on anti-pollution measures, in China the reduction of SO2 emissions by curbing coal-derived thermal power generation is a serious issue, and a decrease in these types of air pollutant emissions through conservation of electricity appears promising. However, it is difficult to obtain information on local emission factors for these substances timely. |
| Contribution to Sustainable Development in Host Country | Not only will energy consumption be reduced through the introduction of control technologies and by switching from batch processing to a continuous automatic control process, but the optimization of resources such as input materials will also be promoted, making it possible to contribute to the cultivation of comprehensive sustainable manufacturing that includes energy and resources. This kind of resource efficiency is a crucial policy pillar in China. Future studies will analyze the working environment and employment, and the position and efficiency of the global market for this country and industry, which are thought to be factors impacting their popularization. |
1. Study implementation structure
   • Iron and Steel Manufacturing Enterprise A of Shaanxi Province (Site of project implementation)
   • Nonferrous Metals Enterprise B of Shaanxi Province (Site of project implementation)
   • Shaanxi Province Development and Reform Commission (Local government counterpart)
   • Shaanxi Province Industry and Information Technology Commission (Local government counterpart)
   • Smart Energy Co. Ltd. (MRV methodology construction consulting)

2. Outline of project & activities:
   (1) Description of project & activities:
   This project assumes the implementation of efforts to reduce greenhouse gas emissions through the introduction of a EMCS (Energy Management and Control System), with the target of this effort being a group of large-scale factories in China’s Shaanxi Province. A survey concerning the feasibility of a bilateral offset credit mechanism (BOCM) for the project is to be carried out.

   The sites where this project is to be implemented are Iron and Steel Manufacturing Enterprise A (a blast furnace steelworks) and Nonferrous Metals Enterprise B (coke and zinc manufacturing and processing), both in Shaanxi Province. Both companies belong to business groups representative of Shaanxi Province and, when it comes to energy usage, both are also included in the “1,000 companies with particularly high energy utilization” (1,008 companies with especially significant energy usage for which energy conservation initiatives are being managed and supervised by the national government). They are target sites of the “Energy Visualization” model project designated by the National Development and Reform Commission and the Ministry of Industry and Information Technology for FY 2011. What’s more, the two companies are also included in the “200 important energy-consuming companies of Shaanxi Province” as established by Shaanxi Province in accordance with the energy conservation policy objectives of the country’s 12th Five-Year Plan, with Shaanxi Province taking a direct leadership role in energy conservation.

   With regards to the targets for introduction and application, the hypothesized introduction of EMCS by this project is to be to non-manufacturing facilities powered and operated by incoming electricity (these facilities are to include ancillary equipment that supplies air and cool water to production facilities as well as air conditioning and lighting for employee benefit as opposed to for immediate manufacturing purposes). In order to reduce the waste resulting from electricity supply and demand mismatches and as well as from between multiple supply facilities at the point of application in these plants, both supply- and demand-side facilities are to be made to cooperate with each other with energy conservation accomplished by optimum control of the entire process. This EMCS consists of measurement functions for related information and data, acquired information, database and calculator functions, control functions that carry out command-based controls, dashboard functions that carry out visualization and application management of information collected en masse, and other functions. EMCS is a technique for implementing optimization by repairing or otherwise upgrading existing facilities; it thus differs from individual measures to update to new, highly efficient facilities.

   With the introduction of EMCS, load-following becomes feasible for the electricity consumption of the targeted facilities, while standby electricity requirements are also reduced, resulting in an anticipated electricity savings for each factory of about 10%. This in turn would result in a reduction in greenhouse gas emissions related to grid power.

   In China, the *individual facilities measures* mentioned above are becoming more widespread. However, because repair and instrumentation engineering technology hasn’t improved, EMCS introduction has not become prevalent. However, with the “Energy Visualization Model Project” and other initiatives by the Chinese government, there has been a shift towards introducing information and data measuring functions as well as dashboard functions that carry out visualization and application management of collected information and control status to local production facilities. This is the place where Japan’s signature technologies, such as engineering technology for repairs and instrumentation, as well as related products, are to join together in a collaborative effort to create a model for energy conservation
by means of EMCS, thus serving as a blueprint for the implementation of pertinent projects and activities.

(2) The status in the host country
The National Development and Reform Commission Office on Climate Change, which is responsible for multilateral negotiations related to climate change, has jurisdiction related to the new mechanism. On the other hand, while this project assumes emissions reduction activities by means of energy conservation aimed at production facilities, the body with jurisdiction over policies to promote energy conservation is the National Development and Reform Commission Office on the Conservation of Resources and Environmental Protection and the Industry and Information Technology Commission Office for the Conservation and Coordinated Utilization of Resources.

The National Development and Reform Commission Office on Climate Change stuck to its basic policy of not bearing responsibility for international reductions and also supported simplifying and tentatively extending the Kyoto Protocol at COP16 (Cancun Conference), where the organization of post-Kyoto Protocol initiatives were discussed. Moreover with regards to the investigation of the construction of new market mechanisms at COP17 (including bilateral credits), although this was finally approved, there is deep-seated opposition to international and third party MRV checks with regards to such reduction activities.

On the other hand, as the driving force behind implementation, the National Development and Reform Commission Office on Climate Change and the Industry and Information Technology Commission Office for the Conservation and Coordinated Utilization of Resources, which promote energy conservation domestically, are laying a foundation focused on market mechanism activities. This has also been specified in the basic policies included in the directives of local government and state-owned enterprises of the National Development and Reform Commission Office on Climate Change, which was affected by the publication of the 12th five-year plan. This is often cited as the reason why traditional policies that focus on the forced reorganization of inefficient enterprises are rather expensive when compared with market mechanism activities, as well as the basis behind high expectations for new industry creation by market mechanism activities. This way of thinking has also produced proactive investigations into a domestic emissions trading system for the energy conservation lineup of efforts offered by the National Development and Reform Commission Office on Climate Change and the Industry and Information Technology Commission Office for the Conservation and Coordinated Utilization of Resources. What’s more, initiatives to visualize energy consumption also involve advancing model projects aimed at the 1,000 companies with particularly high-energy utilization and other organizations. This serves as the base for market mechanism activities and has as its aim heightened transparency with regards to the status of energy consumption and the results of related measures.

This lineup of efforts to deal with climate change and implement energy conservation will sometimes result in the latter policies acting as obstacles to the former international negotiation strategies. (If the domestic environment for market mechanism activities is properly readied, there will be increased pressure to come to the table to negotiate obligatory reductions.) However, due to the vertical functions of each organization, horizontal adjustments have been insufficient.

With regards to prospective large-scale reduction credits made possible by energy conservation in the Chinese market, in addition to the bilateral credit system of the post-Kyoto protocol, targets have also been established with the aim of acquiring existing emissions market trading system and other mechanisms, which would intensify competition. Looking at Europe, which has the EU-ETS, aiming for market integration and enlargement, the UK, Germany and other countries are redoubling lobbying efforts and offering technical support to the Environmental Exchanges of Beijing and Shanghai. Moreover, in order that China meet its greenhouse gas emission reduction targets for 2020 (a reduction in carbon dioxide emissions per unit of GDP of 40 to 45 percent from 2005 levels), the National Development and Reform Commission has announced that it will initiate its own emissions trading system by 2015. It will also be important to keep an eye on competition between these two systems.
In the iron manufacturing and chemical industries that these project activities belong to, guidance related to economic rationalization measures in the iron industry will be carried out by the National Development and Reform Commission in an order of precedence equivalent to that of the energy conservation implementation framework related to the 1,000 companies with particularly high energy utilization. This basic policy acts to contain excessive increases in the same industries, and stresses increasing product quality and profitability while at the same time transforming traditional methods of development and emphasizing structural adjustments and rationalization across all industries. As a basic policy measure that shapes the direction of industrial development, the National Development and Reform Commission issued “Development Policies for the Iron and Steel Industry” in 2005. As a three-pronged policy that covered energy conservation, clean manufacturing and the promotion of recycling, this document advanced such lofty yet tangible goals as the realization of industrial reorganization, consolidation and optimization by 2010 and 2020.

(3) The qualifications of the new mechanism:
Let’s now look at investment and technological barriers to the additionality of applicable projects and activities.

With regards to investment barriers, if we verify the EMCS (a control function that consists of measurement functions for related information and data, acquired information, database and calculator functions, control functions that carry out command-based controls, dashboard functions that carry out visualization and application management of information collected en masse, and other functions) introduction costs and the cost reduction effects of introduction and energy conservation, the average investment recovery period to date in China has been from 4 to 6 years. On the other hand, the permissible standard for investment recovery when deciding to invest in energy conservation in China has been two to three years. As such, if there is no credit revenue from the new mechanism for applicable projects and activities, the permissible local standards for local investment will not be satisfied; thus investment barriers exist.

With regards to technological barriers, for improvements to existing equipment for which the introduction of EMCS is necessary, flexible facilities design that matches the various physical and technical limitations currently present, as well as engineering technology that helps construction work get off the ground are both critical. However, currently no such engineering technology exists locally. With regards to controlled construction as well, switching over from traditional manual management to automated control requires a practical investigation into the parameter items to be acquired, as well as the locations and periods of acquisition. However, technology relevant to this type of effort has not become widespread locally. Moreover, some instrumentation devices are difficult to acquire. Therefore, it is problematic to introduce EMCS with the normal local initiatives using only local technology; thus technological barriers exist.

With regards to the precision of the new mechanism, besides the additionality noted above, there are plans to present the qualifications of the new mechanisms in accordance with such prospective trends as: conformity of applicable projects and activities to the partner country’s energy policy goals and objectives; having Japanese technology and products serve as the core for implementation of applicable projects and activities; the feasibility of construction of rational MRV techniques concerning the reduced output of greenhouse gases because of the applicable project and actions; and the difficulty that initiatives analogous to the applicable projects and activities have in performing registration without an applicable methodology based on the existing Kyoto Mechanisms.

(4) Plans to spread projects & activities
In order to spread applicable projects and activities in China, the first plan of action is to develop activities promoting their introduction that act in conjunction with the Chinese government’s “energy consumption visualization project” and which are targeted towards the 1,000 companies with particularly high energy utilization. Targeted at 30 to 40 companies a year, the “energy consumption visualization project” is currently scheduled to be carried out up through 2015. With regards to
applicable operations and activities in Shaanxi Province, it is anticipated that government referrals will lead to popularization if favorable results are presented and these are recognized as models. What’s more, the 1,000 companies emphasizing high-energy utilization are large enterprises representative of China and the results here will serve as good PR for spreading these to other areas and companies.

3. Study description
(1) Research subjects

i) Issues related to trends in methodology construction

- With the introduction of EMCS, these projects and activities are to calculate the optimal crosscutting operational points for the system of energy-consuming facilities and devices. In order to meet these computations, they control these facilities and devices but there is almost no similar precedence in the existing CDM of reduced quantities of MRV due to this control and optimization; most cases assume calculations of reduced quantities resulting from the difference between new and old efficiencies according to individual measures. Thus a new way of thinking that offers a departure from these prior conditions is needed.

- With regards to project boundaries, these projects and activities involve non-production facilities but it is critical to investigate whether such cuts are feasible and logical from an information and data collection, as well as an energy flow, point of view.

- Because the system is complex and interconnected, leakage specifics are difficult to gauge. (This is especially true of ironworks, where there is much cascading use of energy.)

- We are making it a point to search out the results of cases where leakage countermeasures have been introduced, but it is difficult to know whether this is realistic.

- With regards to the efficiency indexes (energy consumption rate) adopted to seek out reduced emissions quantities, there is the question of whether an energy consumption mark tied to production output (production output of crude steel/production weight) is reasonable. (I.e., are there no other factors having a major influence on fluctuations of energy consumption?)

- When there are methods for pursuing quantity reductions based on differences in efficiency before and after the project, or in the case where the scope of countermeasures and their results are small with regards to the items effecting manufacturing fluctuations and other energy consumption, are any numerical values apparent?

- With regards to the measures of the reference scenario, it is important to ascertain whether it is reasonable to expect a scenario whereby energy efficiency improves by 1 – 3% per year as well as whether complex scrap and build measures will not indeed influence the assumed scenario when it comes to the Chinese government’s special industries (especially when it comes to iron and steel).

ii) Issues related to local support

- Integrity from the standpoint of the information gathering and available technology of MRV methodology construction trends and local production facilities

- Whether related stores of information, maintenance and accuracy are sufficient

- Whether there is the possibility of unnecessary costs in excess of those assumed attributable to locally available technology and the manufacturing process and operation characteristics of production facilities

- Information concerning energy flow characteristics (especially for ironworks) and power stations contained in production facilities

- Whether the facilities and equipment for which introduction is assumed will be integrated with existing facilities, technology and specifications (For example, control transmissions protocol and the like)

(2) Study description

i) Studies concerning trends in methodology construction

Prior to the local survey, in order to forge a basic methodological direction, we investigated what kind of methodology to use to calculate energy savings by the control and total optimization efforts that are envisioned to be introduced and spread, and whether it would be feasible to rationally explain this.
With regards to energy conservation techniques based on control and overall optimization, because operations and other conditions were not coordinated before and after project introduction, and also due to the fact that the places where application is to take place have increased to a countless number, the effects were specified at the places where a particular application took place and the different techniques that had been tried were judged based on whether they were pragmatic. Therefore, we used a direction that looked at the results of overall energy expenditure differences before and after introduction of the project.

Because at this juncture there was a mixture of various factors leading to energy fluctuations, to the degree possible we aimed to exclude these by turning our attention to energy consumption rate differences and the treatment of non-production facilities as project boundaries as well as including the comparisons of differences before and after project introduction in the methodology.

Pursuant to verifying the qualifications of this direction in methodology, we carried out a survey analysis regarding not just the existing CDM methodology, but also the existence or lack thereof of similar methodologies. With regards to the methodologies registered with UNFCCC, much as with the current proposal, we identified that methodologies exist that result in reduced emissions amounts from the energy consumption rate variances before and after the project. These will be referred to hereafter.

ii) Studies concerning the feasibility of local applications of the methodology
With regards to the testing site, we planned fieldwork consisting mainly of three stages: walking through local production facilities to gain a better understanding of their present status, first-order energy conservation analysis aimed at sampling and evaluating potential places for energy conservation by means of appropriate energy-conservation techniques, and second-order energy conservation analysis aimed at additional information gathering and sample data measurements related to potential places for energy conservation.

The data that we collected walking through local production facilities is as follows:
- The fundamental manufacturing process of the plant and an understanding of its layout
- The basic operations status of the plant, fluctuations in production, seasonal fluctuations, etc.
- The identification of available information (plant diagrams, single-line diagrams, layout drawings of main facilities, motor spec list for main facilities, monthly energy consumption, monthly production amount, etc.)
- Investigations into whether it is feasible to access essential information at the site (access to the switch room, facilities, machinery and the motor; types of existing gauges that are available in the switch room (power meters, voltmeters, ammeters))
- Assuming the proposed methodology, the possibility of coming to an understanding of the amount of electricity used in non-production facilities (distribution systems, measurement points, etc.)
- A rough confirmation of potential control parameters

Looking at the testing sites, the ironworks has seen annual production increases and received guidance on quality and rationalization from the managing authorities, with the facilities undergoing an intricate scrap and build. Retained data has not been able to keep up with this. However, for information that is critical but has not been preserved, we verified the addition of on-site confirmations, data collection and other measures.

Output that includes the collection of information via first-order energy conservation analysis and the addition of further assessment analysis (sample example is of Enterprise A) is shown below.
As noted above, we investigated the feasibility of introducing the applicable techniques at the model site, and this helped to give us an idea of those areas where introduction would be technically feasible. Energy saving and reduction effects were also considerable, and, what's more, with regards to the economic feasibility of the decided introduction from an investment return standard point of view, it was established that, as long as credit revenues can be anticipated, this was at a level that could be accepted at the site.

iii) Other studies
In an effort to investigate the additionality of the applicable project and activities and post-project outreach promotions, we studied local energy conservation measures and the rationalization measures of related industries. Moreover, we also looked at China’s attitude toward the worldwide trends in such areas as new mechanisms post-Kyoto as well as related domestic initiatives.

During these investigations it became apparent that while the energy conservation measures used to date in China have consisted of focused policy positions involving reorganizing small-scale and inefficient plants and making upgrades to more efficient equipment, attention was also beginning to be paid to how to go about making improvements in the performance of the new systems. The energy visualization model project aimed at China’s 1,000 companies with particularly high-energy utilization - which is being advanced in unison with these efforts at the test sites - is a manifestation of this interest.
4. Study results concerning the feasibility of the new mechanism project & activities

(1) Emission reductions resulting from implementation of the project & activities

i ) The emission reduction mechanism

The EMCS whose introduction is aimed for by means of the applicable project and activities is
designed to conserve electricity by coordinating facilities on the demand and supply side so that they
optimally manage the entire system. It accomplishes this in the four patterns shown below by reducing
the waste that results from mismatches between energy supply and demand, as well as from the
existence of multiple supply facilities.

<EMCS: Coordinated control patterns>

1. Supply side control
Optimized control by taking advantage of individual facilities' characteristics and their combination

2. Supply side control (multiple supply stations)
Cooperative work between multiple supply stations to establish optimized secondary energy distribution.

3. Supply side control in response to demand side burden
Supply side control in response to on-demand operation burden

4. Supply/demand side bi-direct control
Supply side control in response to demand side production load, and demand side control in response to supply side operation status

EMCS consists of measurement functions for related information and data, acquired information,
database and calculator functions, control functions that carry out command-based controls, dashboard
functions that carry out visualization and application management of information collected en masse,
and other functions. It makes the coordinated operations noted above possible.

With regards to the targeted facilities of the four patterns above, the introduction of EMCS makes
load-following feasible with regards to electricity consumption while standby electricity requirements
are also reduced. A representative example of this control is the unit control of the targeted machinery
and the motor variable speed/load follow control of power equipment. The mechanism that leads to
this energy conservation is shown below.
<The unit control mechanism>
Example: Four compressors, independently operated, with an average load factor of 60% given the operations indicated below

○ Current status: The four compressors run in parallel, with an average load factor of 60% given the operations indicated below

○ Starting/stopping the compressor in response to unit control load

Putting together an automatic start/stop unit control that can be implemented in response to load as indicated above.

○ Energy conservation mechanism

Case: 4 air compressors, average load rate 60%
① Before (60%*4台)
② After installing control system (100%*2+40%*1)
(③ Inverter machine case)

The horizontal axis variation for each load represents the amount of energy saved.

<Load-following by means of inverter variable speed control>
Ex.: Cold water pump of a central AC system
The cold-water pump of central AC systems creates cold water using a central refrigerating machine (heating source) with the cold-water pump transporting this water to the various parts of building structures where cold air is conveyed by heat exchanger and AHU (fan) for air conditioning operations. The quantity of cold water needed by the system on the day with highest annual ambient temperature is shown on the graph below.
When the AC system is introduced and designed, its capacity is established in such a way that it can respond to the highest loads of the year, meaning that the motor capacity of the water pump is selected to be commensurate with a water capacity 100 as shown on the graph. As a result, the motor operates at a rotation speed equal to a water capacity of 100 throughout the year. When there is excess capacity, the common plumbing valve is closed to regulate the rate of water flow.

Faced with this situation, introducing an inverter would make it possible to directly manage the rotation speed of the motor so that it matched the cold-water load. The diagram below explains exactly how this works as well as its energy saving results.
The energy savings by load indicated in the upper right diagram is achieved by controlling the pump motor rotation speed to satisfy the load.

By combining the control and other functions noted above, electricity is conserved and the greenhouse gas emissions originating from these operations are reduced.

ii ) Emissions reduction effects testing methodology
The target of introduction of EMCS for the applicable project and activities were non-production facilities driven and operated by electric power inputs (ancillary equipment that supplies air, cold and warm water and other inputs to plant and equipment, as well as equipment not directly related to production, including equipment that provides lighting and air conditioning for workers). With the introduction of EMCS, control is implemented in concert with fluctuations in production for optimization across systems with regards to the facilities targeted for introduction. Consequently, similarly to individual measures, with the methods that tally up and then calculate the impacts of each part of the measures, calculations become complex and vague. Therefore, as a testing methodology, reduction effects are calculated based on the differences in electric power before and after the introduction of the applicable emission reduction techniques of the parts targeted for introduction (non-production facilities).

Moreover, with regards to the specified reduction results, because of lessened fluctuations in the amount of electricity consumed due to production fluctuations, this comparison focuses on energy consumption rates (i.e., differences in efficiency).
Pursuant to adopting the techniques noted above, we recognized that the following types of operations would be necessary.

- Specific stable electric energy techniques using the “non-production facilities” framework (Includes leakage indicators)
- An existing store of data sufficient to derive a baseline electric power calculation formula
- Removal methods for any electric power reduction components not included in the EMCS within the “non-production facilities” framework (Individual measures: for example, updating refrigerating machinery to the latest high efficiency models and similar measures)

(2) Establishing reference scenarios and boundaries:

i) Reference and BaU scenarios

Referring to data that the National Development and Reform Commission – which has jurisdiction over China’s energy policies – presented, the reference scenarios for the applicable projects and activities are felt to be as follows.

In 2009 China’s State Council Development Research Center (DRC) and the National Development and Reform Commission Energy Research Institute gave the following as a reference scenario with regards to the implementation of policies to conserve energy in the country: “In 2050, China’s per capita energy consumption is to be the same as today’s newly industrialized economies and 10% lower than the top world standard for energy efficiency as of 2005. With the advance of industrialization, despite the fact that technological improvements have led to considerable improvements in energy utilization efficiencies, the amount of energy consumed has reached 7.8 billion TCE. Furthermore, with regards to the top ten projects of the 2004 medium-to-long term energy conservation plan, the National Development and Reform Commission observes that the efficiency standards of the main energy-consuming machinery in China will be about 25% lower than the top standards of developed nations. Putting all of these numbers together, it is hypothesized that China will improve its energy efficiency by 1% every three years over the 45-year period stretching from 2005 to 2050. If we assume that this standard of improvement involves something more like annual improvements by replacing plant and equipment at each plant with more energy efficient versions when upgrading (referred to previously as “individual measures”), as opposed to the adoption of the drastic energy measures that utilize control techniques assumed by the applicable projects and activities, it is logical that this be captured in the reference scenarios.

Referring to the reference scenarios, the BaU scenario is to be configured as follows: “With regards to plants that power and operate non-production facilities by means of inputs of electricity, the efficiency standards/status of all applicable facilities involves the continued use of the existing applicable facilities without the introduction of EMCS.”

ii) Boundaries

The target of introduction of EMCS via the applicable projects and activities is non-production
facilities powered and operated by electrical power inputs (ancillary equipment that supplies air, cold and warm water and other inputs to plant and equipment, as well as equipment not directly related to production, including equipment that provides lighting and air conditioning for workers). With regards to the energy-saving effects of introduction aimed at these targets, these are derived from the energy differences before and after measure enactment. Furthermore, with regards to the results of individual measures that do not include energy conservation by means of controls, these will be removed from the overall results. This is presented in table format below.

### Reduction activity targets

<table>
<thead>
<tr>
<th>Energy consumption facilities</th>
<th>Non-production facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production facilities</td>
<td></td>
</tr>
<tr>
<td>Infrastructure facilities</td>
<td>Others including office facilities</td>
</tr>
</tbody>
</table>

Power

Energy saving target in the project

Non-power (fuel, steam etc)

Energy saving effect by EMCS to be specified
Energy saving effect by simple replacement to be excluded

Shown in diagram form, these project boundaries appear as below.

### Project boundaries

- Grid
- In-house power generator

A conceptual diagram showing the system after EMCS introduction to the applicable projects and activities appears below.

### (3) Monitoring techniques & design

A conceptual diagram showing the system after EMCS introduction to the applicable projects and activities appears below.
It is felt that pursuant to calculating energy saving effects using electric power efficiency (energy consumption rate) before and after introduction of EMCS to the targeted areas (non-production facilities) to derive reduction effects, it is important to carry out the following monitoring activities.

<table>
<thead>
<tr>
<th>Monitoring item</th>
<th>Monitoring method</th>
<th>Documentation method</th>
<th>Frequency</th>
<th>Targeted techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption of non-production facilities prior to EMCS introduction</td>
<td>Derive the relationship between existing total energy and non-production facility energy, calculating the non-production facility energy from past total energy</td>
<td>Print medium</td>
<td>Monthly</td>
<td>Control of all energy conservation goals</td>
</tr>
<tr>
<td>Electricity consumption of non-production facilities after EMCS introduction</td>
<td>Use a power meter to measure the distribution system energy produced by each sub-transformer station that is intended for the non-production facilities</td>
<td>Print medium</td>
<td>Monthly</td>
<td>Control of all energy conservation goals</td>
</tr>
<tr>
<td>Production volume prior to EMCS introduction</td>
<td>Refer to written production reports and other documentation</td>
<td>Print medium</td>
<td>Monthly</td>
<td>Control of all energy conservation goals</td>
</tr>
<tr>
<td>Production volume after EMCS introduction</td>
<td>Refer to written production reports and other documentation</td>
<td>Print medium</td>
<td>Monthly</td>
<td>Control of all energy conservation goals</td>
</tr>
<tr>
<td>Targeted facilities’ operations documentation</td>
<td>Refer to the history of directives aimed at the EMCS control instruments</td>
<td>Electronic medium</td>
<td>Continuous documentation</td>
<td>All control systems targeting energy conservation</td>
</tr>
<tr>
<td>Carbon emissions factors of electricity</td>
<td>If there are power stations in default value production facilities as announced by the Shaanxi Electric Power Company, the default value is established based on the previous three years’ worth of results</td>
<td></td>
<td>Annually</td>
<td>All control systems targeting energy conservation</td>
</tr>
</tbody>
</table>

For these monitoring items, we carried out local confirmation of whether stable procurement of applicable information was possible or not with regards to all plant and equipment systems specified as potential energy conservation locations at the time of energy conservation diagnosis. We were able
to verify that stable procurement was possible (i.e., related information was already being collected by some sort of measures, or it was otherwise feasible to collect related information electronically at the time of introduction of the energy conservation control machinery).

(4) Greenhouse emissions and reductions volumes:
With regards to the quantification methods (calculations and estimates) for the emissions volumes (as well as leakage amounts) for the reference and project and activity implementation scenarios of the applicable projects and activities, for sectors where the adoption of these methods is assumed (i.e., 1,000 companies with particularly high energy utilization), reduction volume is estimated using model subjects, with estimates carried out to cover the case where these methods spread to other companies in this sector made based on the scale and conditions of this reduction.

Amongst these models, the following results were seen with regards to the feasibility of energy conservation by means of the application of the pertinent techniques at the A Steel Group.

- Annual energy consumption at the facilities: roughly 2,000,000 MWh per year
- Current energy consumption of the targeted facilities: 249,436 MWh per year
- Anticipated energy consumption after EMS application at the targeted facilities: 171,149 MWh per year
- Anticipated energy savings at the targeted facilities: 78,287 MWh per year
- Average rate of energy savings/conservation: 31.4%
- Rate of energy consumption by secondary facilities as compared to that of the entire plant (estimated): 35%
- Reduction volume for targeted facilities (annual): 78,287 × 1.0246 (NWPG emission factor) = 80,213t-CO₂

The following types of enterprises are to be created as sector models.

- Annual energy consumption: 80,000 MWh
- Average energy conservation results as per the concerned project: 10% (Model business facility results)
- Project period: 10 years

After which, the annual reduction volume as per the model subjects is as follows:
80,000 × 0.1 × 0.9 (Average emission factor at the time of adoption) = 7,200t-CO₂/year

The reduction during the project period is 72,000t-CO₂
If we assume an adoption rate of 20% by the sector (1,000 companies) we get:
72,000 × (1000 × 0.2) = 14,400,000t-CO₂

(5) Techniques for measuring, reporting and verifying emissions reduction effects (MRV):
i) Description of the proposed MRV technique
Reduction targets for the applicable projects and activities are in the form of electrical energy for non-production facilities; the idea behind this is as shown in the diagram below.
At this time an MRV seeking reduced emissions volumes is created based on efficiency differences before and after the introduction of the project. Efficiency is taken to be the removal of the amount of power consumed in the applicable category from the applicable factory’s production volume (the rate of energy expenditure). At the project/testing site, the production volume of the ironworks is measured in terms of annual production of crude steel, and the production volume of the chemical fertilizer plant is the total weight of all manufactured product. The reduced emissions volumes that are sought based on improved efficiencies after the introduction of the project are indicated in the diagram below.

< Reduced emissions volumes called for by the project>

The baseline energy consumption rate is to call for a formula that approximates the relationship between past electricity consumption and production numbers.

When expressed as a numerical formula, the proposed MRV technique would be as indicated below.

- Baseline emissions volume

\[ BE_y = E_{BL,y} \times EF_{CO2,ELEC,y} \]
\[ E_{BL,y} = EER \times Q_y \]

- \( BE_y \): Baseline emissions volume
- \( E_{BL,y} \): Annual baseline energy usage
- \( EF_{CO2,ELEC,y} \): Emissions factor
- \( EER \): Energy consumption rate
- \( Q_y \): Annual production volume
- Project emissions volume

\[ PE_y = EP_{P,y} \times EF_{CO2,y} \]

- Emissions reduction volume

\[ ER_y = (BE_y - PE_y) - LE_y \]

ii) Investigation related to existing analogous MRV techniques

With regards to existing methodologies that resemble the MRV techniques proposed as per the applicable projects and activities, there are UNFCCC registration results as well as plans to identify and advance the analysis of the following items from adoption methodologies for Japan’s domestic credits.

<table>
<thead>
<tr>
<th>Category</th>
<th>Methodology #</th>
<th>Title</th>
<th>Description of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale methodology</td>
<td>AM0018</td>
<td>Baseline methodology for steam optimization systems</td>
<td>• Project aimed at reducing CO2 emissions by improving the energy consumption rate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Baseline consists of calculations of daily manufacturing output level by performing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>measurements over a fixed period</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Calculation of reduction amounts based on differences in consumption rate</td>
</tr>
<tr>
<td></td>
<td>AM0052</td>
<td>Increased power generation by existing hydroelectric</td>
<td>• Improved efficiency by means of introduction of decision support systems with the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>plants by means of decision support systems</td>
<td>resulting supplemental power replacing the electric power that had previously been</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>purchased, leading to lessened emissions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Establishment of a baseline using operation results as a precondition for stable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Nothing specified regarding an optimization system description</td>
</tr>
<tr>
<td>Small-scale methodology</td>
<td>AMS-II-C</td>
<td>Improvements in energy efficiency on the demand side</td>
<td>• Small-scale methodology to fit the size of smaller projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Baseline consists of calculating the energy consumption rate using the operation results</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of existing facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The project line consists of calculating the energy consumption rate after introduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of the project</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Calculation of reduction amounts based on differences in the consumption rate</td>
</tr>
<tr>
<td></td>
<td>AMS-II-D</td>
<td>Improved energy efficiency and fuel conversion techniques</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by industrial facilities</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>AMS-III-Z</td>
<td>Fuel conversion, improved manufacturing processes, and</td>
<td>Same as above</td>
</tr>
</tbody>
</table>
improved energy efficiency by brick manufacturers

| Domestic credit system | Methodology 005 | The introduction of a pump fan type of variable regulator in the form of intermittent operation control, inverter control or unit control | Project involves the addition of intermittent operation control, inverter control or unit control to existing pump fan equipment
• Baseline consists of multiplying operating time by the electricity consumption spec catalogue value of the targeted equipment
• Calculation of reduction amounts based on differences in emissions amounts before and after project introduction |

Examples of similarities seen in CDM

1. Case 1

| Project name | Reduction in Steam Consumption through Revamping of Ammonia Plant of Indian Farmers Fertilizer Cooperative Ltd (IFFCO) plants |
| Registration no. and date | Ref.0866, April 15, 2007 |
| Annual reduction in volume | 295,308 tons/year |
| Host country | India |
| Annex I country | Japan |
| Project details | - This project’s goal is to curtail CO\textsubscript{2} emissions via improvements in the energy consumption rate (i.e., the specific steam consumption rate (SSCR)). Reduction volume is calculated based on differences in the consumption rate.
- The targets of the project are three ammonia fertilizer plants operated by IFFCO. By utilizing new technology, making improvements and making use of new designs and waste heat, refinements are to be made in existing plant technology, with the plant’s specific steam consumption rate (SSCR) improved. Because these energy consumption rate improvement project efforts are to be implemented during the fertilizer plant’s various manufacturing processes, the improvement results of individual revamping projects will become linked to the revamping/improvement results of other manufacturing processes. The project goal is to curtail the steam consumption of the entire plant; by abating the steam consumption of specific manufacturing processes, boiler fuel consumption in the form of coal, natural gas, naphtha and low sulfur diesel fuel oil is decreased, leading to reduced CO\textsubscript{2} emissions by each plant.
- The specific steam consumption rate (SSCR) concept: \[ SSCR = \frac{\text{amount of steam}}{\text{NH}_3 \text{ production output of the ammonia plant}} \]
- Main monitoring items for calculating baseline SSCR \[ SSCR = \frac{\text{representative value of steam consumption rate (tons/day)}}{\text{representative value of NH}_3 \text{ production output (tons/day)}} \]
- Main monitoring items for calculating project SSCR

Representative value of steam consumption rate = aggregate amount of steam produced during the monitoring period (actual measurements) \div number of days in the monitoring period
Representative value of NH\textsubscript{3} production output = aggregate amount of NH\textsubscript{3} produced during the monitoring period (actual measurements) \div number of days in the monitoring period |
| CER issue status | Number of times issued: 1
Monitoring period: April 15, 2007 – December 31, 2007 (8.5 months)
Number of CER issues: 82,722 (Roughly 40% of issues noted on the PDD plan) |
2. Case 2

<table>
<thead>
<tr>
<th>Project name</th>
<th>Azerenerji Hydropower Optimization Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration no. and date</td>
<td>Validation being reviewed (Public comment period: February 28, 2008 – March 28, 2008)</td>
</tr>
<tr>
<td>Annual reduction in volume</td>
<td>38,753 tons/year</td>
</tr>
<tr>
<td>Host country</td>
<td>Azerbaijani Republic</td>
</tr>
<tr>
<td>Annex I country</td>
<td>The Netherlands</td>
</tr>
</tbody>
</table>

**Project details**
- This project’s goal is to cut CO₂ emissions by improving the operating rate.
- This project consists of introducing an advanced supervisory control and data acquisition system (SCADA) and a decision support system (DSS) to a cascade type of hydroelectric power system consisting of four hydroelectric plants owned by Azerenerji Joint Stock Company, a state-owned power company located in the Azerbaijani Republic (located on the same river system, these power plants were constructed in an linked fashion). These operational systems are used to replace the existing power generation system, which has generation capacity that is dispersive and inefficient.
- Without anything regarding system optimization-related techniques or ideas noted on the PDD, it is impossible to get a firm grasp on these matters.
- The concept of emissions reductions: After implementing the project, the output of the hydroelectric plant established in cascade style is to be regulated by means of the introduction of a decision support system, with an improvement in the operating rate of the entire system. Fossil fuel-derived generation is replaced by incremental generation made possible by improvements in the rate of operation, leading to reduced CO₂ emissions.
- Establishment of a baseline scenario: A baseline was established from past operation results premised on stable operations during this period. For this reason, as per the methodology, in order to indicate the relation between flow rate and power generation for the baseline, a condition of the methodology is that a minimum of the past three years’ worth of recorded data is to be available.
- CO₂ emissions after implementation of the project: the actual value of generated volume after operations

CER issue status: Not yet issued

3. Case 3

<table>
<thead>
<tr>
<th>Project name</th>
<th>Chhattisgarh Lighting Improvement Project (CLIP) in Rajnandgaon Circle, Chhattisgarh, India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration no. and date</td>
<td>Ref.2709, October 12, 2009</td>
</tr>
<tr>
<td>Annual reduction in volume</td>
<td>24,927 tons/year</td>
</tr>
<tr>
<td>Host country</td>
<td>India</td>
</tr>
<tr>
<td>Annex I country</td>
<td>Great Britain</td>
</tr>
</tbody>
</table>

**Project details**
- This project’s goal is to curtail CO₂ emissions via improvements in the energy consumption rate (electricity consumption for lighting). Reduction volume is calculated based on differences in the consumption rate.
- The project involves the sales of compact fluorescent light bulbs (CFLs) to consumers at a price equivalent to that of the incandescent lights (ICLs) registered with the Chhattisgarh Province Electricity Generating Board. Sales are limited to consumers registered with the Chhattisgarh Province Electricity Generating Board and, when exchanging bulbs, the number of CFL bulbs to be replaced is to exactly match the number of ICL bulbs. CFL bulbs consume less electricity than ICL bulbs, so it is expected that electricity consumption will be reduced.

Actual reductions in electricity usage = amount of reduction in energy consumption due to lighting upgrade ÷ (1 – energy transmission and distribution loss rate)
The concept of baseline electricity consumption:
All ICL output wattage prior to project implementation × lighting time after
project implementation ÷ (1 – energy transmission and distribution loss rate)

The concept of project power consumption:
All CFL output wattage after project implementation × lighting time after
project implementation ÷ (1 – energy transmission and distribution loss rate)

CER issue status
Number of times issued: first issue now going through verification examination
Monitoring period: April 15, 2010 – February 28, 2011 (10.5 months)
Number of CER issues: 42,509 (Roughly 195% of issues on the PDD)

4. Case 4

Project name
Reducing heat loss into atmosphere along with the flue gases by utilizing it for
preheating of combustion air of service boiler at Indo-Gulf Fertilizers (A unit of
Aditya Birla Nuvo Limited), Jagdishpur

Registration no. and date
Ref.0794, January 14, 2007

Annual reduction in volume
1,709 tons/year

Host country
India

Annex I country
Switzerland

Project details
- This project’s goal is to curtail CO\textsubscript{2} emissions via improvements in the
energy consumption rate (i.e., the specific steam consumption ratio (SSCR).
Reduction volume is calculated based on differences in the consumption
rate.
- Targeting ammonia urea fertilizer production facilities, the project
implementer (IGF) is to improve the specific steam consumption ratio
(SSCR) of process air compressors (PAC), reducing the amount of specific
steam and decreasing CO\textsubscript{2} emissions.
- The concept behind the specific steam consumption ratio (SSCR):
SSCR = quantity of steam ÷ air production volume
- Main monitoring items for calculating baseline SSCR
SSCR established utilizing actual steam volume and air production volume
measurement values from before the commencement of the project (i.e., the
company’s database values).
- Main monitoring items for calculating project SSCR
SSCR calculated utilizing steam volume and air production volume
measurement values gained during the monitoring period.
- With implementation of the project, a new motor was to be installed, so the
increased CO\textsubscript{2} emissions resulting from motor operations were to be
counted towards project emissions.

CER issue status
Number of times issued: three times, currently fourth issue going through
verification examination

<table>
<thead>
<tr>
<th>Monitoring period</th>
<th>Number of CER issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/15/2007 ~ 10/31/2007</td>
<td>1,196</td>
</tr>
<tr>
<td>2 11/1/2007 ~ 10/31/2008</td>
<td>1,360</td>
</tr>
<tr>
<td>3 11/1/2008 ~ 10/31/2009</td>
<td>1,540</td>
</tr>
<tr>
<td>4 11/1/2009 ~ 11/31/2011</td>
<td>4,098</td>
</tr>
</tbody>
</table>

5. Case 5

Project name
India-FaL-G Brick and Blocks Project No.2.

Registration no. and date
Ref.4585, June 20, 2011

Annual reduction in volume
11,294 tons/year

Host country
India

Annex I country
Netherlands, Italy
Targeted at 11 brick production plants, this project’s goal is to facilitate fuel conversion, improve both manufacturing processes and energy efficiency in the production process.

Main items for calculating baseline emissions: production output, average annual consumption of various fuels using fossil fuels as a baseline, average annual production rates for past baseline brick production rates.

Main monitoring items after project implementation: production output, monthly purchase quantities of main manufacturing raw materials and extra raw materials, testing every six months to see whether or not comprehensive brick strength is fulfilling relevant requirements, monthly fossil fuel and electricity usage amounts, fossil fuel purchase slips to be used for cross-checking amounts used.

CER issue status Not yet issued

A. Similar examples seen in the domestic credit system

1. Case 6

<table>
<thead>
<tr>
<th>Project name</th>
<th>Multiple techniques for creating comprehensive energy conservation efforts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approval number/approval date</td>
<td>JCDM-0141, January 18, 2010</td>
</tr>
<tr>
<td>Annual volume of reduction</td>
<td>Total project: 129 tons/year</td>
</tr>
<tr>
<td></td>
<td>Methodology 005: 57 tons/year</td>
</tr>
<tr>
<td></td>
<td>Methodology 006: 18 tons/year</td>
</tr>
<tr>
<td>Entity reducing emissions</td>
<td>Nagano Prefecture</td>
</tr>
<tr>
<td>Partner</td>
<td>Chubu Electric Power Co. Inc.</td>
</tr>
</tbody>
</table>

Project details

This project consists of three energy conservation efforts: air conditioning improvements (Methodology 004); the introduction of a pump fan type of variable control device by means of intermittent operations control, inverter control or unit control (Methodology 005); and updating lighting equipment (Methodology 006).

【Methodology 005】

- This effort consists of introducing an inverter to the AC fan to improve energy efficiency, while also introducing intermittent operations control to the switch room ventilation fan to improve energy efficiency and reduce the amount of electricity used.
- The concept of the baseline: multiply operating time by the rated electricity consumption catalogue value of the targeted equipment.
- Amount of electricity used after implementation of project: use of actual values provided by BEMS.
- Main monitoring items: use of amount of electricity used and operations time for targeted equipment after implementation of project, as well as actual values.

【Methodology 006】

- This effort involves reducing CO₂ emissions through an improved energy consumption rate (electricity consumption for lighting).
- Based on such factors as place of usage, utility and lighting time, these are divided into groups, with the rate of energy consumption before and after updates established. Reduction amounts are calculated from the rate of energy consumption before and after the updates are carried out.
- Individual groups’ energy consumption rates = output wattage × targeted number of lighting units.
- Main monitoring items: each group’s annual lighting use in hours and actual values.

iii) Examining the suitability of MRV systems

Energy conservation through automatic control similar to the EMS control envisioned to be adopted.
and spread through the project in question has been an abstract energy conservation method that has yielded a negligible performance in existing CDM systems, even among the few energy-saving schemes. This is surmised to stem from the difficulty of explaining a baseline in circumstances where, unlike the so-called “individual measures,” the equipment concerned is not necessarily operated in the same pattern according to baseline and project scenarios. In these circumstances, the performance discrepancy between old and new equipment becomes the sole focus of energy conservation, which means that the popularization of control—at which Japanese technology excels, and overall optimization technology cannot be encouraged under the existing organization and approach. Therefore, it is important to develop an MRV system that makes it possible to explain this kind of outcome through a new MRV mechanism.

The table below compares existing CDM with the proposed system.

<table>
<thead>
<tr>
<th>Activity Level Indicators (Production Volume)</th>
<th>CDM</th>
<th>Proposed MRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>No debate (implicitly regarded as equal before and after the project)</td>
<td>Examined to create a baseline standardization</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity Utilization Level Indicators (ex: annual operating)</th>
<th>CDM</th>
<th>Proposed MRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>No debate (presupposed to be equal before and after the project)</td>
<td>Capacity utilization includes start/stop control, etc.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Consumption Per Unit Area</th>
<th>CDM</th>
<th>Proposed MRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only subject to improvement per unit area through equipment updates</td>
<td>In addition to updating instruments, energy loss is improved through the management system</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Expenditure</th>
<th>CDM</th>
<th>Proposed MRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated through capacity utilization level indicators and energy consumption per unit area</td>
<td>In addition to the calculation at left, the performance of automatic control operation is considered</td>
<td></td>
</tr>
</tbody>
</table>

Whether this type of approach will be internationally and rationally received is to be considered and examined.

**6) Ensuring environmental integrity:**
The project is not anticipated to bring about any specific negative environmental impacts, but the operation patterns for plant facilities will change with the introduction of controls, and that could conceivably generate noise and vibration. Efforts should be made to identify and reference applicable local laws and standards germane to this point, and to keep in close contact with on-site plant management to avoid negative impacts.

Although an environmental impact assessment system does exist in China, only new construction projects come under its legal purview.

**7) Other indirect impacts:**
In some industries such as the iron, chemical, and papermaking industries, which include the 1000 targeted companies, like this demonstration site the entire process in advanced nations is continuously linked and controlled, making it difficult to introduce new controls from the aspect of energy conservation. It is quite possible that clarifying the extent to which batch treatment processing is incorporated into these types of industries, and the potential to introduce the envisioned technologies...
into those 1000 targeted companies will trigger a transformation in manufacturing in China. It is understood that the social impacts (such as labor and employment) and economic impacts (rise in production and intensification of global economic competition) are factors that will influence popularization in the future.

(8) Comments about parties concerned:
The 3 groups recognized as being important parties involved in the project in question are administration at the state and provincial level, relevant plant employees, and local control and engineering industry groups.

While the attitude of local administration toward new mechanism systems is undetermined, there is significant interest in the utilization of economic mechanisms for domestic energy conservation and reduction of greenhouse gas emissions. On this point, it should be confirmed whether this model is politically acceptable as a potential new mechanism, and if cooperation with the department handling climate change is possible.

As for the relevant plant employees, if the EMS control system envisioned to be popularized by this project does indeed spread, conflict could arise from a shortage in facilities management. Ultimately, economic principles will likely determine whether this kind of replacement progresses, but if the possibility of conflict exists, then opinions must be gathered and analyses conducted in advance, and appropriate measures must be taken.

When a business model in a new field is developed, local control and engineering industry groups must settle opinions on topics such as the degree to which the supply chain can be locally leveraged, and the possibility of building a win-win relationship through role division and business cooperation. Analyses must then be conducted and a positive cooperative relationship sought after.

Comments from such parties have yet to be gathered. At the completion of this demonstration site’s technical diagnosis, there are plans to interview these relevant parties to acquire opinions when a specific, overall concept of relevant businesses/activities can be locally presented.

(9) Project implementation system:
Expanding the popularization of the project could involve not only user corporations as candidates for accepting the system, but also local administrations and local cooperative management organizations involved in the utilization of the new mechanism system. Measuring instrument vendors are needed to gather relevant information/data, DB/computing equipment is required for collected information/data, control facilities are necessary for conducting command-based control, and a dashboard is needed for sequential, collected information, the visualization of control conditions, and carrying out operations management. Because the EMS control system is constructed from those functions, it is thought that systems will be organized around corporations that are normally responsible for SI control.
Since the primary implementation bodies in this system will maintain technological standards and ensure the spread of Japanese technologies, Japanese corporations must be established as the core SI control, and the affiliated control equipment manufacturers and measuring instrument manufacturers. On the other hand, since IT vendors and construction vendors make up the principal expenditure element for labor costs, Japanese vendors are not plausible since they lack economic competitiveness. The cooperation of local resources should be secured.

(10) Financial Plan:
Below is a model case for corporations/schemes targeted by the project.

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual electricity use</td>
<td>80,000 MWh</td>
<td>Minimum for 1000 target companies</td>
</tr>
<tr>
<td>Energy conservation using the</td>
<td>8,000 MWh/year</td>
<td>10% energy conservation (avg. company performance)</td>
</tr>
<tr>
<td>project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project scope</td>
<td>280,000,000 yen</td>
<td>5-year return on investment (avg. company performance),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power: 7 yen/kWh</td>
</tr>
<tr>
<td>Income from credit sales</td>
<td>50,400,000 yen</td>
<td>Carbon Conversion Factor:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9t-CO2/MWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>800 yen/t of income estimated from credit sales</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Period: 10 years</td>
</tr>
<tr>
<td>Project scope net</td>
<td>229,600,000 yen</td>
<td></td>
</tr>
<tr>
<td>Annual cost when everything is</td>
<td>55,870,000 yen/year</td>
<td>Project Period: 5 years</td>
</tr>
<tr>
<td>not covered by outside financing</td>
<td></td>
<td>Annual interest: 8%</td>
</tr>
<tr>
<td>Annual cost reduction through the</td>
<td>56,000,000 yen/year</td>
<td>8,000 MWh/year of energy conservation;</td>
</tr>
<tr>
<td>project</td>
<td></td>
<td>7 yen/kWh</td>
</tr>
<tr>
<td>Annual balance during project</td>
<td>12,000 yen/year</td>
<td></td>
</tr>
<tr>
<td>period</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown above, income and expenditures will be balanced in the model case even if the user entirely depends on outside financing for project funding. The financing standard in this case for a 5-year project period at 8% annual interest is one that can, for example, be offered by a major leasing company doing business in China if the credit structure is in place. There is a need to work with a financier in this area.

(11) Measures for promoting the introduction of Japanese technologies:
Control equipment and measuring instruments are Japanese technologies central to this project. Retaining quality in local energy conservation projects and strategic system solutions are important to maintaining and popularizing the competitiveness of these technologies in energy conservation.

As for the quality of energy conservation projects, even when projects are conducted there is no framework in place in China for precisely validating their outcomes, and there is a tendency for projects to concentrate on initial equipment purchase. This means the focus is aimed solely on the cost competitiveness of the equipment, which presents an obstacle for Japanese technology because of weak cost competitiveness. It also promotes the commoditization in that equipment field, which in turn negatively impacts the popularization of Japanese technologies. This points to a need to simultaneously popularize a framework allowing energy conservation technologies to be easily and reasonably evaluated.

It is also important to build a model that prepares and offers system solutions, and to ensure that the relevant technology is not subjected to competitiveness as a stand-alone product to prevent Japanese technologies from getting caught up in commoditization. The lifecycle in energy conservation business is constructed from a variety of businesses and matters, from technological consulting for the purpose of evaluating energy-saving potential to providing equipment, repairing existing equipment, educating users on new technologies, and verifying efficacy. There are a number of areas within this lifecycle where it would be difficult to achieve high standards with Japanese technologies alone. It is important that SI, which holds the initiative for overall business structure in these matters, exhibits that value and steadfastly refrains from competing in commoditization.

On the other hand, when switching over to this technology, the issue of intellectual property rights emerges. In particular, in the kind of approach noted above, demand components involving intellectual property exist both in the tangible and intangible elements of relevant technologies, but in China infrastructure for intellectual property rights for intangible elements is lacking. In the cooperative framework for energy conservation between Japan and China, several efforts are being made to lay the groundwork for this type of infrastructure for intellectual property rights, and China is also beginning to make endeavors (Example: Subcommittee for the Protection of Intellectual Property Rights in the Japan-China General Forum on Energy Conservation & Environmental Preservation). Information on these initiatives will be compiled so that it can be referenced when applying the new mechanism.

5. Survey Results on Co-benefits
In regard to the effects the implementation of this project will have on anti-pollution measures, in China the reduction of SOx and NOx emissions by curbing coal-derived thermal power generation is a serious issue, and a decrease in these types of air pollutant emissions through conservation of electricity appears promising. However, it is difficult to obtain information on local emission factors for these substances, and the project does not quantify the outcomes.

6. Survey Results on Contributing to Sustainable Development
Not only will energy consumption be reduced through the introduction of control technologies and by switching from batch processing to a continuous automatic control process, but the optimization of resources such as input materials will also be promoted, making it possible to contribute to the cultivation of comprehensive sustainable manufacturing that includes energy and resources. This kind of resource efficiency is a crucial policy pillar in China. Future studies will analyze the working environment and employment, and the position and efficiency of the global market for this country and industry, which are thought to be factors impacting their popularization.