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**Mid-Term Review (Revised Draft)**

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Acronyms and Abbreviations

ACC Air Conditioner Compressor

APF Annual Performance Factor

APPR Annual Project Progress Report

AMIS Air Conditioning Market Information System

BRESL Barrier Removal to the Cost Effective Development and Implementation of

Energy Efficiency Standards and Labelling (Project)

CEEE Center of Environmental Energy Engineering, University of Maryland

CERs Certified Emissions Reductions

CDM Clean Development Mechanism

CFC Chlorofluorocarbons

CHEAA China Household Electric Appliance Association

CHEARI China Household Electric Appliance Research Institute

CNIS China National Institute of Standardization

COP Coefficient of Performance (an efficiency measure)

CO2 Carbon Dioxide

CTA Chief Technical Advisor

EE Energy Efficiency; energy efficient

EEI Energy Efficiency Index

EER Energy Efficiency Ratio

EOP End of Project

FECO Foreign Economic Cooperation Office (of MEP)

GC-MS Gas Chromatograph Mass Spectrometer

GDP Gross Domestic Product

GOC Government of China

GEF Global Environment Facility

GHGs Greenhouse Gases

GWP Global Warming Potential

HFC Hydrofluorocarbons

HCFC Hydrochlorofluorocarbons

HPMP HCFC Phaseout Management Plan

MIIT Ministry of Industry and Information Technology

Mtce Million tons coal equivalent

MTR Mid-Term Review

NDRC National Development and Reform Commission

NHEAQSTC National Household Electric Appliance Quality Supervision Testing Center

NPD National Project Director

NGO Non-governmental Organization

ODS Ozone Depleting Substance

PEERAC Promoting Energy Efficient Room Air Conditioners (Project)

PIR Project Implementation Review

PMO Project Management Office

PSC Project Steering Committee

RAC Room Air Conditioner

SAC Standardization Administration Committee

SEER Seasonal Energy Efficiency Ratio

SEPA China State Environment Protection Agency

TA Technical Assistance

tce Tons coal equivalent

TORs Terms of Reference

UN DESA United Nations Department of Economic and Social Affairs

UNDP United Nations Development Programme

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It should be noted that all PEERAC personnel were fully cooperative in this evaluation; answered all queries made by the MTR team; provided any additional information requested; assisted team members in better understanding the project components; and – importantly!--were also willing to diplomatically point out the team’s misunderstandings. The fact that they did all of this in such a cordial and very helpful manner made the evaluation a truly rewarding experience.

UNDP personnel (including especially Ms. Liu Shijun and Ms. Teng Yue) and PMO staff (especially Mr. Yun Jinqi and Ms. Liu Qin) organized an efficient and timely MTR schedule, with numerous interviews and site visits falling within a very compact period of time. The subcontractors (CHEAA, CHEARI, NHEAQSTC, CNIS); governmental agencies (MEP; SAC; MIIT); and industry participants (Gree and Zhuhai Landa) all displayed considerable hospitality to the MTR team. Ms. Wei Wenting’s translation assistance was also particularly helpful.

Given such assistance, the MTR Team hopes that the observations, conclusions and recommendations included in this report prove useful to the PEERAC project team, and assist them in the very important work that they are undertaking.

**EXECUTIVE SUMMARY**

China currently produces 70% of the world’s room air conditioners (RAC), for both domestic and export purposes. The country is building an estimated 1.9 billion m2 of new buildings every year, and double-digit growth in the RAC industry is expected to continue, as incomes (and thus demand) in China and other developing countries around the world increase over coming decades.

Foreign manufacturers have been withdrawing from the Chinese market in recent years, and domestic demand is increasingly being met by Chinese air conditioning manufacturers. Chinese ACC and RAC manufacturers now export approximately half of their production, so the industry will be meeting future demand not only in China, but around the world.

This growth rates raises concerns about the levels of energy necessary to meet such cooling demand, and some analyses project a forty-fold increase in energy requirements during the current century. There are also concerns about the ozone depleting properties and Global Warming Potential (GWP) of refrigerants employed in these new RAC units. But the concentration of ACC and RAC manufacturing capacity in China also offers an opportunity to directly address such concerns – and the GEF/UNDP Project entitled ‘Promoting Energy Efficient Room Air Conditioners’ (PEERAC) is designed to do exactly that.

PEERAC’s objective is to increase the production and sale of energy-efficient RACs through three project components: 1) air conditioner compressor (ACC) efficiency upgrades; 2) RAC efficiency upgrades; and 3) energy efficient RAC promotion. The project began in early 2010, and is scheduled to run through late 2015.

This report presents the results of an evaluation conducted at the mid-point of the project’s duration, in order to address two fundamental questions: 1) is the current project effort ‘on-track’ to deliver the environmental benefits sought in the project’s formulation?; and 2) how might the project be improved to deliver such benefits?

**Framework of the Mid-Term Review**

While the project’s activities and management were organized around the three individual project components noted above, this Mid-Term Review (MTR) and report utilized a somewhat broader framework designed to address the key issues in the project. PEERAC was formulated as the follow-up to a comparable project addressing refrigerators, and the considerable success of that program was attributed in part to its “technology push and market pull” approach. This report employs that same system, with the first two components (those addressing ACC and RAC efficiency upgrades) essentially a part of the ‘technology push’ effort, and the third component (addressing energy efficiency RAC promotion) a part of ‘market pull’.

**Project Goals/Indicators Findings**

A 2008 survey by the China Household Electric Appliance Association (CHEAA) found that fully 86% of the country’s RAC products fell within the lowest efficiency Grade 5 category – and continued domestic growth employing such products would clearly lead to unsustainable energy requirements and environmental impacts. To address this significant problem, the Chinese government undertook an aggressive energy efficiency (EE) program with several fronts – and many of these EE programs were being implemented just as PEERAC began. Important programs which affected ACC and RAC manufacturers (and thus PEERAC) included:

* *Energy Standards*. A 2010 revision led to the complete cessation of the production of inefficient units in the original grades 3, 4, and 5, and the market share of original Grades 1 and 2 RAC increased dramatically (i.e., from 5% to over 70%);
* *Rebate Program*. In May 2009 the government introduced an EE appliance rebate program as part of its economic stimulus package which refunded 13% of the consumer’s price for RAC meeting certain EE requirements;
* *Manufacturer Subsidies*. In addition to the consumer rebates, NDRC and the Ministry of Finance provided subsidies to companies whose products reached a defined energy efficiency level, even before the products were sold (at subsidized prices) to consumers. These subsidies ranged from RMB300 to RMB850 for each RAC unit.

At the same time, the industry was undergoing a technological transformation, as variable speed units became widely available, replacing more inefficient constant speed units.

The RAC manufacturer Gree, a project participant and the world’s largest manufacturer of RAC, maintains an R&D staff of approximately 5,000 persons – and while PEERAC training and technical assistance for a handful of employees was certainly valuable to the company (as the MTR interviews made clear), the project’s ‘technology push’ contributions to changing Gree’s product line will probably be minimal. Similarly, the entire PEERAC budget – let alone the funding dedicated to ‘market pull’ activities -- is only a miniscule fraction of the nearly 12 billion RMB stimulus program designed to encourage the adoption of EE appliances in the country.

These concerns do not in any way diminish the value or importance of the PEERAC project, as later sections will discuss. PEERAC has primarily served as a ‘catalyst’ for change, guiding the larger (typically government-driven) actions already occurring within the technology and market arenas. This would appear to be the primary value of the project – but one which is exceedingly difficult to quantify in terms of GHG reductions and direct (or even indirect) energy savings.

These quantification difficulties were made even more difficult because the increased use of variable speed units changed the energy efficiency benchmarks (away from EER employed for constant speed units, towards SEER and APR); and the MTR team also had concerns about some of the data and assumptions employed. These issues could not be resolved during the evaluation period, and the MTR team was not able to quantify energy savings and emission reductions associated with the first half of the project.

**‘Technology Push’ Findings**

* With commendable PMO efforts, the project was able to capture a 95% market share in ACC and RAC participation, a level well above the project’s original 75% target;
* The technical training and assistance efforts have been extremely popular with participating companies, and were very highly rated. Numerous companies sought to increase the quotas for the number of their personnel eligible to receive such training, and a common comment was that these programs should be expanded, and continued in some manner after the project ends.
* Companies found the Air-conditioning Market Information System (AMIS) useful, and similarly wanted the program to expand – perhaps including additional technological (and even international) information about the industry;
* Product testing in the project has confirmed the credibility of the manufacturers testing procedures and lab results, and also provided valuable input for the discussion about changes in the national EE standards;
* The revision of EE standards has had a major impact on the industry, driving out production of inefficient units that represented a significant market share at the time the project was formulated. PEERAC has provided a valuable forum for industry information and discussions about the standards revision, also providing input to the appropriate governmental agencies. PEERAC has also responded by accelerating standards-related activities in order to ensure that its input was timely and relevant in this area;
* The project activities associated with refrigerants have been delayed. This is an important area requiring attention in the second half of the project, and is discussed below in the Recommendations section.

**‘Market Pull’ Findings**

* Most ‘market pull’ tasks will occur in the second half of the project, and are therefore not as well developed. The most significant change in the project’s work plan is a cancellation of the rebate program (i.e., Activities 3.3.1 through 3.3.4), given the scale of the government’s recently ended rebate effort;
* A webpage outreach program was developed, but this ran into problems as FECO decided to consolidate its postings, and the website was not available at the time of the MTR. This issue is being addressed, however;
* Other outreach efforts – conferences, brochures, technical papers, etc. –appear satisfactory, and are fully meeting project requirements. The MTR team considered the project’s logo to be an excellent design, and it is already being employed in advertising by a significant fraction of the project participants; -

**Project Management**

* PEERAC is a complicated project, with numerous activities – much like the refrigerator market transformation project it was modeled on. By all accounts, the PMO team has successfully met that challenge, and is performing in an exemplary manner;
* The PMO has effectively synchronized on-going activities, making schedule and other adjustments as necessary. It has pro-actively responded to recommendations made by participants, to the extent possible within the project’s resource and institutional constraints;
* It has provided effective c communication with subcontractors and industry participants, and has provided necessary information and feedback as required for them to carry out their required tasks;
* It has provided effective coordination between stakeholders, including RAC and ACC manufacturers, government officials, trade associations, standard developers, and others.
* The selection of subcontractors and project accounting has been performed in a transparent manner, utilizing appropriate institutional procedures;
* Other GEF/UNDP considerations (i.e., role of women; climate change, etc.) are being addressed in a satisfactory manner.

**Schedule**

* Almost all PEERAC activities are following the proposed project schedule;
* The variable frequency standard development activities were accelerated to meet governmental timing requirements for this task;
* International training for ACC participants has been slightly delayed, and ODS activities have also been postponed – but these are the normal types of adjustments expected during any project’s implementation.

**Financing**

* The budget and financial outlays are consistent with proposed levels for individual activities;
* The project accomplished a significant increase in co-financing from project partners, although – as with quantifying the project’s energy savings and emissions reductions – it is difficult to place an exact figure on this co-financing. The estimated 13-fold increase in private sector contributions provided to the MTR would appear to be based upon a rather liberal interpretation of co-financing.

**Conclusions**

This is a well-managed and effective project. It was originally designed as a follow-up to a similar project addressing refrigerators -- but is tackling a more-complicated industry, which is simultaneously undergoing considerable technological change, and is doing so with a smaller project budget. Industry participation and financial co-financing has been exemplary, however, and has contributed to the project’s success.

In addition to technological change, the early years of the project have been accompanied by strong governmental action on a number of fronts, including technical standards, financial subsidies for sales of energy efficient units, and subsidies to ACC and RAC manufacturers. Given their magnitude, these government actions have swamped PEERAC’s impact in terms of the project’s stated goals and objectives (i.e., energy savings and GHG reductions), and have made it very difficult to make quantitative estimates of the project’s success in meeting them.

However, PEERAC has clearly served as a very useful “catalyst” during this period of extensive change, providing technical information, liaison activities, auditing functions, and other very appropriate and valuable services for industry participants. The MTR found that the project has been meeting specific indicators for individual project activities, there is clear communication between parties, and attendant project management functions were being performed properly. The project has been able to adapt to the rapid ongoing changes, accelerating schedules when necessary, and shifting resources when appropriate. Interviews with industry participants, subcontractors, advisory personnel and others during the MTR indicate that the project is held in very high regard. It is clearly helping to transform the ACC and RAC industries in China, and its performance through the mid-term period is fully consistent with the project’s design and formulation.

**Recommendations**

The MTR determined that no significant changes in management and project implementation are required to achieve the project’s overall goals.

Several recommendations are included, however, to encourage the project to view its role as a “catalyst” for the market transformation, serving as a ‘liaison’ for the ACC and RAC manufacturers, providing technical information, contacts with international specialists, etc. – and thereby providing input and helping to guide the government’s substantial efforts. These include:

* Placing additional emphasis on retaining an international technical specialist to assist in the tasks normally performed by a Chief Technical Advisor (CTA);
* Looking for means of extending training and technical assistance and AMIS efforts after PEERAC ends;
* Stressing the importance of ‘market pull’ efforts to project participants. The technology push components are very popular, but there seems to be much less interest in ‘market pull’ activities. Such efforts will nevertheless become necessary if the industry is to accomplish a market-driven transformation.

All GEF and UNDP projects undertake considerable efforts to ensure that managers and evaluators can adequately assess the effectiveness of individual activities, using quantitative measures and indicators wherever possible. As noted above, the MTR found it difficult to quantify the project’s contribution to date. The MTR recommends that the UNDP and PMO:

* Undertake a review of the project’s approach for determining goals and objectives, and try to develop a more realistic measure of the project’s contribution to energy savings and emissions reductions;
* Examine the data and assumptions employed in the original calculations of these parameters, and determine whether they are accurate and remain suitable;
* Continue to use other indicators as guides for project management and evaluation, and continue to use quantitative measures to the extent possible.

Finally, the role of refrigerants has several important implications for the ACC and RAC industries, and PEERAC should:

* Complete as soon as possible the policy measures and educational programs for old RAC refrigerant disposal, currently delayed within the project’s work plan;
* Incorporate data about alternative refrigerants (e.g., energy efficiency, GWP, environmental impacts, etc.) in all of its technical training and assistance programs; and
* Coordinate project efforts with other UNDP and MEP programs addressing refrigerants to the fullest extent possible.

**1. INTRODUCTION**

**1.1 Purpose of the Mid-Term Review**

China currently produces 70% of the world’s room air conditioners (RAC), for both domestic and export purposes, and its own domestic demand has been increasing at double digit growth over much of the past two decades. As the standard of living rises within the country, the contribution of the building and appliances sector is expected to increase from 17% of total energy to 25% by 2030, and RAC represents a significant portion of that growth. Such a level would likely require the equivalent of eighteen 1 GW coal-fired power plants, with attendant emissions and environmental impacts.[[1]](#footnote-1) The sheer economies-of-scale inherent in China’s low cost manufacturing of RACs offers a major opportunity to improve energy efficiency and reduce greenhouse gas emissions, however, not only in the domestic realm but also in an international context.

The GEF ‘Promoting Energy Efficient Room Air Conditioners’ (PEERAC) project is designed to capture that opportunity, and to increase the production and sale of energy-efficient RACs. It does so through three project components: 1) air conditioner compressor (ACC) efficiency upgrades; 2) RAC efficiency upgrades; and 3) energy efficient RAC promotion. The project began in early 2010, and is scheduled to run through late 2015.

The specific objectives of the Mid-Term Review (MTR) are to:

**1. Complete an assessment of the PEERAC project;**

The MTR should promote accountability for the achievement of GEF objectives through an assessment of results, effectiveness, processes and performance of the partners involved in PEERAC project activities. The results should be monitored and evaluated for their contribution to global environmental benefits; and

**2. Strengthen the PEERAC project;**

The MTR should promote learning, feedback and knowledge sharing about the results and lessons learned among the GEF and its partners. These will serve as a basis for strengthening the PEERAC program, and inform decision-making on policies, strategies, program management, and related projects, in order to improve both project knowledge and performance.

In order to accomplish these objectives, the MTR addressed the PEERAC project implementation from two perspectives: A) the component level; and B) the project level. The international and national MTR team members participated in both the component and project aspects of the evaluation.

**A. Component Level Evaluation**

The component level evaluation was designed to assess at a fundamental, granular level whether the individual component tasks were being carried out; whether the performance measurement indicators identified in the Project Document were being achieved; whether the consultants retained in the project were performing their tasks successfully; whether the tasks being performed were consistent with those identified in the work plan; whether the budget and financial outlays were consistent with proposed levels; and similar aspects of the day-to-day operations of the ongoing project effort. It was designed to enable the GEF Secretariat and others to discern how closely this ongoing effort matches the project as originally conceived and approved.

**B. Project Level Evaluation**

The project level evaluation has a broader strategic purpose, and was designed to address how well the project is performing in achieving its goals; to identify the factors that are assisting or impeding its ability to do so; to determine whether the management structure and interaction of key project participants are satisfactory, and how such factors might be improved; to identify any critical issues that might affect the project’s ability to achieve its goals, and to propose approaches for addressing such issues; and to make recommendations designed to make the project more efficient, effective and beneficial. It was designed to provide the GEF Secretariat with an understanding of the overall performance of the PEERAC project, and how it might be strengthened.

**1.2 Methodology**

The PEERAC MTR was conducted by an evaluation team comprised of one international consultant (Raufer) and two national consultants (Bai and Yu). The team drew on a range of qualitative and quantitative tools to conduct the evaluation, and key activities undertaken included the following:

**A. Review of Documents**

The MTR team reviewed project documents, including the PEERAC Project Document and Project Brief; the Inception Report; and Annual Project Progress Report/Project Implementation Review (APPR/PIR) for 2011 and 2012. Other materials reviewed during the MTR included Terms of Reference (TORs) for consultants; final reports and other deliverables from project participants; survey results; promotional PEERAC materials; and materials employed in training sessions. All materials specifically requested by the MTR team were provided by the PMO and/or project sub-contractors.

**B. Database Analysis**

Several activities undertaken in the project included surveys, including the design and development of an Air Conditioning Market Information System (AMIS). The MTR reviewed the status of databases developed during the project implementation, including efforts to determine the comprehensiveness, quality, reliability and accuracy of data included, as well as their implications concerning the project’s objective and results.

**C. Interviews with Key Project Participants**

In-depth interviews were conducted with key project participants, including at a minimum the National Project Director; the PMO Director and Manager; the International Chief Technical Advisors for specific components; the Project’s Technical and Financial Officers; members of the Project Advisory (i.e., Steering) Committee; and the UNDP’s Country Office in charge of the PEERAC project.

MTR team members also interviewed a number of sub-contractors, including representatives of the China Household Electrical Appliances Association (CHEAA), subcontractors for AMIS and technical training; the National Household Electric Appliance Quality Supervision Testing Center (NHEAQSTC), subcontracted for ACC and RAC product testing; the China Household Electric Appliance Research Institute (CHEARI), for RAC technical training; and the China National Institute of Standardization (CNIS), for RAC standards and labeling.

PMO and/or UNDP personnel were present during many of these interviews (as well as during site visits described below), and in each of these sessions they were asked to leave the meeting room for a period of time near the end of the interview. This was done in order to provide the MTR team with an opportunity for confidential discussions with the interviewees.

MTR team members also contacted all of the 10 ACC and 16 RAC manufacturers participating in the PEERAC project by email, informing them about the purpose of the MTR and offering them an opportunity to provide input to the evaluation. The email message also notified participants that they might contact a member of the MTR team for a telephone interview if desired.

**D. Field Visits**

Interviews with those noted above (including subcontractors) were held on-site in order to observe actual operating conditions for PEERAC’s implementation.

MTR team members also conduct a site visit with two PEERAC manufacturing participants, one a RAC manufacturer and the second an ACC manufacturer. Gree Electric Appliance Company is the world’s largest RAC manufacturer, and the Zhuhai Landa Compressor Co., Ltd. is a wholly-owned Gree ACC subsidiary supplying approximately 60% of Gree’s compressor needs. Both companies are located in Zhuhai, in Guangdong Province.

**1.3 Structure of the MTR report**

The following section of the report (Section 2) addresses the formulation of the PEERAC project, as well as its development context. This includes a description of the problems that the project is designed to address; the immediate and development objectives; the project management and implementation; its principal stakeholders; and the results anticipated from the project’s implementation.

This is followed by the findings of the MTR in Section 3, including the general framework of the review; the performance assessment of each component area; and an assessment of other project criteria (e.g., gender, climate change, etc.).

The report then describes lessons learned and conclusions from the MTR in Section 4, and includes a series of recommendations for the second half of the project’s implementation in Section 5.

Annexes include detailed information about the MTR, including a listing of the project’s activity status; the review’s Terms of Reference (TOR); documents reviewed; an MTR meetings synopsis and listing of persons interviewed; annual financial allocations; subcontractor TORs; and more detailed testing results.

**2. THE PROJECT AND ITS DEVELOPMENT CONTEXT**

**2.1 Project formulation**

This project follows the same general approach as a previous project, entitled “Barrier Removal for the Widespread Commercialization of Energy-Efficient CFC-Free Refrigerators in China,” supported by GEF/UNDP and the Government of the People’s Republic of China, and executed by the former State Environmental Protection Administration (SEPA) and UN DESA. That refrigerator project began in late 1999, and was completed in 2006.

The refrigerator project was determined to be “extremely effective in achieving its primary goals,”[[2]](#footnote-2) according to its *Final Evaluation Report*, which were to bring about a significant and on-going reduction in greenhouse gas emissions (GHGs) from electricity generation by reducing the amount of electricity used annually by household refrigerators in China.

One of the recommendations in that *Final Evaluation Report* reads:

Apply the concepts of the Project—the technology push/market pull— to other appliances, starting with window-mounted, split and possibly commercial air conditioners. Air conditioning was noted by many project participants as a crucial area for reduction of both electric energy consumption and electricity demand (peak power) reduction, and for the reduction of the environmental impacts associated with supplies of both electric energy and peak power.[[3]](#footnote-3)

In the report’s “Lessons Learned’ section, the reviewers found that “an integrated approach” was crucial for the project’s success, including the “excellent ‘technology push/market pull’ concept.”

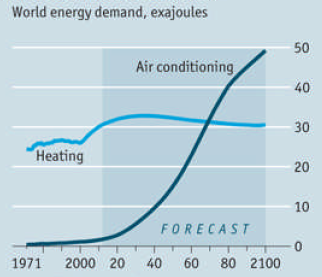
This recommendation became the basis for the development of the PEERAC project, and the ‘Technology Push/Market Pull’ concept became the overall framework for the project’s formulation and implementation.

**2.2 Problems that the Project Seeks to Address**

The problem that the project seeks to address is perhaps best captured in Figure 2.1,by Isaac and van Vuuren (2009)[[4]](#footnote-4) which shows a forty-fold rise in world energy demand (in exajoules) associated with air conditioning through the end of the century. This is driven not only by rising incomes in developing countries – but also the positive feedback associated with temperature change associated with global warming. As temperatures rise, so will air conditioning demand and energy use.

China will play a unique role in this growth, in both a domestic and international context.

Figure 2.1 Projected world energy demand associated with heating and cooling



Between 1995 and 2004, the relative fraction of homes in Chinese cities using air conditioning rose from 8% to 70%.[[5]](#footnote-5) And, as the ASHRAE Journal noted in 2012, “the numbers associated with China’s air-conditioning market are staggering.”[[6]](#footnote-6) The country is building an estimated 1.9 billion m2 of new buildings every year, and the air conditioning manufacturing industry has increased at an annualized average of 12.4% over the past five years.[[7]](#footnote-7) Double-digit growth is expected to continue, as incomes and demand from so-called third and fourth tier cities, as well as the rural population, increase.

Despite this domestic growth rate, foreign manufacturers are playing a decreasing role in supplying air conditioners within China. Major international firms such as Samsung and LG have withdrawn from the market in recent years, and in the five year period ending in in 2010, foreign market share had decreased by 50%.[[8]](#footnote-8) China’s demand is thus increasingly being met by Chinese air conditioning manufacturers. There are currently estimated to be approximately 300 manufacturers in the country, generating $73 billion in revenue every year, and employing approximately 350,000 people.[[9]](#footnote-9)

These manufacturers have now captured an estimated 70% of worldwide production, and with an increasing competitive edge, Chinese-made air conditioners have been gaining a larger market share within the global market.

Energy use and greenhouse gas emissions associated with this rapid growth are obviously of critical concern, and Chinese air conditioners have historically had low energy efficiency levels compared with other countries. An analysis conducted by the China Household Electrical Appliances Association (CHEAA) in 2008 found that 86% of locally made room air conditioner (RAC) products fell within the Grade 5 category (i.e., the lowest energy efficiency grade, 2.6 ≤ EER < 2.8 for cooling capacity lower than 4500W). This led to a vicious circle, whereby low-cost RAC products increasingly drove higher-priced, more efficient units from the marketplace.

The Chinese government has met these concerns with “a comprehensive policy approach to achieving energy efficiency gains from air conditioners, encompassing plans, legislation, standards, pilot studies, building codes, labeling, fiscal incentives, targets, government procurement and institutions.”[[10]](#footnote-10) This project is a complementary effort designed to contribute to the reduction of GHG emissions through the transformation of the Chinese air conditioning market, resulting in more energy-efficient room air conditioners used in residential and commercial buildings both in China and throughout the world.

**2.3 Objectives of the Project**

The **overall project goal** of PEERAC is the reduction of GHG emissions from room air conditioning in China's residential and commercial sectors.

The **project’s objective** is the significant improvement of the energy efficiency of locally manufactured room air conditioners in China. It has three substantive components: 1) AC Compressor Efficiency Upgrades; 2) RAC Efficiency Upgrades; and, 3) Energy Efficient RAC Promotion.

Accordingly, **expected outcomes** from each of these components are as follows:

Outcome 1: More locally produced high efficiency AC compressors;

Outcome 2: More locally produced high efficiency room air conditioners;

Outcome 3: Enhanced enabling environment to support energy efficiency and Increased market share of EE RACs.

**2.4 Project Management and Implementation**

As noted earlier, a previous refrigerator project laid the groundwork for this air conditioning industry effort. During this MTR, it was pointed out by certain participants – notably not within the PMO -- that the air conditioning industry is even more complex than the refrigerator one; that the marketplace is changing more quickly in both technical and consumer demand terms; and yet the PEERAC project is attempting to address these issues with considerably less GEF resources than the previous project (i.e., $9.86 million vs. $6.36 million). Fortunately, that disparity is being addressed by a considerably larger amount of co-financing by project participants. The broader point is a valid one, however, and it has therefore been incumbent upon the PEERAC project to recognize and utilize the successes and lessons learned in the previous effort.

A case study analysis of the previous (refrigerator) project noted that “As a market transformation project, the project included many more activities and was significantly more complex than a traditional highly focused project, but it was therefore able to achieve larger and more sustainable gains.”[[11]](#footnote-11) This project included similar complexities which had to be addressed in project management – but also offered the opportunity for similar significant gains.

Importantly, the project employed the same “technology push/market pull” approach utilized successfully in the previous effort:

* “Technology push” provides a combination of training and technical resources (including financial incentives) to induce ACC and RAC manufacturers to increase the efficiency of their products; and
* “Market pull” helps develop the consumer market for such products, through a combination of procurement guidelines, labelling, consumer education, information campaigns and advertising in various media and a rebate/recycling program.

Structurally, the project was implemented with three “components” – two addressing ‘technology push’ tasks, and the third addressing ‘market pull.’ The two technology push components addressed the ACC and RAC manufacturing industry, respectively, and the Project Document organized the project’s activities in such a manner.

The PEERAC management framework is shown in Figure 2.2.

Figure 2.2 PEERAC Management Framework

**Project Steering Committee**

**Project Assurance**

**Team**

**Technical Advisory**

**Committee**

**Project Management Office**

***Foreign Economic Cooperation Office, MEP***

Component 1

Component 2

Component 3

**2.5 Principal Stakeholders**

Several major stakeholders have been participating in the PEERAC project, including:

* *Air conditioning compressor (ACC) manufacturers*; Ten companies are directly participating in PEERAC, and have signed contracts with the PMO outlining their tasks and responsibilities, as well as financial contributions to the project. While these firms are directly involved, it is anticipated that the project will also provide benefits to the other ACC manufacturers not directly participating;
* *Room air conditioning (RAC) manufacturers*; Sixteen companies are similarly directly participating in PEERAC, with contract agreements and financial contributions to the project. ;
* *Industry trade and research organizations*; Many organizations involved in the air conditioning industry will benefit from the technical improvements and increased market share associated with PEERAC activities, and a number of such organizations are directly involved as subcontractors. The latter includes the China Household Electrical Appliances Association (CHEAA), subcontractors for AMIS and technical training; the National Household Electric Appliance Quality Supervision Testing Center (NHEAQSTC), subcontracted for ACC and RAC product testing; and the China Household Electric Appliance Research Institute (CHEARI), for RAC technical training;
* *China’s governmental agencies*: The PEERAC project is fully consistent with China’s governmental efforts to reduce GHG emissions, improve environmental conditions within the country, and foster technological and economic development of one of the country’s major industries. Several agencies play a key role in PEERAC, including the Ministry of Environmental Protection, which is the National Executing Agency for the project, and houses the PMO; the National Development and Reform Commission, which advises on energy efficiency policy, and serves on the Project Steering Committee (PSC); the Ministry of Industry and Information Technology, which advises on industrial and information technology and serves on the PSC; the Ministry of Finance, which is the National GEF Operational Focal Point and a member of the PSC; and the Ministry of Commerce, which advises on the RAC market and is a member of the PSC;
* *The China National Institute of Standardization (CNIS)*; The CNIS is a subcontractor advising on RAC standards and labeling, and coordinates efforts on the GEF-UNDP BRESL (Barrier Removal to the Cost Effective Development and Implementation of Energy Efficiency Standards and Labeling) Project;
* *International Technical Assistance Organizations*; These stakeholders provide the training and technical input for the ACC and RAC manufacturers participating in the project; and
* *Building Practitioners and Consumers*; These groups benefit from the improved technologies developed under the project, and the incentives supporting both the manufacturers and market development.

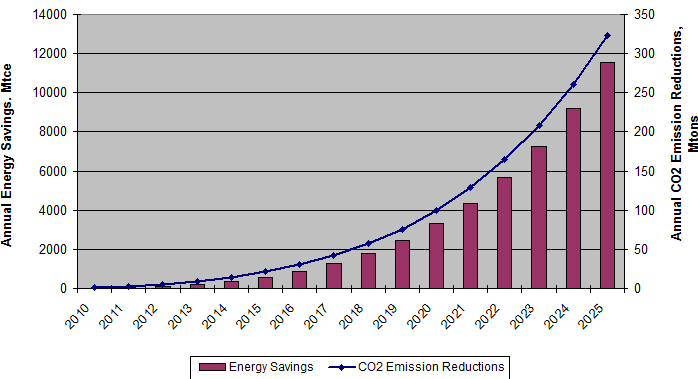
**2.6 Expected Results**

It is expected that the average energy efficiency for all RACs manufactured and sold in China will increase by at least 10% by the end of the project. This is equivalent to raising the EER from 2.67 to 2.94. This target is a performance indicator for both the MTR and the Terminal Evaluation.

The anticipated energy savings and carbon dioxide emissions reductions associated with such a result are shown in Figure 2.3. The Project Document suggests that achieving the 10% goal will result in a cumulative energy savings of 939.5 Mtce by the end of project (EOP), and 35.4 million tons of CO2 over the same period.

Figure 2.3 Estimated Annual Energy Savings and CO2 Emission Reductions Obtained from the

PEERAC project

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A detailed analysis of the project’s goals and indicators – and thus expected energy savings and CO2 emissions reductions from PEERAC – is addressed in Section 3.2 below.

**3. FINDINGS**

**3.1 General Framework**

While the project’s activities and management were organized around the three individual project components, this MTR and report utilizes a broader framework designed to address the key issues associated with PEERAC. There is considerable overlap between the efforts undertaken in the component 1 (ACC) and 2 (RAC) activities, for example, since the ACC units play a key, integral part of the RAC themselves. Similarly, the testing, standards and labeling activities all see considerable interaction. This MTR therefore followed an approach outlined in Figure 3.1, which follows the ‘technology push’ and ‘market pull’ elements of the project design.

Prior to discussing the project’s activities, however, a fundamental task is an understanding of the project’s overall goals and objectives, and the means of determining how the project will be able to determine whether it has met them This Findings section thus begins with a discussion about PEERAC’s goals and indicators.

It then addresses ‘technology push’ measures for both ACC and RAC manufacturers. Most of the PEERAC effort to date has been associated with training and technical assistance tasks, with the ‘market pull’ efforts back-loaded nearer to the project’s end. It is still possible to have significant effects on the market components, however – as the discussion about EE standards and other ‘technology push’ elements makes clear.

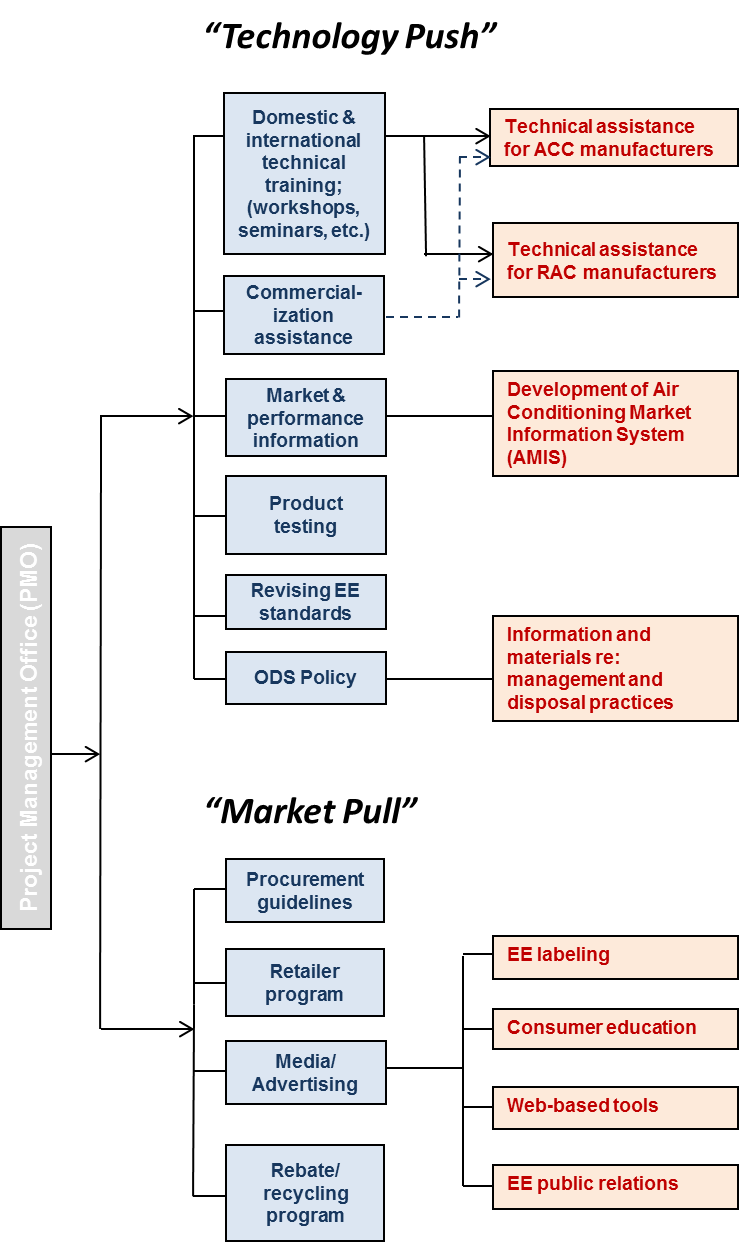
There are still significant ‘technology push’ activities remaining as well, notably in the areas of international training and ozone depleting substances (ODS) activities related to refrigerant management and disposal. Although such tasks have not yet been completed, this section of the MTR discusses important factors which could have implications for accomplishing such tasks, including restrictions on international travel, and an on-going effort within the industry to replace existing refrigerants.

**3.2 Project Goals and Indicators**

The goal and objective of this project were described in the Project Document as follows:

|  |  |  |
| --- | --- | --- |
| **Project Goal**:  Reduction of GHG emissions from room air conditioning in China's residential and commercial sectors | Cumulative CO2 emission reductions from start of project to end-of-project (EOP),  Mtons CO2eq | 35.4 |
| **Project Objective**:  Significantly improved room air conditioner energy efficiency in China. | Average RAC energy efficiency gain by EOP, % | 10 |
| Cumulative energy savings from the use of EE RACs by EOP, Mtce | 939.5 |

Figure 3.1 Overview of the PEERAC Project

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In order to review the project’s progress in achieving these targets in the MTR, it was first necessary to examine the air conditioning market in China; the role that PEERAC plays in improving energy efficiency in that market, and its means of doing so; and to estimate the value and accomplishment of specified indicators resulting from implementation of the project’s activities to date.

**3.2.1 Governmental Policies**

The air conditioning industry in China has undergone considerable growth in recent decades, due to both domestic demand and the development of an export market for its products. The industry surpassed that of the United States in the mid-1990s, and then surpassed Japan as the world’s most important manufacturing base in the late 1990s. As noted above, however, the 2008 survey by CHEAA found that fully 86% of the country’s RAC products fell within the Grade 5 category – and continued domestic growth employing such products would clearly lead to unsustainable energy requirements and environmental impacts.

In order to address this significant energy and environmental problem, the government undertook an aggressive energy efficiency program which incorporated a wide range of policy and implementation measures, including specific energy targets and goals, economic incentives and subsidies, the promotion of advanced technologies, and the development of codes and standards. The 11th Five Year Plan, which covered the period 2006-2010, called for a 20% reduction of energy intensity (per unit of GDP) compared with 2005 levels.

For the ACC and RAC industries, three programs were of particular importance:

* ***Energy Standards***. China had issued RAC standards in 1990 and 2004, but the new focus on EE called for a significant revision, and this was accomplished in 2010. The implementation GB12021.3-2010 led to the complete cessation of the production of inefficient units in the original grades 3, 4, and 5, and the market share of original Grades 1 and 2 RAC increased from 5% to over 70%. As discussed below and in Section 3.3.5, there have been even more changes to energy standards since that time, and these too affect ACC and RAC manufacturers – and thus the PEERAC project;
* ***The Rebate Program***. In May 2009 the government introduced an EE appliance rebate program as part of its economic stimulus package which refunded 13% of the consumer’s price for RAC meeting certain EE requirements. Wealthier provinces and cities were also encouraged to establish funding pools which could be used to encourage the sale of energy efficiency products, including RAC.
* ***Manufacturer Subsidies***. In addition to the consumer rebates, NDRC and the Ministry of Finance provided subsidies to companies whose products reached a defined energy efficiency level, even before the products were sold (at subsidized prices) to consumers. These subsidies ranged from RMB300 to RMB850 for each RAC unit.

These were not the only programs encouraging EE production in ACC and RAC. An even earlier subsidy program for rural household appliances began in 2008; an important “recycling” program encouraged consumers to replace older inefficient AC units with newer, more efficient ones; governmental procurement guidelines were modified; etc., etc.

The results of these programs had a major impact on the industry. NDRC has estimated that the Chinese government provided 11.54 billion RMB promoting high efficiency RAC in 2009 and 2010, resulting in annual electricity savings of 10 TWh, with 80-100 TWh electricity savings over the life of the units. One review suggested that “the magnitude of the increase and effectiveness of the [EE policies] have been rarely seen in the world to date, and the energy efficiency end results are sustainable.”[[12]](#footnote-12) It thus viewed the RAC program as “the first successful example [in China] of industrial and market upgrade achieved through financial incentives.” [[13]](#footnote-13)

**3.2.2 Technological Transformation**

At the same time that these policy shifts were occurring (and in part driven by them), the industry was also undergoing a technological transformation. Traditionally, air conditioners have regulated temperature by using a compressor that is either on (working at full capacity) or off. In recent years, however, advanced units have incorporated adjustable electrical inverters to control the speed of the motor (and thus the compressor and cooling output). Eliminating the stop/start cycles increased the unit’s efficiency, eliminated sharp load fluctuations, cut noise levels and made the units less prone to breakdowns. Such variable frequency units offered a much improved SEER rating because the unit could react to changes in the required cooling load.

China’s RAC industry shift to variable sped units was pushed by the EE standards and market-driven support programs, and is discussed in later sections. This transformation did introduce shifts within PEERAC, however, as the standards and EE indicators employed for such units are different than those of traditional RAC.

PEERAC was thus undertaken at a time of truly dynamic regulatory, market and technological change – and these changes have had an important impact on the project itself, and the attainment of its goals and objectives.

**3.2.3 PEERAC’s Role**

As noted earlier, PEERAC was developed as a follow-up to a successful refrigerator project. That projected ended in 2006, and its terminal evaluation included a recommendation that the RAC industry be addressed in a similar manner. Given the low EE RAC market situation evident in the CHEAA survey, such action was clearly warranted, and development of PEERAC thus took place during 2007 and 2008. It was ultimately approved by GEF in early 2010, and implementation began later that year.

While PEERAC sought to be a driving force for energy efficiency for both ACC and RAC manufacturers through both technology push and market pull activities, realistically it must be acknowledged that the governmental policies and technological changes noted above –occurring at the very same time as the PEERAC activities under review in this MTR – had an effect which essentially swamped such efforts. This makes it very difficult to isolate specific PEERAC contributions in terms of energy efficiency improvements, energy savings, and GHG reductions.

Some of this is due to the very complexity, structure and changing nature of the industry. Gree, a major RAC producer visited during the MTR, has a Research and Development staffing of approximately 5,000 persons – and while PEERAC training and technical assistance for a handful of employees was certainly valuable to the company (as the MTR interviews made clear), the project’s ‘technology push’ contributions to changing Gree’s product line will probably be minimal.

Similarly, the entire PEERAC budget – let alone the funding dedicated to ‘market pull’ activities -- is only a miniscule fraction of the nearly 12 billion RMB stimulus program designed to encourage the adoption of EE appliances in the country.

These concerns do not in any way diminish the value or importance of the PEERAC project. As later sections will discuss, the project has played a valuable role in several ways, including acting as a useful ‘liaison base’ for the air conditioning industry in the development/revision of EE standards; providing data and information for the industry through AMIS; serving as an ‘auditor’ through product testing tasks; connecting China’s domestic ACC and RAC industries with international specialists; etc., etc.

In all of these efforts, PEERAC has primarily served as a ‘catalyst’ for change, guiding the larger (typically government-driven) actions already occurring within the technology and market arenas. This would appear to be the primary value of the project – but one which is exceedingly difficult to quantify in terms of GHG reductions and direct (or even indirect) energy savings.

**3.2.4 Project Indicators**

While the MTR recognized these quantification difficulties, they were compounded by project-specific efforts to quantify the impacts of PEERAC activities.

***Energy Efficiency Gains***

The project seeks a 10% improvement in the energy efficiency of RACS by the end of project (EOP), as stated above. With a base year EER of 2.67, it was assumed that this would be equivalent to raising the EER from 2.67 to 2.94. With the technological transformation noted above, however, the EER indicator typically associated with constant speed units is no longer a useful performance indicator. Variable speed units have more typically employed seasonal energy efficiency ratios (SEER), and even this measure has now been replaced by the Annual Performance Factor (APF) in the new June 2013 RAC EE standards. APF will be able to account for energy use in the RAC units during winter in the middle and southern regions of China.

As noted earlier, the project document was prepared over an extended period, and the baseline determination for the project originally employed 2007 data for baseline information. During the product testing activities, CHEARI requested 2007 models to confirm baseline information – but was told that these were completely obsolete, and not available. The 2.67 baseline EER is identified in the Project Document as 2009 data (p. 97), and this was then used as the 2010 start-of-project basis for energy savings and carbon calculations.

It was then assumed that a 10% EE improvement would occur in a step function of 2% increments over the five year life of the project. Realistically, the early years of PEERAC – which include technical training, technical assistance, etc. – are not likely to produce any energy savings at all. Such savings should certainly occur – but these will only become evident in later stages, as the ACC and RAC companies make technological improvements and ‘market pull’ promotional tasks begins to take effect.

Despite these concerns, it is apparent that significant EE changes occurred in the early years of the PEERAC project. The PMO presented data suggesting that the 2011 constant frequency RAC EER was 3.29, an increase of 17.5% over a 2.80 baseline; while the 2011 variable frequency RAC SEER was 4.19，a 25.1% over a 3.35 baseline. Such data suggest that the EOP project goal has already been exceeded by the second year of the project.

Indeed, given the higher baselines employed in these calculations, it would appear that the project significantly exceed its goals – and it may be, given uncertainty in a number of indicator issues, that the ACC and RAC industry might have exceeded that project goal before the project even started.

The dramatic transformation of ACC and RAC performance in these early years of PEERAC were almost certainly not a result of the project, however, but rather to the tremendous governmental policy efforts and technological transformation noted earlier.

PMO has recognized that fact, and its contracts with the ACC and RAC manufacturers called for a much more significant improvement – 25%, rather than 10% (albeit over their 2007 baseline).

Thus PEERAC appears to be playing the important roles noted earlier, and has taken steps to ensure that it provides a “technology push” –but it has proven exceedingly difficult to quantify these project benefits in efficiency improvement terms in this MTR, and will likely face similar concerns in the terminal evaluation.

***Energy Savings and GHG Reductions***

The quantification difficulties noted above suggest that MTR comparisons with stated project indicators might be of limited value, and such concerns seem even more problematic when the project’s efforts to document such savings and reductions are addressed. The energy and CO2 calculations assume that PEERAC will see an increased EER over the five year project period (i.e., from EER 2.67 to EER 2.94), and that there will be both direct (i.e., improved EE units purchased because of PEERAC activities) and indirect (i.e., industry improvement) energy savings and emissions reductions. The calculations assume that RAC units have a 12 year lifetime, but savings and reductions only occur over a ten year ‘period of influence’ after the project ends.

The MTR team was not able to verify the estimations or interim accomplishments, however, and a preliminary evaluation of correspondence concerning interim estimates was similarly not able to resolve the issue during this limited MTR period. For example, the Project Document identifies RAC energy consumption with the commercial and residential energy sector as being 4,557.2 Mtce/year in 2010 (p. 18) – but this figure is considerably above the energy consumption of the whole country during that same year (i.e., 3,250 Mtce). Similarly, since carbon in fuel is oxidized, CO2 emissions reduction quantities are usually considerably higher than the corresponding fuel savings --but EOP emissions reductions in PEERAC’s goal are only a small fraction of the EOP energy savings identified in the project’s objective.

Despite the difficulty of assigning EE savings and carbon reductions to PEERAC, and the project’s more-important ‘catalytic’ role, the PMO and UNDP Technical Advisors should nonetheless attempt to resolve this indicator issue, and continue to utilize project indicators to the extent possible.

**3.3 ‘Technology Push’ Tasks**

3.3.1 Technical Training and Assistance

ACC Technical Training and Assistance

The air conditioner compressor (ACC) is the most important component of an RAC, and for a long time China’s ACC manufacturing technology lagged behind advanced international levels. The first project component aimed to increase the design capability of ACC manufacturers to design such energy efficient (EE) ACC models; to help RAC manufactures adopt these EE ACCs; and to promote EE ACC within the marketplace. An information system (AMIS, discussed below) and testing centers were established as important tools to help measure the energy efficiency improvement of ACC models.

On 12 July 2012, MEP/FECO advertised the bidding for ACC training tasks, and on 8 August 2012, the China Household Electrical Appliances Association (CHEAA) submitted their bid, one of three received. CHEAA, founded in December 1988, is a national, non-profit, self-regulating industry organization consisting of major manufacturers, retailers and research institutions in the Chinese appliance industry, with more than 350 members. After a re-bidding process (due to ownership concerns with one bidder), MEP/FECO awarded the contract to CHEAA. An agreement between the parties was signed on 19 November 2012.

After winning the bid, CHEAA conducted a survey of the 10 ACC manufacturers in March 2013 to determine and evaluate the current level of capacity of the domestic ACC industry to design and manufacture energy efficient ACCs. The results of the assessment were used in designing a training program for improving the knowledge and skills of the industry in the manufacture of EE ACCs, as well as in the provision of technical assistance. The question sheets employed in this survey are shown in Figure 3.2.

Through the survey, the manufacture designers noted a series of topics they are eager to address, including: 1) measures to reduce the loss of cooling capacity (Discharge); 2) measures to improve the efficiency of motors; 3) loss of energy; 4) application; 5) noise; 6) methodologies for improving energy efficiency; 7) manufacturing and processes; 8) the latest developments on compressor technology in the world, reference measures, benchmarks, etc.

Based upon these needs, CHEAA selected six trainers from different countries, including: three experts from the United State; two experts from Japan; and two domestic experts from well-known universities within China. In order to guarantee the quality of translation, an established translator as well as a professional technical expert from within China acted as translators within the training sessions.

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| Figure 3.2 Survey sheet of ACC manufactures | |

CHERA’s first training course lasted for five days, from May. 27 to 31, 2013, and was held in Beijing.. The training course schedule is included in Annex F. Training materials were developed by the invited experts, and are shown in Figure 3.3. Persons from all ten ACC manufacturers participated in the training, with a participation rate of 100%. Fifty-five (55) persons were trained, which included 28

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| Figure 3.3 ACC training materials |

persons from the 10 ACC manufacturers. There were seven female trainees, representing approximately 25% of the ACC representatives.

Certificates were issued to the trainees, and a post-training survey was conducted by CHEAA for the ACC manufacturing participants. The evaluation indicated that 17 thought the training to be “very good” while 11 considered it “good.” These 100% rankings for ‘very good/good’ were above the 75% included as a project target. Suggestions for the second training course content included additional instruction on the motor; noise and reliability testing; and other topics.

A second round of ACC instruction is scheduled for December, 2013, to be held in Beijing as well.

An ACC international training course and study tours to international compressor design facilities was originally scheduled for PEERAC’s second year of implementation. In this international training task, trainees will receive technical training and exposure to advanced compressor technologies, as well as in the design and manufacture of energy efficient compressors. However, at the present time, this international training program is still under preparation. A significant reason for the delay is the recent issuance of regulations by the Chinese government concerning overseas travel. The proposed oversea trip as originally designed in the PEERAC project could not be approved by Ministry of Environmental Protection, and was therefore postponed.

The PMO has preliminarily selected and made contact with University of Maryland as the potential international technical training agency, based upon success in the previous refrigeration project. The PMO has scheduled a visit to the University in August, 2013, and a plan and schedule for the international ACC training activities will be determined at that time. It should be noted, however, that approval for the August trip had not yet been granted at the time of the MTR.

In addition to these domestic and international training efforts, on-site technical assistance (TA) was conducted from May 31 to June 3, 2013, at two ACC companies -- Guangdong Meizhi and Zhuhai Landa. This one-site assistance was provided by one expert from the United States and one domestic expert, both of whom had received high ratings in the previous training sessions. This team assisted the manufacturers in the application of new energy efficient design of ACCs. Moreover, they held discussions with company management as well as production and engineering specialists, and provided technical advice concerning: 1) proposed designs for setting up new -- or modifying existing -- production lines for the manufacturing of EE ACCs; 2) ideas for manufacturers about the design of EE ACCs; 3) technical requirements in the application of proven technologies for improving the COP of ACCs; 4) adopting manufacturing processes to comply with set EE standards for RACs; and, 5) research and development on the design of EE ACCs. The on-site technical assistance included lectures, question-and-answer sessions, as well as visits, commentary and suggestions about the production line and manufacturing processes. At Zhuhai Landa’s facility, the discussions primarily focused on vibration and noise, lubricant circulation, design optimization of components, testing, motor torque, and lubricants and refrigerants. At the Guangdong Meizhi plant, the focus addressed vibration and noise, EE improvements in compressors running at low frequency, reliability evaluations, Annual Performance Factor (APF) for inverter compressors, compressor materials, compressor technology development, and the application of simulation methodologies for compressor design.

Approximately 130 participants from the two manufacturers were involved in the on-site TA program. This effort was considered highly effective and beneficial by the manufacturers, and participants were so enthusiastic at the Landa factory that the course ran well beyond the scheduled time, lasting an additional two hours until 7 pm.

During the MTR’s visit to the Zhuhai Landa ACC manufacturing facility, the team had an opportunity to query participants about the on-site TA – and it was clearly warmly welcomed, and received high praise. Almost all trainees from the two manufacturers were satisfied with the two technical experts employed. Due to the extended time of discussions, the Landa organizer forgot to perform the evaluation survey after the on-site TA was conducted. However, anecdotal experience with participants suggests that the satisfactory rate would easily meet the 75% target requirement.

According to the project plan, another four on-site TAs will be conducted over the remaining period of the project.

RAC Technical Training and Assistance

Technical training and assistance for RAC as well as ACC manufacturers are important elements of “technology push” aspects of PEERAC, contributing to the upgrade of overall RAC energy efficiency. A similar series of RAC technical activities including RAC in-country training (output 2.2), intensive RAC design training (output 2.3) and RAC technical assistance (output 2.4) were planned and implemented together to ensure good connection and synergy among them.

In parallel with procurement of ACC technical consulting services, RAC technical consulting services were procured through competitive bidding. A detailed and comprehensiveimplementation plan for RAC technical training and assistance was developed jointly by CHEARI and FECO. At the planning stage, an RAC operational team was established within CHEARI to design and organize RAC technical training and assistance activities.

In order to ensure the training could meet the most necessary technical assistance, CHEARI conducted a capacity needs assessment of local RAC manufacturers, and wrote a report on this topic outlining the investigation methodology, scope, findings and conclusions. The investigation methods included interviews with manufacturers in meetings and through questionnaires, and also a review of key technical documents about the RAC industry in China (including “Suggestions on the 12th FYP for the Chinese household electrical appliance industry”, published in 2011; and “Technical roadmap of the Chinese household electrical appliance industry”). The questionnaires included questions about key technologies and technical difficulties associated with future development of the air conditioning industry, and were disseminated to 16 RAC manufacturers. Feedback was analyzed by the CHEARI team. Based upon these efforts, the principal requirements for technical training were identified as follows:

* Air conditioning system design optimization and simulation;
* Efficient design and simulation technology of the air conditioning system components;
* Air-conditioner inverter technology and design;
* New refrigerant research both at home and abroad, including the application of energy saving measures and testing procedures;
* Air conditioning duct design and noise control; etc.

Based on capacity needs of RAC manufacturers, a training expert base was formed, including ten national experts and five international experts. The training experts covered a range of expertise in the field of RAC technology, including Andrew Gigiel from the Refrigerant Center of University of Bristol in the UK; Reinhard Radermacher from the Environment Energy Engineering Center at the University of Maryland in the USA; Mr. Saiakiral from Japan; and local experts from Tsinghua University, Shanghai Jiaotong University, Huazhong University of Science and Technology, etc.

The first training workshop was held on March 28 through April 2, 2013 in Beijing, and the program training schedule is outlined in Annex F. Thirteen enterprises participated in the training, sending 21 engineers. Twelve other engineers (from other home appliance enterprises, as well as CHEARI and CHEAA) also attended, bringing the total number of trainees to 33. Experts for the first training came from UK, USA, Japan and local universities and industry associations.

During the training sessions the experts presented technical material, allowing full question-and-answer opportunities for trainees. This provided for interactions between experts and trainees – all of whom were technical personnel engaged in the R & D of new air conditioner products. These participants usually have prior academic experience in refrigeration specialties, and also have hands-on practical experience. An evaluation survey of the training program indicated that 100% of the trainees found the workshop sessions "very satisfactory" (52%) or "satisfactory" (48%).

A second training workshop is planned for August 12 through 16, 2013 in Beijing. Application forms were sent to participating air conditioner enterprises, and at the time of the MTR the CHEARI team had already received feedback from enterprises. The lecture experts have been identified, presentation topics determined, and the lecture experts have confirmed acceptance of both the training invitation and topics to be addressed. Preparatory work for the workshop, including the development of training materials, was thus underway.

In late August 2013, CHEARI in conjunction with the PMO will send a delegation to the CEEE (Center of Environmental Energy Engineering) at the University of Maryland in the U.S. to undertake preparatory work and evaluations for the ‘intensive training’ RAC tasks still remaining in the project.

3.3.2 Commercialization Assistance

To facilitate commercialization of EE RAC products, a manufacturer incentive program targeting ACC and RAC manufacturers was begun under PEERAC in 2011. At the beginning, 10 mainstream ACC manufacturers in China participated in the project and developed their own PEERAC project implementation plans. Under the incentive program, participation manufacturers well fulfilled their important roles in developing and commercializing EE products, reaching the following major accomplishments: 1) development of new EE ACC products; 2) enhancement of ACC efficiency; and 3) delivery of counterpart funding from private sector.

Progress of the manufacturer incentive program is strongly backed up by a series of events organized by PMO, including:

* "Green Energy-Conservation Pioneer" awards. On 14th June 2012, 10 ACC manufacturers were awarded the honorary title of "Green Energy-Conservation Pioneer" jointly by UNDP and FECO. The awards highly motivated manufacturers;
* Project Enterprises’ Symposium. On 14th June 2012, manufacturers were invited to a project enterprises’ symposium to communicate on project progress. During the meeting, representatives from 10 ACC manufacturers reported their implementation progress. Manufacturers stated their ambition to further invest in EE products development and advocacy, and expressed their confidence in achieving or outperforming the project goal of enhancing energy efficiency by 10%;
* Establishment of regular reporting mechanism. In order to monitor the implementation progress of manufacturers and to obtain qualified statistics for evaluation, a set of guidelines for the ACC Corporate Annual Project Implementation Report was developed and finalized after consultation with experts. Manufacturers are required to submit implementation reports according to the guidelines every year. Implementation reports for 2012 were submitted by the 10 ACC manufacturers in January 2013.

The project’s PMO has signed contracts with ten ACC manufacturers, representing a 95% market share, through the period of this MTR– a figure well above the 75% targeted in the project’s development, and a very positive indicator of PMO diligence and effort. According to their contracts, ACC manufacturers must develop energy efficient ACC models, submit them to the testing centres, and also provide data concerning their EE to the information system. ACC manufacturers will both implement general design improvements in order to increase average RAC efficiency (10% by EOP), and will develop at least one new high efficiency (15% over baseline COP) models (or series of models) to submit for competitive incentive funding to the PMO. The manufacturers will receive GEF funding at the end of the project if these contract requirements are met.

The aim of PEERAC is to increase the Average AC compressor efficiency (COP) by EOP to 2.94 by the end of this five year project. The MTR team found that as a result of strong government subsidy policy on EE RAC and the help of this project, China’s energy efficiency of ACC increased dramatically. Constant speed ACC’s COP has reached 3.10 by 2012, variable speed ACC’s COP has reached 3.54, which both exceeded the original EE target.

The energy efficiency level of constant speed ACC products in China tended to increase slowly, and the domestic sales weight average of COP for constant speed ACC products was in the 3.00 to 3.10 range (Figure 3.4). With the growth of variable speed RAC industry, the energy efficiency level of variable speed ACC products in China increased significantly (Figure 3.5). This increase is caused by the increasing demand of energy efficient ACC driven by governmental policies. The first round of the EE RAC subsidy policy ended on May 31, 2011, and the energy efficiency of ACC therefore decreased somewhat due to the decrease of market share of the more efficient models. On June 1st, 2012, a second round of EE RAC subsidy policies began, and the ACC efficiency continued to improve. This second round of subsidy policy ended on May 31, 2013 for most electric appliances.

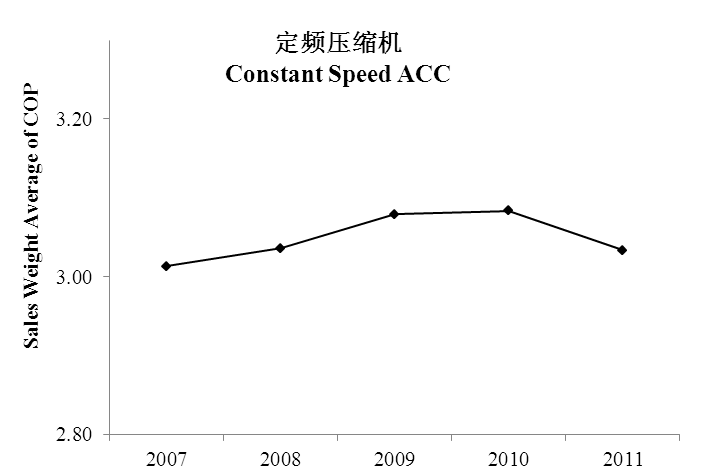


Fig 3.4 COP of constant speed ACC

Figure 3.5 COP of variable speed ACC

The domestic sales of constant speed ACC were primarily distributed in the 3.0 ~ 3.2 range, which counts for approximately 60% of the total amount (see Figure 3.6). The domestic sales of variable speed ACC mainly distributed at the range of 3.8~4.0, which counts for approximately 25% of the total amount (see Figure 3.7).

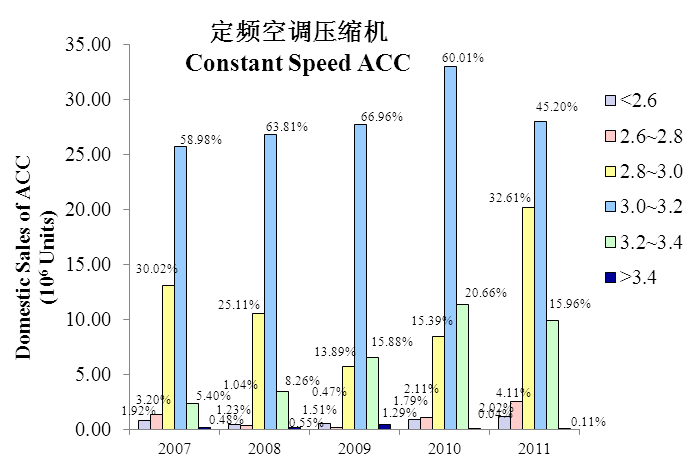


Figure 3.6 Domestic Sales Distributions of ACC Products on COP

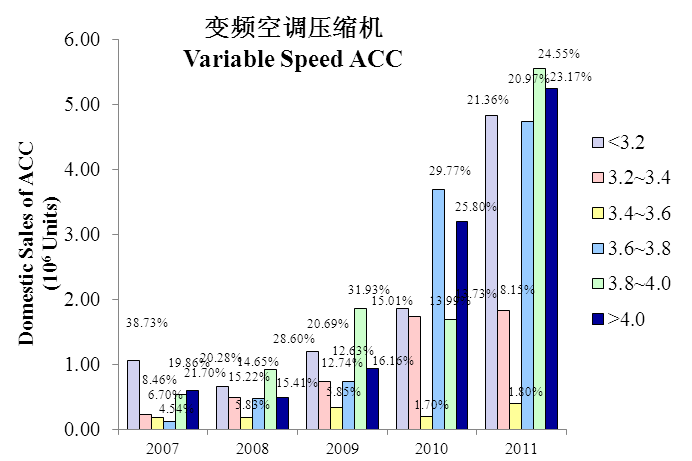


Figure 3.7 Domestic Sales Distributions of ACC Products on COP

The product commercialization activities in PEERAC will be undertaken in the remaining years of the project. In 2011, the market share of constant speed EE ACC was at 63.7%, and the market share of variable speed EE ACC reached 26.2%. These indicators are already much higher than the 15% target for EE ACC market share included in the Project Document.

**Commercialization of EE RAC products**

Under PEERAC, RAC manufacturers will complete commercialization of new energy efficient models. Because risk adversity and market insecurity inhibit EE product commercialization, the project will provide air conditioner manufacturers with incremental cost funding support via a manufacturer incentive program. RAC manufacturers will develop new energy efficient designs which will then be submitted to the project as competitive bids for receipt of incentive funding on a competitive, least-cost, and tiered basis to award recipients, with awards issued to the most energy efficient products and greatest energy savings delivered. In addition to competitive incentive funding, participating manufacturers that fulfil project requirements will also receive basic award funding in order to help cover their fixed costs of participating in the project and meeting project requirements such as the 10% average EE increase across their product lines.

These commercialization-related activities will begin in Year 4. At present, 15 RAC enterprises will participate in the energy efficiency RAC commercialization because one small one manufacturer (Wentu) went into bankruptcy.

An industry dialog between ACC manufacturers and RAC manufacturers is designed to remove the barrier of the adoption of new energy efficient ACC by RAC manufactures. This task was contracted to CHEAA, and according to the project work plan, this activity will take place in Year 3 of the project. CHEAA has planned to organize this industry dialog in December of 2013. Participants indicated in MTR interviews that the liaison functions between industries was one of the most valuable attributes of PEERAC, and very much encouraged future efforts in this area.

3.3.3 Market and Performance Information

The Air-conditioning Market Information System (AMIS) aims at gathering, analysing and storing ACC and RAC market and energy performance information during the project period. The contract for AMIS was awarded to CHEAA in January 2012, after a November 2011 bidding process. The AMIS process began in February 2012, after the signing of the contract, and is scheduled to run from 2012 through 2016.

An internal meeting was held in February 2012 within the working group of the information centre to analyse the parameters and their interactions of the RAC energy efficiency; to define the classification of the products and analysed relevant data that reflect the effect of energy conservation for the project activities; and to address the confidentiality and data sensitivity of necessary information for the energy efficiency evaluation tasks. An information survey on energy efficiency of the project products was established that same month, and the following June the work group communicated with project participants and reached consensus on the selected data with project participants. Since July 2012, CHEAA has collected information from ACC manufactures, including information on compressor production, sales, efficiency levels, and other technical data (see Figure 3.8). From August through October 2012, CHEAA verified the product information data, and then conducted analyses in November and December, and prepared the annual AMIS report. The work plan for 2013 is similar, and the AMIS work is now a routine, day-to-day task carried out at CHEAA.



Figure 3.8 Information survey sheet of ACC manufactures

The ten ACC manufactures provided information about 4,403 ACC models to AMIS, increasing every year (see Table 3.1). The total output of these 4,403 models at the ten ACC manufactures was 337 million units over the five year period.

Table 3.1 Summary of data collected by AMIS on ACC

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2007 | 2008 | 2009 | 2010 | 2011 | 2012  (in progress) |
| Number of ACC Manufacturers | 10 | 10 | 10 | 10 | 10 | 5 |
| Number of ACC Models | 587 | 641 | 749 | 876 | 1009 | 541 |

According to the information collected by AMIS, the domestic sales of the ACC companies continued to increase from 2007 to 2011. With the rapid recovery of the ACC industry from the financial crisis, the growth rate of domestic sales of ACC products was approximately 18.4% in 2010. The share of variable speed ACC products increased significantly during this period. The proportion of variable speed ACC on domestic sales in 2007 is approximately 2.77%, but increased to 22.62% in 2011 (see Figure 3.9).

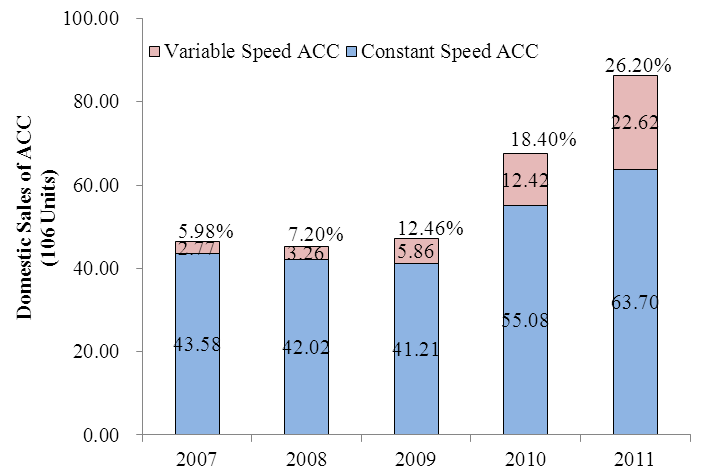


Figure 3.9 sales and market share of ACC Products

AMIS provided the information of energy efficiency improvement and the change of market share of ACC models shown previously in Figures 3.4 through 3.7. According to AMIS data, the average efficiency of ACCs for constant frequency RACs (sales-weighted average COP) in 2011 was 3.03, an increase of 13% over the project baseline (COP=2.67). The average efficiency of ACCs for variable frequency RACs (sales-weighted average COP) in 2011 was 3.71, an increase of 4.80% over the 2007 level (COP=3.54).

AMIS is thus employed to support monitoring and evaluation project activities, to help quantify project results, and for other project activities which require such data as well (e.g., standards and labelling activities).

According to the feedback from ACC manufacturers, some companies would like to receive additional information from the AMIS system. Thus, AMIS is wrestling with the issue of how it might provide further information about the ACC industry (to further encourage technology innovation and show the industry’s technology improvement), but at the same time keep enterprise data confidential data.

In addition to the data from ACC manufacturers, relevant statistics from the 15 participating RAC manufacturers were collected, analyzed and verified.

According to the 2012 AMIS Operational Report, the average efficiency (sales-weighted average EER) of constant frequency RACs in 2011 was 3.29, an increase of 23% over than project baseline (EER=2.67) ; average efficiency(sales-weighted average SEER) of inverter RACs in 2011 was 4.19, increased by 25.1% than 2007 level (SEER=3.35)[[14]](#footnote-14).

3.3.4 Product Testing

The effectiveness of the project interventions on improving the energy efficiency of ACCs as well as the ACC manufacturer performance were verified through product testing. The provision of ACC product samples for testing was required for participation in the project. Test results will be used to monitor and evaluate project activities, quantify project results, and to provide support for other project activities which require test data (e.g., energy efficient ACC and RAC design).

The National Household Electric Appliance Quality Supervision Testing Center (NHEAQSTC) at CHEARI developed a project team (including a project manager, deputy project manager, and five technical experts) in November. 2011, and then submitted their bid later that same month. After winning the competitive tender, CHEARI signed a contract for the project testing tasks on January 18, 2012, and submitted the Testing & Advisory Service Project Implementation Plan to the PMO the following month (on February 6, 2012).

Twenty three (23) technical staff from CHEARI participated in ACC testing activities. The principal self-contained test facilities include: two sets of ACC calorimeters; one set of Gas Chromatograph Mass Spectrometer (GC-MS) for analysing the contents of the refrigerants; one set of ACC life-cycle testing device; and other related equipment. CHEARI has the testing capabilities for both performance and safety testing of ACC for national standards, including: GB/T 15765-2006 Hermetic motor-compressors for room air conditioners; GB/T 18429-2001 Hermetic scroll refrigerant compressors; GB/T 10079-2001 Single-stage reciprocating refrigerant compressors; GB 4706.17-2010 Household and similar electrical appliances – Safety: Particular requirements for motor-compressors; and numerous other standards.

In the Project’s work plan and bidding documents, no less than 150 types of ACC must be tested during the project. Further, there are numerous types of ACC units being tested, including those ten products developed as part of the intensive training results related to the manufacturers.

CHEARI has completed the first year’s baseline testing, and 50 types of ACC were tested in 2012. In the second & third sections, CHEARI will test 50 types of ACCs, including specialized design of ACC models with high COP for the first level of RAC energy savings, as well as comparison products’ testing on the effects of ACC incentive prizes. In the fourth and final section, at least 100 types of RAC and 50 types of ACC will be tested for the purpose of evaluation on the project implementation and outcome. . The testing work of the second through fourth sections will be done in year 4 and year 5 of the PEERAC Project.

The baseline testing was conducted from June to October, 2012. Fifty types of ACC were included, and the testing/analysis report was completed.

Designated 2007 test samples were specified in the project document, but the project testing was actually implemented in 2012. Manufacturers participating in the project argued that the products made in 2007 were obsolete, and they were not able to provide the test samples for baseline testing. Moreover, ACC manufacturers’ products are normally tested by the delivery contract requirements instead of the testing methods required in the national standard. The difference between the working conditions and the standards would lead to different testing results, and the results would therefore be incomparable. The testing center worked with the ACC manufacturers and other ACC experts to resolve these problems, and developed a new set of principles to test the baseline.

A comparison of EER testing was conducted between the project testing center and five manufacturers’ labs. Figure 3.10 shows the comparison of the COP testing results related to constant-speed ACC. These results show that ACC manufactures have their own capabilities for testing products precisely and in a satisfactory manner.

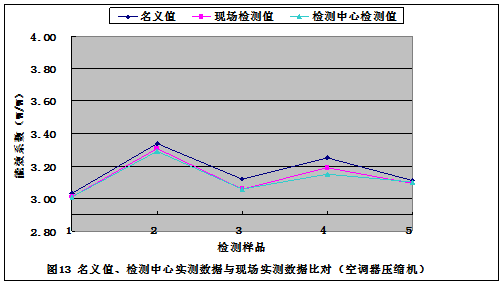


Figure 3.10 COP testing for constant-speed ACC

The testing center similarly verified the nominal COP and tested COP data for ACC products. For selected high efficient constant speed ACC models, the bias between nominal COP and tested COP is 1.3%. For selected high efficient variable speed ACC models, the bias between nominal COP and tested COP is 1.5%. For selected average COP constant speed ACC models, the bias between nominal COP and tested COP is 0.7%. For selected average COP variable speed ACC models, the bias between nominal COP and tested COP is 1.1%. (For graphical presentation of these results, please see Annex H).

The CHEARI testing center also compared information collected by AMIS and with that obtained by testing. For constant speed ACC models, the average deviation between reported data and measured results was 2.7%, while for variable speed ACC models, the average deviation was 2.9% (also shown in Annex H).

Through these findings, PEERAC has determined that: 1) the manufacturing enterprises have sound product testing capabilities, and their product efficiency data has sound credibility; 2) the deviation between the enterprise nominal COP and the PEERAC measured results is quite small; and; 3) nearly every manufacturer measures the compressors’ COP under their own contracted working conditions with RAC manufactures, which are not the nominal working condition required by the National Standard. Therefore, measured results are not exactly comparable between different models. In PEERAC, the baseline COP value of the ACC is measured using its actual working conditions (required by the manufacturer’s contract), and similar working conditions must be used in the future to evaluate the energy efficiency improvements -- and thus the project’s final result.

***RAC product testing***

In 2012, the first round of EE RAC product testing was conducted together with the ACC product testing. One hundred RAC models from 14 RAC manufacturers were selected and tested in total. Product testing experts visited the factories of the 14 RAC manufacturers to conduct on-site testing. In addition, 12 RAC models were tested at the NHEAQSTC lab to verify the manufacturers’ reported data

According to NHEAQSTC‘s 2012 Annual Summary Report: 1) comparisons between the of testing results from NHEAQSTC lab and manufacturers’ labs demonstrates sufficient testing ability of participating manufacturers and the credibility of their tested data; and 2) with small deviations, the data reported by the RAC manufacturers to AMIS is basically in line with the measured data (see Figures H8.7 through H8.10 in Annex H).

**3.3.5 Revising EE Standards**

China’s energy standards are administrated by the China Standardization Commission. Within the country, there are four classifications: 1) national standards; 2) industrial (or sectoral) standards; 3) regional standards; and 4) enterprise standards. National standards are standards issued by the China Standardization Commission, and must be complied with by all enterprises within the country. Industrial (or sectoral) standards are issued by the Ministry of Industry or by industrial associations. Regional standards are issued by local governments (e.g., by the government of Shandong Province). Enterprise standards are designed and utilized by an enterprise itself, often for transaction purposes. Regional, industrial and enterprise standards are usually more stringent than national standards.

Further, standards within the country can be classified as compulsory or voluntary. Energy efficiency standards usually belong to the compulsory standard category. Energy standards are often employed as a means of stopping the production and/or use of low energy efficient appliances, industrial production process and buildings. It thus acts as a useful tool for promoting technological advancement, especially in promoting energy efficiency within the RAC and ACC industry.

PEERAC is designed to support the development and improvement of China’s minimum energy efficiency standard for both ACC and RACs. The standard development subcontract was awarded to the China National Institute of Standardization (CNIS). The new standard for variable frequency RAC was issued on June 9th, 2013, an accelerated pace brought about by a strong push from Chinese government. As a compulsory standard, all manufactures in China must comply with the new standard.

There were many formal and informal discussions organized during this revision procedure. During the development of the standard, many manufactures attended the CNIS workshops and provided recommendations to standard developers. As a result, new ideas were included in the design of the new standard of variable frequency RAC. For example, the influence of heat generation, consumer habits, and weather zones were all included in the new standard. Figure 3.11 shows the RAC operational hours by Chinese consumers under different environmental temperatures, indicating use of the RAC in winter. A new energy efficiency indicator, the Annual Performance Factor (APF), was introduced as a substitute for the old indicator, SEER. Experts from both the United States and Japan were complimentary about China’s new standard, and indicated they would explore revising their own standards based upon China’s experience.

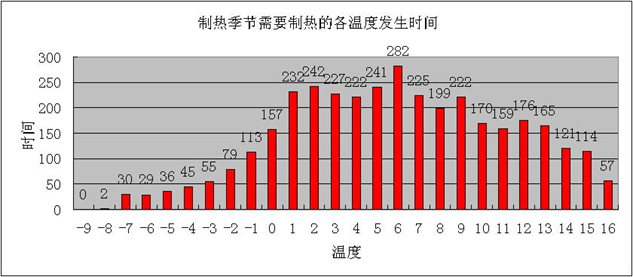


Figure 3.11 Operational hours of RAC by Chinese consumers under different environmental

temperatures

Correspondingly, energy labeling of variable frequency RAC is required to change. The Chinese government wants energy labeling changed within the June 9 to October 1, 2013 time period, which is a very short time. Manufacturers, labs, testing centers, and retail establishments must get ready to adapt to the new standard and labeling within the 3 month period.

Originally, the revision of the variable frequency RAC standard was scheduled to be completed at the end of 2014. However, those revisions were finished and officially published on June 9, 2013 – a full year and a half ahead of the original time schedule (see Figure 3.12).

The energy efficiency standard for constant frequency RAC was revised in the year 2010, and remains unchanged since then. Because the market for constant frequency RAC is shrinking, it is unnecessary to revise it.

CNIS has been conducting research to revise the ACC standard since earlier this year. According to PEERAC’s schedule, this work will be finished before the end of 2014.

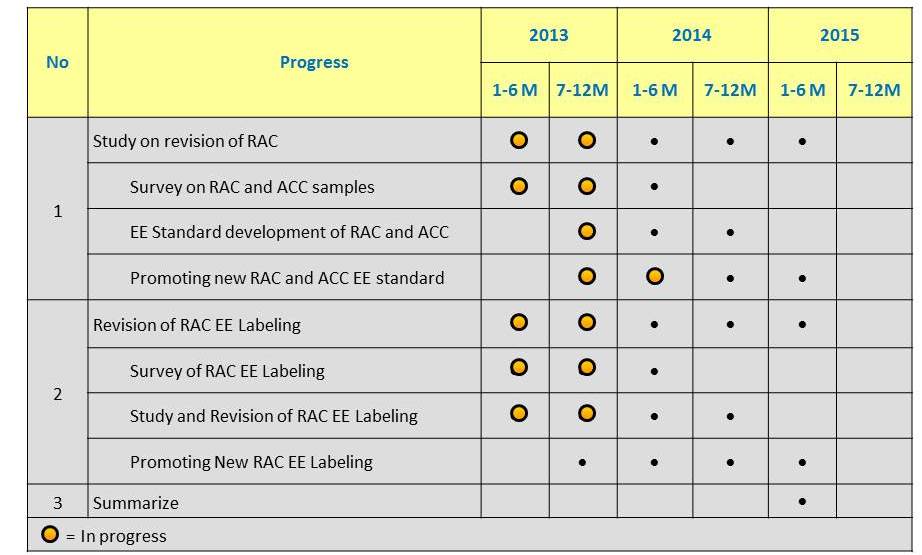


Figure 3.12 Schedule of EE standards and labeling in PEERAC Project

**3.3.6 ODS Policy and Information Materials**

PEERAC Is designed to tackle the significant energy demand associated with air conditioning (as shown previously in Figure 2.1), and its goal is the reduction of GHG emissions from RAC in China’s residential and commercial sectors. Accompanying that increase in energy demand is a concomitant increase in the use of refrigerants employed in the RAC – as well as potential GHG effects associated with their production, management and disposal.

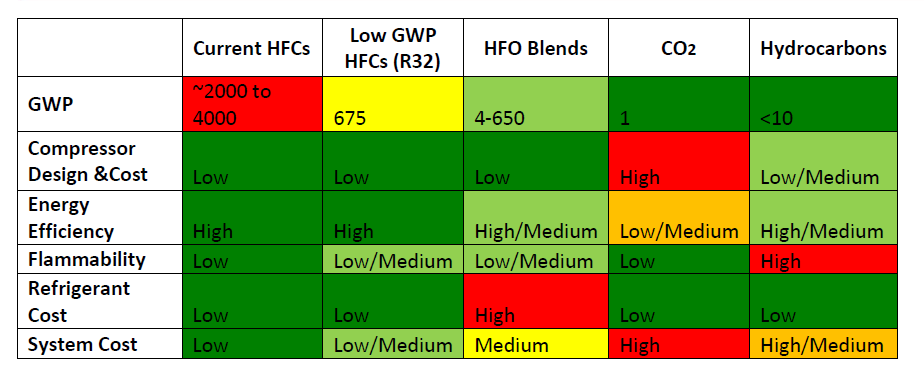
The change in refrigerants over recent decades has been driven primarily by environmental concerns of two types – ozone depletion in the stratosphere, and the global warming potential of alternatives. The Montreal Protocol in 1987 set in place a process which led to the replacement of then-dominant chlorofluorocarbons (CFCs) with hydrochlorofluorocarbons (HCFCs), which are themselves being phased out because they have both ozone and GHG impacts. The current replacement hydrofluorocarbons (HFCs) do not harm the ozone layer (i.e., they do not contain chlorine), but they do pose a GHG problem, which could become quite significant.

PEERAC has an interest in refrigerants in a couple of ways:

* The project has **several ODS activities** (2.9.1, 2.9.2 and 3.8.4) addressing refrigerant management and disposal for old RACs, including the formulation of policy recommendations in this area, advocacy and lobbying activities, and information and educational campaigns for ACC and RAC manufacturers, refrigerant traders and suppliers, central and local government authorities, and other interested stakeholders; and
* The **technological transformation** of ACCs and RACs – and their future energy efficiency - will be affected by the change in refrigerants. As suggested above, there is an international effort currently underway to shift away from HFCs in RACs, because of their relatively high Global Warming Potential (GWP). Most alternatives suffer from some undesirable characteristics (e.g., greater flammability, toxicity, etc.), however, and Table 3.2 shows the status of a number of potential refrigerants. Importantly for PEERAC, ‘energy efficiency’ is one of the key characteristics which has to be addressed in selecting alternatives, and the EE of alternative refrigerants varies.

China has already begun to act on this latter issue, and in its HCFC Phaseout Management Plan (HPMP) developed under the Montreal Protocol it agreed to convert at least 18 manufacturing lines for the production of room air-conditioning equipment to the hydrocarbon R-290.[[15]](#footnote-15) Efforts underway at both Gree and Zhuhai Landa were evident in the MTR visits. This factor could have important implications for the ACC and RAC manufacturers in future years.

Table 3.2 Status of alternative refrigerants[[16]](#footnote-16)

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Further, under an April 2013 agreement, the Montreal Protocol’s Multilateral Fund will assist the country with US$ 385 million of funding for the phase out of China’s HCFC production. As part of this agreement, China agreed to “...coordinate with stakeholders and make best efforts to manage HCFC production and associated by-product production in HCFC plants in accordance with best practices to minimize associated climate impacts.”[[17]](#footnote-17)

PEERAC ACC and RAC participants have no direct responsibility for Montreal Protocol or Kyoto Protocol actions of their government, nor the emissions of the country’s refrigerant producers. However, the refrigerants employed by ACC and RAC manufacturers clearly have significant environmental consequences, and are likely to play an increasing role in future technological development within the industry.

**3.4 ‘Market Pull’ Tasks**

Energy efficient RACs will be promoted in the third (i.e., ‘market pull’) component through a variety of coordinated and complementary measures, including procurement promotion, retail promotion, national energy efficiency label enhancement, consumer education, web-based information dissemination and promotion, public relations, and policy promotion.

**3.4.1 Procurement Guidelines**

According to the schedule, a procurement guide for energy efficient RACs will be developed and distributed to 100+ organizations from year 2013 to the end of year 2014. Detailed work includes: 1) a review of typical corporate RAC procurement procedures; 2) formulation of a RAC procurement guidelines; 3) promotion of the application of the RAC procurement guidelines; and 4) an effectiveness evaluation of the guidelines. These activities had not yet begun at the time of the MTR, and will be carried over the next two and half years.

**3.4.2 Retailer Program**

According to the PEERAC schedule, a RAC Retailer Program will be designed from year 2013 to the end of year 2015. Informational and promotional materials will be distributed to at least 1000 retail locations. At least 50 key retailers will receive training in energy efficiency and energy efficient products. A demonstrative retail incentive program will implemented to provide incentive to purchase at least 100,000 high efficiency RACs, at a unit cost of $1/RAC. Detailed work includes: 1) a capacity needs assessment of local RAC retailers; 2) design and implementation of a RAC retailer training workshop; 3) in-store marketing of EE RACs; 4) design and implementation of a retail incentive program; and 5) evaluation of the RAC retailer program. These activities had not yet begun at the time of the MTR, and will be carried over the next two and half years.

**3.4.3 Media/Advertising**

In order to raise the consumer’s awareness about purchasing EE RACs, media and advertising tools will be introduced in the PEERAC project from year 2013 through 2015. Detailed activities includes: 1) survey on level of consumer awareness about EE RACs; 2) development of a consumer education program; 3) implementation of the consumer education program; 4) implementation of cooperative advertising campaign with manufacturers; 5) evaluation of the consumer education program; and 6) development of a sustainable continuing education program. These activities had not yet begun at the time of the MTR, and will similarly be carried over the next two and half years.

**Actual**

As a complement to the consumer education campaign, a web-based system for dissemination of informational and promotional materials about energy efficiency and energy efficient RACs is being developed from 2012 through 2015. Detailed activities include: 1) website design, implementation and maintenance; 2) development of web-based tools; 3) promotion and launching of the website; 4) evaluation of the website performance. The PMO has retained a subcontractor for website development, and in 2012 the subcontractor developed a preliminary website and applied for its domain name (see Figure 3.13). However, during the MTR evaluation period, the website was not in operation. The MTR team was informed that FECO is trying to integrate all of their project websites under FECO’s main website in order to improve the sustainability of the project effort dissemination. The PEERAC project website is therefore not working temporarily, until FECO’s new website arrangements are accomplished.

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Figure 3.13 PEERAC’s project website

**3.4.4 Rebate/Recycling Program**

Originally, PEERAC intended to develop a RAC Rebate Program similar to that employed in the refrigerator project, in order to encourage consumers to purchase energy efficient models. However, the massive government rebate program in the early years of the project made such a program moot, and in a May 28, 2013 meeting the Project’s Steering Committee agreed to cancel Activities 3.3.1 through 3.3.4. The MTR concurs in this decision, and suggests that any funds accrued be employed to help carry out the MTR’s recommendations.

**3.5 Other Assessment Criteria**

**3.5.1 Gender**

UNDP has important leadership responsibilities, which entail the obligation as well as the opportunity to promote gender equality, and accordingly has put forward a proposed UNDP corporate gender strategy and action plan. This plan: a) develops capacities – both in-country and in-house – to integrate gender concerns in all practice areas and in global, regional and country programmes; b) provides gender responsive policy advisory services that promote gender equality and women’s empowerment; and c) supports specific interventions that benefit women.

This project is following the gender equality criteria. For example, even though the majority of engineers in ACC and RAC manufacturing companies are male, the PMO encouraged women’s participation in technical training activities offered by PEERAC. Special requirements for gender equality were explicitly expressed in the ‘Notification of ACC Training Workshop’ conducted by CHEAA in late May, 2013. Twenty-eight of the trainees came from 10 ACC manufacturers, and seven of them were female -- thus accounting for 25% of participants. This was a very significant (and laudable) response for this industry. Gender equality issues are thus being addressed in the project, especially through capacity enhancement for women.

**3.5.2 Climate Change**

Climate change lies at the very heart of the PEERAC project, and its stated goal is the reduction of China’s future GHG emissions through the transformation of the Chinese room air conditioner (RAC) market (by providing for the production and sale of more energy-efficient RACs). These CO2 emission reductions will be realized from the utilization of the EE RACs that will be locally manufactured, and used by consumers in the commercial and residential (C&R) sectors of China.

There will be a significant amount of indirect CO2 emissions reductions due to the PEERAC project. These indirect impacts are attributed to the facilitation/creation of the following major conditions:

* Implementation of policies that are supportive of EE RAC manufacturing, and widespread EE RAC applications approved or influenced by PEERAC;
* Enhanced knowledge and technical capacity of local ACC and RAC manufacturers to produce EE RACs both for the domestic and foreign markets;
* Continued GOC commitment in promoting energy efficiency and climate change mitigation. Considering the barrier removal activities that will be carried out under PEERAC, it is deemed that the GEF influence in achieving the above mentioned CO2 emission reductions during the influence period (which in this case is until 2025) will be high relative to that during the project period.

With the above overall goal of significantly reducing GHGs emissions from ACC/RAC industries, PEERAC project directly contributes to the world’s commitment in mitigating climate change. Some activities related to the global GHG reduction have already been implemented by the project. For instance, a Green Energy Conservation Pioneers event was held on June 14, 2012. Relevant government and multilateral agencies (i.e., MEP, MIIT, SAC, NECC, FECO and UNDP), industry associations, research institutions, and the media -- a total of more than 200 persons-- participated in this event. FECO, in conjunction with UNDP, awarded Gree, Midea and other well-known domestic RAC enterprises , as well as Guangdong Meizhi, Shanghai Hitachi and other ACC manufacturers the honorary title of ”Green Energy Pioneer.” The PMO also organized an International Symposium on Refrigeration Technologies in 2012, and presented project results and concepts about promoting green development to more than 600 delegates (who had arrived at the meeting from more than 20 countries and regions).

**3.6 Manufacturers’ Response**

During the mid-term evaluation, the team sent emails to 10 ACC and 15 RAC manufacturers in order to collect their comments and feedback about the PEERAC project. Six of the 10 ACC manufacturers and six of the RAC companies responded, and all were satisfied with the project’s implementation.

Proposed recommendations principally focused on three topics: 1) requests for additional personnel quotas for training; 2) requests for additional information from the AMIS system; and 3) requests to receive additional information from the testing center. Others hoped to have more interactions with (and briefings from) the PMO concerning the overall PEERAC project. Responses are summarized in Table 3.3. The firms are not identified by name because they were promised confidentiality in the emails.

Table 3.3 Manufacturers Response

|  |  |  |
| --- | --- | --- |
| **ACC Manufacturers Response** | | |
|  | Name | Comment |
| **1** | A | We’ve received your email. If you have any questions, please inform us. We’ll answer you ASAP. |
| 2 | B | We are delighted to receive your email. If you need anything, please let us know. We’ll do as much as we can. |
| 3 | C | 1) AMIS and the testing center will be conducting evaluations of each enterprise; we would like to these overall evaluation result in summary (through project progress reports, etc.).  2) Concerning training, we’d like to have additional quotas for personnel to attend. |
| 4 | D | Many thanks to the project in promoting ACC energy efficiency in China;  Our company is developing EE ACC models, And corresponding to this project, we have developed a new model, and have accomplished our project target;  We’d like to welcome the evaluation team to come to our company for a visit. |
| 5 | E | We hope that AMIS can provide some feedback concerning: 1) technological information (including international updates, information about other enterprises, etc.); and 2) PEERAC project information and communications regarding project progress, etc.;  Concerning the testing, we hope that project managers might give additional feedback and compare the testing data, share additional information with enterprises, etc..  Concerning the training, we hope that PEERAC would focus on more =professional training, and also provide more on-site TA for enterprises. |
| 6 | F | With the end of the national subsidy policy for RAC, many RAC manufactures have shift from producing N2 RAC to N3 RAC. Many variable frequency RACs have shifted to fixed speed RAC. This might have a strong impact on the targets of this project. Hope that this project might provide in-depth coordination with national policy makers, to provide more for further energy conservation and emission reductions in China. |
| **RAC Manufacturers Response** | | |
| 1 | A | Thanks for your message; if you need anything, please let us know and we will reply ASAP. |
| 2 | B | Hope the trainings assisted by international and domestic experts can be continued after the project. |
| 3 | C | Due to the RAC standard upgrade, the energy efficiency indicators and noise index have been changed. The indicators of the project therefore need to be adjusted; otherwise it will be hard to track the new changes accomplished by the project. |
| 4 | D | Thanks for your message; if you need anything, please let us know and we will reply ASAP. . |
| 5 | E | Thanks for your message; if you need anything, please let us know and we will reply ASAP. |
| 6 | F | Thanks for your message; if you need anything, please let us know and we will reply ASAP. |

These responses essentially confirmed the feedback that was obtained in a project questionnaire sent by the PMO by post to these same 15 RAC and 10 ACC on February 28th, 2013. Their response rate was higher, with 21 of 25 participants responding.

That survey found that that:

* All of the enterprises thought that AMIS was useful;
* Almost all (87% of ACC and 100% of RAC) thought the testing was helpful, and most (75% of ACC and 85% of RAC) have used the test results to improve their own testing or product quality;
* All found the Green Energy Conservation Pioneer award to be helpful in their marketing;
* 92% of the RAC and 75% of the ACC have adopted the project’s logo in their advertising; and
* More than three-quarters of respondents thought the PMO has played a very helpful role in providing guidance and helping participants implement the project.

These respondents also offered recommendations for improving the project:

* AMIS should provide more information about EE within the sector, EE trends, policy directions, new technology and products in China and abroad, marketing analyses, etc.
* AMIS should also provide more detailed analytical information, broken down by enterprise; cooling capacity; sales volumes; etc. Such data would be useful for enterprises trying to develop new models;
* The testing center should provide timely feedback to the enterprises in the form of a third-party report, as well as total industry data;
* The project needs to give the participants sufficient time to produce EE prototype models;
* The project should enhance communications between RAC and ACC manufacturers, and also among subcontractors;
* An interaction platform to share discussion on interesting topics should be established within the project’s website
* The project should encourage visits and communications with international institutes, universities and enterprises;
* More technical training is needed, and training quotas for company personnel should be increased;
* The PMO should report regularly about the project’s progress, and increase publicity efforts to improve the industry's influence.

The PMO has responded to these suggestions by:

* Agreeing to prepare and disseminate brief reports on a regular basis, as well as hold technical briefings on occasion, that would include information about R&D analyses, updates about standards and policies, and similar sectoral information;
* Agreeing to have the testing center provide third-party product testing results to individual enterprises;
* Agreeing to provide an online interactive platform (with message boards or other communication forums) on the project website ; and
* Including in that website a special section allowing participants to document the progress they have achieved, and to encourage other enterprises to participate in the effort.

**3.7 Performance Assessment Summary**

A detailed listing of individual activities in PEERAC, including targets, accomplishments through the MTR period, and MTR remarks can be found in Annex A. This material – as well as performance ratings for each project output and other factors -- is summarized in Table 3.4. Please note that many of these activities and outputs are on-going, and while they may have already accomplished some of their objectives, they are not complete. The ratings in Table 3.4 should therefore be recognized as indicative of project efforts to date.

Table 3.4 Performance Assessment Summary

|  |  |  |
| --- | --- | --- |
| **Project Function** | **MTR Comments** | **Performance** |
| **Project Formulation and Development** | | |
| **Concept** | Recommended in previously successful refrigerator project;  Results of 2008 CHEAA survey showed significant problem in industry, with 86% of locally manufactured RAC products in lowest, most inefficient category;  Significant need for a project of this type. | **Highly satisfactory** |
| **Design** | Adopted successful “technology push – market pull’ approach employed in refrigerator project;  Realistically addressed both component (ACC) and complete system (RAC) elements of the product;  Questionable assumptions about energy savings and GHG reductions employed in Project Document;  Questionable data employed in energy savings and GHG reduction calculations; | **Satisfactory** |
| **Development** | Long project development time led to significant policy and technological change within industry – although institutional requirements and rapid changes in governmental policies certainly affected this factor;  Changes may have led to project goals being accomplished before project even implemented. | **Marginally unsatisfactory** |

| **Project Function** | **MTR Comments** | **Performance** | | |
| --- | --- | --- | --- | --- |
| **Project Implementation** | | | | |
| **Component 1: AC Compressor Efficiency Upgrades** | | | | |
| 1.1: In-country Technical Training on High Efficiency AC Compressor Design and Manufacturing | Capacity Needs Assessment completed;  May 2013 workshop completed, with second scheduled for December 2013;  55 persons trained, 28 from 10 ACC manufacturers;  100% ‘very good’ or ‘good’ ratings. | | **Highly satisfactory** |
| 1.2: International Technical Training on High Efficiency AC Compressor Design and Manufacturing | Course design and schedule to be finalized in August 2013 international visit to University of Maryland, USA;  Recent governmental travel restrictions may affect implementation. | | **TBD** |
| 1.3: Manufacturer Dialogue and Product | Not yet completed. | | **TBD** |
| 1.4: Technical Assistance on EE Compressor Design and Production | On-site TA completed in two companies in May/June, 2013, with approx. 130 participants;  Surveys not completed, but anecdotal evidence suggests high level of participant satisfaction;  Continuing efforts for additional ACC companies. | | **Highly satisfactory** |
| 1.5: Commercialized EE Compressor Products | Ten ACC manufacturers were recruited for this project, representing 95% market share – a figure well above the 50-60% target;  Efficiency significantly improved, with EOP targets already met;  More aggressive targets included in project participation contracts. | | **Highly satisfactory** |
| 1.6: Compilation of ACC Market and Performance Information | 100% participation of ACC manufacturers in AMIS;  AMIS data collection and reports now on-going tasks;  Companies requested even additional data and analytical reports | | **Satisfactory** |
| 1.7: EE Compressor Product Testing | Baseline and 50 models of ACC have been tested;  Results confirm manufacturers testing results. | | **Satisfactory** |
| **Component 2: RAC Efficiency Upgrades** | | | |
| 2.1: International Technical Training on High Efficiency RAC Design and Manufacturing | Course design and schedule to be finalized in August 2013 international visit to University of Maryland, USA;  Recent governmental travel restrictions may affect implementation. | | **TBD** |
| 2.2: In-country technical training on high efficiency RAC design and manufacturing | Capacity Needs Assessment completed;  March/April 2013 workshop completed;  33 persons received training, with 21 from RAC manufacturers;  52% found the program ‘very satisfactory and 48% ‘satisfactory.’ | | **Satisfactory** |
| 2.3: Intensive RAC Design Training | Plans to be developed in late 2013, and implemented in 2014. | | **TBD** |
| 2.4: Technical Assistance on EE RAC Design and Production | Planned for 2014. | | **TBD** |
| 2.5: Commercialization of EE RAC Products | Sixteen RAC manufacturers were recruited for this project, representing 95% market share – a figure well above the 75% target;  RAC efficiency significantly improved, with EOP targets already met;  More aggressive targets included in project participation contracts. | | **Highly satisfactory** |
| 2.6: RAC Efficiency Standards | Government introduced revised standard in June 2013, with full implementation in October;  Project accelerated related tasks, including input for government, workshops, information and liaison for manufacturers, etc. | | **Highly satisfactory** |
| 2.7: Compilation of RAC Market and Performance Information | 100% participation of RAC manufacturers in AMIS;  AMIS data collection and reports now on-going tasks;  Companies requested even additional data and analytical reports | | **Satisfactory** |
| 2.8: EE RAC Product Testing | Baseline and 100 models of RAC have been tested;  Results confirm manufacturers testing results. | | **Satisfactory** |
| 2.9: Policy Recommendations, etc., Addressing ODS | Delayed. | | **TBD** |
| **Component 3: Energy Efficient RAC Promotion** | | | |
| 3.1: High Efficiency RAC Procurement Guide and Procurement Promotion | Not yet completed. | | **TBD** |
| 3.2: RAC Retailer Program | Not yet completed. | | **TBD** |
| 3.3: RAC Rebate/Recycling Program Design and Implementation | Cancelled. | | **N/A** |
| 3.4: Enhancement of the National EE Label for RACs | Not yet completed. | | **TBD** |
| 3.5: Consumer Education Campaign | Not yet completed. | | **TBD** |
| 3.6: Web-based Tools | Website established in Chinese and English;  Operations undergoing revision, with inclusion on FECO website. | | **TBD** |
| 3.7: EE RAC Public Relations Campaign | Green Energy Conservation Pioneers program held in June, 2012;  Brochures, presentations and promotional materials prepared for dissemination;  15 technical papers. | | **Satisfactory** |
| 3.8 RAC Energy Efficiency Policy Promotion | Coordinated 2012 international symposium on refrigeration technology | | **Satisfactory** |
| **Project Management** | | | |
| Structure | Effective PMO structure;  Some personnel changes, but effective and productive staffing. | | **Satisfactory** |
| Execution | Well-managed and coordinated activities, in a complicated project;  International CTA could prove useful for certain second-half tasks. | | **Satisfactory** |
| Transparency | Fully transparent, following institutional requirements;  Responsible adjustment to bidding process when problems arose. | | **Satisfactory** |
| Communication with stakeholders, subcontractors and participants | Interviews suggest there is effective communication with stakeholders and subcontractors;  Some companies requested additional information/communication from PMO, which has responded accordingly. | | **Satisfactory** |
| Monitoring and evaluation | PMO providing effective oversight of subcontractors;  Undertaking required evaluation tasks (only one evaluation missing, for understandable reasons and with anecdotal satisfaction of activity);  Response promised for participant recommendations. | | **Satisfactory** |
| **Scheduling** | | | |
| Synchronizing activities | Most activities proceeding on-schedule. | | **Satisfactory** |
| Adjustments | Some activities have been accelerated (e.g., those related to RAC efficiency standard), due to government schedules;  Some have been delayed (e.g., ODS-related tasks, procurement guidelines) for various reasons – but typical of a long-term, interrelated project of this type. | | **Satisfactory** |
| **Financing** | | | |
| Project outlays | Consistent with Project Document. | | **Satisfactory** |
| Co-financing | Thirteen-fold increase in participant co-financing, from $20 million to more than $262 million;  This would appear to use a very liberal interpretation of co-financing;  However, it nonetheless helps to demonstrate the ‘buy-in’ of project participants evident in the MTR. | | **Highly Satisfactory** |
| **Goals and Objectives** | | | |
| Project Goal: Reduction of GHG emissions from room air conditioning in China's residential and commercial sectors | Project plays ‘catalytic’ role with respect to more significant governmental actions;  Difficult to determine quantitative impact of GHG reductions through MTR;  Approach outlined in Project Document would appear to overstate project GHG reductions through Mid-Term;  EOP impacts should still be significant. | | **Satisfactory** |
| Project Objective: Significantly improved room air conditioner energy efficiency in China. | Project plays ‘catalytic’ role with respect to more significant governmental actions;  Difficult to determine quantitative impact of energy savings through MTR;  Approach outlined in Project Document would appear to overstate project GHG reductions through Mid-Term;  EOP impacts should still be significant | | **Satisfactory** |
| **Overall PEERAC Project at Mid-Term** | | | |
| Overall Project | Tackling a very significant energy/environmental concern;  Project plays important ‘catalytic’ role with respect to more significant governmental actions;  Valuable industry interest and participation (including co-financing);  Overall a well-managed and effective project. | | **Satisfactory** |

**4. LESSONS LEARNED AND CONCLUSIONS**

**4.1 Overall MTR Conclusion**

This is a well-managed and effective project. It was originally designed as a follow-up to a similar project addressing refrigerators, and employs the same “technology push and market pull” approach successfully applied in that project. It is tackling a more complicated industry undergoing considerable technological change– and is doing so with less multi-lateral financial resources. Industry participation and financial co-financing has been exemplary, however, and has contributed to the project’s success.

In addition to technological change, the early years of the project have been accompanied by strong governmental action on a number of fronts, including technical standards, financial subsidies for sales of energy efficient units, and subsidies to ACC and RAC manufacturers. Given their magnitude, these government actions have swamped PEERAC’s impact in terms of the project’s stated goals and objectives (i.e., energy savings and GHG reductions), and have made it very difficult to make quantitative estimates of the project’s success in meeting them.

However, PEERAC has clearly served as a very useful “catalyst” during this period of extensive change, providing technical information, liaison activities, auditing functions, and other very appropriate and valuable services for industry participants. The MTR found that the project has been meeting specific indicators for individual project activities, there is clear communication between parties, and attendant project management functions were being performed properly. The project has been able to adapt to the rapid ongoing changes, accelerating schedules when necessary, and shifting resources when appropriate. Interviews with industry participants, subcontractors, advisory personnel and others during the MTR indicate that the project is held in very high regard. It is clearly helping to transform the ACC and RAC industries in China, and its performance through the mid-term period is fully consistent with the project’s design and formulation.

**4.2 Component-Level Evaluation**

* The individual component tasks are being carried out effectively and efficiently;
* The first half of the project has been heavily oriented towards ‘technology push’ activities, and the technical training and assistance efforts have been extremely popular with participating companies. Numerous companies have sought to increase quotas for the number of their personnel eligible to receive such training. The most common comment in MTR interviews focused on this topic, with many persons suggesting that the technical training and assistance efforts be expanded, and continued in some manner after the project ends.
* The ACC on-site technical assistance appeared to be particularly valuable, with Dr. Leyderman’s lectures and technical assistance drawing particular praise;
* Commercialization activities are underway. Manufacturers have signed contracts, and after technical training, initial design efforts are being pursued. It is unclear exactly how much of the EE improvements can be attributed to PEERAC, however, particularly in the case of larger, worldwide manufacturing participants.
* The Air-conditioning Market Information System (AMIS) is now gathering, analysing and publishing a range of information about production, sales, energy efficiency, market share and other data provided by all of the participating companies. Despite such data, some companies expressed a desire to receive even more – perhaps including additional technological (and even international) information about the industry;
* Product testing in the project has confirmed the credibility of the manufacturers testing procedures and lab results, and also provided valuable input for the discussion about changes in the national EE standards;
* The revision of EE standards has had a major impact on the industry, driving out production of inefficient units that represented a significant market share at the time the project was formulated. PEERAC has provided a valuable forum for industry information and discussions about the standards revision, also providing input to the appropriate governmental agencies. PEERAC has also responded by accelerating standards-related activities in order to ensure that its input was timely and relevant in this area;
* PEERAC has delayed project activities associated with refrigerants. This is an important area requiring attention in the second half of the project, and is discussed in the Recommendations section.
* Most ‘market pull’ tasks occur in the second half of the project, and are therefore not as well developed. The most significant change in the project’s work plan is a cancellation of the rebate program (i.e., Activities 3.3.1 through 3.3.4). The government recently ended a massive rebate program which completely overwhelmed the scale of PEERAC’s proposed system.
* A webpage outreach program was developed, but this ran into problems as FECO decided to consolidate its postings, and the website was not available at the time of the MTR. This issue is being addressed, however.
* Other outreach efforts – conferences, brochures, technical papers, etc. – appear satisfactory, and are fully meeting project requirements;
* Sub-contractors are performing successfully, with good interaction of industrial participants and the PMO;
* With commendable PMO efforts, the project was able to capture a 95% market share in ACC and RAC participation, a level well above the project’s original 75% target;
* Other GEF/UNDP considerations (i.e., role of women; climate change, etc.) are being addressed in a satisfactory manner.

**4.3 Project-Level Evaluation**

* PEERAC was developed to tackle a significant energy and environmental problem, since a CHEAA survey in 2008 found that 86% of RAC units sold within the country were in the lowest, Grade 5 category. The government addressed this problem with a range of measures and policies, including improved technical standards, rebates to consumers for the purchase of efficient units, subsidies to manufacturers for the production of these units, and numerous other actions. These actions considerably changed the ACC and RAC industry, and made it extremely difficult to quantify the project’s direct (and indirect) impacts;
* PEERAC has nonetheless played a valuable role in several ways, including acting as a useful ‘liaison base’ for the air conditioning industry in the development/revision of EE standards; providing data and information for the industry through AMIS; serving as an ‘auditor’ through product testing tasks; connecting China’s domestic ACC and RAC industries with international specialists; etc.
* The MTR team was not able to quantify energy savings and emission reductions associated with the initial half of the project. The reasons noted above presented methodological difficulties, and data presented in the original Project Document presented additional concerns which could not be resolved during the MTR period. For example, RAC energy consumption appeared to exceed that of the whole country during the base year, and end-of-project GHG emissions reductions were less than fuel savings, despite positive emission factors.
* The role of refrigerants is important today for the ACC and RAC industries, and affects PEERAC in a couple of ways. The project has disposal and management tasks which have been delayed, and will be addressed in the second half of the project. Changes in refrigerants will also likely have important impacts on future energy efficiency, and the project’s participants are already introducing new models with alternate refrigerants such as R-290. The subject receives some attention within the technical training/assistance areas – one presentation, for example, encourages participants to “Think like a refrigerant”[[18]](#footnote-18) – but there is apparently little coordination with a number of other ongoing projects within UNDP and MEP/FECO. The training presentation noted that “Although engineers can make a large contribution to the choice of refrigerant, the final choice is normally taken on political and commercial grounds.” [[19]](#footnote-19) Efforts to make the ACC and RAC participants aware of these broader concerns about ODS and GWP –and their industry’s impact on the environment -- would prove valuable.

**4.4 Management**

* PEERAC is a complicated project, with numerous activities – much like the refrigerator market transformation project it was modeled on. A case study of that project noted the more difficult management tasks, but suggested that such projects offered an opportunity for “larger and more sustainable gains.” This project offers similar management challenges – but also comparable opportunities, particularly as the project tries to guide and influence the larger governmental actions in this industry. By all accounts, the PMO team has successfully met that challenge, and is undertaking a difficult management task in an exemplary manner;
* The PMO has effectively synchronized the on-going activities, making schedule and other adjustments as necessary;
* It has provided effective communication with subcontractors and industry participants, and has provided necessary information and feedback as required for them to carry out their required tasks;
* It has provided effective coordination between stakeholders, including RAC and ACC manufacturers, government officials, trade associations, standard developers, and others. Participants in the MTR interviews noted that PEERAC’s inter-industry and industry-government liaison functions played a crucial role, and encouraged continued efforts in this area;
* The selection of subcontractors and project accounting has been performed in a transparent manner, utilizing appropriate institutional procedures;

**4.5 Schedule**

* Almost all PEERAC activities are following the proposed project schedule;
* The variable frequency standard development activities were accelerated to meet governmental timing requirements for this task;
* International training for ACC participants has been slightly delayed, and ODS activities have also been postponed – but these are the normal types of adjustments expected during any project’s implementation.

**4.6 Financing**

* The budget and financial outlays are consistent with proposed levels for individual activities;
* The project accomplished a significant increase in co-financing from project partners, although – as with quantifying the project’s energy savings and emissions reductions – it is difficult to place an exact figure on this co-financing.
* The original project document identified $100,000 in government co-financing, and $20 million from private sector participants. During the MTR, co-financing contributions through the end of 2012 were identified as $70,136 for the government, and $262,455,564 for industry participants. This 13-fold increase in private sector contributions would appear to be based upon a rather liberal interpretation of co-financing.
* The project has considerable back-loading, as 53% of project funding will be spent in the very last year. Since much of this funding is associated with performance under the industry participants’ contracts, such back-loading offers an opportunity to ensure that terms are fully met. It might present a problem, however, if the project was not successful -- i.e., leaving little time for course corrections. Given the catalytic role described earlier, however, it would appear to be an advantage in PEERAC’s case.

**5. RECOMMENDATIONS**

The MTR determined that no significant changes in management and project implementation are required to achieve the project’s overall goals.

The PMO and Project’s Advisory (Steering) Committee have already recognized the significant driving force of the government’s actions concerning ACC and RAC– the revised standards, the rebate and subsidy policies, etc. – and have steered the project to respond accordingly, by accelerating schedules, cancelling the small rebate program, etc.

The project’s management seems well aware that the principal value of PEERAC lies in its “catalytic” role, serving as a ‘liaison’ for the ACC and RAC manufacturers, providing technical information, contacts with international specialists, etc. – and thereby providing input and helping to guide the government’s substantial efforts.

Accordingly, several recommendations are designed to help strengthen that role, including the following:

* The project had difficulty finding a suitable Chief Technical Advisor (CTA), and instead broke the work and budget for that into a several contracts, covering applicable tasks. The terminal evaluation of the refrigerator project noted, however, that the valuable contributions of the CTA were a “key factor” in that project’s success. Given the industry participants’ emphasis on the value of technical training and assistance, and the value they placed on PEERAC’s role as a link to the international technical community, the PMO should place additional attention on retaining an international technical specialist in remaining tasks;
* ACC and RAC participants clearly found the technical training and assistance valuable, and sought to increase their quotas of personnel attending, as well as the international input in such courses – and hoped that such programs might be continued after PEERAC ended. Given the significant resources that the country is putting into addressing energy and environmental concerns, the project should look into ways of sustaining such training efforts after the project’s completion;
* In a similar manner, participants were appreciative of information provided by AMIS, and wanted even more (concerning market trends, international information, etc.) – but also worried about the system’s demise at the end of the project. There are always concerns about confidentiality (since one reason for a call for additional information is to help gather such data about competitors) – but efforts in the second half of the project to both expand the information system to the extent possible, and continue its life post-PEERAC, would be appropriate;
* While participants were appreciative of the ‘technology push’ programs and training, they seemed much less sanguine about the effectiveness of the ‘market pull’ components of the project. Some of this might be due to the fact that the former tasks were already underway, and thus were concrete in nature – while the latter still remained in the future. It might also be due to the fact that the governmental efforts in the ‘market pull’ areas were so much larger than PEERAC’s comparable efforts. Given the “market transformation” intent of the project, however, it would be worthwhile to continually stress to participants the importance of ‘market pull’ activities;

All GEF and UNDP projects undertake considerable efforts to ensure that managers and evaluators can adequately assess the effectiveness of individual activities, using quantitative measures and indicators wherever possible. This project’s focus on energy savings and emissions reductions would seemingly lend itself well to such an approach – but for reasons discussed at length above (including significant governmental actions in support of energy efficiency and technological transformations within the industry), it has proven difficult to quantify the project’s contribution to date. Nevertheless, the MTR recommends that the UNDP and PMO:

* Undertake a review of the Project Document’s approach for determining the project’s goals and objectives given the significant external factors which occurred during the project’s early years, and try to develop a more realistic measure of the project’s contribution to energy savings and emissions reductions;
* Examine the data and assumptions employed in the original calculations of these parameters, and determine whether they are accurate and remain suitable;
* Continue to use other indicators as guides for project management and evaluation, and continue to use quantitative measures to the extent possible.

Finally, the role of refrigerants has several important implications for the ACC and RAC industries, and PEERAC should:

* Complete as soon as possible the policy measures and educational programs for old RAC refrigerant disposal, currently delayed within the project’s work plan;
* Incorporate data about alternative refrigerants (e.g., energy efficiency, GWP, environmental impacts, etc.) in all of its technical training and assistance programs; and
* Coordinate project efforts with other UNDP and MEP programs addressing refrigerants to the fullest extent possible.

**ANNEXES**

**A. Component Status Summary**

**B. Terms of Reference for the PEERAC Mid-Term Review**

**C. List of Documents Reviewed**

**D. MTR Meetings Synopsis and Listing of Persons Interviewed**

**E. Overview of PEERAC Financing Allocation**

**F. Schedule for ACC and RAC Training Programs**

**G. Summary of Subcontractor TORs**

**H. ACC and RAC Product Testing Results**

**ANNEX A: Component Status Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Main Activity** | **Indicators** | **Target** | **Accomplishment** | **Results Achieved** |
| **Activity 1.1.1:** Capacity Needs Assessment of Local ACC Manufacturers | Number of completed Assessment Reports by mid-Year 1 | 1 | 1 | Capacity Needs Assessment of Technical training on ACC was done in Mar, 2013, and Capacity Needs Assessment Report is completed |
| **Activity 1.1.2:** AC Compressor Technology Training Workshop Design and Implementation | Number of training workshops designed, organized and conducted by end Year 3 | 2 | 1 | Completed 1 workshop from May. 27 to May 31, 2013, lasting five days. Training Materials; Training Reports & Evaluation Reports are completed. 2nd workshop is designed to be held in Dec. 2013 |
|  | Number of individuals trained by MTR | 24 | 28 | Participants: 55 persons, 28 of them are from 10 manufacturers, and 7 of trainee are female (25%). Training Certificates Issued |
| **Activity 1.1.3:** Evaluation of In-Country AC Compressor Technical Training | Percentage of trainees that rated the training workshop training as good/excellent, % | 75 | 100 | Post-Training Survey is done. The training was evaluated by the 28 trainee from the 10 manufacturers, Evaluation on the training: 100% of trainee noted “very good” (17 trainees) and “good”(11 trainees) |
| **Activity 1.2.1:** International AC Compressor Technology Training Course Design and Implementation | Number of international training courses designed, organized and conducted by end Year 2 | 1 | 0 | Will be conducted in Aug. 2013 |
|  | Number of individuals trained by end Year 2 | 8 | 0 | Will be conducted in Aug. 2013 |
| **Activity 1.2.2:** Evaluation of International AC Compressor Technical Training | Percentage of trainees that rated the training course as good/excellent,% | 75 | 0 | Will be conducted in Aug. 2013 |
|  | Proportion of trainees still involved in ACC design/production at company and/or sector at EOP, % | 75 | 0 | Will be conducted in Aug. 2013 |
| **Activity 1.3.1:** Organization and Conduct of an ACC Manufacturer Dialogue and Product Planning Workshop | Number of participating ACC & RAC manufacturers in workshop held by end Year 3 | 18 | 0 | Will be conducted in Aug. 2013 |
| **Activity 1.3.2:** Coordination and Evaluation of Follow-up Manufacturer Dialogue | Cumulative number of follow-up dialogue meeting held by EOP | 5 | 0 | Will be conducted in Dec. 2013 |
|  | Average number of participating ACC meeting minutes & RAC manufacturers in each dialogue meeting | At least 2 | 0 | Will be conducted in Dec. 2013 |
|  | Number of EE RACs using new EE ACCs by end Year 4 | At least 1 | 0 | Will be conducted after Dec. 2013 |
| **Activity 1.4.1:** Selection of Local ACC Manufacturers for TA Provision | Number of ACC manufacturers selected for on-site TA activities by end year 2 | 6 | 2 | On-site TA Provision is completed in 2 companies(Guangdong Meizhi and Zhuhai Landa) from May 31–June 3, 2013 |
| **Activity 1.4.2:** ACC Manufacturing TA Program | Number of design, manufacturing and technical services provided under the TA program by Year 2 | 30 | N.A. | Approx. 130 participants from 2 manufacturers involved in the TA program |
| **Activity 1.4.3:** Evaluation of ACC Manufacturing TA Program | Percentage of manufacturers that rated the TA service they received as good/excellent by EOP, % | 75 | N.A. | Most trainees from 2 manufacturers were satisfied with 2 professors’ on-site TA (not rated) |
|  | Proportion of ACC manufacturers that received TA services producing EE ACC products by EOP, % | 75 | N.A. | Most trainees from 2 manufacturers were satisfied with 2 professors on-site TA (not rated) |
| **Activity 1.5.1:** Product Commercialization Contracting and Mobilization | Sales-weighted percentage of ACC manufacturers signing participation contracts by end Year 1, % | 50 - 60 | 95 | 10 ACC manufacturers hold 95% market share. Project activity reports were written. Signed manufacturer contracts are completed. |
| **Activity 1.5.2:** Product Design Implementation | Average AC compressor efficiency (COP) by EOP | 2.94 | 3.01 with constant speed ACC, 3.54 with variable speed ACC | ACC efficiency improved effectively |
| **Activity 1.5.3:** Selection of Product Commercialization Models | Number of bids received for incentives on new EE ACCs developed (COP = 3.4 @ 20% EE gain)/ by end Year 3 | 6 | 0 | Remains to be done |
| **Activity 1.5.4:** Product Commercialization Implementation | EE ACC market share by EOP, % | 15 | 60%for constant speed EE ACC, 25% for variable speed EE ACC | ACC efficiency improved effectively |
|  | Number of EE ACC models provided incentive funding (for incremental cost) by end Year 4 | 3 | 0 | Remains to be done |
| **Activity 1.5.5:** Monitoring and Review of the Product Commercialization Program | Number of interested ACC manufacturers that are planning to produce or already producing the new EE ACC models by EOP | 3 | 10 |  |
| **Activity 1.6.1**: Air Conditioner Information System Design and Establishment | Air Conditioning Market Information System (AMIS) established by end Year 1 | Year 2010 | Completed | AMIS was established in November 2011 and began operations in Jan. 2012 |
| **Activity 1.6.2**: ACC Information Collection and Annual Reporting | Average percentage of ACC manufacturers submitting reports annually to AMIS starting Year 1, % | 100 | Achieved | 10 ACC manufactures submitted reports to AMIS with 2007-2012 data |
|  | Percentage of ACC manufacturers that rated the AMIS as useful by EOP, % | 80 | 100 | Confirmation of data in testing activities gives ACC confidence in AMIS |
| **Activity 1.7.1**: AC Compressor Testing Center Establishment | Appliance testing facility selected and established as ACC Testing Center by end Year 1 | Year 2010 | Completed | Testing center was set up on Jan. 18th, 2012 |
| **Activity 1.7.2**: ACC Product Testing | Percentage of ACC manufacturers that participated in product testing by EOP, % | 100 | Achieved | There were 50 types of ACC testing samples delivered by 10 manufacturers |
| **Activity 1.7.3**: ACC Product Testing Results Reporting | Percentage of manufacturers that rated the ACC Product Testing as useful & good/excellent by EOP, % | 80 | 100 | With small deviations, data tested by the ACC manufacturers to testing center are basically in line with measured data |
|  | Proportion of ACC manufacturers that made use of the product testing results in improving their EE ACC products by EOP, % | 80 | Not Yet Completed | Should be checked in EOP |
| **Activity 2.1.1** International RAC Technology Training Design and Implementation | Number of international training courses designed, organized and conducted by end Year 2 | 1 | Designed but implementation | To be postponed until the end of 2013, through early 2014 |
| **Activity 2.1.2:** Evaluation  of International Room Air  Conditioner Technical  Training | Number of individuals trained by end Year 2 | 12 | Designed but implementation | To be postponed until the end of 2013, through early 2014 |
| **Activity 2.2.1**: Capacity Needs Assessment of Local RAC Manufacturers | Number of completed Assessment Reports by mid-Year 1 | 1 | 1 | Utilized “Suggestions on the 12th FYP for Chinese household electrical appliance industry ” and “Technical roadmap of the Chinese household electrical appliance industry ”;  Developed a “requirement list of RAC enterprises for technical training”;  Collected feedback from all participating RAC enterprises;  Completed “Requirements Report of RAC enterprises for technical training ”; |
| **Activity 2.2.2**: RAC Technology Training Workshop Design and Implementation | Number of training workshops designed, organized and conducted by end Year 1 | 2 | 1 | Conducted on March 28 - April 3, 2013 in Beijing |
| Number of individuals trained by end Year 2 | 48 | 33 | 13 participating enterprises sent 21 engineers to attend the training; 12 other engineers from other home appliance enterprises, CHEARI and CHEAA were added; the total number of trainees was 33. |
| **Activity 2.2.3**: Evaluation of In-Country RAC Technical Training | Percentage of trainees that rated the training workshop training as good/excellent by EOP, % | 75 | 100 | Survey results indicated that 52% considered the program "very satisfactory"; 48% “satisfactory." |
| Proportion of trainees still involved in RAC design/production at company and/or sector at EOP, % | 75 | 100 |  |
| **Activity 2.3.1**:Development of Intensive RAC Design Training Course | A comprehensive intensive RAC design and manufacturing training course by end Year 2 | 1 | Not yet completed | Plan to be developed in late 2013 and completed in mid-2014 |
| **Activity 2.3.2:** Preparation of Initial RAC Prototypes/Models | Number of EE RAC prototypes or  models prepared by selected RAC manufacturers by Year 3 | 6 | Not yet completed | Planned for 2014 |
| **Activity 2.3.3:** Conduct and Evaluation of the Intensive RAC Design Training Course | Number of intensive training courses conducted by end Year 4 | 4 | Not yet completed | Planned for 2014 |
| Number of manufacturers trained by end Year 4 | 6 | Not yet completed | Planned for 2014 |
| Total number of individuals trained under this Output by end year 4 | 24 | Not yet completed | Planned for 2014 |
| **Activity 2.4.1**: Selection of Local RAC Manufacturers for TA Provision | Number of RAC manufacturers selected for on-site TA activities by end year 1 | 12 | Not yet completed | Planned for 2014 |
| **Activity 2.4.2:** RAC Manufacturing TA Program | Number of design, manufacturing and technical services provided under the TA program by Year 4 | 60 | Not yet completed | Planned for 2014 |
| **Activity 2.4.3:** Evaluation  of RAC Manufacturing TA  Program | Percentage of manufacturers that  rated the TA service they received as good/excellent by EOP, % | 75 | Not yet completed | Planned for 2014 |
| **Activity 2.5.1:** Product  Commercialization Contracting and Mobilization | Sales-weighted percentage of RAC manufacturers signing participation contracts by end Year 1, % | 75 | 95 | 16 RAC manufactures account for 95% of market share in 2011 |
| **Activity 2.5.2:** Product  Design Implementation | Average RAC (EER) by EOP | 2.94 | Achieved | Average energy efficiency of constant frequency RACs has achieved a 17.5% increase over the baseline (2.80) in 2011; and a 25.1% increase over the baseline (3.35) for variable frequency RAC; |
| **Activity 2.5.3:** Selection of  Product Commercialization  Models | Number of bids received for incentives on new EE RACs developed (EER = 2.94 @ 10% EE gain)/ by end Year 4 | 12 | Not yet completed | Will be implemented in 2014 and 2015 |
| **Activity 2.5.4:** Product  Commercialization  Implementation | EE RAC market share by EOP, % | 15 | Not yet completed | Will be implemented in 2014 and 2015 |
| Number of EE RAC models provided  incentive funding (for incremental cost)  by end Year 4 | 12 | Not yet completed | Will be implemented in 2014 and 2015 |
| **Activity 2.5.5:** Monitoring  and Review of the Product  Commercialization  Program | Number of interested RAC  manufacturers that are planning to produce or already producing the new EE RAC models by EOP | 12 | Not yet completed | Will be implemented in 2015 |
| **Activity 2.6.1**:  Development of RAC Energy Performance Standards | Proposed standards for new minimum EER for RACs by mid-Year 4 | Year 2013 | Completed | Submitted proposed updated RAC minimum EE standard in May 2013 |
| **Activity 2.6.2:** Revision of  Current RAC Energy  Performance Standards | Number of comments and  recommendations considered for the revision of EER Standards by end Year 4 | At least 2 | Completed | Ascertained the revisions required in current standards, including the use of APF instead of EER in the new standard;  Conducted studies on APF indicator system;  Developed a working plan for standard revision;  Conducted surveys on consumers’ use and operation time of RACs;  Analyzed RAC operation time curve for local users in order to guide RAC manufacturers in designing new products |
| **Activity 2.6.3:** Formal &  Informal Discussions on  Revised Standards | Number of provisions in EER  standards for recommendation for  approval by GOC policymakers by end Year 4 | At least 2 | Completed | Workshops were conducted to discuss the basic environment and feasibility of developing national standards, and finalize framework and criteria of the standard. |
| **Activity 2.6.4**: Publication and Capacity Building on the Revised Standards Compliance | Published new standards on minimum EER of RACs | Year 2014 | Advanced | An updated RAC minimum EE standard was issued in June 2013, with full implementation in October. |
| **Activity 2.6.5:** Evaluation of  the Impacts of the Revised  Standards Enforcement | Market share of EE RACs by EOP | 15 | Not yet completed | Will be implemented in 2014 and 2015 |
| **Activity 2.7.1**: Definition of RAC Information for Inclusion in AMIS | Information System (AMIS)established by end Year 1 | Year 2010 | Completed | The establishment and operation of AMIS was initiated after the signing of the contract, and runs through 2016;  An information questionnaire on the EE of products was sent to participating companies;  Resulting data was collected, analyzed and verified (including communication with the project contacts about data with suspected errors);  The data were summarized in an AMIS database, an Annual Report was written, and delivered to the PMO in 2013. |
| **Activity 2.7.2**: RAC Information Collection and Annual Reporting | Percentage of RAC manufacturers submitting reports each year to AMIS starting Year 1, % | 100 | 100 |  |
| **Activity 2.8.1**: RAC Conditioner Testing Center Establishment | Appliance testing facility selected and established as RAC Testing Center by end Year 1 | Year 2010 | Completed | First section (Baseline Test ), 100 types of RAC and 50 types of ACC were tested in 2012;  Implementation of both testing in the project testing center and witness testing in manufacturer’s lab from August to October, 2012;  Testing reports and the analysis reports on testing results were completed in late October, 2012 |
| **Activity 2.8.2**: RAC Product Testing | Number of RAC manufacturers that participated in product testing by EOP | 100 | 88 | 88% of the RAC manufacturers participated in product testing in 2012 |
| **Activity 2.8.3:** RAC Product Testing Results Reporting | Percentage of manufacturers rating  the RAC Product Testing as useful and  good/excellent by EOP, % | 80 | 100 | With small deviations, data reported by the RAC manufacturers to AMIS are basically in line with measured data |
| **Activity 2.9.1:** Formulation  of Policy Recommendations on  Proper ODS Refrigerant Management and Disposal | Completed satisfactory acceptable policy study on the most cost-effective  approach for managing the old refrigerants from old RACs | Year 2011 | Not yet completed | Postponed |
|  | Proposed national policy and set of guidelines for the management and  disposal/destruction of the ODS refrigerants | Year 2012 | Not yet completed | Postponed |
| **Activity 2.9.2:** Development of  Information, Education and  Communication Materials on ODS Refrigerant Management and Disposal | Completed and published guidebook on managing and disposal of ODS  containing old RACs and other refrigeration appliances/equipment | Year 2012 | Not yet completed | Postponed |
|  | Number of ACC/RAC manufacturers,  refrigerant traders and suppliers that committed to use the guidebook in  their action plans to address the ODS refrigerant issues by EOP | At least 50 | Not yet completed | Postponed |
| **Activity 3.1.1**: Review of Typical Corporate RAC Procurement Procedures | Completed survey/review report on typical corporate RAC procurement procedures/practices | Year 2013 | Not yet completed | Will be implemented in late 2013 and 2014 |
| **Activity 3.1.2**: Formulation PEERAC of RAC Procurement Guidelines | A procurement guide for RACs with standardized information for group procurement of EE RACs | Year 2014 | Not yet completed | Will be implemented in late 2013 and 2014 |
|  | Number of organizations receiving  procurement guides by EOP | 100 | Not yet completed | Will be implemented in late 2013 and 2014 |
| **Activity 3.1.3**: Promotion of the Application of the RAC Procurement Guidelines | Number of organizations that either have committed or have carried out actions, to procure EE RACs by EOP | At Least 5 | Not yet completed | Will be implemented in late 2013 and 2014 |
| **Activity 3.1.4**: EE RAC  Procurement Guidelines Effectiveness Evaluation | Number of organizations finding the RAC procurement guides useful by EOP | At Least 75 | Not yet completed | Will be implemented in late 2013 and 2014 |
| **Activity 3.2.1**: Capacity Needs Assessment of Local RAC Retailers | Number of completed Assessment Reports by mid-Year 4 | 1 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.2.2**: RAC  Retailer Training Workshop  Design and Implementation | Number of retailers that received  training and informational materials by end Year 4 | 50 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.2.3**: Conduct of  In-Store Marketing of EE RAC | Number of retailers that implemented in-store marketing using received promotional materials by EOP | 1,000 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.2.4**: Retail Incentive Program Design and Implementation | Number of EE RACs that were sold under the Retail Incentive Program by EOP | 100,000 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.2.5**: Evaluation  of the RAC Retailer Program | Number of RAC manufacturers by  EOP that find the RAC Retailer  Program useful for promoting EE  RACs, and committed to strategically employ it after PEERAC | 8 | Not yet completed | Will be implemented in 2015 |
|  | Percentage of RAC retailers by EOP that find the RAC Retailer Program useful for promoting EE RACs | 70 | Not yet completed | Will be implemented in 2015 |
|  | Percentage of consumers that find the RAC Retailer Program useful for promoting EE RACs by EOP | 70 | Not yet completed | Will be implemented in 2015 |
| **Activity 3.3.1**: Conduct of RAC Rebate Program Workshop | Number of RAC manufacturers that committed to develop and implement a rebate/recycling program by end Year 3 | 12 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
| **Activity 3.3.2**: RAC  Rebate Program Design | Number of rebate/recycling program plans submitted to PEERAC by end Year 4 | 12 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
|  | Number of rebate/recycling program plans approved by the PEERAC PAC by end Year 4 | 12 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
| **Activity 3.3.3**: RAC Rebate Program Implementation | Total number of inefficient RACs  retired, recycled, and replaced with new efficient ones through the approved rebate/recycling programs by end Year 5 | 16,000 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
| **Activity 3.3.4**: RAC Rebate Program Evaluation and Incentive Award Issuance | Percentage of total number of EE  RACs sold under the program  accounted for by the top 3 RAC  manufacturers by end Year 5 | At Least 50 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
|  | Number of RAC manufacturers by  EOP that find the RAC Rebate/Recycling Program useful for promoting EE RACs, and committed to strategically employ it after PEERAC | 8 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
|  | Percentage of RAC retailers by EOP that find the RAC Rebate/Recycling Program useful for promoting EE RACs by EOP, % | 70 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
|  | Percentage of consumers that find the RAC Rebate/Recycling Program useful for promoting EE RACs by EOP, % | 70 | Canceled | China government launched a much larger Rebate Program in May 2009 and ended it on May 30,2013 |
| **Activity 3.4.1**: Review of RAC Labeling System | Completed review of existing RAC  energy labeling system by end Year 4 | Year 2013 | Advanced | Conducted a survey for the existing labeling system, which was completed in early 2013 |
| **Activity 3.4.2**: Modification  of the RAC Energy Labeling Program | Percentage of provisions in the  existing RAC labeling program that were modified in the new approved program by end Year 4, % | 25 |  | Developed the preliminary recommendations for improving labeling system by May 2013;  Completed a draft working plan for RAC Energy Labeling Program |
| **Activity 3.4.3**: Planning and Promotion of the RAC Energy Labeling Program | Number of promotional workshops conducted by Year 4 | 2 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.4.4**: Implementation of the RAC Energy Labeling Program | Percentage of RAC brands that qualify for the new EE RAC energy label by EOP, % | 10 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.4.5**: Evaluation  of the Modified RAC Energy Labeling Program | EE RAC market share by EOP, % | 15 | Not yet completed | Will be implemented by 2015 |
| **Activity 3.5.1**: Survey on Level of Consumer Awareness about EE RACs | Completed consumer awareness  survey by mid-Year 3 | Year 2012 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.5.2**: Development of a Consumer Education Program | Number of consumer education  programs developed by end Year 3 | 1+ | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.5.3**: Implementation of the Consumer Education  Program | Number of completed consumer  education events | 5 | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.5.4**: Implementation of Cooperative Advertising  Campaign with Manufacturers | Number of advertisement templates and materials developed by end Year 3 | At Least 2 | Not yet completed | Will be implemented in late 2013 through 2015 |
|  | US$ value of EE RAC project related advertising placed by manufacturers by end Year 5 | 7.5 million | Not yet completed | Will be implemented in late 2013 through 2015 |
| **Activity 3.5.5**: Evaluation  of the Consumer Education  Program | Share of RAC advertising by  manufacturers for high efficiency  products by EOP, % | 10 | Not yet completed | Will be implemented in 2015 |
| **Activity 3.5.6**: Development of a Sustainable Continuing  Education Program | EE RAC market share by EOP, % | 15 | Not yet completed | Will be implemented in 2015 |
|  | % Increase in number of consumers that are either planning or are ready to purchase EE RAC by EOP | 10 | Not yet completed | Will be implemented in 2015 |
| **Activity 3.6.1**: Website Design, Implementation and Maintenance | Designed website including, website materials and operational plan by Year 1 | Year 2010 | Design completed | On going revision of operational plan;  Hosting on FECO website |
|  | No. of officially established access to other related domestic and foreign based websites/databases by EOP | At Least 5 | Not yet completed | On-going |
| **Activity 3.6.2**: Development of Web based Tools | Cumulative number of users of web based tools by EOP | 100,000 | Not yet completed | On-going |
| **Activity 3.6.3**: Promotion  and Launching of the  Website | Officially launched and operational website by end Year 1 | Year 2010 | Completed | A website has been established in Chinese and English; operations currently undergoing revision |
| **Activity 3.6.4**: Evaluation of the Website Performance | Total number of page views and/or downloads by EOP | 350,000 | Not yet completed | Will be implemented by 2015 |
|  | Total number of RAC purchase  decisions affected by EOP | 10,000 | Not yet completed | Will be implemented by 2015 |
|  | % of website users each year that are satisfied with information downloaded starting Year 2 | 50 | Not yet completed | Will be implemented by 2015 |
|  | % share of participating RAC  manufacturers that link to website for cross-promotion by EOP | 50 | Not yet completed | Will be implemented by 2015 |
|  | Number of new informational and  promotional products available each year in website starting Year 2 | 12 | Not yet completed | Will be implemented by 2015 |
| **Activity 3.7.1**: Preparation and Publication of Articles on EE RAC | Number of articles on EE RACs  published throughout the project  duration by EOP | 60 | 15 | On-going |
| **Activity 3.7.2**: Presentation of PR Campaign Achievements | % of cumulative EE RAC sales that were directly influenced by the PR campaigns by EOP | 25 | Completed | Green Energy Conservation Pioneers was held in June 2012;  Included visits to enterprises and promoted high-level dialogue;  Developed brochures, presentations, promotional materials and other dissemination materials for green energy concept, including corporate promotional items |
| **Activity 3.8.1**: Conduct of EE Air Conditioning Policy Studies | Number of completed satisfactorily acceptable policy studies by EOP | At Least 2 | Not yet completed | Will be implemented in remaining project period. |
| **Activity 3.8.2**: Organization and Conduct of EE Air Conditioning  Policy Workshop | Number of EE air conditioning policy materials prepared, presented and disseminated to GOC policy makers by Year 2 | At Least 2 | Not yet completed | Will be implemented in remaining project period. |
| **Activity 3.8.3**: Conduct of  International Policy Exchange | Number of policies from other  countries that were considered for the improvement of existing EE policies by end Year 3 | At Least 2 | 1 | Coordinated 2012 International symposium on refrigeration technology |
| **Activity 3.8.4**: Conduct of an International ODS Workshop | Number of policies on ODS refrigerant management (including implementing rules & guidelines) from other countries considered in the formulation of ODS management policy recommendations in China by Year 3 | 3 | Not yet completed | Will be implemented in remaining project period |
| **Activity 3.8.5**: Conduct of Targeted Policy Coordination Meetings | Cumulative number of targeted policy coordination meetings conducted by EOP | 10 | Not yet completed | Will be implemented in remaining project period |
|  | Number of EE air conditioning & ODS refrigerant management policy recommendations accepted for consideration of approval by the relevant GOC authorities by EOP | At Least 2 | Not yet completed | Will be implemented in remaining project period |

**ANNEX B: TOR for the PEERAC Mid-Term Review**

**Name of Project: UNDP/GEF Promoting Energy Efficient Room Air Conditioners（PEERAC） Project**

***Terms of Reference for the Mid-Term Review***

1. **Introduction**

1.1 Project Background

RAC manufacturing developed at a high growth rate during the 80s and 90s. The local production of RACs reached 75 million in 2007, and this amount accounts for more than 75% of the RAC market worldwide. RAC manufacturing has become mainstay in the Chinese industry sector. In China, the dominant energy efficiency products are classified into Grade 5 (the lowest energy efficiency grade, 2.6 ≤ EER < 2.8 for cooling capacity lower than 4500W).

GEF Promoting Energy Efficiency Room Air Conditioners Project (PEERAC) is operational phase project commenced in November 2010, jointly developed by FECO/MEP and UNDP, with the support of Ministry of Finance of P. R. China, to promote energy conservation of air conditioner industry in China.

1.2 Project Summary

The budget of the PEERAC project is US$ 6,263,600 granted by GEF, with a 5 years’ implementation period from 2010 to 2015. This project is executed by the Foreign Economic Cooperation Office, Ministry of Environmental Protection (FECO/MEP) as the national executive agency and the United Stations Development Programme (UNDP) as the international executive agency.

The project objective is the reduction of China’s future GHG emissions through transformation of the Chinese room air conditioner (RAC) market to production and sale of more energy-efficient RACs. The implementation of PEERAC project is expected to achieve 10% improvement in the energy efficiency of RACs and got 939.5Mtce Energy Savings by end of project.

The project is divided into of three major complementary and interdependent components:

**Component 1: Air-Conditioner Compressor Efficiency Upgrades** –This project component is designed to address air conditioner compressor (ACC) manufacturers’ lack of familiarity with energy efficient (EE) technology, as well as their “chicken-and-egg” dynamic that keeps them from developing and commercializing more efficient products given the lack of demand for such products from room air conditioner (RAC) manufacturers. The expected outcome from the interventions that will be carried out under this component is that there will be more energy efficient AC compressors manufactured and sold in China. In the absence of activities implemented under this project component, manufacturers would not implement significant EE activities, and no significant compressor EE gains would be achieved. The realization of the expected outcome will be indicated by increased market share, production levels, and average efficiency levels for EE ACCs.

**Component 2: Room Air Conditioner Efficiency Upgrades** –This project component is intended to address the technical and financial barriers that prevent room air conditioner (RAC) manufacturers from developing more energy efficient products. In the absence of activities implemented under this component, local RAC manufacturers would not implement significant EE activities and no significant RAC EE gains would be achieved. More locally produced high efficiency room air conditioners is the expected outcome from the interventions that will be carried out under this project component. It is expected that RAC manufacturers representing at least 75% of domestic RAC sales will participate in the various activities that have been line up under this project component. The realization of the expected outcome will be gauged from increased average efficiency of locally manufactured RACs (at least 10% higher); and; increased market share (targeted 10% increase) for EE RACs.

**Component 3: Energy Efficient RAC Promotion** – Under this project component, energy efficient RACs will be promoted through a variety of coordinated and complementary measures, including procurement promotion, retail promotion, a recycling/rebate program, national energy efficiency label enhancement, consumer education, web-based information dissemination and promotion, public relations, and policy promotion. These measures will also complement and be coordinated with the training and technology development activities under outputs 1 and 2 (see “Demand-Pull” discussion above for further elucidation of the relationship between activities). For example, the consumer education program will be timed so as to begin when new RACs are hitting the market during the product commercialization activity.

* 1. Project Expected Outcomes and Outputs

A number of outputs resulting from full project activities are expected. These include:

* Completed and evaluated in-country technical training on high efficiency AC compressor design and manufacturing
* Completed and evaluated international technical training on high efficiency AC compressor design and manufacturing
* Completed manufacturer dialogue and product planning
* Completed technical assistance on EE compressor design and production
* Commercialized EE compressor products
* Compilation of ACC market and performance information
* Completed EE compressor product testing
* International technical training on high efficiency RAC design and manufacturing
* In-country technical training on high efficiency RAC design and manufacturing
* Completed intensive RAC design training
* Completed technical assistance on EE RAC design and production
* Commercialization of EE RAC products
* RAC efficiency standard
* Compilation of RAC market and performance information
* Completed EE RAC product testing
* Policy recommendations and information, education and communication materials on addressing ODS refrigerant replacement and disposal
* High efficiency RAC procurement guide and procurement promotion
* Completed RAC retailer program
* RAC rebate program design and implementation
* Enhanced national EE label for RACs
* Completed consumer education campaign
* Web-based tools on EE RACs
* Completed EE RAC public relations campaign
* RAC energy efficiency policy promotion

1. **Objectives of the Mid-Term Review**

The objectives of this Mid-Term Review (MTR) seek to fulfill the following overarching objectives of the monitoring and evaluation of GEF projects:

1. Promote accountability for the achievement of GEF objectives through the assessment of results, effectiveness, processes and performance of the partners involved in GEF activities. GEF results will be monitored and evaluated for their contribution to global environmental benefits;
2. Promote learning, feedback and knowledge sharing on results and lessons learned among the GEF and its partners, as basis for decision-making on policies, strategies, program management, and projects and to improve knowledge and performance.
3. **Scope of the Evaluation**

The scope of the MTR covers the entire UNDP/GEF-funded project and its components as well as the co-financed components of the project.

The MTR will assess the Project implementation taking into account the status of the project activities and outputs and the resource disbursements made up to the point of the start of the review

The evaluation will involve analysis at two levels: component level and project level. On the component level, the following shall be assessed:

* Whether there is effective relationship and communication between/among components so that data, information, lessons learned, best practices and outputs are shared efficiently, including cross-cutting issues.
* Whether the performance measurement indicators and targets used in the project monitoring system are specific, measurable, achievable, reasonable and time-bounded to achieve desired project outcomes.
* Whether the use of consultants has been successful in achieving component outputs.

The evaluation will include such aspects as appropriateness and relevance of work plan, compliance with the work and financial plan with budget allocation, timeliness of disbursements, procurement, coordination among project team members and committees, and the UNDP country office support. Any issue or factor that has impeded or accelerated the implementation of the project or any of its components, including actions taken and resolutions made should be highlighted.

On the project level, it will assess the project performance in terms of: (a.) Progress towards achievement of results, (b.) Factors affecting successful implementation and achievement of results, (c.) Project Management framework, and (d.) Strategic partnerships.

* 1. Progress towards achievement of results (internal and within project’s control)
* Is the Project making satisfactory progress in achieving project outputs compared to the targets and related delivery of inputs and activities?
* Are the direct partners and project consultants able to provide necessary inputs or achieve results?
* Given the level of achievement of outputs and related inputs and activities to date, is the Project likely to achieve its Immediate Purpose and Development Objectives?
* Are there critical issues relating to achievement of project results that have been pending and need immediate attention in the next period of implementation?

* 1. Factors affecting successful implementation and achievement of results (beyond the Project’s immediate control or project-design factors that influence outcomes and results)
* Is the project implementation and achievement of results proceeding well and according to plan, or are there any outstanding issues, obstacles, bottlenecks, etc. on the consumer, government or private sector or other organizations that are affecting the successful implementation and achievement of project results?
* To what extent does the broader policy environment remain conducive to achieving expected project results, including existing and planned legislations, rules, regulations, policy guidelines and government priorities?
* Is the project logical framework and design still relevant in the light of the project experience to date?
* To what extent do critical assumptions/risks in project design make true under present circumstances and on which the project success still hold? Validate these assumptions as presently viewed by the project management and determine whether there are new assumptions/risks that should be raised?
* Is the project well-placed and integrated within the national government development strategies, such as community development, poverty reduction, etc., and related global development programs to which the project implementation should align?
* Do the Project’s purpose and objectives remain valid and relevant, or are there items or components in the project design that need to be reviewed and updated?
* Are the Project’s institutional and implementation arrangements still relevant and helpful in the achievement of the Project’s objectives, or are there any institutional concerns that hinder the Project’s implementation and progress.
  1. Project management (adaptive management framework)
* Are the project management arrangements adequate and appropriate?
* How effectively is the project managed at all levels? Is it results-based and innovative?
* Do the project management systems, including progress reporting, administrative and financial systems and monitoring and evaluation system, operate as effective management tools, aid in effective implementation and provide sufficient basis for evaluating performance and decision making?
* Is technical assistance and support from project partners and stakeholders appropriate, adequate and timely?
* Validate whether the risks originally identified in the project document and, currently in the APPR/PIRs, are the most critical and the assessments and risk ratings placed are reasonable.
* Describe additional risks identified during the evaluation, if any, and suggest risk ratings and possible risk management strategies to be adopted.
* Assess the use of the project logical framework and work plans as management tools and in meeting with UNDP-GEF requirements in planning and reporting.
* Assess the use of electronic information and communication technologies in the implementation and management of the project.
* On the financial management side, assess the cost effectiveness of the interventions and note any irregularities.
* How have the APPR/PIR process helped in monitoring and evaluating the project implementation and achievement of results?
  1. Strategic partnerships (project positioning and leveraging)
* Assess how project partners, stakeholders and co-financing institutions are involved in the Project’s adaptive management framework.
* Identify opportunities for stronger collaboration and substantive partnerships to enhance the project’s achievement of results and outcomes.
* Are the project information and progress of activities disseminated to project partners and stakeholders? Are there areas to improve in the collaboration and partnership mechanisms?

1. **Evaluation Methodology**

The MTR Team is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits. Review relevant project documents and reports will be based on the following sources of information: review of documents related to the project and structured interviews with knowledgeable parties

The MTR Team will conduct an opening meeting with the National Project Director (NPD), Project Management Office (PMO), Sub-Contracting Parties/Entities, UNDP Country Office Counterparts, members of the Project Steering/Advisory Committee/s, etc. An “exit” interview will also be held to discuss the findings of the assessment prior to the submission of the draft Final Report.

Prior to engagement and visiting the PMO, the MTR Team shall receive all the relevant documents including at least:

* The PEERAC Project Document and Project Brief
* Inception Report
* Annual Work and Financial Plans
* Annual Project Progress Report/Project Implementation Review (APPR/PIR) for 2010 and 2011 and 2012

To provide more details, as may be needed, the following will be made available for access by the MTR Team:

* Executive summary of all quarterly reports
* Internal monitoring results
* Terms of Reference for past consultants’ assignments and summary of the results
* Past audit reports

All additional material related to the project management and implementation and held by the PMO and their subcontracts will be available for review at the discretion of the Evaluation Team.

The MTR Evaluation Team should at least interview the following people:

* National Project Director
* PMO Director
* PMO Manager
* International Chief Technical Advisor
* Project Technical Officer
* Project Financial Officer
* A representative of the Project Steering Committee
* UNDP Country Office in China in-charge of the PEERAC Project

It is also anticipated that the MTR will interview a number of sub-contractors and recipients of services, and make site visits to implementation areas. However, the degree to which such interactions are required will be at the discretion of the Evaluation Team.

With the aim of having an objective and independent evaluation, the MTR Team is expected to conduct the project review according to international criteria and professional norms and standards as adopted by the UN Evaluation Group.

1. **MTR Team**

The MTR Team will be composed of one International Lead Consultant and one National Consultants. The Team is expected to combine international standards of evaluation expertise, excellent knowledge of Energy Efficiency and Climate Change projects and the national context of in which PEERAC is being implemented.

At the minimum, the members of the MTR Team shall have the following professional background and responsibilities:

1. **International Lead Consultant （one person）**

Numbers of working days: 15 days

Anticipated missions to China: 1

Location: Beijing and other cities in China

Profile

* Minimum of ten years accumulated and recognized experience in the Energy Efficiency and climate change area
* Minimum of five years experience of project evaluation and/or implementation experience in the result-based management framework
* Familiarity with China
* Experience with multilateral and bilateral supported project environments
* Comprehensive knowledge of international project best practices
* Very good report writing skills in English

Responsibilities

* Define the evaluation methodology and schedule, and report to the PMO
* Documentation of the review
* Leading the MTR Team in planning, conducting and reporting on the evaluation
* Deciding on division of labor within the team and ensuring timeliness of reports
* Use of best practice evaluation methodologies in conducting the evaluation
* Leading presentation of the draft evaluation findings and recommendations in-country
* Conducting the debriefing for the UNDP China Office and the PEERAC PMO
* Leading the drafting and finalization of the MTR report

1. **National Consultant (two person)**

Numbers of working days: 15 days

Location: Beijing and other cities in China

Profile

* Post-graduate in engineering, management or business, or college degree in said areas with at least ten years experience of project development and implementation.
* A minimum of five years of project management experience in Energy Efficiency or related climate change projects
* Energy Efficiency and climate change training and technical experience
* Knowledge of Energy Efficiency projects
* Multilateral and bilateral funded project development and implementation
* Familiarity with Energy Conservation national development policies, programs and projects

Responsibilities

* Define the evaluation methodology and schedule, and report to the PMO
* Documentation review and data gathering
* Contributing to the development of the evaluation plan and methodology
* Conducting those elements of the evaluation determined by the International Lead Consultant
* Contributing to presentation of the evaluation findings and recommendations at the evaluation wrap-up meeting
* Contributing to the drafting and finalization of the evaluation report.
* Translate the final evaluation report into Chinese.

1. **All MTR Team Members**

The members of the team must be independent from both the policy-making process and the delivery and management of the UNDP/GEF assistance to the PEERAC project. Therefore, candidates who had any direct involvement with the design and implementation of the project will not be considered.

1. **Evaluation Schedule and Deliverables**

The MTR is provisionally scheduled to commence in May and June 2013. The draft evaluation report should be produced with 4 weeks, highlighting important observations, analysis of information and key conclusions including its recommendations. Based on the scope of the MTR described above, the Evaluation Report will include, among others:

* Findings on the project implementation achievements, challenges, and difficulties to date;
* Assessments of the progress made towards the attainment of outcomes;
* Recommendations for modifications and the future course of action;
* Lessons learned from the project structure, coordination between different agencies, experience of the implementation, and output/outcome and,

The report will be initially shared with the PEERAC PMO and the UNDP China Office to solicit comments or clarifications. Consequently, a presentation of the report will be made to an open meeting of all project stakeholders for comment. The final MTR report will then be submitted within 2.5 months of the initiation of the evaluation. Three copies of the report will be submitted to the UNDP China Office and a copy to the PEERAC PMO.

There will be two main deliverables:

* MTR report, including an executive summary, fulfilling the evaluation requirements set out in this Terms of Reference (TOR). The final report (including executive summary, but excluding annexes) should not exceed 50 pages.
* A power-point presentation of the findings of the evaluation.

1. **Budget**

All the costs incurred for the conduct of the MTR for the PEERAC Project shall be charged against project funds allocated for the conduct of such activity. Payment of the MTR Evaluation Team’s professional fees shall be made in accordance with the Special Service Agreement to be issued in this regard.

**ANNEX C: List of Documents Reviewed**

|  |  |  |
| --- | --- | --- |
|  | Name of Document | Authors |
| 1 | Project Document of Promoting Energy Efficient Room Conditioners (PEERAC) | GEF/UNDP/MEP(China) |
| 2 | Inception Report of Promoting Energy-Efficient Room Air Conditioners Project (PEERAC) | PMO |
| 3 | Annual Project Progress Report (APP) by 2011 | PMO |
| 4 | Annual Project Progress Report (APP) by 2012 | PMO |
| 5 | Rating of Progress Towards Meeting Development Objectives (DO) | UNDP, PMO |
| 6 | Project Implementation Report (PIR) | UNDP, PMO |
| 7 | Identify Policies and Implementation Strategies for Improving Energy Efficiency – Case Study 2 on Energy Efficient Air‐Conditioners | Centre for Strategic Economic Studies, of Victoria University, Australia With the assistance of the Energy Research Institute, National Development and Reform Commission |
| 8 | Cooling the Planet: Opportunities for Deployment of Superefficient Room Air Conditioners | Shah, N., Phadke, A., and Waide, P, of Lawrence Berkeley Labs and Navigant Consulting, Inc. |
| 9 | Manual for Project Management | PMO |
| 10 | Training Requirement Questionnaire for ACC | CHEAA |
| 11 | Training Agenda for the First Training of ACC | CHEAA |
| 12 | Training Materials for the First Training of ACC | CHEAA |
| 13 | Feedback Evaluation Form for the First Training of ACC | CHEAA |
| 14 | Information questionnaire on energy efficiency of the project products | CHEAA |
| 15 | Annual Report on Information System 2013 | CHEAA |
| 16 | Training Requirement Questionnaire for RAC | CHEARI |
| 17 | Training Agenda for the First Training of RAC | CHEARI |
| 18 | Training Materials for the First Training of RAC | CHEARI |
| 19 | Feedback Evaluation Form for the First Training of RAC | CHEARI |
| 20 | Draft Report for Approval of the RAC Updated Standard | CNIS |

**ANNEX D: MTR Meetings Synopsis and Listing of**

**Persons Interviewed**

| **DATE** | **ACTIVITY** | **VENUE** | **PARTICIPANTS** | **LOGISTICS** |
| --- | --- | --- | --- | --- |
| DAY1  July 8 Monday | 09:30-12:00  Kick off meeting with PEERAC PMO | FECO  Room 818 | MTR Consultants, CHEAA, CHEARI, PMO (Zhu Liucai, Yun Jinqi, Liu Qin, Wu Weiling) |  |
| 14:00-17:00  Discussion and Desk Review | FECO  Room 818 | MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| DAY2  July 9 Tuesday | 09:30-12:00  Meeting with ACC Training Sub-contractor China Household Electrical Appliances Association | CHEAA | Ms. Wang Lei, Mr. Dou Yan wei (CHEAA),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00  Meeting with AMIS Sub-contractor China Household Electrical Appliances Association | CHEAA | Ms. Wang Lei, Ms. Dou Yan wei (CHEAA),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| DAY3  July 10 Wednesday | 09:30-12:00  Meeting with ACC Training Sub-contractor China Household Electrical Appliances Research Institute | CHEARI | Mr. Zhong Shuihe (CHEARI),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00  Meeting with Testing Center Sub-contractor National Quality Supervision and Inspection Center for Household Electrical Appliances | NQSICHEA | Mr. Zhong Shuihe (NQSICHEA),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| DAY4  July 11 Thursday | 09:30-12:00  Meeting with Standard Revision Sub-contractor China National Institute of Standardization | CNIS | Mr. Cheng Jianhong (CNIS),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00  Meeting with Standardization Administration, member of PAC | SAC | Mr. Yin Minghan (SAC), MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| DAY5  July 12 Friday | 09:30-12:00  Meeting with Ministry of Industry and Information Technology, member of PAC | MIIT | Ms. Xiao Duyu (MIIT),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00 |  |  |  |
| DAY6-7  July 13-14  Weekends | 09:30-17:00  Desk review and internal discussion of MTR | FECO  Room 818 | MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| DAY8  July 15 Monday | 09:30-12:00  Meeting with Ministry of Environmental Protection, member of PAC | MEP | Mr. Jiang Hong (MEP),  MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00  Flight from Beijing to Zhuhai | Beijing-Zhuhai | MTR Consultants, UNDP (Liu Shijun, Teng Yue ), PMO (Yun Jinqi, Liu Qin) |  |
| DAY9  July 16 Tuesday | 09:00-17:00  A site visit to the Gree Electric Appliance Company | Gree | Mr. Liu Huaican (GREE),  MTR Consultants, UNDP (Liu Shijun, Teng Yue ), PMO (Yun Jinqi, Liu Qin) |  |
| DAY10  July 17 Wednesday | 09:30-12:00  A site visit to the Zhuhai Landa Compressor.Co.,Ltd. | Landa | Landa representatives, MTR Consultants, UNDP (Liu Shijun, Teng Yue ), PMO (Yun Jinqi, Liu Qin) |  |
| 14:00-17:00  Flight from Zhuhai to Beijing | Zhuhai-Beijing | MTR Consultants, UNDP (Liu Shijun, Teng Yue ), PMO (Yun Jinqi, Liu Qin) |  |
| DAY11  July 18 Thursday | 09:30-12:00  Summary meeting of the MTR | FECO,  Room 818 | MTR Consultants, PMO (Yun Jinqi, Liu Qin) |  |
| 15:00-18:00  Draft report. |  | MTR Consultants |  |

**Meetings Synopsis and Site Visits**

**July 8, 2013**

**9:30 - 12:00**

Meeting Purpose: Kick off meeting with PEERAC PMO

Location: Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Room 818, Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Mr. Carsten Germer, UNDP

Ms. Liu Shijun, UNDP

Ms. Teng Yue, UNDP

Dr. Zhu Liucai, Director Division Ⅳ of FECO of SEPA

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Wu Weiling, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Zhong Shunhe, former chief-engineer of CHEARI

Meeting Process:

1. Introduction of the participants by Mr. Carsten Germer

2. Dr. Roger Raufer introduced the purpose and content of the evaluation and expressed the willingness to hear from the ideas and information from related parties.

3. Dr. Zhu Liucaigave a general introduction of the implementation of the project

4. Mr. Yun Jinqi gave a presentation on the detailed progress of the PEERAC project.

5. The other participants gave supplementary comments on the presentation.

6. Q&A

**July 8, 2013**

**14:00-17:00**

Meeting Purpose: Discussion and Desk Review

Location: Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Room 818, Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Meeting Process:

1. MTR group internal discussion and responsibility allocation

2. Discussion about the documents provided by PMO

3. Internal discussion on the purpose and framework of MTR report

4. Raise question list that needs to be resolved in the MTR evaluation

5. Q&A with PMO

**July 9, 2013**

**9:30-12:00**

Meeting Purpose: Meeting with ACC Training Sub-contractor China Household Electrical Appliances Association (CHEAA)

Location: 7th floor, Tongzheng International Mansion, Guangqumennei Street, Chongwen District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Ms. Liu Shijun, UNDP

Ms. Teng Yue, UNDP

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Wang Lei, Deputy Director- general of CHEAA

Mr. Dou Yanwei, Deputy Division Director of CHEAA

Meeting Process:

1. Ms. Wang Lei gave a welcome speech and a brief introduction of CHEAA

2. Mr. Dou Yanwei gave a detailed introduction on the progress of RAC training

3. Q&A with PMO staff

4. Q&A without PMO staff

**July 9, 2013**

**14:00-17:00**

Meeting Purpose: Meeting with AMIS Sub-contractor China Household Electrical Appliances Association (CHEAA)

Location: 7th floor, Tongzheng International Mansion, Guangqumennei Street, Chongwen District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Ms. Liu Shijun, UNDP

Ms. Teng Yue, UNDP

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Wang Lei, Deputy Director- general of CHEAA

Mr. Dou Yanwei, Deputy Division Director of CHEAA

Meeting Process:

1. Ms. Wang Lei gave a brief introduction of AMIS system

2. Mr. Dou Yanwei gave a detailed introduction on the progress of AMIS system

3. Q&A with PMO staff

4. Q&A without PMO staff

**July 10, 2013**

**9:30-12:00**

Meeting Purpose: Meeting with ACC Training Sub-contractor China Household Electrical Appliances Research Institute (CHEARI)

Location: No. 3 BoXing 8 road, Beijing economic and technological development area, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Wu Shangjie, Deputy Director-General of CHEARI

Mr. Liu Ting, Chief-Engineer of CHEARI

Mr. Zhong Shunhe, former Chief-Engineer of CHEARI

Mr. Qu Zongfeng, deputy Division Director of CHEARI

Meeting Process:

1. Mr. Wu Shangjie gave a welcome remark

2. Mr. Qu Zongfeng gave a brief introduction of CHEARI

3. Mr. Wu Shangjie shows the labs of CHEARI

4. Mr. Zhong Shunhe gave a detailed introduction on the progress of ACC Training Sub-contract

5. Q&A with PMO staff

6. Q&A without PMO staff

**July 10, 2013**

**14:00-17:00**

Meeting Purpose: Meeting with Testing Center Sub-contractor National Quality Supervision and Inspection Center for Household Electrical Appliances

Location: No. 3 BoXing 8 road, Beijing economic and technological development area, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Wu Shangjie, Deputy Director-General of CHEARI

Mr. Liu Ting, Chief-Engineer of CHEARI

Mr. Zhong Shunhe, former Chief-Engineer of CHEARI

Mr. Qu Zongfeng, deputy Division Director of CHEARI

Meeting Process:

1. Mr. Qu Zongfeng and expert from CHEARI gave a detailed introduction on the progress of Testing Center Sub-contract

2. Q&A with PMO staff

3. Q&A without PMO staff

4. Mr. Wu Shangjie gave wrap up remarks

**July 11, 2013**

**9:30-12:00**

Meeting Purpose: Meeting with Standard Revision Sub-contractor China National Institute of Standardization (CNIS)

Location: Zhichun Street No.4, Haidian District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Prof. Cheng Jianhong, Research Professor from CNIS

Dr. Li Yan, Researcher from CNIS

Meeting Process:

1. Prof. Cheng Jianhong gave a welcome remark and a brief introduction of CNIS

2. Prof. Cheng Jianhong gave a detailed introduction on the progress of Standard Revision Sub-contract

3. Q&A with PMO staff

4. Q&A without PMO staff

**July 11, 2013**

**14:00-17:00**

Meeting Purpose: Meeting with Standardization Administration, member of PAC

Location: Room 213, Building B, Madian East Street No. 9, Haidian District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Yin Minghan, Deputy Director-general of SAC

Mr. Wang Junwei, Division Director of SAC

Meeting Process:

1. Mr. Yin Minghan gave a welcome remark and a brief introduction of SAC

2. Q&A with PMO staff

3. Q&A without PMO staff

**July 12, 2013**

**9:30-12:00**

Meeting Purpose: Meeting with Ministry of Industry and Information Technology (MIIT), member of PAC

Location: Room 218, Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Xiao Duyu, Deputy Division Director of Ministry of Industry and Information

Meeting Process:

1. Ms. Xiao Duyu gave a detailed introduction of MIIT and their comments on PEERAC project

2. Q&A with PMO staff

3. Q&A without PMO staff

**July 12, 2013**

**1:40-17:00**

Meeting Purpose: Discussion and Desk Review of MTR group

Location: Room 218, Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Meeting Process:

1. Dr.Roger Raufer gave a brief introduction on the framework of the MTR report

2. MTR members discuss the framework and key findings from the survey in the first week.

3. MTR members discuss the responsibility allocation and work schedule in the next phase.

**July 15, 2013**

**9:30-12:00**

Meeting Purpose: Meeting with Ministry of Environmental Protection, member of PAC

Location: Room 218, Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Prof. Yu Cong, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Jiang Hong, Division Director of Ministry of Environment Protection

Meeting Process:

1. Mr. Jiang Hong gave a detailed introduction of MEP and their comments on PEERAC project

2. Q&A with PMO staff

3. Q&A without PMO staff

**July 16, 2013**

**9:30-17:00**

Meeting Purpose: Site visit to the Gree Electric Appliance Company

Location: Gree’s meeting room, Zhuhai City, Guangdong Province

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Liu Huaican, Deputy Division Director of Technology, Gree RAC Co. Ltd.

Meeting Process:

1. Mr. Liu Huaican gave a welcome remark and introduction of Gree RAC Co. Ltd.

2. Mr. Liu Huaican showed MTR group about the new products and production line in Gree RAC Co. Ltd.

3. Mr. Liu Huaican introduced Gree’s progress in the PEERAC project

4. Q&A with PMO staff

5. Q&A without PMO staff

**July 17, 2013**

**9:30-12:00**

Meeting Purpose: Site visit to the Zhuhai Landa Compressor.Co.,Ltd

Location: Zhuhai Landa’s meeting room, Zhuhai City, Guangdong Province

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Wang Yong, Division Director of Technology, Zhuhai Landa ACC Co. Ltd.

Meeting Process:

1. Mr. Gan, the Director General, gave a welcome remark and introduction of Zhuhai Landa Co. Ltd

2. Mr. Wang Yong showed MTR group about the new products and production line in Zhuhai Landa Co. Ltd.

3. Mr. Wang Yong introduced Zhuhai Landa’s progress in the PEERAC project

4. Q&A with PMO staff

5. Q&A without PMO staff

**July 18, 2013**

**9:30-11:00**

Meeting Purpose: Meeting with Madam Li Pei, National Project Director, and Deputy Director of FECO

Location: Room 818, Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Madam Li Pei, Deputy Director-General of FECO of SEPA, National Project Director

Dr. Zhu Liucai, Director of Division Ⅳ of FECO of SEPA, Project Manager

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Meeting Process:

1. Madam Li Pei gave a welcome remark and introduction of FECO and her comments of PEERAC project

2. Q&A

**July 18, 2013**

**15:30-18:00**

Meeting Purpose: Presentation of MTR Preliminary Findings

Location: Room 818, Foreign Economic Cooperation Office (FECO), State Environmental Protection Administration (SEPA), Houyingfang Lane No.3, Xicheng District, Beijing

Participants:

Dr.Roger Raufer, Evaluation Expert

Dr. Bai Quan, Evaluation Expert

Mr. Carsten Germer, UNDP

Ms. Liu Shijun, UNDP

Ms. Teng Yue, UNDP

Dr. Zhu Liucai, Director of Division Ⅳ of FECO of SEPA, Project Manager

Mr. Yun Jinqi, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Ms. Liu Qin, member of Division Ⅳ of FECO of SEPA, Official of the Project.

Mr. Zhong Shunhe, former chief-engineer of CHEARI

Mr. Dou Yanwei, Deputy Division Director of CHEAA

Meeting Process:

1. Dr.Roger Raufer and Dr. Bai Quan gave a brief introduction of the preliminary findings of MTR of PEERAC project

2. Discussion preliminary findings with UNDP, PMO members and stakeholders

3. Discussion of schedules of next phase.

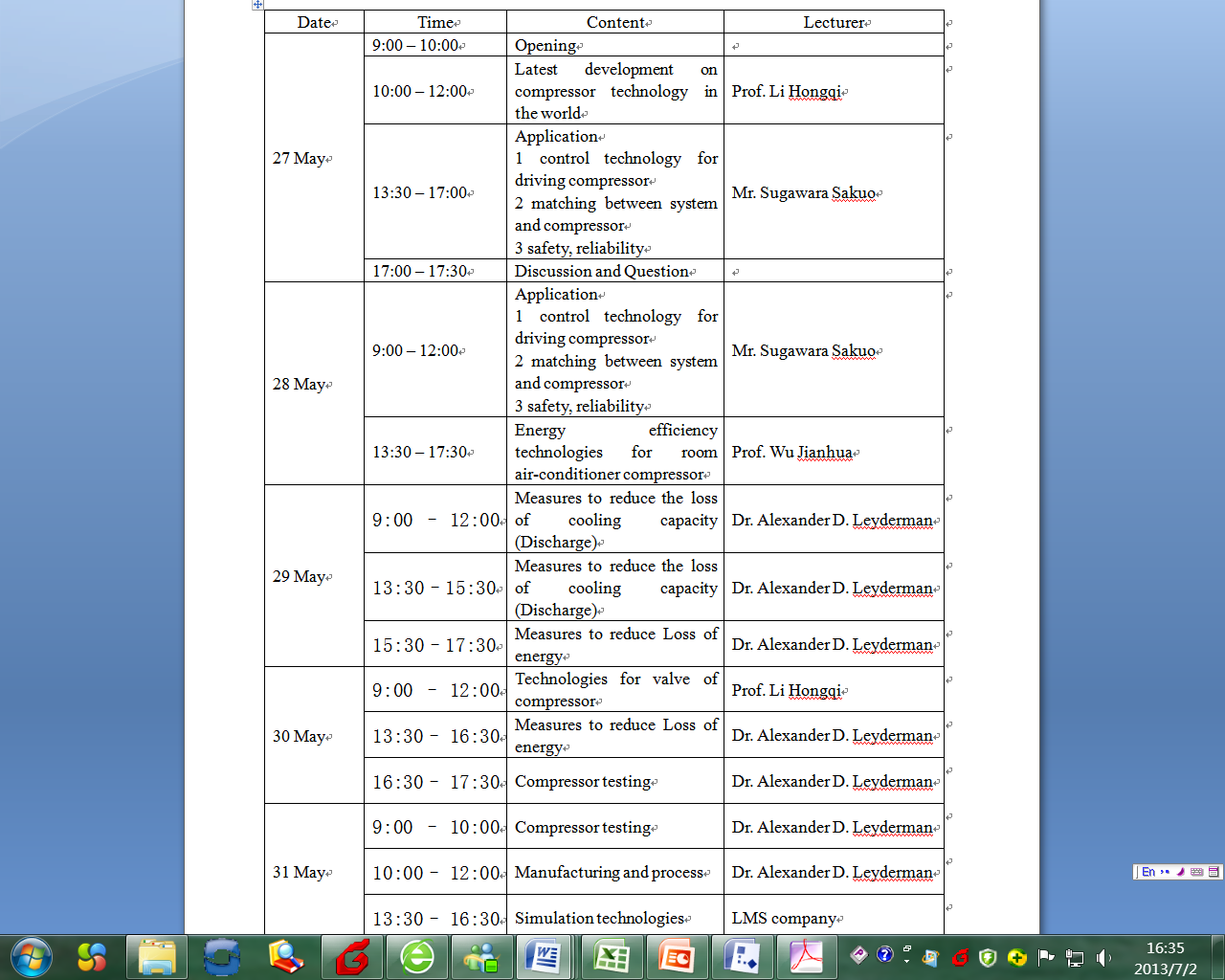
|  |
| --- |
| **ANNEX E: Overview of PEERAC Financing** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | **A.** | **Original PEERAC Funding (Project Document)** |  |  | | | | | | | |
|  |  |  |  |  |  |  |
|  | GEF |  |  |  | $6,263,600 |  |
|  | Government |  |  |  | $100,000 |  |
|  | Other |  |  |  | $20,000,000 |  |
|  | In-kind |  |  |  | $1,250,000 |  |
|  | **Total:** |  |  |  | **$27,613,600** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| |  |  | | --- | --- | | **B.** | **PEERAC Funding at MTR (PMO presentation, 08-07-13)** | | | | | | | |
|  |  |  |  |  |  |  |
|  | GEF |  |  |  | $6,263,600 |  |
|  | Government |  |  |  | $350,000 |  |
|  | Other |  |  |  | $21,000,000 |  |
|  | **Total:** |  |  |  | **$27,613,600** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| |  |  |  | | --- | --- | --- | | **C.** | **Spending through MTR Period (PMO presentation, 08-07-13)** |  | | | | | | | |
|  |  |  |  |  | **Budget** |  |
|  |  | **Comp.** | **Output** | **Code** | **Spending** |  |
| **2010** |  | PM |  | 75700 | $12,069 |  |
|  |  |  |  | **2010 Total:** | **$12,069** |  |
|  |  |  |  |  |  |  |
| **2011** |  | 1 | 1.5 | 72100 | $44,069 |  |
|  |  | 2 | 2.5 | 72100 | $300,472 |  |
|  |  | PM |  | 71300 | $3,750 |  |
|  |  | PM |  | 71600 | $442 |  |
|  |  | PM |  | 71600 | $3,784 |  |
|  |  | PM |  | 74200 | $2,765 |  |
|  |  | PM |  | 73100 | $2,064 |  |
|  |  | PM |  | 75700 | $15,450 |  |
|  |  | PM |  | 74100 | $68 |  |
|  |  | Unrealized loss | | 76100 | -$7,848 |  |
|  |  |  |  | **2011 Total:** | **$365,016** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Budget** |  |
|  |  | **Comp.** | **Output** | **Code** | **Spending** |  |
|  |  |  |  |  |  |  |
| **2012** |  | 1 | 1.1 | 72100 | $38,533 |  |
|  |  | 1 | 1.3 | 72100 | $6,678 |  |
|  |  | 1 | 1.4 | 72100 | $14,199 |  |
|  |  | 1 | 1.6 | 72100 | $16,071 |  |
|  |  | 1 | 1.7 | 72100 | $31,064 |  |
|  |  | 2 | 2.2 | 72100 | $48,044 |  |
|  |  | 2 | 2.3 | 72100 | $219,831 |  |
|  |  | 2 | 2.4 | 72100 | $28,874 |  |
|  |  | 2 | 2.7 | 72100 | $32,146 |  |
|  |  | 2 | 2.8 | 72100 | $63,963 |  |
|  |  | 3 | 3.6 | 71300 | $35,978 |  |
|  |  | PM |  | 71300 | $35,923 |  |
|  |  | PM |  | 71600 | $4,033 |  |
|  |  | PM |  | 74200 | $4,831 |  |
|  |  | PM |  | 73100 | $571 |  |
|  |  | PM |  | 75700 | $9,027 |  |
|  |  | Unrealized loss | | 76100 | -$4,982 |  |
|  |  |  |  | **2012 Total:** | **$584,783** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| |  |  |  | | --- | --- | --- | | **D.** | **Co-financing through MTR (Materials from PMO, 21-07-13)** |  | | | | | | | |
|  |  |  |  |  |  |  |
| **Governmental co-financing:** | |  |  |  |  |  |
|  |  | 2011 |  |  | $34,755 |  |
|  |  | 2012 |  |  | $35,381 |  |
|  |  |  |  | **Gov't Total:** | $70,136 |  |
| **Manufacturers co-financing:** | |  |  |  |  |  |
|  |  | Through 2012 | |  | $262,385,565 |  |
|  |  |  |  |  |  |  |
|  |  |  | **Co-financing Total:** | | **$262,455,701** |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| |  |  | | --- | --- | | **E.** | **Summary of Annual GEF Funding Allocation** | | | | | | | |
|  |  |  |  |  |  |  |
|  |  | 2010 |  |  | $12,069 |  |
|  |  | 2011 |  |  | $365,016 |  |
|  |  | 2012 |  |  | $584,783 |  |
|  |  | 2013 |  |  | $859,710 |  |
|  |  | 2014 |  |  | $1,108,540 |  |
|  |  | 2015 |  |  | $3,333,483 |  |
|  |  |  |  | **Total:** | **$6,263,600** |  |
|  |  |  |  |  |  |  |

**ANNEX F: Schedule for ACC and RAC Training Programs**

**A. ACC Training Program, 27-31 May, 2013 in Beijing**



**B. RACC Training Program, 28 March – 2 April, 2013 in Beijing**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Time** | **Contents** | **Lecturer** |
| Mar. 28, 2013 |  | Trainee registration date |  |
| Mar.29, 2013 | Early Morning | Opening ceremony | Addressing by Leaders from China household electrical appliances research institute, FECO, UNDP's Beijing office, China refrigeration association, and British expert Mr. Andrew Gigiel |
|  | Late Morning | -Basic theory of air conditioner refrigeration system | British expert Mr. Andrew Gigiel |
|  | Afternoon | Frequency conversion air conditioner refrigeration cycle with more online control | Prof. Shi Wenxing, Tsinghua University |
| Mar.30, 2013 | Whole day | Refrigeration system design considerations, how to choose the spare parts, and how to connect  -Energy saving air conditioner design research and development, the optimization of system performance | British expert Mr. Andrew Gigiel |
| Mar.31, 2013 | Morning | Room air conditioner simulation and optimization design of the machine and parts | Prof. Ding Guoliang, Refrigeration center of Shanghai Jiaotong University |
|  | Afternoon | Development trend of inverter, key technology and design points | Japanese experts Zuojing Yang, Mr. Xu Hong |
| Apr.1, 2013 | Morning | -Air conditioner of the vapor compression cycle  - Different cycle choice of the refrigeration system | Prof. Reinhard Radermacher, Maryland University |
|  | Afternoon | Environmental alternative refrigerants application and energy saving technology of the room air conditioner | Prof. He Guogeng, University of Huazhong Science and Technology |
| Apri.2, 2013 | Whole day | -CAD process of a new energy saving air conditioner  -Environmental energy engineering center CEEE refrigeration system design software is introduced | Prof. Reinhard Radermacher, Maryland University |
|  | Late afternoon | Summary and Closed |  |

**ANNEX G: Summary of Subcontractor TORs**

**(Note: Prepared by PEERAC PMO)**

**Outputs in TOR——AMIS**

1. Within one month of signing the contract, complete the "establishment and operation of information systems project implementation plan" and get the Party approved. Detailed description of the implementation plan shall be required for all activities, time, inputs, outputs, and technical reports during the implementation period;

2. Within two month of signing the contract, establish of air conditioners, compressors and energy efficiency database, determine the design data structure, the establishment of information systems and submit information system construction project completion report;

3. Finish and submit the annual report (both Chinese and English version) (2012-2015);

4. By the end of the project, submit the summary report (both Chinese and English version).

**Outputs in TOR——Testing Center**

1. Within one month of signing the contract, complete the "Testing Center project implementation plan" and get the Party approved. Detailed description of the implementation plan shall be required for all activities, time, inputs, outputs, and technical reports during the implementation period;

2. Within 10 days of the testing activities, submit to the PMO about products tested test results and analysis reports with evaluations. List of reports to be submitted see Annex B.

3. Submit annual report to PMO by the end of January (both Chinese and English version) (2012-2015);

4. By the end of the project, submit the summary report (both Chinese and English version).

**Outputs in TOR——Website**

1. Within one month of signing the contract, complete the "Web-site project implementation plan" and get the Party approved. Detailed description of the implementation plan shall be required for all activities, time, inputs, outputs, and technical reports during the implementation period;

2. Within two month of signing the contract, creating a website user, air conditioning enterprise and their products database, determine the site architecture, create a website and submit site construction project completion report;

3. Finish and submit annual report, (both Chinese and English version) (2012-2015);

4. By the end of the project, submit the summary report (both Chinese and English version).

**Outputs in TOR——EE label**

*ⅠRAC energy efficiency standards revision*

1. Finish RAC and compressor energy efficiency standards Investigation Report;

2. Complete RAC inverter draft national energy efficiency standards;

3. Supports standard authorities released the revised "national variable frequency air conditioner energy efficiency standards";

4. Complete air conditioning compressor national energy efficiency standards for Approval;

5. Completed for the new energy efficiency standards for corporate training sessions.

*ⅡImprove RAC energy efficiency labeling*

1. Complete air conditioner energy efficiency labeling Investigation Report;

2. Completed and reported to the RAC energy efficiency labeling recommendations for improvement document;

3. Improve the implementation of the completion of energy efficiency labeling program, including implementation details, identification documents, etc.;

4. Completed two seminars to improve energy efficiency labeling / promotion.

*Ⅲ Reports*

Submit annual report by the end of December during the implementation period

**Outputs in TOR——RAC technical training**

Within one month of signing the contract, complete the " RAC technical training implementation plan" and get the Party approved. Detailed description of the implementation plan shall be required for all activities, time, inputs, outputs, and technical reports during the implementation period;

*ⅠRAC energy-saving design and production of domestic technical training*

1. Within two months of signing the contract, complete the project RAC manufacturing enterprise energy level of technology and training needs assessment survey report;

2. Held the first domestic air conditioners technical training before the end of March 2013;

3. Held the second domestic air conditioners technical training before the end of March 2013;

4. Submitted summary report within two weeks after completion of each of the training;

*Ⅱ Completed Intensive RAC Design Training*

1. Complete the design of a RAC intensive training abroad by the end of June 2014;

2. Submit summary report within two weeks after the end of training abroad;

*ⅢCompleted Technical Assistance on EE RAC Design and Production*

1. Completed air-conditioner production site technical assistance before the end of 2014;

2. Submitted summary report within two weeks after the on-site technical assistance work;

 Submit RAC technical training summary report (both Chinese and English version) to PMO within a month after all the activities finished.

**Outputs in TOR——ACC technical training**

Within one month of signing the contract, complete the "ACC technical training implementation plan" and get the Party approved. Detailed description of the implementation plan shall be required for all activities, time, inputs, outputs, and technical reports during the implementation period;

*ⅠACC energy-saving design and production of domestic technical training*

1. Within two months of signing the contract, complete the project ACC manufacturing enterprise energy level of technology and training needs assessment survey report;

2. Held the first domestic ACC technical training before the end of June 2013;

3. Held the second domestic ACC training before the end of June 2013;

4. Submitted summary report within two weeks after completion of each of the training;

*ⅡCompleted Technical Assistance on EE Compressor Design and Production*

1. Complete the design of a RAC intensive training abroad by the end of 2013;

2. Submit summary report within two weeks after the end of training abroad;

*ⅢCompleted Manufacturer Dialogue and Product Planning*

1. Completed before the end of 2013 compressor manufacturer dialogue and product planning;

2. Carry out follow-up dialogue no less than seven times before the end of 2013;

3. Submit summary report within two weeks after completion of corporate dialogue;

 Submit ACC technical training summary report (both Chinese and English version) to PMO within a month after all the activities finished.

**Outputs working plan(Highlight means un-implementing activities)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Output** | **Activity** | **Planning implementing period** |
| Component 1: AC Compressor Efficiency Upgrades | Output 1.1: Completed and Evaluated In-country Technical Training on High Efficiency AC Compressor Design and Manufacturing | Activity 1.1.1: Capacity Needs Assessment of Local ACC Manufacturers- | 2013-2015 |
| Activity 1.1.2: AC Compressor Technology Training Workshop Design and Implementation | 2013-2015 |
| Activity 1.1.3: Evaluation of In-Country AC Compressor Technical Training | 2015 |
| Output 1.2: Completed and Evaluated International Technical Training on High Efficiency AC Compressor Design and Manufacturing | Activity 1.2.1: International AC Compressor Technology Training Course Design and Implementation | 2014 |
| Activity 1.2.2: Evaluation of International AC Compressor Technical Training | 2015 |
| Output 1.3: Completed Manufacturer Dialogue and Product Planning | Activity 1.3.1: Organization and Conduct of an ACC Manufacturer Dialogue and Product Planning Workshop | 2013-2015 |
| Activity 1.3.2: Coordination and Evaluation of Follow-up Manufacturer Dialogue | 2015 |
| Output 1.4: Completed Technical Assistance on EE Compressor Design and Production | Activity 1.4.1: Selection of Local ACC Manufacturers for TA Provision | 2013-2015 |
| Activity 1.4.2: ACC Manufacturing TA Program | 2013-2015 |
| Activity 1.4.3: Evaluation of ACC Manufacturing TA Program | 2015 |
| Output 1.5: Commercialized EE Compressor Products | Activity 1.5.1: Product Commercialization Contracting and Mobilization | 2011-2015 |
| Activity 1.5.2: Product Design Implementation | 2011-2015 |
| Activity 1.5.3: Selection of Product Commercialization Models | 2013-2015 |
| Activity 1.5.4: Product Commercialization Implementation | 2013-2015 |
| Activity 1.5.5: Monitoring and Review of the Product Commercialization Program | 2015 |
| Output 1.6: Compilation of ACC Market and Performance Information | Activity 1.6.1: Air Conditioner Information System Design and Establishment | 2011-2015 |
| Activity 1.6.2: ACC Information Collection and Annual Reporting | 2011-2015 |
| Output 1.7: Completed EE Compressor Product Testing | Activity 1.7.1: AC Compressor Testing Center Establishment | 2011-2015 |
| Activity 1.7.2: ACC Product Testing | 2011-2015 |
| Activity 1.7.3: ACC Product Testing Results Reporting | 2011-2015 |
| **Component 2: RAC Efficiency Upgrades** | Output 2.1: International Technical Training on High Efficiency RAC Design and Manufacturing | Activity 2.1.1: International Room Air Conditioner Technology Training Course Design and Implementation | 2013 |
| Activity 2.1.2: Evaluation of International Room Air Conditioner Technical Training | 2015 |
| Output 2.2: In-country technical training on high efficiency RAC design and manufacturing | Activity 2.2.1: Capacity Needs Assessment of Local RAC Manufacturers | 2013-2015 |
| Activity 2.2.2: RAC Technology Training Workshop Design and Implementation | 2013-2015 |
| Activity 2.2.3: Evaluation of In-Country RAC Technical Training | 2015 |
| Output 2.3: Completed Intensive RAC Design Training | Activity 2.3.1: Development of Intensive RAC Design Training Course | 2013-2015 |
| Activity 2.3.2: Preparation of Initial RAC Prototypes/Models | 2013-2015 |
| Activity 2.3.3: Conduct and Evaluation of the Intensive RAC Design Training Course | 2015 |
| Output 2.4: Completed Technical Assistance on EE RAC Design and Production | Activity 2.4.1: Selection of Local RAC Manufacturers for TA Provision | 2013-2015 |
| Activity 2.4.2: RAC Manufacturing TA Program | 2013-2015 |
| Activity 2.4.3: Evaluation of RAC Manufacturing TA Program | 2015 |
| Output 2.5: Commercialization of EE RAC Products | Activity 2.5.1: Product Commercialization Contracting and Mobilization | 2011-2015 |
| Activity 2.5.2: Product Design Implementation | 2011-2015 |
| Activity 2.5.3: Selection of Product Commercialization Models | 2013-2015 |
| Activity 2.5.4: Product Commercialization Implementation | 2013-2015 |
| Activity 2.5.5: Monitoring and Review of the Product Commercialization Program | 2015 |
| Output 2.6: RAC Efficiency Standard | Activity 2.6.1: Development of RAC Energy Performance Standards | 2013-2015 |
| Activity 2.6.2: Revision of Current RAC Energy Performance Standards | 2013-2015 |
| Activity 2.6.3: Formal & Informal Discussions on Revised Standards | 2013-2015 |
| Activity 2.6.4: Publication and Capacity Building on the Revised Standards Compliance | 2013-2015 |
| Activity 2.6.5: Evaluation of the Impacts of the Revised Standards Enforcement | 2015 |
| Output 2.7: Compilation of RAC Market and Performance Information | Activity 2.7.1: Definition of RAC Information for Inclusion in AMIS | 2011-2015 |
| Activity 2.7.2: RAC Information Collection and Annual Reporting | 2011-2015 |
| Output 2.8: Completed EE RAC Product Testings | Activity 2.8.1: Room Air Conditioner Testing Center Establishment | 2011-2015 |
| Activity 2.8.2: RAC Product Testings | 2011-2015 |
| Activity 2.8.3: RAC Product Testing Results Reporting | 2011-2015 |
| Output 2.9: Policy Recommendations and Information, Education and Communication Materials on Addressing ODS Refrigerant Replacement and Disposal | Activity 2.9.1: Formulation of Policy Recommendations on Proper ODS Refrigerant Management and Disposal | 2013-2014 |
| Activity 2.9.2: Development of Information, Education and Communication Materials on ODS Refrigerant Management and Disposal | 2013-2014 |
| **Component 3: Energy Efficient RAC Promotion** | Output 3.1: High Efficiency RAC Procurement Guide and Procurement Promotion | Activity 3.1.1: Review of Typical Corporate RAC Procurement Procedures | 2013-2014 |
| Activity 3.1.2: Formulation of RAC Procurement Guidelines | 2013-2014 |
| Activity 3.1.3: Promotion of the Application of the RAC Procurement Guidelines | 2013-2014 |
| Activity 3.1.4: EE RAC Procurement Guidelines Effectiveness Evaluation | 2013-2014 |
| Output 3.2: Completed RAC Retailer Program | Activity 3.2.1: Capacity Needs Assessment of Local RAC Retailers | 2013-2015 |
| Activity 3.2.2: RAC Retailer Training Workshop Design and Implementation | 2013-2015 |
| Activity 3.2.3: Conduct of In-Store Marketing of EE RAC | 2013-2015 |
| Activity 3.2.4: Retail Incentive Program Design and Implementation | 2013-2015 |
| Activity 3.2.5: Evaluation of the RAC Retailer Program | 2015 |
| Output 3.3: RAC Rebate Program Design and Implementation | Activity 3.3.1: Conduct of RAC Rebate Program Workshop | Cancel |
| Activity 3.3.2: RAC Rebate Program Design | Cancel |
| Activity 3.3.3: RAC Rebate Program Implementation | Cancel |
| Activity 3.3.4: RAC Rebate Program Evaluation and Incentive Award Issuance | Cancel |
| Output 3.4: Enhanced National EE Label for RACs | Activity 3.4.1: Review of RAC Labeling System | 2013-2015 |
| Activity 3.4.2: Modification of the RAC Energy Labeling Program | 2013-2015 |
| Activity 3.4.3: Planning and Promotion of the RAC Energy Labeling Program | 2013-2015 |
| Activity 3.4.4: Implementation of the RAC Energy Labeling Program | 2013-2015 |
| Activity 3.4.5: Evaluation of the Modified RAC Energy Labeling Program | 2015 |
| Output 3.5: Completed Consumer Education Campaign | Activity 3.5.1: Survey on Level of Consumer Awareness about EE RACs | 2013-2015 |
| Activity 3.5.2: Development of a Consumer Education Program | 2013-2015 |
| Activity 3.5.3: Implementation of the Consumer Education Program | 2013-2015 |
| Activity 3.5.4: Implementation of Cooperative Advertising Campaign with Manufacturers | 2013-2015 |
| Activity 3.5.5: Evaluation of the Consumer Education Program | 2015 |
| Activity 3.5.6: Development of a Sustainable Continuing Education Program | 2015 |
| Output 3.6: Web-based Tools on EE RACs | Activity 3.6.1: Website Design, Implementation and Maintenance | 2012-2015 |
| Activity 3.6.2: Development of Web-based Tools | 2012-2015 |
| Activity 3.6.3: Promotion and Launching of the Website | 2012-2015 |
| Activity 3.6.4: Evaluation of the Website Performance | 2015 |
| Output 3.7: Completed EE RAC Public Relations Campaign | Activity 3.7.1: Preparation and Publication of Articles on EE RAC | 2011-2015 |
| Activity 3.7.2: Presentation of PR Campaign Achievements | 2011-2015 |
| Output 3.8: RAC Energy Efficiency Policy Promotion | Activity 3.8.1: Conduct of EE Air Conditioning Policy Studies | 2013-2015 |
| Activity 3.8.2: Organization and Conduct of EE Air Conditioning Policy Workshop | 2013-2015 |
| Activity 3.8.3: Conduct of an International Policy Exchange | 2013-2015 |
| Activity 3.8.4: Conduct of an International ODS Workshop | 2013-2015 |
| Activity 3.8.5: Conduct of Targeted Policy Coordination Meetings | 2013-2015 |

**ANNEX H: ACC and RAC Product Testing Results**

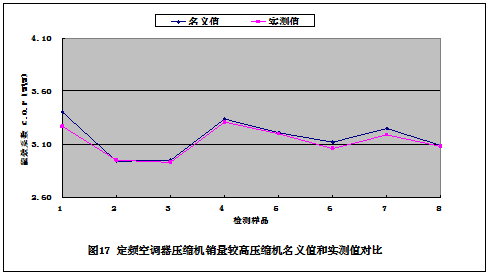


Figure H8.1 Nominal COP and tested COP of high efficient constant speed ACC models

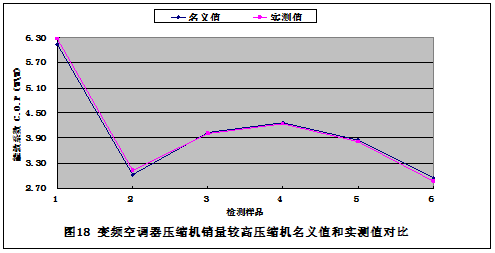


Figure H8.2 Nominal COP and tested COP of high efficient variable speed ACC models

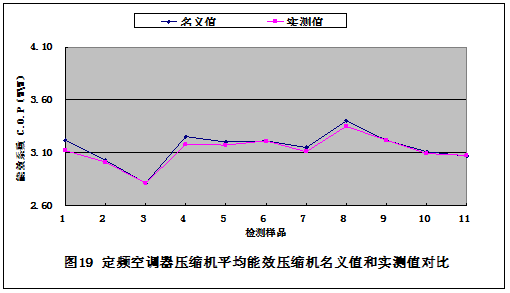


Figure H8.3 Nominal COP and tested COP of average efficient constant speed ACC mode

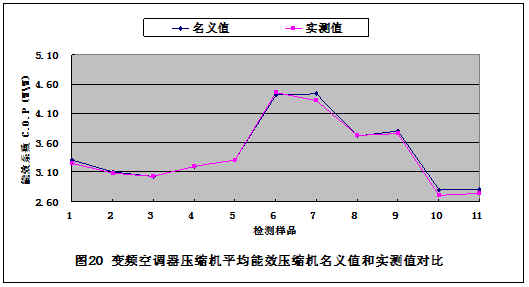


Figure H8.4 Nominal COP and tested COP of average efficient variable speed ACC models

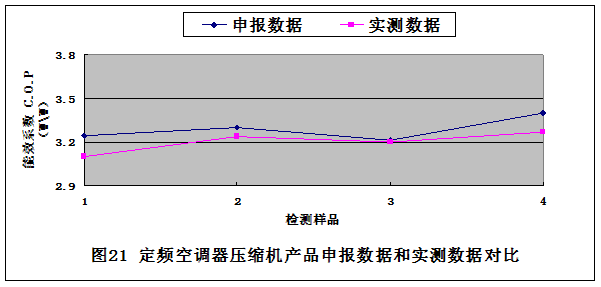


Figure H8.5 Deviation between reported data and the measured data of constant speed ACC

models

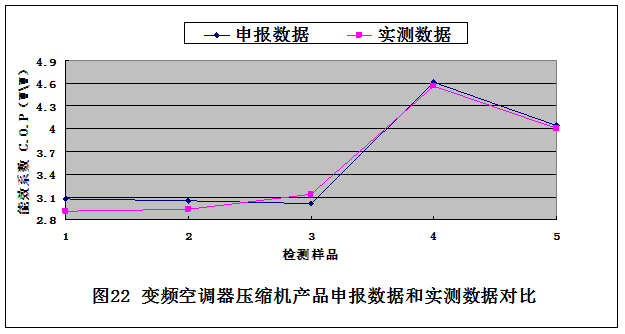


Figure H8.6 Deviation between reported data and the measured data of variable speed ACC models



Figure H8.7 The EER values deviation from manufacturers’ labs and NHEAQSTC lab

(constant frequency RAC)



Figure H8.8 The EER values deviation from manufacturers’ labs and NHEAQSTC lab

(inverter RAC)



Figure H8.9 Contrast between EER measured values and reported values

(constant frequency RAC)



Figure H8.10 Contrast between SEER measured values and reported values (inverter RAC)

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