Prepared for:

**USAID-SARI/Energy Program**

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# Roadmap for Harmonization of Energy Efficiency Standards in South Asia

## Report on the Second SARI/Energy Harmonization Meeting

Nexant

**October 2003**

# Roadmap for Harmonization of Energy Efficiency Standards in South Asia

**Report on the Second SARI/Energy Harmonization Meeting**

**For**

**United States Agency for International Development**

**Under**

**South Asia Regional Initiative for Energy**

**Prepared by**

**Nexant SARI/Energy**

## Acknowledgements

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Most importantly, we appreciate the input regarding the status and goals of regional efficiency programs provided by regional stakeholders. In particular, the attendees of the meeting provided the effort and insight needed to move forward with efficiency programs in the region, in both the preparation of presentations made during the proceedings and in the stimulating and productive discussions that followed. Participants to the meeting and other contributors to the report include members of the Indian Bureau of Energy Efficiency, Bureau of Indian Standards, Bangladesh Standards and Testing Institution, Bangladesh Power Cell, Ceylon Electricity Board, Sri Lanka Standards Institution, and Nepal Bureau of Standards and Metrology. Particular thanks go to the Engineering staff of the Demand Side Management branch of the Ceylon Electricity Board.

Nexant SARI/Energy would also like to acknowledge the contribution of CLASP to the report and the harmonization activities undertaken under SARI/Energy technical assistance program.

## List of Acronyms

| | |
|---|---|
| BEE | Indian Bureau of Energy Efficiency |
| BSTI | Bangladesh Standards and Testing Institution |
| CEB | Ceylon Electricity Board |
| CFL | Compact fluorescent lamp |
| CPRI | Central Power Research Institute |
| CLASP | Collaborative Labeling and Appliance Standards Program |
| ECF | Energy Conservation Fund |
| EES&L | Energy Efficiency Standards and Labeling |
| ERDA | Electrical Research and Development Association |
| ERTL | Electronics Regional Test Laboratory |
| FNCCI | Federation of Nepal Chambers of Commerce and Industry |
| ISO | International Standards Organization |
| NBSM | Nepal Bureau of Standards and Metrology |
| NEA | Nepal Electricity Authority |
| SARI/Energy | South Asia Regional Initiative for Energy |
| SLSI | Sri Lanka Standards Institution |

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# Executive Summary

The South Asia Regional Initiative for Energy (SARI/Energy) promotes mutually beneficial energy linkages among the nations of South Asia. SARI/Energy is sponsored by the U.S. Agency for International Development (USAID). The objectives of the technical assistance component of the SARI/Energy program are to:

- Assist the local standards institutions to understand the benefits from energy efficiency standards and labeling
- Communicate the role and benefits from energy efficiency standards in competitive markets
- Develop a mechanism and network for regional standards setting
- Evaluate the benefits from regional testing facilities and recognize regional testing bodies for labeling to support energy efficiency standards; and
- Establish a monitoring process to determine impacts

The South Asian Regional Initiative for Energy calls for a series of activities to promote Energy Efficiency Standards and Labeling (EES&L) of end-use appliances in the region. In pursuit of this goal, the project supports several seminars and meetings that bring together policymakers and stakeholders from throughout the region. The purpose of these gatherings is to encourage a dialogue among participants as to the benefits and barriers associated with EES&L programs. In addition, it is the role of the program organizers to provide participants with the technical details necessary to make progress towards effective efficiency programs.

One component of the initiative is to encourage the harmonization (alignment) of existing program components and the pursuit of new programs coordinated at the regional level. In support of this goal, the report provides information aimed at motivating and enabling cooperative activities that will provide concrete benefits to programs in each country, whether well developed, or still in the initial planning stage. This report supports the goals of the technical assistance effort in the development of mechanisms for harmonization of policy elements between the countries in the region.

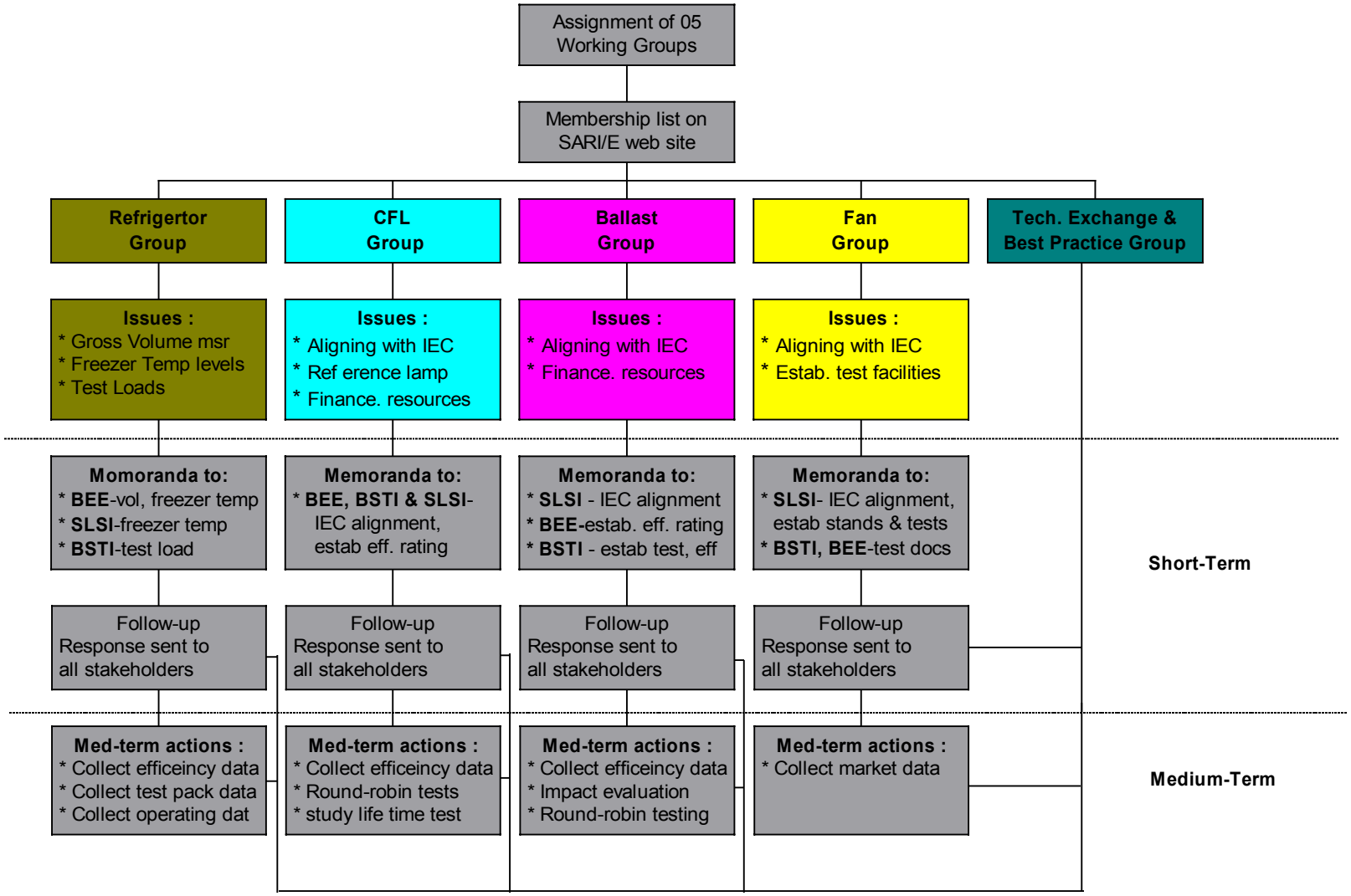
It should be emphasized that the underlying objective of the harmonization component of the SARI/Energy project is to increase the potential for success of EES&L programs of all countries involved, and to reduce burdens on manufacturers, exporters, and importers in each country. Harmonization "for its own sake" is not desirable, nor is it suggested that policymakers should bring their programs in line with international norms if doing so would present a disadvantage to their own efficiency programs, or to commercial interests within their country. If there are no such disadvantages, the program encourages alignment of policies and provides a forum at which this alignment can be pursued.

This report is the product of one of a series of meetings organized as part of the SARI/Energy project that focused on Harmonization of Energy Efficiency Labeling and Standards Programs. The meeting, held in Chennai, India on September 4-5, 2003, was

the second gathering of regional stakeholders and policymakers for the express purpose of discussing harmonization. This meeting tried to build on the progress made in the first and focused on concrete action items to be developed and discussed by all participants. Development of recommendations for action was pursued within an atmosphere of open moderated discussion, rather than in seminar form.

This report summarizes the outcome of these discussions, and it is also meant as a resource document facilitating steps toward development of EES&L programs in the region. A general introduction provides background for the discussions on harmonization, and it provides an outline of the strategy taken in organizing the meeting. This material is similar to that presented in a companion report "Opportunities for Regional Harmonization of Appliance Labeling and Standards Programs", although it is much abbreviated. In addition to general considerations of harmonization, it places the harmonization process in the specific context of the countries involved. Section Two presents the proceedings of the meeting. Section Three provides detailed technical information regarding one of the main issues discussed during the meeting – the comparison of Draft Refrigerator Test Procedures in Bangladesh, India, and Sri Lanka. This section is followed by a brief summary of recommendations. The final section is presented as a roadmap – it elaborates on the recommendations and considers immediate steps to be taken in the short term as well as the long-term goals.

**ROADMAP**


Assignment of 05 Working Groups
Membership list on SARI/E web site
Refrigertor Group
CFL Group
Ballast Group
Fan Group
Tech. Exchange & Best Practice Group
Issues :
* Gross Volume msr
* Freezer Temp levels
* Test Loads
Issues :
* Aligning with IEC
* Ref erence lamp
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* SLSI-freezer temp
* BSTI-test load
Memoranda to:
* BEE, BSTI & SLSI- IEC alignment, estab eff. rating
Memoranda to:
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* BEE-estab. eff. rating
* BSTI - estab test, eff
Memoranda to:
* SLSI- IEC alignment, estab stands & tests
* BSTI, BEE-test docs
Short-Term
Follow-up Response sent to all stakeholders
Follow-up Response sent to all stakeholders
Follow-up Response sent to all stakeholders
Follow-up Response sent to all stakeholders
Med-term actions :
* Collect efficeincy data
* Collect test pack data
* Collect operating dat
Med-term actions :
* Collect efficeincy data
* Round-robin tests
* study life time test
Med-term actions :
* Collect efficeincy data
* Impact evaluation
* Round-robin testing
Med-term actions :
* Collect market data
Medium-Term

# Section 1 Introduction

## 1.1 Background

During the past decade, the nations of South Asia have experienced difficulty in maintaining an adequate and reliable supply of electricity, which is a serious concern both to citizens experiencing long hours of load shedding and to the nations as a whole in terms of economic development. Several discussions regarding the benefits of energy efficiency programs as an alternative to increasing supply and as a policy tool to address the supply problem have been held. Partially as a result of SARI/Energy activities, policymakers and stakeholders throughout the region have come to have a favorable view of energy efficiency programs, including Appliance Energy Efficiency Labeling and Standards Programs (EES&L).

India and Sri Lanka are the regional leaders in this area with well-developed programs. These programs are complementary, with Indian programs concentrating on refrigerators and air conditioners, and Sri Lanka implementing lighting product programs. Bangladesh has recently taken steps toward establishing a program by creating a steering committee to guide foundational activities. A National Seminar on Energy Efficiency Standards and Labeling of End Use Appliances was held in July to a positive reception of nearly a hundred participants representing government, industry, academic, and non-profit institutions. The Government of Nepal has also initiated a program concentrating on lighting products. A National Seminar in Nepal is scheduled for the fall of 2003.

The SARI/Energy Harmonization program aims to facilitate development of efficiency programs in all of these countries at this critical stage early. Harmonization may serve the interests of all countries involved, whether more or less advanced in their development of a program. On one hand, economies with well-developed energy efficiency programs for appliances have an interest in brining their programs into better alignment for the purposes of promoting free trade. This means that different existing standards are made to agree by modifying the specifications of one or both existing programs. On the other hand, for governments that are in the early phase of initiating a program, harmonization can refer to the selection of procedures and practices from the list of already existing programs throughout the world. In this way, governments can take advantage of well-established successful practices.

There can be a significant advantage to adopting program components according to what is already in use in other countries. The most obvious advantage involves the time and resources necessary to develop a complex program. It should not be necessary to repeat all of the research that has previously been done by others; rather it may be possible to benefit from the experiences of others by finding out about the successes and challenges they had. Adopting relatively generic aspects of the program from the practice of others may free up resources to concentrate on those areas for which individual consideration should be paid by any country. An example of this would be to adopt a well-accepted test procedure for a particular product, and use the saved resources on evaluating consumer's reaction to a certain public announcement campaign. For this reason,

harmonization of some aspects will likely speed up the process of building labeling and standards programs in the region.

Thus far, discussions of harmonization in the region have concentrated on the following products:

- Refrigerators
- Fluorescent Lamp Ballasts
- Compact Fluorescent Lamps
- Ceiling Fans
- Room Air Conditioners

This is by no means an exhaustive list of products that may be targeted for efficiency programs; rather, it is a short list of products that probably deserve immediate consideration. Situations vary from country to country. Lighting products almost certainly are an important part of any country's policy consideration, due to the large fraction of demand created by lighting in all sectors and the importance of lighting at peak load. Refrigerators are already a large consumer of electricity in India and Sri Lanka, and their use, along with air conditioning, is growing throughout the region. Other products that should be considered in the longer term are electric motors, water heaters, and smaller appliances like rice cookers.

Refrigerators were the first subject of harmonization efforts in the SARI/Energy region. The concentration on this product was in part due to the significant progress made in implementing a refrigerator program in India. This program is in a critical stage of development where it is perhaps most likely to be aligned with a wider regional policy. As the harmonization program was initiated, there were draft test procedures in both India and Sri Lanka. The first step of the program was to investigate the possibility of bringing these procedures into alignment. This effort was the subject of the First Harmonization Meeting, held in Colombo, Sri Lanka in August of 2002. Although this meeting yielded positive results, resulting in revisions to both test procedures, a perfect alignment was not achieved. A revisiting of this issue with the hope of coming to a final agreement on the alignment of these procedures was therefore the first topic discussed during the Second Harmonization Meeting. By this time, Bangladesh had adopted test procedures for refrigerators as part of its program. The Bangladesh test procedures are adopted from international (ISO) procedures. Therefore, consideration of regional adoption of international norms was a key part of discussions.

In addition to the discussion of refrigerators, the Second Harmonization Meeting strove to take advantage of the interest in lighting product programs in all four countries represented and the fact that programs already exist with a wealth of experience to share throughout the region. Therefore, there was significant time allotted for the discussion of fluorescent lamp ballasts and compact fluorescent lamps. The goal for these products was to outline specific steps to most effectively move programs forward in all four countries with a unified set of procedures. Finally, the meeting covered development and harmonization of ceiling fan programs. This product is thought to represent a particular

opportunity because of its high use rates, availability of international procedures, and existing and proposed test facilities.

## 1.2 Current Status of Efficiency Labeling Programs in SARI/Energy Region

### 1.2.1 Refrigerator Test Procedures

Three of the countries in the SARI/Energy region – India, Sri Lanka, and Bangladesh have decided to pursue a program of energy efficiency labeling for refrigerators. Nepal is still considering whether to build a program for refrigerators. The refrigerator program in India is the most advanced – the Indian Bureau of Energy Efficiency (BEE) expects labeled products by early 2004. There are several manufacturer-owned and independent laboratories capable of testing products at this time in India. In Sri Lanka, a test procedure for refrigerators is in the draft stage, and a refrigerator test facility is being built using funds from the World Bank. In Bangladesh, test procedures identical to those developed by ISO have been proposed for adoption.

A Standards and Labeling program for refrigerators in India is already well developed. Manufacturers in India are expected to begin distributing labeled products in early 2004. Initially, only frost-free refrigerators will be labeled by manufacturers. These will be followed by direct cool refrigerators and then by air conditioners.

The focus of the project, led by the Indian BEE has been a voluntary comparative label for refrigerators and air conditioners. To date, the following activities have been completed, or are in progress:

- An extensive market study leading to an adopted design for comparative labels
- Creation and convening of Technical and Advisory Committees to develop standards and protocols
- Development of refrigerator test procedures
- Upgrade and accreditation of test facilities for refrigerator tests[1]
- Development of enforcement mechanisms for a labeling program (see Section 6); and
- Market survey and test data collection to assess efficiency levels and energy level ratings (in progress)

Refrigerators have been identified as a candidate for the labeling program facilitated by the Ceylon Electricity Board (CEB) in liaison with the Sri Lanka Standards Institution (SLSI). As part of SARI/Energy's harmonization project, Sri Lanka has agreed to pursue alignment of refrigerator test procedures with those being proposed by BEE as part of the Indian program. The details of refrigerator test procedures and the current difference between procedures used in India, in Sri Lanka, and international procedures are given in Section 4.3. A testing facility is expected to be in operation in early 2004 funded by the World Bank. The target for program implementation is June of 2004.

[1] Currently independent labs are in development at ERDA, ERTL, CPRI, CERC and ITS

Not only are the countries of the SARI/Energy region at different stages of program development, but they have different market configurations. India, like the larger industrialized countries, has a large domestic refrigerator market and a large domestic manufacturing industry to supply that market. Although multinationals have recently become players in the Indian appliance industry, the bulk of sales continue to be made by India-based companies, or Indian subsidiaries of international companies. Domestic manufacturers have a strong interest and expertise in the development of procedures and standards for measuring and rating efficiency. This role is recognized by BEE, which solicits and considers industry inputs via its technical and advisory committees. In this way, the regulating agency is developing policy with a built-in component of buy-in from manufacturers, who will be more likely to participate in the process.

Sri Lanka, however, has little domestic refrigerator manufacturing and relies primarily on imports to supply its market. Regulators there have chosen to adopt test procedures that are drawn from elements of international procedures. They have shown a great deal of flexibility in choosing procedures that may be agreed upon at the regional level.

In developing and EES&L program, representatives of Bangladesh Standards and Testing Institution (BSTI), the agency in Bangladesh responsible for setting standards, declared a strong preference for procedures aligned with international norms. There is little if any refrigerator manufacturing in Bangladesh, and representatives for there expressed serious concern for avoiding trade barriers whenever possible.

The draft test procedures for refrigerators in India, Sri Lanka, and Bangladesh are described in detail in the next section. These technical parameters formed a large part of the discussion during the meeting.

In general, it should be said that among the participants there was a consensus that uniform refrigerator testing procedures throughout the region would be desirable. All parties recognized, however, that there were differing circumstances and interests at play in each country, making harmonization not a trivial matter of having participants in agreement at the meeting. The strategy taken was as follows:

- Specify as completely and as specifically as possible, the differences between current draft test procedures
- Address each feature of the procedures during the meeting and solicit comment from all participants
- Identify areas for which we would like to request a change in draft procedures, which items for which clarification is to be requested; and
- Create recommendations for representatives to take back and request for follow-up

### 1.2.2 Fluorescent Lamp Ballasts

Authorities in Sri Lanka have had an efficiency labeling program for lighting products for several years. The facilitating authority in that country is the Demand Side Management

(DSM) Branch of the CEB in liaison with the SLSI which also acts as the certification authority, and the testing institute for testing ballasts in the labeling program. The DSM branch of CEB was established in 1995. In 1999, a household survey was performed, and a feasibility study for a standards and labeling program was completed in 2000. Phase 1 of the labeling program addresses magnetic ballast efficiency. Ballasts are labeled by suppliers on a voluntary basis according to rating scheme shown in Table 1-1 and 1-2.

**Table 1.1 Star Ratings for Ballasts Used for 18/20W Fluorescent Lamps**

| Percent Active Power Loss | Active Power Loss | Star Rating |
|---|---|---|
| $P_{\%} \leq 20$ | $P \leq 4$ | * * * * * |
| $20 < P_{\%} \leq 25$ | $4 < P \leq 5$ | * * * * |
| $25 < P_{\%} \leq 30$ | $5 < P \leq 6$ | * * * |
| $30 < P_{\%} \leq 35$ | $6 < P \leq 7$ | * * |
| $35 < P_{\%} \leq 45$ | $7 < P \leq 9$ | * |
| $45 < P_{\%}$ | $9 < P$ | No Star |

$P_{\%}$ = Percentage active power loss in ballast; P = Active power loss in ballast in watts
Additional note: The standard notes that "all electronic ballasts that conform to recognized international standards (IEC 928 and 929) shall be labeled with ' * * * * * ' (five star) rating."
Source: SLS 1200: 2001

**Table 1.2 Star Ratings for Ballasts Used for 36/40W Fluorescent Lamps**

| Percent Active Power Loss | Active Power Loss | Star Rating |
|---|---|---|
| $P_{\%} \leq 10$ | $P \leq 4$ | * * * * * |
| $10 < P_{\%} \leq 15$ | $4 < P \leq 6$ | * * * * |
| $15 < P_{\%} \leq 20$ | $6 < P \leq 8$ | * * * |
| $20 < P_{\%} \leq 25$ | $8 < P \leq 10$ | * * |
| $25 < P_{\%} \leq 30$ | $10 < P \leq 12$ | * |
| $30 < P_{\%}$ | $12 < P$ | No Star |

$P_{\%}$ = Percentage active power loss in ballast; P = Active power loss in ballast in watts
Additional note: The standard notes that "all electronic ballasts that conform to recognized international standards (IEC 928 and 929) shall be labeled with ' * * * * * ' (five star) rating."
Source: SLS 1200: 2001

The results of this program to date are the labeling of seven models of ballast, which are distributed by six different importers. Of these, six models are rated "3-star" and one is rated "4-star". However, it is reported that only **20%** of the 1.2 million ballasts imported to the country per year participate in the labeling program at present[2].

The Government of Nepal has chosen fluorescent lamp ballasts as its first target product for developing an efficiency labeling program. Toward this goal, a national technical committee has been established with responsibility for setting energy efficiency standards and labeling for lighting appliances. Institutions represented include the Nepal Bureau of

[2] Personal communication with DSM Division of CEB

Standards and Metrology (NBSM), Nepal Electricity Authority (NEA), Federation of Nepal Chambers of Commerce and Industry (FNCCI), the Ministry of Industry, Commerce and Supplies, and Ministry of Science and Technology, among others. In addition, the following actions have been taken:

- An information exchange with Sri Lanka has taken place
- A market survey has been completed; and
- The standard setting process has begun

The results of the market survey indicate that 400,000 ballasts are sold in Nepal each year, the majority of which are imported from India and China. For this reason, regulators in Nepal strongly prefer that lighting standards developed there be compatible with those in place in India and China. There are eight major brands of ballasts. Generally, products are found to be very inefficient, with losses from 8 to 10 Watts.

### 1.2.3 Compact Fluorescent Lamps

Phase Two of the efficiency labeling program in Sri Lanka concerns the promotion, testing and labeling of compact fluorescent lamps (CFLs). The labeling phase of the CFL program was officially launched earlier this year with the participation of the Ministry of Power and Energy, and a group of stakeholders in March 2003.

The CFL program in Sri Lanka has a history going back several years, with a promotion project led by the CEB. This program began with the bulk purchase of 100,000 CFLs in 1995-1996. Following this, CEB began to distribute certified CFLs to utility customers, offering interest-free payment over the course of the year, to be collected as part of utility bills (Easy Payment Plan). It is estimated that 300,000 CFLs have been distributed through this program to date, either via CEB, or directly from manufacturers/suppliers.

This certification program has since developed into a “star” labeling program, based on efficacy and power factor. The rating levels of this scheme are shown in Table 2-5. This rating scheme will be subsequently linked directly to the promotion scheme through the requirement that only those products rated with three stars or better (out of five) will qualify for the easy payment scheme. Product lifetime is also covered in the promotion program, since a minimum warranty of one year is required in order to qualify. Currently, 26 CFL models provided by eight importers and one manufacturer are labeled according to the five-star system.

Both Bangladesh and Nepal are considering development of CFL programs.

### 1.2.4 Ceiling Fans

Sri Lanka is currently developing a labeling program for ceiling fans as part of its overall labeling program that includes lighting products and refrigerators. Ceiling fans are widely used in Sri Lanka as means of achieving thermal comfort in domestic, commercial, and industrial environments. There are a large number of brands and varieties in the local

market supplied by about 20 major importers. Thus, the necessity to evaluate their performance in terms of energy use and otherwise is crucial. There are no very well established performance indicators for this purpose. Moreover, there is as of this time no test facility, but one is to be constructed using local funding from the Energy Conservation Fund (ECF).

The University of Moratuwa is assigned to develop a proper testing procedure, identify suitable performance indices, and establish a star-rating methodology. This testing procedure will be an enhanced version of the ones available at present in some countries in the region. The goal for implementation of this program is the end of 2004.

# Section 2 Proceedings of the Meeting

The *Second Regional Energy Efficiency Standards Harmonization Meeting* was hosted in Chennai, India by Nexant, Inc., on behalf of the USAID SARI/Energy program. The primary purpose of the meeting was to constitute the next step in discussions and actions related to harmonization of EES&L programs in the SARI/Energy region, which had been initiated by the *First Meeting on Harmonization* held in Colombo in August of 2002.

The meeting took place on September 4-5, 2003; invitees represented Bangladesh, India, Nepal, and Sri Lanka. Participants included members of regulatory and testing agencies, electric power agencies, consumer advocacy groups, and manufacturers. In addition, the meeting was attended and addressed by Mr. N.V. Seshadri, Country Coordinator, India and Bhutan (SARI/Energy), USAID, and Mr. Robert W. Beckman, Regional Program Manager (SARI/Energy), USAID. To facilitate discussion and provide technical support, presentations were made by consultants provided by Nexant, Inc.

***Presentations: Day 1— September 4, 2003***

- *Welcome Address - Mr. N.V. Seshadri – USAID, New Delhi*
- *Opening remarks – M.S. Jayalath*
- *Opening Remarks – Robert W. Beckman*
- *Status of Energy Efficiency Standard Setting and Labeling Programs in Bangladesh – Mr. B.D. Ramadullah / Liaquat Ali*

The presentation described the background of the power sector indicating its structure and the current status highlighting the supply and demand scenarios in Bangladesh. Some explanation for the current unsatisfactory power supply scenario was given, including the absence of a proper energy efficiency standards and labeling program and policy. The implementation of a standards and labeling program with strong administrative support is envisaged to improve the supply situation. An estimated cumulative energy savings of 2900 GWh and peak demand reduction of 625-875 MW is expected as a result of a 5-year standards and labeling program. To date, this program has resulted in the formulation of the following standards by the BSTI:

- BDS 1724: 2003 – Specifications for energy efficiency rating – Fluorescent lamp ballasts (assistance derived from SLS 1200:2001)
- BDS ISO 7371: 2003 – Household refrigerating appliances – refrigerator with or without low temperature compartment - characteristics and test methods; and
- BDS ISO 5149: 2003 – Mechanical refrigerating systems used for cooling and heating safety

In addition, the following were presented as draft standards based on the adoption of the international standards (IEC 60968:2003, IEC 60969:2003, IEC 60901:2003):

- Specifications for energy efficiency labeling requirements for compact fluorescent lamps; and
- Specifications for energy efficiency rating for self ballasted lamps

Finally, in the concluding remarks it was also stated that BSTI could issue certification for energy efficiency rating of end use appliances.

- *Status of Energy Efficiency Standard Setting and Labeling Programs in India – Mr. Tanmay Tathagat*

The presentation described the role of the advisory committee and responsibilities of the technical committee of the Indian labeling program as a comparative label. It also covered the aspects of empowerment to affix the labels by the manufacture, enforcement through testing, and the regulatory mechanism. It was then stated that the role of the advisory committee was to coordinate all the activities including the review of the rating plan every three years especially with reference to the product classes, efficiencies and star levels. It was highlighted that a market-based enforcing mechanism is being adopted where the product efficiency levels could be challenged and checked with the intervention of an approved third party leading to a subsequent withdrawal of the label in case of the check test.

The features of the Indian comparative label were discussed and followed by the status of the labeling program for refrigeration and air-conditioners. It was stated that the technical committee is established involving all stakeholders under the BEE leadership and the manufacturers had agreed to the label rating plan and test procedures. It was also highlighted that the accreditation process and the inter-lab proficiency testing are in progress with independent labs being set up by ERDA, ERTL, CPRI, CERS and ITS.

- *Status of Energy Efficiency Standard Setting and Labeling Programs in Nepal – Mr. Shree Bhakta Prajapati*

The role of the NEA and the energy supply scenario in Nepal was explained at the beginning. It was highlighted that imports of all kinds of electrical appliances were mainly from India, China, Thailand, Korea, USA, Europe, and Japan. It was stated that the infrastructure for the development of energy efficiency standards and labeling is being strengthened with the leadership of NBSM. The focus was also given to the needs such as capacity building in testing and also the barriers such as lack of awareness, testing, and calibration facilities and trained personnel. The benefit from an energy efficiency standards and labeling program has been estimated as 50-80 MW electricity over a period of five years. Finally, it was noted that a technical committee comprised of public and private sector establishment has been set-up for a sustainable implementation of a standards and labeling program.

- *Status of Energy Efficiency Standard Setting and Labeling Programs in Sri Lanka – Ms. J. Devasurendra*

The need for an energy efficient standards and labeling program followed by the existing institutional structure for the implementation of the program was stated. In this regard, the Demand Side Management (DSM) branch of the CEB plays the role of facilitator with Energy Conservation Fund (ECF) as the promoter, while the SLSI is the standards setting authority. The typical end-use demand for domestic appliances in the Sri Lankan context was also highlighted with reference to their contribution to energy and the system peak. A voluntary labeling program for fluorescent lamp ballasts was launched in October 2001 followed by a voluntary labeling program for CFLs in March 2003.

The performance rating system for assigning stars for these two appliances was described. Ballast rating is through measured energy loss while for the CFLs it is based on the combination of luminous efficacy and power factor. It was also stated where the testing of these appliances are being carried out. The current status of the refrigerator and ceiling fans labeling program was also noted, with the refrigerator program having an approved standard (SLS 1230: 2003) awaiting the establishment of the testing facilities next year. As for the ceiling fans, the standards are being drafted together with planning activities for establishing test facilities. Finally, it was brought to notice that the goals have been set to implement voluntary standards and labeling programs for refrigerators and fans in June 2004 and December 2004, respectively, followed by drafting standards for Air-conditioners.

- *Benefits of Regional Harmonization of Energy Performance Test Protocols: Presentation of SARI/Energy Report – Dr. Michael McNeil*

The presentation by Dr. McNeil began with circumstances that motivated a regional harmonization and factors that facilitated the development of a harmonized energy efficient standards and labeling program in the region. He also highlighted in detail the components of a harmonization program and steps and factors involved in harmonizing test procedures, followed by a description of the benefits of harmonization especially when falling in line with relevant international standards. Then issues related mainly for harmonizing refrigerator test protocols were taken up. The issues on other appliances, e.g., CFLs, ballasts, fans, and air-conditioners were also briefly presented. Summarizing the current status of the standards and labeling programs in participatory countries concluded the presentation.

- *Cross-Comparison of Domestic Refrigerator Standards developed by India and Sri Lanka – Prof. R.S. Agarwal*

The presentation commenced with a background indicating the need of energy efficiency standards and labeling programs for SARI/Energy countries. It was noted that the refrigerating appliances can be broadly classified as direct cool and forced air circulation types followed by a secondary classification. A comprehensive list of relevant

international standards was also presented thereafter. This was then followed by the specific test protocol issues:

- Volume measurement
- Rating temperatures and humidity for energy consumption
- Test loads

As for the volume measurement, acceptable methods and necessary conditions for the determination of its value with reference to direct cool and forced air circulation (frost-free) types were clearly emphasized. Similarly, temperature test protocols and test conditions and test loading conditions were also highlighted. This was then followed by a comprehensive cross comparison of relevant SLS, Draft BEE, Australian/New Zealand, and ISO standards with reference to test protocols summarizing the key differences. The presentation concluded by noting the benefits of harmonizing these standards and working in line with relevant international standards.

***Presentations: Day 2— September 5, 2003***

- *Moderated Discussion on Harmonization of Domestic Refrigerator Energy Efficiency Test Protocols – Dr. Michael McNeil, moderator*

- *Moderated Discussions on Potential for Harmonization of Energy Efficiency Test Protocols of Other Appliances. – Dr. Michael McNeil, moderator*

Day 2 commenced with the discussion moderated by Dr. McNeil addressing the issues that surfaced during the country presentations with reference to harmonizing test protocols on ballasts, CFLs, refrigerators, and fans for the time being and possibility of air-conditioners for the future. The major elements under refrigeration category were volume measurement, temperature test protocols, and test loading.

A detailed description of these two sessions in terms of observations, recommendations and follow-up action is given in Section 4 of this report.

- *Follow up Actions for Regional Harmonization of Standards – Dr. Rahula Attalage*

The presentation commenced with a brief recapitulation of energy efficiency standards and labels, major issues in implementing and follow-up action required for a successful implementation such a program. Major issues included the selection of appliances for labeling, establishment of rating indices and rating levels, costs and acceptance of testing, market differences in selected countries, cultural factors, and policies of each country of participation and the selection of participatory countries of a harmonized standards and labeling program.

This was followed by stating a few elements for immediate action, such as the possibility of sharing real-life experience with countries that have implemented programs, sharing

test facilities, building and mobilization of capacity of personnel involved in testing, and also carrying out monitoring and evaluation.

Finally, follow-up actions for discussion of future activities were presented as follows:

- Establishment of a Working Groups
- Identification of common target activities for aligning test protocols with international standards
- Development of a common work plan and timeframe
- Strategy of sharing test facilities until proper centers are established
- Preliminary testing for identifying initial rating levels
- Search for accredited test centers; and
- Development of strategy for monitoring and evaluation and enforcement

- *Concluding Remarks – Mr. M.S. Jayalath*

Mr. Jayalath concluded this two-day meeting session stating the assistance that could be provided to participatory countries and especially to the core working group under the SARI/Energy program to establish an electronic network through which efficient and effective liaison can be maintained. He also extended his gratitude to all the involved personnel for their efforts during the two days and for preparatory tasks.

The three main types of domestic refrigerating appliances used are designated according on the design and temperature levels maintained in the cabinets:

- Direct Cool Single / Double Door Refrigerators (with and without low temperature compartment)
- Direct Cool Single / Double Door Refrigerator – Freezers; and
- Forced Air Circulation Single / Double Door Refrigerator – Freezers

Currently, most of the SARI/Energy countries markets are dominated by direct cool appliances, which hold a market share of more than **85%.**

There are at present three ISO standards (ISO 7371, ISO 8187, and ISO 8561). These standards are not country specific but are developed in consultation with representatives from ISO member institutions and countries from around the world. In general, refrigerator test standards used in Asia are based on the ISO standards, as shown in Table 3-1. In particular, Thailand, which has a well-developed EES&L program and is a significant exporter to the SARI/Energy region, has adopted an explicit policy of alignment with ISO standards.

**Table 3.1 Refrigerator Standards in Asia**

| Country | Test Procedure | Based on | Comment |
|---|---|---|---|
| Bangladesh | BDS-ISO-7371 | ISO 7371,8561 | Similar to ISO-7371 and 8561 |
| China | GB 12021.2-89 | ISO 7371-8561 | |
| India | IS 1476 | ISO 7371/8561/8187 | BEE Procedure in Draft |
| Indonesia | SNI 05-3086:1992 | ISO 7371/8561/8187 | Voluntary Labeling Program |
| Korea | KS C 9305-96 | | Not Equivalent to other Standards |
| Malaysia | MS ISO:8561/8187 | ISO 7371/8561/8187 | |
| Philippines | PNS 1474-1477 | ISO 7371/8561/8187 | |
| Chinese Taipei | CNS 2062 & CNS 9577 | | Similar to ISO 5155, 7371, 8187 |
| Thailand | TIS 455-2537 | ISO 7371/8561/8187 | Does not appear to differ significantly from ISO |
| Singapore | | ISO 7371/8561/8187 | |
| Sri Lanka | SLS 1230:2003 | ISO 7371/8561/8187 | |

Sources: Harrington et al -Review of Energy Efficiency Test Standards and Regulations in APEC Member Economies, APEC-ESIS Website

Currently, ISO standards for refrigerators are under review, and it is likely that, before the end of 2005, new standards will be issued. No significant changes to the test procedures are expected from this revision, but the three standards are expected to be combined into a single one covering all product classes. In the longer term, there is an effort to produce a significantly improved ISO standard that takes into account the comments of representatives of all member countries. This process promises a significant improvement in the test procedures, but it is expected to take several years.

In addition to the ISO standards there are quite a few country specific standards, such as Australia New Zealand Standard (AS/NZS 4474), Indian Standard (IS1476), draft BEE (Indian Standard), Sri Lanka Standard SLS 1230:2003, U.S. National Standard (ANSI/ AHAM HRF), Chinese National Standard (CNS2062), Japanese Industrial Standard (JIS-C 9607), Canadian Standard (CAN/CSA), and European National Standard (EN 153). Bangladesh has drafted refrigerator test procedures in alignment with ISO, called BDS-ISO 7371:2003.

The country specific standards generally are based on ISO, but there are some specific deviations depending on their own country needs. However, such approach limits the utility of the standard as the markets are opening specially in the neighboring countries. It may be worthwhile to harmonize standards within the region so that consumer is able to compare the products properly. The following are the relevant standards for refrigerators with and without low temperature compartments and refrigerator freezers

- ISO 7371: 1995 (Refrigerators with and without low temperature compartment)
- ISO 8187: 1995 (Refrigerator-freezers)
- ISO 8561: 1995 (Frost-free refrigerators, refrigerator – freezers and freezers)
- AS/NZS 4474.1:1997 (Refrigerating appliance)
- IS 1476.1:2000 (Refrigerators with or without low temperature compartments)
- BEE, Draft Indian Standard (Direct cool and forced air circulation refrigerators-freezers)
- SLS 1230:2003, Sri Lanka Standard (Refrigerator, refrigerator – freezers and freezer)
- BDS-ISO-7371 Bangladesh Standard (Refrigerators with and without low temperature compartment)
- BDS-ISO-8561 Bangladesh Standard (Frost-free refrigerators, refrigerator – freezers and freezers)

The following were key elements identified in the refrigerator test standards for harmonization during the workshop:

- Gross volume measurement
- Temperature protocols; and
- Humidity, test period, and freezer test load

### 3.1 Gross Volume Measurement – Direct Cool Appliances

Table 3-2 shows a comparison of gross volume measurement for direct cool appliances. It can be seen that all the standards have the same procedures for measuring the gross volume except the IS 1476, where the water-filling method is used to determine the gross volume.

**Table 3.2: Gross Volume Measurement – Direct Cool Appliances**

| | |
|---|---|
| ISO 7371 | Dividing the total volume into convenient units of volumes of easily measured geometric shapes.<br>Internal fittings such as shelves, removable partitions, containers evaporators thermostats and interior light housings shall be considered as not being in place.<br>Shall contain exact shapes of the walls if they contain depressions or projections. |
| ISO 8187 | Same as ISO 7371 |
| AS/ NZS 4474 | Same as ISO 7371 |
| IS 1476 | ▪ Same as ISO 7371<br>▪ Use water filling method to determine gross volume |
| Draft BEE Standard (India) | Same as ISO 7371 |
| SLS 1230:2003 | Same as ISO 7371 |
| BDS-ISO-7371 | Same as ISO 7371 |

### 3.2 Gross Volume Measurement – Frost-Free Appliances

Table 3-3 shows a comparison of gross volume measurement for frost-free refrigerator-freezers. All of the standards have the same procedures for measuring the gross volume, with the exception of the inclusion or exclusion of *inaccessible volume because of air ducts, fans, evaporators, and other associated accessories*. This is an important difference, since energy efficiency ratings are generally scaled by gross volume. A difference in volume measurement therefore prevents direct comparison of efficiency ratings.

**Table 3.3 Gross Volume Measurement – Frost-Free Appliances**

| | |
|---|---|
| ISO 8561 | Same as ISO 7371 and in addition "Any volume, which is inaccessible because of air ducts, fans, evaporators and other associated accessories shall also be deducted." |
| AS/NZS 4474 | Same as ISO 7371, in addition to that<br>"Any volume, which is inaccessible because of air ducts, fans, evaporators and other associated accessories shall also be included if it is with in the space bounded by the liner otherwise excluded |
| Draft BEE Standard (India) | Same as AS/NZS 4474 |
| SLS 1230:2003 | Same as ISO 8561 |
| BDS-ISO-8561 | Same as ISO 8561 |

## 3.3 Temperature Protocols – Direct Cool and Frost-Free Appliances

Table 3-4 compares values of ambient temperature levels and compartment temperature settings required as part of the test conditions. The draft BEE and SLS standards require the same temperature test conditions as that of ISO 7371 and ISO 8187 except for the freezer compartment temperature setting. The difference in freezer compartment temperature is an important discrepancy that prevents direct comparison of results of test using the different protocols.

**Table 3-4 Temperature Protocol – Direct Cool and Frost-Free Appliances**

| | **ISO 7371/8187/8561** | **Draft BEE (India)** | **AS/ NZS** | **SLS 1230:2003** | **Bangladesh BDS-ISO-8561** |
|---|---|---|---|---|---|
| Ambient Temperature ($^oC$) | 25/32<br>± 0.5 | 25/32<br>± 0.5 | 25/32<br>± 0.5 | 16/32<br>± 0.5 | 25/32<br>± 0.5 |
| Fresh Food Temperature ($^oC$) | ≤ 5 | 5 | 3 | 5 | ≤ 5 |
| Freezers ($^oC$) | * ≤ -6<br>** ≤ -12<br>*** ≤ -18 | STFC - 6<br>FC - 15 | -15 | -15 for Classes 4,5,6 &7<br>-9 for Class3 | * ≤ -6<br>** ≤ -12<br>*** ≤ -18 |

STFC: Short-Term Freezer Compartment; FC: Freezer Compartment

### 3.4 Humidity, Test Period, and Freezer Test Load – Direct Cool and Frost-Free Appliances

The draft BEE, SLS, and ISO test procedures have more or less similar specifications with regard to humidity and test period, as shown in Table 3-5. It is unlikely that the small differences in these specifications would significantly impact the test results. However, there is one significant difference—namely, the requirement of a freezer test load in the ISO test protocol. There is no such requirement in the other protocols. This difference should be eliminated, if results from the different test procedures are to be compared directly.

**Table 3.5 Humidity, Test Period, and Test Load Gross Volume Measurement – Frost-Free Appliances**

| | **ISO 7371/8187/8561** | **Draft BEE (India)** | **AS/ NZS** | **SLS 1230:2003** | **Bangladesh BDS-ISO-7371/8561** |
|---|---|---|---|---|---|
| Humidity (%) | 45-75 | 45-75 | Not Specified | 45-75 | 45-75 |
| Test Period (hrs) | ≥24 | wtcc ≥6<br>tcc ≥24 | ≥16 | ≥16 | ≥24 |
| Test Load | **100%** | No Load | No Load | No Load | **100%** |

wtcc without temperature control cycle
tcc with temperature control cycle

### 3.5 Summary of Key Difference in ISO and Draft BEE / SLS Standards for Direct Cool and Frost-Free Appliances

The ISO/BDS-ISO and Draft BEE/SLS standards for direct cool refrigerator-freezers that are commonly used are more or less similar except the following minor differences:

- Draft BEE and SLS 1230:2003 uses different set of Temperatures for Refrigerator-Freezers in comparison to ISO star system for Freezer Compartment Ranking
- Draft BEE and SLS 1230:2003 specify Test Without Load while ISO specifies **100%** Load

### 3.6 Summary of Key Difference in ISO and Draft BEE / SLS Standards for Frost-Free Appliances Only

In addition to the differences listed above, there is another, more significant difference in the case of frost-free appliances. The ISO 8561 and draft regional standards for frost-free

refrigerator-freezers differ in the measurement of gross volume, which in turn may significantly impact efficiency rating.

- Draft BEE includes the inaccessible volume that is not usable. It causes a major difference in the capacity specify by the manufacturer of a refrigerator-freezer
- SLS 1230:2003 excludes the inaccessible volume similar to ISO 8561
- BDS-ISO-8561 is the same as ISO 8561

### 3.7 Refrigerator Test Procedure – Recommendations

The workshop recommended the harmonization of refrigerator test procedures between Sri Lanka, Bangladesh, and India, and the development of a refrigerator labeling program.

If practical, harmonized test procedures should be aligned with international norms. It was recognized, however, that there may be significant reasons for policymakers to make modifications to these procedures. These reasons may have to do with particular characteristics of products in the national market, or there may be logistical difficulties or additional expenses associated with carrying out the international standards as written. However, it may be useful to carefully look into the possibilities of adaptation of ISO standards. In case some changed approach in test procedures is needed, the same may be discussed in the ISO committee by the members rather than forming a country specific test procedures. The SARI/Energy program has been providing a useful forum where these details are being discussed openly and solutions to these difficulties may be addressed.

# Section 4 Conclusions and Recommendations

Based on known usage patterns and sales growth rates in the region, the following appliances should be considered for regional standards harmonization:

- Refrigerators
- Fluorescent Lamp Ballasts
- Compact Fluorescent Lamps
- Ceiling Fans
- Room Air Conditioners

Policymakers in Bangladesh, India, Nepal, and Sri Lanka have expressed interest in developing programs for all of these products. In addition, within the region there is some experience in developing a program for all of them. Some of these programs have been in operation for several years, while others have completed the development stage and will soon be launched. It is the general recommendation of this report that one or more working groups be formed among representatives of the four countries to complete the following action items:

1. **Refrigerator Test Procedures** – Investigate the potential to align existing test procedures within the SARI/Energy region, and to consider a policy of aligning all test procedures with international norms as revised procedures become available (ISO test procedures for refrigerators are expected by approximately 2006).
   - Consider reporting gross volume for the purpose of energy rating in accordance with ISO test procedure in Draft Indian Standard (relevant for frost-free appliances only)
   - Explain and document rationale for the choice of freezer compartment set point temperatures during energy test in Draft Indian Standard
   - Consider adoption of test procedures in Bangladesh that do not require the loading of freezer compartment during energy test as a short-term measure
   - Secure commitment by all parties to reconsider alignment with ISO procedures once a new revision of these becomes available

2. **Fluorescent Lamp Ballasts** – Develop regionally harmonized test procedures and efficiency metric for fluorescent lamp ballasts. Evaluate the possibility of alignment with international test procedures.
   - Verify that current procedures used or proposed in India, Sri Lanka, and Bangladesh are in alignment with IEC test procedures, or evaluate requirements for bringing current procedures into alignment
   - Develop regionally agreed upon methodology for determining efficiency rating parameters

3. **Compact Fluorescent Lamps** – Develop regionally harmonized test procedures and efficiency metric for compact fluorescent lamps. Evaluate the possibility of alignment with international test procedures.
   - Verify that procedures used in India and Sri Lanka are in alignment with IEC procedures, or evaluate requirements for bringing current procedures into alignment
   - Develop regionally agreed upon methodology for determining efficiency rating parameters
   - Develop regional procedures for evaluating mean life expectancy of lamps

4. **Ceiling Fans** – Develop regionally harmonized test procedures and efficiency metric for ceiling fans. Evaluate the possibility of alignment with international test procedures.
   - Verify test procedures used in test facilities for ceiling fans in Bangladesh and India
   - Evaluate feasibility and/or desirability for adoption of test procedures in alignment with IEC test procedures in Sri Lanka, and throughout the region. Develop regionally agreed upon methodology for determining efficiency rating parameters
   - Collect market data to assess typical types of fans used, major manufacturers and importers, as well as sales and penetration rates

5. **Technical Exchange and Best Practices** – Dissemination of lessons learned through previous program experience, either in the form of direct exchanges, or through written reports.
   - Promotion Program – Sri Lanka Compact Fluorescent Distribution Program
   - Enforcement Issues – Sri Lanka Lighting Program and India Refrigerator Program
   - Development of Labels – Sri Lanka Lighting Program and India Refrigerator Program; and
   - Market Data Collection – India Refrigerator Program

# Section 5 Roadmap →Proposed Way Forward

The Second Meeting on Harmonization provided policymakers and stakeholders with an update on the current status and recent activities going on throughout the region. It also allowed for the exchange of views and helpful discussion regarding some key issues relevant to all participants. Ultimately, however, the purpose of the meeting was to facilitate progress on development of EES&L programs by providing an outline of concrete steps to be taken by meeting attendees in both the short-term (weeks) and medium-term (months). This section is the agenda for action (or *roadmap*) that emerged out of the discussions that took place at the meeting in Chennai, India in September 2003.

## 5.1 Establish Working Groups

The first agreed upon step forward, and which is a precursor to all other activities, is the establishment of working groups. Each working group will have the responsibility of coordinating efforts throughout the region, within a specific topic outlined in this roadmap.

The establishment of working groups serves two primary purposes:

1. It divides the work to be done into more specialized, manageable units, and clearly identifies responsibility for action items with specific individuals.
2. Each working group constitutes a distribution list by which regional cooperation can be achieved directly and efficiently.

Establishment of the following working groups is recommended:

- Harmonization of Refrigerator Test Procedures
- Development and Harmonization of Fluorescent Lamp Ballast Programs
- Development and Harmonization of Compact Fluorescent Lamp Programs
- Development of Regional Program for Ceiling Fans
- Technical Exchanges and Best Practices

***Deliverable*** – Assignment of members of five working group committees. Posting of membership lists on SARI/Energy web site.

## 5.2 Refrigerator Test Procedures

The status of development of refrigerator efficiency labeling and standards programs is was given in Section 1. To summarize briefly, a program is well on its way to implementation in India, test facilitates are just being developed in Sri Lanka, a test procedure has been decided upon in Bangladesh (but no test facilities are available), and a program is still under consideration in Nepal. Not only are the countries of the

SARI/Energy region at different stages of program development, but they have different market configurations. India, like the larger industrialized countries, has a large domestic refrigerator market, and a large domestic manufacturing industry to supply that market. Although multinationals have recently become players in the Indian appliance industry, the bulk of sales continue to be made by India-based companies, or Indian subsidiaries of international companies. Domestic manufacturers have a strong interest and expertise in the development of procedures and standards for measuring and rating efficiency. This role is recognized by BEE, which solicits and considers industry inputs via its Technical and Advisory Committees. In this way, the regulating agency is developing policy with a buy-in from manufacturers, who will be more likely to participate in the process.

Sri Lanka has little domestic refrigerator manufacturing, relying primarily on imports to supply its market. Regulators there have chosen to adopt test procedures that are drawn from elements of international procedures, and have shown a great deal of flexibility in choosing procedures that may be agreed upon at the regional level.

In developing and EES&L program, representatives of BSTI, the agency in Bangladesh responsible for setting standards, have declared a strong preference for procedures aligned with international norms. There is little if any refrigerator manufacturing in Bangladesh, and representatives for there expressed serious concern for avoiding trade barriers whenever possible.

Much of the Second Meeting on Harmonization was therefore devoted to the discussion of alignment of test procedures with international standards, with particular attention to refrigerator test procedures. In general, there was a consensus that *uniform refrigerator testing procedures throughout the region would be desirable*. All sides recognized, however, that there were differing circumstances and interests at play in each country, making harmonization not a trivial matter of having participants in agreement at the meeting. The strategy taken towards moving forward as far as possible toward harmonization was as follows:

- Specify as completely and as specifically as possible the differences between current draft test procedures
- Address each feature of the procedures during the meeting and solicit comments and discussion from all participants
- Identify areas for which we would like to request reconsideration of draft procedures, and areas for which clarification is to be requested
- Draw up a list of requests and recommendations for representatives to take back to decision-making bodies, and a request follow-up report to the Working Group for Harmonization of Refrigerator Test Procedures

The following subsections cover each area for which reconsideration is requested, and specify working group deliverables for each area.

### 5.2.1 Measurement of Gross Volume

The measurement of the gross volume of refrigerator compartment has a direct impact on energy efficiency ratings. Methods for determining rating level vary from program to program, but generally ratings are formed by a combination of energy consumption and gross volume[3]. This is because most programs rate appliances according to a scaled efficiency, which allows for larger appliances to consume more energy than small ones and still qualify for the same efficiency rating. A simple scheme is to simply divide energy consumption by gross volume to determine a maximum qualifying level. The maximum-scaled consumption is therefore given in terms of *kilowatt-hours per liter*.

For the purposes of international comparison of test results for the purpose of efficiency labeling, it is not necessary that each country have the same scheme for scaling consumption according to gross volume, only that the *gross volume and energy consumption are measured according to the same procedure*.

As detailed in Section 3, there is currently some disagreement in test procedures drafted or proposed by countries in the SARI/Energy region. This discrepancy does *not* appear for direct cool appliances, rather is relevant only for frost-free models. Specifically, the draft Indian test procedure specifies that inaccessible volumes should be *included* while the test procedure drafted by Sri Lanka, as well as the ISO procedure (proposed for adoption by Bangladesh) and the Australia/New Zealand stand specify that these volumes be *excluded*. It should be noted that frost-free appliances enjoy only a small fraction of the market (about **15%** in India), so that for the majority of refrigerators, there is no disagreement.

There was a significant amount of discussion during the meeting on the possible rationale for defining gross volume in such a way as to include inaccessible volumes. In particular, the view was expressed by representatives of consumer advocacy groups that they did not see a justification for this position, based on their experience, and that they would prefer that a test procedure be based on international norms. There was general concurrence on this issue from other regional representatives. It was pointed out that, in many cases, manufacturers use electronic design programs (CADs) for the specification of refrigerator components, and can report cabinet volumes based on these programs. For this reason, separate reporting of the cabinet and air passage volume need not pose a significant measurement burden.

***Deliverable*** – Memorandum requesting elaboration of rationale used by Technical and Advisory committees of BEE refrigerator program in including non-accessible volume in the measurement of gross volume for frost-free appliances. Requested information should include:

[3] Gross volume is to be distinguished from storage volume, which represents the space available for actual food storage. Gross volume generally includes all accessible spaces, and is thus closer to the actual space cooled by the refrigeration system.

- Rationale for defining gross volume measurement as to exclude non-accessible volumes
- Assessment of willingness to modify measurement of gross volume in order to conform to international norms (specifications of ISO test procedure)
- Assessment of acceptability of reporting gross volume measured as per international procedures, if only for the purpose of efficiency rating

***Deliverable*** – Follow-up memorandum summarizing response to request of information by regional Working Group, to be circulated among all meeting participants and other interested stakeholders and policymakers.

### 5.2.2 Freezer Compartment Set Point Temperature

There was significant discussion during the Second Harmonization Meeting of whether temperature specifications of international standards are appropriate for the climates and appliance designs in the region. First of all, there was the question of the ambient temperature. ISO uses a climate category system with a tropical class to be tested at 32°C. This is an appropriate temperature for much of the region, but not all of it. In particular, it was noted that there are climate differences within countries, such as the cooler regions of North India, or the interior highland regions of Sri Lanka. Discussion of this matter led to the conclusion that, at least for the time being, the ambient testing condition of 32°C was sufficiently representative of the countries currently considering test procedures.

Of more immediate concern is the question of the appropriateness of ISO test procedure freezer set point temperatures. In India, in fact, there is a suggestion that freezer set point temperatures prescribed by ISO do not correspond to normal operating set points for typical Indian refrigerator freezer units, since the Advisory Committee to BEE have recommended a particular temperature (-15°C) for freezer compartments in that country. A critical first step in moving forward is the clarification of motivations for this.

As detailed in Section 2, ISO test procedures (and those adopted by Bangladesh) require a freezer set point temperature of –6, -12, or –18 degrees Celsius during the energy consumption test. ISO procedures refer to a classification system for freezer compartments denoted by stars (or snowflakes). A single star freezer compartment (short-term frozen food storage) is expected to operate at –6°C a two star (long-term frozen food storage) at –12°C and a three star (deep freeze) unit at –18°C. The Indian refrigerator industry does not use such a star system for categorization.

Both current test procedures in India and Sri Lanka require a freezer set point temperatures of –15°C for long-term frozen food storage. The Sri Lanka standard requires a temperature of –9°C for short-term storage compartments and the Indian draft requires –6°C for short-term storage. Deep freeze units are not considered in the Sri Lanka and India procedures. A set point temperature of –15°C for long-term frozen food storage is also specified by Australian / New Zealand test procedures.

- Explain and Document rationale for the choice of freezer compartment set point temperatures during Energy Test in Draft Indian Standard

***Deliverable*** – Memorandum requesting elaboration of rationale used by Technical and Advisory committees of BEE refrigerator program. Requested information should include:

- History of decision to recommend set point temperatures in current draft test procedure, including consideration of ISO test procedures and Australian / New Zealand test procedures as part of development process.
- Evaluation and technical documentation relating to typical design and intended operating set point temperatures of freezer compartments of appliances manufactured in India. Information should include the average, or typical operating set point temperature as well as estimates of the range of design characteristics and operating conditions.
- Assessment of possibility of reconsideration of test procedures in order that freezer compartment set point temperatures agree with those used in ISO procedure.

***Deliverable*** – Follow-up memorandum summarizing response to request of information by regional Working Group, to be circulated among all meeting participants and other interested stakeholders and policymakers.

### 5.2.3 Test Packs

The use of freezer test packs during the energy consumption test is another area where differences appear between the refrigerator test procedures proposed throughout the region. In short, the current ISO test procedure requires that the freezer compartment be completely filled with packages of specified dimensions and of a specific composition during the energy consumption test. The use of test packs is meant to provide a more realistic approach for actual use conditions, although the quantitative impact on consumption results is not known.

To date, Bangladesh has proposed adoption of standards identical to the current ISO test procedure. Neither the draft Indian standard nor the Sri Lanka draft standard require the use of test packs in the freezer compartment. Australian / New Zealand test procedures also omit the use of test packs. There is a general perception that the use of test packs is quite expensive, and that attaining the ISO specified packs is difficult in the region. There have also been reports that the use of test packs has a negative impact on the stability of the test procedure. On the other hand, some meeting attendees, including consumer group representatives, submitted that the use of test packs, while adding some cost to the testing process, do not do so in a manner that is prohibitively expensive, pointing out that the test need be performed only once for an entire product line.

We recognize that the impact on energy consumption from freezer test packs is controversial and hope that this issue will be addressed in the development of revised ISO standards, which should come out in the next few years. The member countries of ISO

committee may send their observations on this aspect for the consideration of the committee. For the time being, workshop recommended that the Working Group investigate the possibility of all countries drafting standards for the time being that does not require the use of freezer test packs.

***Deliverable*** – Memorandum to Bangladesh Standards and Testing Institute (BSTI) and other relevant authorities in Bangladesh requesting consideration of refrigerator test procedures that do not require test packs.

***Deliverable*** – Follow-up memorandum summarizing response to request for consideration by regional Working Group, to be circulated among all meeting participants and other interested stakeholders and policymakers.

### 5.2.4 Refrigerator Labeling Program – Medium Term Goals

There are several actions, which should be taken in the longer term, once the short-term deliverables are met. The first of these is a regional data collection program. Working group members should coordinate activities of collecting test data for refrigerators and distributing it, as resources and facilities allow. Some items to be pursued are:

- Indian Efficiency Data for Frost-Free models – Some data has already been provided by Indian manufacturer reports on their own products. This information should be distributed in a way, which does not violate confidentiality agreements made with the manufacturers.
- Test Pack Data – An analysis should be performed to compare energy consumption test results for units tested with and without test pack loading. This data should be collected for as many units as possible.
- Operating Temperature Data - A survey of operating temperature characteristics should be carried out for typical units sold in Bangladesh, Nepal, and Sri Lanka (this data should be provided in the short term for Indian units). In addition, impacts on energy consumption tests from set point temperatures should be evaluated.
- Efficiency Data Collection – Once testing facilities are established in Sri Lanka (and possibly Bangladesh), the Working Group should coordinate a data collection program to assess efficiency levels of many models sold in each market, as India has already done for frost-free models. In addition to the exchange of this data, the Working Group should also organize the exchange of actual units, or equivalent models, to be tested at laboratories in different countries. In this way, laboratories can be calibrated and impacts of differences in procedures can be well understood.

## 5.3 Fluorescent Lamp Ballasts

The development of regionally harmonized test procedures for fluorescent lamp ballasts is much simpler than that of refrigerators for two reasons. First, the test procedures for ballasts are generally much simpler to perform and involve fewer parameters than those for refrigerators. Second, there is less diversity among test procedures used in different countries. Furthermore, there was general agreement on the desirability to coordinate

testing of ballasts and development of a program.

Sri Lanka has a well-establish ballast labeling program, and therefore has real-life experience that can be useful. India also has testing facilities for ballasts, but currently does not have a labeling program specifically designed for rating efficiency.

Representatives from Sri Lanka indicated that the ballast test procedure that has been used in Sri Lanka is more or less equivalent to the IEC standard, IEC 921. The main issue in conforming to the procedure is the need for reference lamps, which are required by IEC. The Sri Lanka authorities have no reference lamps, but they are interested in acquiring the same. While the exact cost of a reference lamp is not known, it is estimated that they cost around $US 5000 each.

There are three main goals regarding fluorescent lamp ballasts in the short term. First, the Working Group should coordinate agreement on a test procedure, conforming to international norms, if possible. Second, it should take the first steps towards establishing test facilities to perform these procedures, and third, it should develop a methodology for evaluating efficiency based on the agreed upon test procedures.

***Deliverable*** – Report from relevant agencies in each country assessing the following:

- Verification of whether test procedures currently used, or currently proposed, are in alignment with IEC test procedures
- If test procedures are not in alignment with IEC test procedures, evaluation of the desirability /feasibility of brining procedures into alignment with international procedures; and
- If test facilities are not capable of performing IEC test procedures, evaluation of components and financial resources needed to bring them up to this capability

***Deliverable*** – Summary of regional deliberations on efficiency rating metric and, if applicable, documentation describing the agreed upon methodology.

In the medium term, steps should be taken to develop or improve the process by which lamp ballasts are rated and labeled. This is to be achieved primarily through a program of product collection and testing.

- Test Procedure Impacts Evaluation – If and when an upgrade of test facilities is completed in Sri Lanka, Working Group members from that country should test a sample of ballast models under the old procedure, and under IEC procedures, and report on differences found between the two procedures.
- Efficiency Data Collection – Market survey to generate a sample of representative ballast models (already available in Nepal and Sri Lanka) and subsequent acquisition of model samples for testing. Testing of a representative sample of models and dissemination of this data among Working Group members.
- Round Robin Tests – Exchange of ballast samples that have been tested in each country, for the purpose of testing in laboratories in the other countries. Exchange of

resulting data for the purpose of evaluating differences in test procedures and facilities.

### 5.4 Compact Fluorescent Lamps (CFLs)

Sri Lanka and India currently have adopted procedures based on IEC test procedures, and closely resemble the international norms. The following is the result of a cursory comparison of the regional standards with the IEC standard, IEC 969. More research is necessary to make a comprehensive comparison of the procedures.

The Indian Standard (IS 15111-Part 2: 2002) is nearly identical to IEC 969. Some important differences are:

- IEC 969 scope includes wattage up to 60W, while IS includes only up to 26 W)
- IEC 969 specifies that the start up time should comply with values indicated by the manufacturer, whereas the IS specified a 4.0 s start up time
- IEC 969 requires lamp wattage to be +/- manufacturer claim; this tolerance is –10 to +15% for IS
- IS requires 6000 h average lifetime. This is not included in IEC 969
- IS includes a table of maximum harmonic factors, which is not included in IEC 969 This similar to the requirements specified in the ballast procedure, IEC 921
- IS includes a table of required efficacy for lamps as a function of wattage. This is not included in IEC 969

The test procedure used in Sri Lanka to rate CFLs is SLS 1225:2002. This procedure references IEC 969, in addition to CIE 84: 1984, which gives detailed information regarding the measurement of luminous flux. In general, the test procedure followed the IEC procedure closely, with some additions and elaboration. Like the Indian procedure, there are some additional requirements in the SLS procedure not found in the IEC procedure. For instance, SLS 1225:2002 requires an average lifetime of 8000 hours. Also, like the IS procedure, there is an explicit minimum power factor, in this case at 0.5. There is no explicit efficacy requirement. This is handled in the section defining the star rating of the lamps.

From this investigation and from the input of country representatives at the Second Harmonization Meeting, it seems that the test procedures being used in India and in Sri Lanka may provide equivalent results to that of the IEC procedure, from which an efficiency rating metric may be derived.

The next steps forward for CFLs are similar to those for fluorescent lamp ballasts. They involve first verifying the test procedures that can currently used and their equivalence to international test procedures. Next, like ballasts, there is no consensus on the methodology for evaluation of efficiency. The metric devised for the labeling program in Sri Lanka is given by *Performance Grade* = 0.8 x *Efficacy* + 0.2 x *Power Factor.* The Working Group should coordinate discussion and design of a regional metric for efficiency. Possible outcomes of this process include a regional adoption of the

methodology currently used in Sri Lanka, or universal adoption of an improved metric. In addition, there should be an investigation into lifetime testing, which currently is a long (many months) process. Recently, authorities in Thailand have been developing a lifetime equivalence test that may shorten the testing process. Working group members, in conjunction with SARI/Energy should coordinate in order to arrange a technical exchange with experts in Thailand.

***Deliverable*** – Report from relevant agencies in each country assessing the following:

- Verification of whether test procedures currently used, or currently proposed, are in alignment with IEC test procedures
- If test procedures are not in alignment with IEC test procedures, evaluation of the desirability /feasibility of brining procedures into alignment with international procedures
- If test facilities are not capable of performing IEC test procedures, evaluation of components and financial resources needed to bring them up to this capability

***Deliverable*** – Summary of regional deliberations on efficiency rating metric and, if applicable, documentation describing the agreed upon methodology.

***Deliverable*** – Summary of regional investigation of lifetime testing, including results of technical exchange with experts in Thailand.

In the medium term, steps should be taken to develop or improve the process by which lamp ballasts are rated and labeled. This is to be achieved primarily through a program of product collection and testing.

- Efficiency Data Collection – Market survey to generate a sample of representative CFL models and subsequent acquisition of model samples for testing. Testing of a representative sample of models and dissemination of this data among Working Group members.
- Round-Robin Tests – Exchange of CFL samples that have been tested in each country, for the purpose of testing in laboratories in the other countries. Exchange of resulting data for the purpose of evaluating differences in test procedures and facilities.

### 5.5 Ceiling Fans

There is great potential for the establishment of regionally harmonized labeling programs for ceiling fans. Test facilities for ceiling fans are already operating in India and Bangladesh, and they are in development in Sri Lanka. Furthermore, international (IEC) test procedures exist for ceiling fans. It is not known whether there are any undesirable features of these procedures from the perspective of regional policymakers.

***Deliverable*** – Report by Working Group on status and development of ceiling fan labeling programs in the region. Report should cover:

- Investigation and documentation of test procedures used in test facilities for ceiling fans in Bangladesh and India
- Evaluation of feasibility and/or desirability for adoption of test procedures in alignment with IEC test procedures in Sri Lanka, and throughout the region
- Deliberation and recommendation of common methodology for determining efficiency rating parameter for ceiling fans
- Collection of market data to assess typical types of fans used, major manufacturers and importers, as well as sales and penetration rates

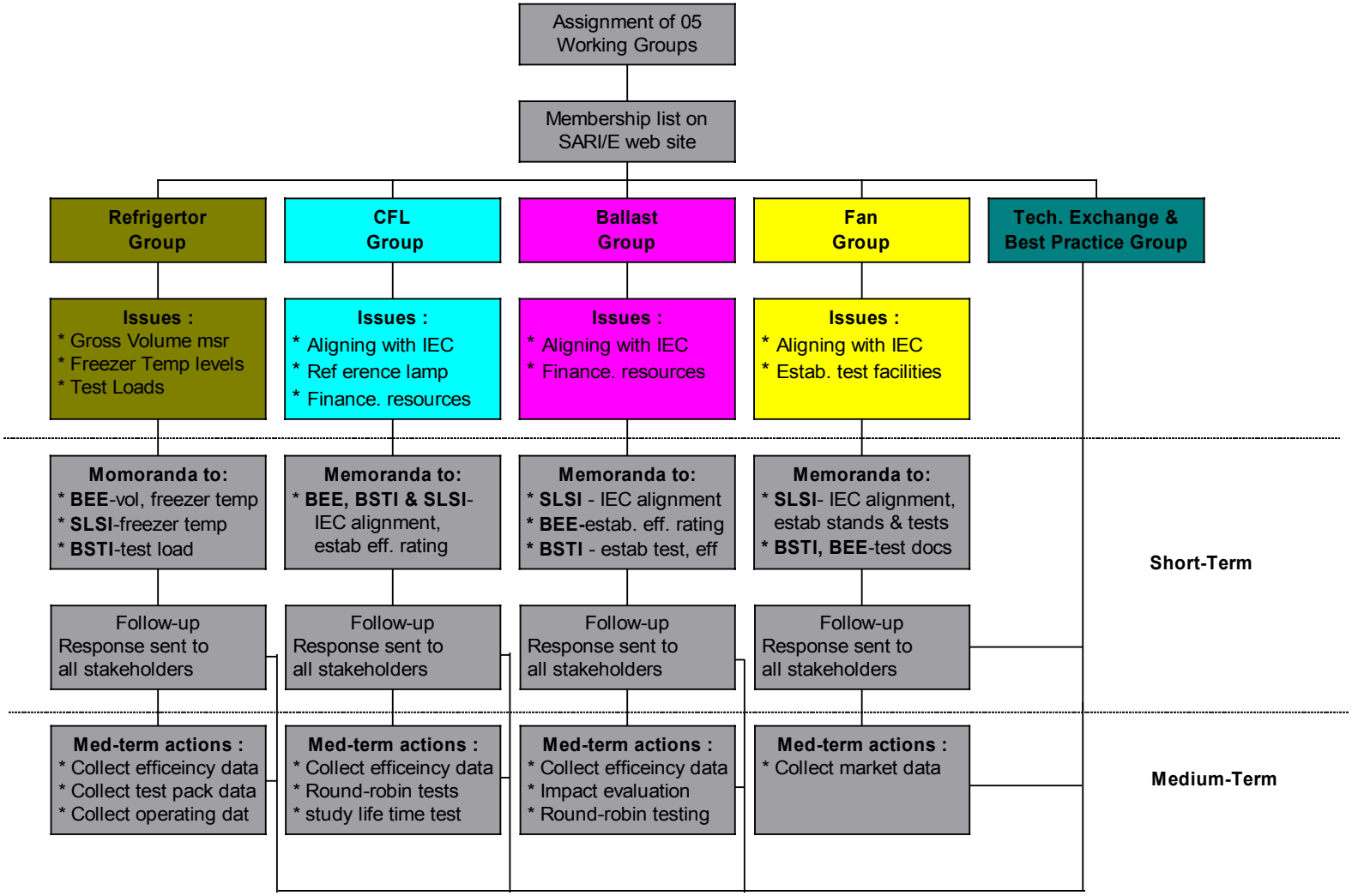


**Figure 5.1 Roadmap**

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