

random sampling technique keeping in mind the demography of the state. The coverage of the survey is shown in table 4. This is evident that base metro, metro and class I towns contribute more than 70% of the total population of any kind of consumer durable, such as refrigerators. In case of base metro, metro and class I, census survey was carried out and the level of confidence was 99% plus (with respect to information coverage and listing of RAC unit), referring to the area surveyed, i.e. within the city limits, and the enterprises visible during the survey time, i.e. off-season. In case of class IA to class-IV, census survey approach was taken amongst representative sample towns and the outcome would be projected to the universe of those representative sample towns and the level of confidence would be in the tune of 90% plus in case of towns other than metro and class-I (as this projection is based on sample survey). Sample towns were selected within the state due to homogeneity in demographic profile in consultation with Ozone Cell, Ministry of Environment and Forests, Government of India.

**Table 4: Survey coverage**

<b>Town Class</b>	<b>Universe</b>	<b>Coverage (% of total)</b>	<b>Coverage (nos)</b>
<b>Base metro</b>	6	100%	6
<b>Metro</b>	17	100%	17
<b>Class – I</b>	32	100%	32
<b>Class – IA</b>	245	50%	122
<b>Class –IA-a</b>	Population more than 300'000 to 500'000		38
<b>Class –IA-b</b>	Population between 100'000 to 299'000		85
<b>Class – II</b>	344	10%	36
<b>Class – III</b>	944	10%	95 (89)
<b>Class – IV</b>	2108	5%	105 (82)
<b>Total</b>	3696		414

The survey identified 20,735 RAC units both including formal and informal units in 385 selected towns where 37% of the service unit population are confined into 6 base metros only and 57% of service units are within first 23 high pop-strata towns.

#### 4.7.3 Methodology for projecting to a national level

The survey has been carried out both by census and sample survey approach with respect to town class. In a second step the data has to be projected to get realistic picture at national level. It is also observed that 29 towns do not have any RAC units amongst surveyed town (414) and this fact has to be taken into account while projection. It is important to mention that linear projection has not been made to keep / maintain the trend of RAC units availability of lower pop-strata towns. Therefore, proportionate projections of identified RAC units have been made with respect to particular state and thereby, tuned with national level. Thus the projected results;

Total RAC units extrapolated: 39'259 (of that 20'735 identified in survey)

Total CFC-12 consumption extrapolated: 1'235'989 kg (of that 725'826 kg identified in survey)

This projection does not include the CFC consumption by institutional customers with their own service personnel, such as e.g. the Indian Railways etc.

The horizontal survey did provide detailed sub-sector specific information. The total amount of information provided cannot be displayed and discussed in this phase-out plan because of its magnitude. Nevertheless, the data used has formed the background for the underlying principles of the phase-out plan as well as for determination of the infrastructure needed and the deliverables. This takes especially into account the regional distribution found, showing significant differences in the character and density of enterprises between the different states.

It should be noted that the above number of enterprises is rather conservative out of two reasons:

- The survey had to be conducted through the off-season (wintertime) in order to allow for relatively complex survey questionnaires. In the peak season, the sector is so busy with repair work that such a survey could not have been carried out simply because the entrepreneurs and technicians are not willing to spare the time needed. Conducting it in off-season excludes by default all those entrepreneurs that are not present in that season. These are typically , having some business throughout the year and offering refrigeration equipment service only during the peak season.
- The survey was confined to the city limits. There are probably several (predominantly larger) service companies providing their service from premises in industrial areas outside city limits without formal representation within the cities (in case of a representation there they would have been identified in the survey). Typical customers of such enterprises are those industries being present in industrial areas and the neighboring cities, and users of commercial refrigeration equipment. The very low amount of service companies working

in certain sub-sectors (industrial refrigeration, fishing vessel equipment, ...) identified in the survey indicates that this is a likely scenario.

#### **4.8 Vertical survey**

##### **4.8.1 General**

The vertical survey was carried out for all segments (domestic refrigeration, commercial refrigeration, ...) mentioned in chapter 4.5, taking also into account small scale manufacturing or assembly taking place in some of the enterprises on an opportunity driven basis. Each segment was investigated concerning the following aspects:

- Characteristics                      informing about type of enterprises carrying out the service, their size, equipment, number of technicians, other business, customers and workshop characteristics
- Servicing practices                informing about servicing habits, typical faults, practice followed and tools used, handling of alternative refrigerants, recovery
- Know-how supply                    informing about the education background, typical ways to upgrade know-how, willingness to participate in courses, ...
- Financial means                    informing about turnover and income of the firms, view to and capabilities for investments, ...
- Possible access roads              informing about means how to reach out to service companies in this specific sector
- Development in recent years    providing a basis to understand the dynamics in the sector.

The know-how established was used as a basis for the development of the strategy.

#### **4.9 Compiled consumption data by sub-sector**

In order to obtain a good picture of the situation in service sector enterprises and small assemblers of refrigeration equipment, the horizontal survey was cross-checked with results from the vertical survey. In addition, compressor manufacturers and other experts assessed the data and found it congruent with their own information.

The vertical survey did also fill the gaps concerning institutional owners of refrigeration equipment, which were not covered by the horizontal survey. Data obtained by manufacturers of CFCs does actually very closely resemble this consumption. An overview is given in table 5.

**Table 5:** ODS consumption and number of enterprises / internal workshops in the different segments and industries

	Main business	ODS consumption [ODP tons]	Service enterprises
	<b>Refrigeration / a/c enterprises</b>	Domestic and commercial	824
Automotive		227	2509
Bus / truck		6	44
Window AC (mainly through servicing domestic, commercial)		117	4197
Other		63	2078
Subtotal		1237	36345
<hr/>			
	Business	ODS consumption [ODP tons]	Internal workshops / departments
	<b>Institutional owners</b>	Indian Railways	110
State Tourist Boards		60	20
Food Industry		40	28
Chemical Industry		55	45
Subtotal		265	145
<hr/>			
<b>Total</b>		<b>1502</b>	<b>36'490</b>

The deviation between use shown in this table and the eligible consumption as being defined for this project according to ExCom decision 35/57 is due to the differences between use and consumption, e.g. stockpiling and similar measures, as well as because of the uncertainties related to determining the eligible consumption.<sup>1</sup>

<sup>1</sup> The actual no. of (extrapolated) firms is 39259. Out of these 39259, the number of (extrapolated) firms with zero consumption is 2914 (e.g. consumption only in HCFC, HFC or no consumption in the previous years). Thus, (39259-2914 = 36345) firms are being accounted above, plus an additional 145 service departments of institutional owners. With that, the total amount of service sector firms or departments comes to 36'490.

## 5 STRATEGY AND PLAN OF IMPLEMENTATION

### 5.1 Overview

The objective of the strategy is to support India in its complete phase-out of ODS in the refrigeration service sector.

India has through a number of measures ensured compliance with the Montreal Protocol, among them

- The ratification of the Montreal Protocol and all its amendments related to CFC phase-out schedule, with that agreeing to a consumption and production phase-out schedule
- The production sector phase-out plan and the related agreement with the MLF, reducing the amount of CFCs produced
- The notification of the "Ozone Depleting Substances (Regulation and Control) Rules 2000", whereby
  - A licensing system has been established controlling the CFC supply in the country fulfilling India's obligations under the Montreal Protocol,
  - Manufacturing of ODS containing equipment has been forbidden from January 1<sup>st</sup>, 2003 onwards, reducing not only CFC demand in manufacturing but also future CFC demand in the service of refrigeration products.

Through these steps, both the availability of as well as the dependence on CFCs have already been reduced and will be reduced further. It should be noted that so far India has fulfilled its obligations under the Montreal Protocol always ahead of time, and intends to continue this practice wherever feasible.

Having determined through these largely supply oriented measures the pace of CFC phase-out in the country in line with India's obligations under the Montreal Protocol, this sector plan is concentrating on the incremental efforts necessary for India's vast refrigeration service sector to change over to non-ODS technology. This service sector – at least in the domestic and small commercial segments - is largely comprised of technicians being school drop-outs, having undertaken many years to achieve basic understanding of the directly refrigeration appliance related problems with minimum background knowledge. Due to non-existing alternative work opportunities for these people as well as because of the need for affordable refrigeration service throughout the country, any sector plan has to focus on keeping this part of the service infrastructure largely intact. The objective of this plan is therefore to minimize the socio-economic impact of the phase-out of CFCs on the service sector by supporting enterprises in the sector through skill development and equipment support. The sustainability of this effort is ensured through the already existing Rules and phase-out agreements reducing the supply of CFC for the sector.

The sustainability in development terms is achieved through the strong, coordinating role associated with the project coordinator reporting to the Ozone Cell, as well as with the significant involvement of the decentralized administration structures available, in particular

referring to the State Governments with their environment ministries and the existing small-scale enterprise support structure. The roles of these will be to a certain extent supporting the directly phase-out related efforts like identification of eligible firms, outreach etc., but to a larger extent the monitoring of the activities and results achieved. A monitoring structure will collect the inputs and back them up through independent monitoring missions. The outcomes will be

- Reported on a continuous basis to the Project Coordinator and the Ozone Cell for direct implementation control,
- Summarized in semi-annual reports for the Steering Committee to allow adjustment of implementation measures where necessary
- Used as a basis for the annual reporting to the MLF.

The sector plan is based on a number of basic understandings:

- The use of CFCs for refrigeration purposes by small assemblers which might not have been targeted through Multilateral Fund projects will be dealt with under this sector plan
- This sector plan is not targeting the consumption of CFC-11 in chillers. The phase-out of chillers is supported through a World Bank project.
- Equipment supply is coordinated with training in a way requesting training as a precondition. The equipment will be delivered soon after the training is being conducted.

On this basis, the sector plan foresees a number of well-coordinated measures to achieve the phase-out. The phase-out of India's CFC-12 consumption will be ensured by three different approaches to reduce the consumption (see also chapter 9):

- Natural retirement of CFC-based equipment reaching the end of its natural life. As per India ODS rules 2000, no new equipment containing CFC is to be manufactured after 1.1.2003.
- Better practices in the service sector, including recovery or recovery and recycling will reduce the consumption without being able to achieve a complete phase-out.
- The existing refrigeration equipment remaining in the year 2010 and the following will have to be converted when there is the need for service. The last systems to be converted will undergo this procedure probably before 2015. This service sector plan provides the necessary infrastructure to carry out such conversions.

The backbones of the implementation are training and equipment supply measures. Both are targeting reductions in CFC consumption through better practice, capability to convert equipment (in particular domestic refrigerators) to non-CFC technologies, continuous service of converted equipment and recovery and recycling. The outreach to about 40'000 enterprises with more than 70'000 technicians with typically little transportation and networking means is a complex problem that requires a sound infrastructure both for delivering the training as well as the equipment. For example, a total of 80 organizers are to be established under this plan to directly address the potential beneficiaries, determine their eligibility and organize

training and equipment supply. The total number of such organizers and of the subsequent training cells has been determined on the basis of the geographical reality in India, with its 28 States and 7 Union Territories, where actually more than 20'000 enterprises are located in more than 3500 smaller cities, each with less than 500'000 inhabitants.

Both training as well as equipment will only be supplied if the related enterprises display a genuine interest. The Indian Ozone Regulations with their phase out of CFC based production of refrigeration equipment in 2003 will increase the awareness and interest of service companies already considerably above the present level. In order to further increase the awareness and the perception of need in the target group, an awareness program is established, commencing activities shortly after project approval. The awareness program will also include interaction with and through the refrigerant/parts supply structure and the Indian administrative institutions (Ministries of Environment, Technology Institutes, Pollution Control Boards) associated with the sector plan activities and monitoring.

The logistics needed to deliver this sector plan and to monitor it will require considerable time to be established across India, especially because of the size and diversity of the country. The most important driving force for efforts within the enterprise will be the known decrease of CFC availability, expected to be known to the sector in 2004/2005 and to be felt in the sector in 2007. Sufficient capacities are needed to ensure that a considerable portion of the service sector has gained support before the availability of CFC ceases at the end of 2009. Consequently, efforts of establishing the infrastructure and creating awareness have to commence as soon as possible. First technicians, coming from OEM service centers or franchisees already today informed about the change in technology and interested in phasing out CFCs, will be trained and subsequently equipped as early as 2004, with steadily increasing numbers in 2005 and 2006 while the infrastructure is being fully developed.

## **5.2 Efficient minimization of CFC consumption**

### **5.2.1 Cause for refrigerant use in service sector**

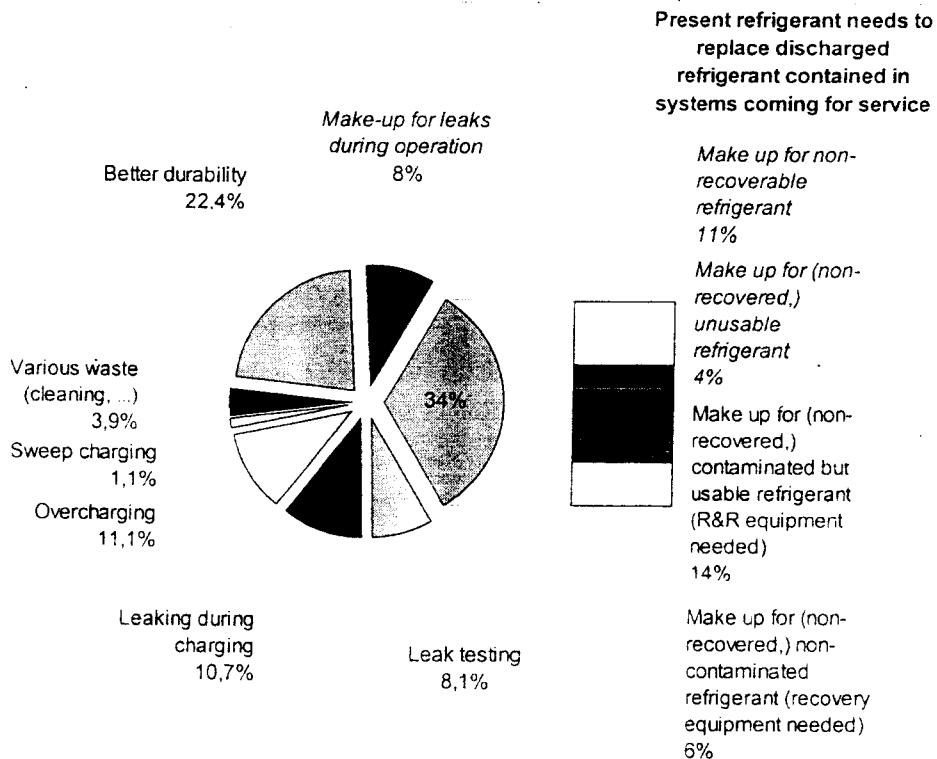
As part of this strategy preparation, an investigation has been carried out on the CFC use pattern in the service sector in terms of what type of CFC losses in this sector are causing the CFC demand. Experts from Indian OEM and compressor manufacturers with a long experience in the service sector repairs have assessed this pattern. This type of study, never undertaken before, was looking at the different type of repairs performed, the condition of the refrigeration equipment before being repaired by the service, the refrigerant use pattern during service, and the service quality in terms of service patterns inherently leading to a higher number of repairs in the future. In a second round, it was assessed how many of the latter could be remedied through the measures which can be undertaken by the service sector plan.

According to the horizontal survey, the predominant CFC use in the service sector in India is related to service of domestic and small commercial refrigeration appliances. As per the results of the horizontal survey, the aggregated CFC use in domestic refrigeration by all service sector enterprises in India (i.e. also the use of those enterprises which service



domestic refrigerators “on the side” with the main business being something else) amounts to 872 tons. 73% of this consumption (640 tons) is actually associated with companies predominantly active in the domestic and commercial segment. Consequently, the CFC use pattern of the domestic and small scale commercial refrigeration sector is dominating the overall assessment. Nevertheless, also the use patterns in other segments have been assessed, e.g. in the commercial, the industrial and the MAC segments. The different assessments have been combined using the consumption-weighted average of the horizontal survey.

Graph 1 shows a breakdown of the refrigerant use in India.



**Graph 1:** Refrigerant use in the Indian refrigeration service (weighted average of all sectors)

From the numbers provided in it, technically realistic assumptions of reduction in CFC use through different measures can be derived; technically realistic refers in this case to reductions which are technically possible with training and equipment means proposed in this sector plan. Given that the majority of these measures actually benefit the enterprises in a directly recognizable way, it is assumed that those potentials can largely or completely be utilized.

The uses given in italics are unavoidable if CFCs are used in the system; they amount to about 15%. While the relative use of refrigerant will remain approximately constant, the absolute

number will decrease in any case because of the gradual decrease in CFC refrigerators. Nevertheless, a substantive number of these systems remain to be operational in 2010 and beyond (expected is a bank of 19 million remaining CFC refrigerators in 2010), which service needs can only be fulfilled if they are converted to non-CFC.

13.6%, presently equivalent to annually 119 tons of refrigerant could be recovered and recycled (of that, typically 60% need recycling because of significant moisture levels; due to lack of moisture identification kits, that actually requires full recycling capacities). The savings related to better durability (20%) actually refer to improvements in service practice leading to less frequent repairs. The absolute potential is here much larger, at around 60%, but it is expected that with the limited means of the sector plan and only limited incentives for optimum practice, 1/3rd is the reduction achievable under this plan. This reduction is mainly associated with less overcharging (which is not only consuming more refrigerant than necessary, but also causing frequent failures) and better brazing techniques (reducing the frequency of small leaks, which actually leads to around 12% of all repairs).

A very considerable amount of refrigerant is lost because of sweep charging (avoiding the use of a vacuum pump), overcharging (not using measurement techniques for determining the amount to be charged) and losses during charging (because of improper valves, manifolds, hoses). Without a vacuum pump on location, sweep charging is difficult to avoid. Using sweep charging, efficient measurement of the amount of refrigerant charged is, to say the least, difficult, independent of the availability of equipment for measuring the amount. Consequently, this consumption might be tackled to a large part by vacuum pump equipment, better manifolds, and equipment to determine the amount of refrigerant being charged.

The refrigerant use during leak testing is also considerable, amounting presently to 38 tons in the domestic segment alone. This use might only be reduced by nitrogen leak testing. Finally, various waste includes a number of poor practices (e.g. cleaning using CFC similar to compressed air), but to a large extent also losses due to the frequent non-professional decanting of CFCs etc.

In addition, the large cylinder sizes associated with the rules are also an impediment for gradual introduction of new refrigerants, since the costs of a large cylinder filling (to be paid upfront by the service enterprise) in relation to the time needed for recovering these costs. Assuming an enterprise uses 25% alternative refrigerant, more than 85% of the enterprises (using about 50% of the CFC) need more than one year to use up one "legal" cylinder of that refrigerant. The up-front costs – especially in case of the more expensive alternatives - and the associated time needed to recover these costs are almost prohibitive. In case of HFC-134a equipment to be serviced, this promotes re-conversion to CFC. The strategy will therefore engage in refrigerant logistics and discussions with the relevant authorities in India.

The above use of refrigerant is largely associated with the domestic and small commercial equipment service. In other segments, in particular MACs, the share of the types of losses is quite different. While leaks and potential for recovery and recycling play a more important role, losses associated with charging and lower service quality are smaller.

### 5.3 Outreach and Training

This chapter outlines the strategy for training of service technicians in the sector to meet the challenges of CFC phase-out process. Various issues concerned with training have been examined in the chapter. These include appraisal of the target group and their training needs, as well as an appraisal of the existing training providers. Finally, it highlights key guiding principles for developing the recommended approach leading to the outreach strategy.

#### 5.3.1 Appraisal of the Target Group

According to the projections made in the National Survey of RAC Servicing Sector, the total no. of RAC servicing firms in the entire country is estimated as 39,259, plus the service department in institutions; in addition, some enterprises have not been identified being outside the borders of the survey (city limits) or being non-existent during the survey (entrepreneurs servicing RAC in peak season only). Assuming that these will not change the structure of the sector significantly, the phase-out plan has been built on the basis of the survey results plus institutional owners. On this basis, the total number of skilled service technicians for the country has been projected as nearly 77,000. Based on the vast majority of enterprises in the service sub-sector compared to service departments of institutional owners, the design of the sector plan concentrates on the former and integrates the latter during implementation.

More than 50% of the servicing firms are concentrated in the five top ranked States (Uttar Pradesh including Uttaranchal, Maharashtra, Andhra Pradesh, Tamil Nadu and Gujarat). In the next ten States following another 47% of the total number of firms have been identified. Accordingly the top 15 states account for 97% of servicing firms and also nearly 97% of the number of skilled technicians. In the remaining eleven States and four Union Territories, RAC servicing firms and skilled technicians do not have a substantial presence (3%). Below table 5 (chapter 4.9) displays that the most prominent main business types reported are domestic refrigeration followed by window and split AC service (the firms with this HCFC-22 based main business retain a CFC-12 based side business). Car AC follows on the third rank by number of firms, on the second on basis of CFC consumption. These survey findings underscore the key role played by the service of domestic refrigerators.

The CFC consumption distribution of the servicing firms, as projected for the entire country has been placed at table 6. According to this survey, about 82 % of the servicing firms have a CFC-12 consumption below 50 kg per annum. Nearly 17.50% have a CFC consumption between 51 to 500 kg per annum, and the rest 0.48% have a CFC consumption above 500 kg per annum. The average CFC consumption is 31.48 kg. per annum per firm (accounting also for those with zero CFC consumption reported).

**Table 6:** Distribution of Firms according to CFC Consumption Range

CFC consumption range in kg.	No. of firms in the country	Percentage to total
0	2'914	7.42%

1-50	29'288	74.60%
51-500	6'867	17.50%
Over 500	190	0.48%
<b>Total</b>	<b>39'259</b>	<b>100.00%</b>

In India, failures of refrigeration equipment, in particular in the domestic and commercial sub-sectors, are to a large degree connected to faulty electrical components, such as starters, relays etc. Because of the poor power supply conditions in particular related to unstable voltage, electrical components fail frequently and are, according to national technical experts, the by far dominating cause for refrigeration equipment failures (between 80% and 95% of all repairs). Again in the vast majority of these cases, the refrigeration cycle does not need to be opened. Consequently, the refrigeration cycle itself is only opened in case of about every 10<sup>th</sup> repair.

### 5.3.2 Appraisal of Training Providers

There are four broad categories of training providers, namely

- a) ITIs and affiliated private training institutes of the Directorate General of Employment & Training (DGET), Government of India
- b) Small Industry Service Institutes (SISIs) of the Development Commissioner Small Scale Industries (DCSSI)
- c) Non-affiliated private training institutes/NGOs offering private diploma, and
- d) Industry as training provider

In addition, independent consultants and research institutions such as IIT Delhi and NCL Pune have played a key role in standardization of training materials and quality assurance in Training of the Trainers workshops under the HIDECOR project.

ITIs are training institutes set up under the Craftsmen Training Scheme (CTS) of DGET. These include Government-owned ITIs and private-owned ITCs (Industrial Training Centres) affiliated to DGET. ITIs/ITCs conduct craftsmen training courses of two years duration for high school pass-outs. The syllabi of these courses are uniformly prescribed in all ITIs/ ITCs all over the country by the National Council of Vocational Training (NCVT), a tripartite non-statutory advisory body at the national level. It is mandatory for all ITIs/ ITCs to follow the prescribed syllabi. Besides, trade testing and certification is also centrally administered by NCVT for all trades. Regulation of the day-to-day administration of ITIs however, vests with the respective State Government Directorates of Vocational Training. The number of ITIs offering craftsmen training in the RAC trade is 423 (285 Govt. and 138 private), with an estimated seating capacity of 8000 trainees/course (4000 trainees per year). There are nearly 400 RAC instructors in various ITIs/ ITCs. Nearly 28% of service technicians working with servicing firms are ITI pass-outs. Strengthening of training provided by these training

institutes can therefore be expected to significantly contribute to preparing service technicians for the future with appropriate know-how and skills in coping with non-CFC technology.

SISIs are training institutes set up under DCSSI. There exist 28 SISIs (and 30 branch SISIs) in the country, and their activities include upgrading the skills of workers and managerial capabilities of small-scale industrial units. Training is provided by SISIs in most conventional trades, but not in RAC. DCSSI has also set up a special Ozone Cell, headed by Director (ODS) to oversee implementation of Montreal Protocol in the small-scale sector. SISIs have been designated to have available information for small enterprises on all matters related to ODS phase-out, and to receive project reports from small enterprises seeking financial assistance for adoption of new technologies and to act as registration authorities for small scale manufacturers of CFC-based appliances and compressors, under ODS Regulation 2000. Unlike ITIs, the SISIs have no direct role in training of future technicians.

Private training schools and NGOs provide training in various fields including that of RAC. Typically, they offer admission to high school pass students and school drop-outs, unable to or not eligible for admission to ITIs. These training providers don't follow any standard curricula prescribed by the NCVT, nor are their students eligible for appearing in the All India Trade Tests conducted by NCVT; hence, they don't receive any nationally recognised certificates. The duration of courses offered by the private training institutes ranges from six months to three years. Pass-outs of these training institutes seek self-employment in the country or wage employment in the overseas labour market.

Industry is another important training provider. Most domestic refrigerator manufacturers have in-house training activities to impart training to their own service technicians. In addition, they provide opportunity for on-the-job training to them. In most cases, training of service personnel of the franchisees and authorised service centres is also taken up by the industry on a periodic basis, along with their own employees. Under the statutory Apprenticeship Act, most of the industrial units provide seats to apprentices for one year on-the-job training.

### **5.3.3 HIDECOR Initiatives**

Skill training methodologies for RAC service sector have been developed since 1998 under the Indo-Swiss HIDECOR initiative. This initiative does aim at the skills of micro and small enterprises for coping with the non-CFC technologies available in India in the domestic and commercial refrigeration service sector. The methodologies, capacity and infrastructure built will, however, facilitate an early start-up of CFC phase-out based training activities under this strategy. CFC12 good practice and retrofit elements can be integrated into these trainings in a cost effective manner. The Swiss co-financing, which will support the implementation of this strategy, is displayed separately in the cost calculation. Under HIDECOR the potential of several training providers to become a training cell under this strategy has been assessed.

#### **ITIs/ITCs**

Several RAC instructors in various ITIs/ ITCs have received training in the field of new refrigerants under HIDECOR. In close cooperation with the DGET an effort was undertaken

to revise the syllabus for RAC trade under CTS. The draft-revised syllabus specifically deals with issues of (i) refrigerants, handling, safety, leak testing, evacuating and charging, and good practice; (ii) recovery/ recycling of CFC systems with replacement refrigerants; and (iii) servicing and retrofitting of appliances with non-CFCs. This has been submitted to DGET for approval and implementation. The project has also agreed to support (a) revision of syllabus for apprenticeship training; (b) development of Instructional Media Package (IMP).for RAC trade; and (c) upgrading of two Advanced Training Institutes (ATIs) of DGET for instructor training.

In the HIDECOR pilot phase, training programmes of two days duration for MSE (Small & Micro-enterprises) technicians have been conducted at a few selected ITIs and one ATI, thereby providing training to nearly 100 service technicians. Additionally, in the main phase, training to MSE technicians has been provided by a private ITC in Delhi. A few more Govt. ITIs and private ITCs are likely to become engaged as training cells up to 2004. Across the country 15 to 20 ITIs could qualify as training cells.

### **SISIs**

Under the HIDECOR pilot phase, four Small Industry Service Institutes (SISIs Delhi, Mumbai, Chennai and Kolkata) have been provided training equipment. At SISI Kolkata, Mumbai and Delhi, one training programme each was conducted during the pilot phase to train service technicians, achieving mixed results. A constraint with SISIs is the lack of own RAC trainers. SISIs are therefore not considered as training cells under this strategy. However, they can collaborate with industry training providers (see below) by acting as agencies for mobilisation of training participants.

### **Private Training Providers**

A number of private training providers have been selected as training cell under HIDECOR to impart training to technicians from RAC servicing firms in the States cooperating under the project. These identified institutes have been imparting such training successfully. Important selection criteria were the entrepreneurial orientation and the flexibility of these institutions to deliver when the training demand arises during the off season.

### **Industry as Training Providers**

In HIDECOR pilot phase, two domestic refrigerator manufacturers, one compressor manufacturer and one medium-scale commercial appliance manufacturer are so far key partners in organizing training programmes for service technicians. These included participants from their own servicing network as well as from independent servicing firms. Participants from independent firms are fully funded, technicians from the industry's own service network participate in a self-sustained manner. Two domestic refrigerator manufacturers have contributed to skill training of technicians, in particular towards addressing skills for handling new refrigerants. Two additional industry partners have committed to join the initiative, as from 2002 onwards. The industry from the domestic and commercial subsector has committed its interest to continue its association with training under the India RAC SSS project

### 5.3.4 Specific Training Needs

Above, the various sub-sectors in RAC servicing and their key profile were identified (chapter 4.5). The key training needs, in order to cope with the challenges of CFC phase-out, can be broadly categorized as follows:

- a) Best practices in servicing of CFC-based appliances to minimize CFC consumption in servicing of such appliances. These include practices such as brazing/ debrazing, flushing, leak testing, evacuation and charging of refrigerants using proper tools & equipment.
- b) Best practices in retrofitting of appliances using non CFC refrigerants, and service of the retrofitted equipment. This training for best practices in servicing and retrofitting will be relevant for sub-sectors where the potential use of alternative refrigerants appears to be significant, particularly in domestic and commercial refrigeration sub-sectors as well as for some institutional owners. There will still be 19 million CFC refrigerators left in 2010, which will to a large extent need retrofitting.
- c) Recovery and "Recovery & Recycling" (R&R) of CFC refrigerant. Recovery of refrigerant, being a low cost option, is relevant for smaller equipment and for smaller enterprises connected through a centralized R&R machine used jointly. R&R will be relevant for sub-sectors in which charge quantity of CFC refrigerant is quite substantial, and/or where large quantities are handled at one location.

The above identified training needs are for those handling CFC refrigerants. It is apparent that the number of target group for training under (a) and (b) above will be much higher than for (c) above.

Instructors of training cells are an important target group for training. The trainers for instructors of ITI in different States will be trained through joint efforts of the Indo-Swiss HIDECOR project in cooperation with the Government of India in the context of the syllabus revision. These instructors play an important role in the formal vocational training system for regular students undergoing pre-employment training (future technicians).

Awareness cum training of State Government officials, responsible for monitoring of implementation of the project in their respective States, will be another important activity featuring a largely non-technical content. This effort will be implemented through the awareness part of the project.

### 5.3.5 Guiding Principles for developing a Training Approach

The approach to training suggested in this chapter is based on the following guiding principles.

- a) The training activities are seen as a tool to achieve sustainable development while phasing out CFCs. They shall mitigate adverse socio-economic impacts of the CFC phase out on the businesses of small scale enterprises largely located in the informal sector. In order to achieve sustainability the efforts under this strategy shall be mainstreamed with the processes and networks established in the sub-sector to enhance skills considering

multiple options of possible training providers. The training efforts shall lead to build capacities with institutions capable to deliver training through market based mechanisms.

- b) Identify training cells as training providers in each State on a nation-wide standardized set of well-established criteria. The number of training cells allocated shall be based on number of servicing firms using CFCs.
- c) In the initial years (2004/2005) priority should be given to identify and train service technicians from firms with higher CFC consumption (above 100 kg per annum), as they are often already now aware of the issues, interested in upgrading their skills, and providing greater scope to reduce CFC consumption by applying good practices.
- d) Though firms with lower CFC consumption offer relatively lesser scope to achieve reductions in CFC12 consumption in aggregate, the importance of imparting training to these firms results for the Government of India from socio-economic considerations, with the general eligibility of such undertakings being determined by the "Indicative List of Categories of Incremental Costs", in particular para (c) i, ii and, especially, iii. The priority in targeting smaller firms in the informal sector shall increase from 2006/7 onwards as and when the shortage in supply starts manifesting in the market.
- e) Public private partnerships shall, to the extent possible, contribute to training for the direct target group on a self-sustaining basis. Private training providers strengthened under the strategy shall offer training responding to demand on a market basis. It is projected that a part of the concerned target is prepared to pay a nominal to realistic participation fee for good quality certified training.
- f) Full funded training thus might be considered to target firms in the lower ranges of CFC consumption of 50 kg per annum and below. These firms may not come forward to attend training against a substantive participation fee. Training the informal sector technicians is a challenge because a majority of them may fall below meaningful threshold levels, and yet may have to be imparted training on a full funding basis, owing to their inadequate paying capacity. Co-financing option becomes extremely important for this category of servicing firms.
- g) Training strategy should build upon experiences of HIDECOR, UNEP, GTZ and other such bodies. A number of HIDECOR initiatives have been successful in making training responsive to country's needs, both for training of direct users and for instructors of training providers. At the same time, insights gained through not-so-successful concepts (such as mobile training units) can also contribute in a realistic assessment of the success factors of training strategies.
- h) The core competencies of implementing agencies to be engaged in the project should be understood and effectively made use of. These include: Swisscontact/INFRAS (implementing HIDECOR on behalf of Switzerland), GTZ, UNDP and UNEP.
- i) The IIT Delhi and research institutes such as NCL, experienced national and international experts as well as the regional organizations mandated with the management of the



training programme have a key role in this project in assuring continuity and quality assurance through training of the trainers monitoring and internal evaluation.

- j) Efforts should be made to involve additional IITs and/or engineering colleges to enhance the national capacity for retraining and non-CFC technology dissemination in the long run.

### 5.3.6 Identification of Training Cells

A model similar to the one followed under HIDECOR project for training of service technicians through identified training cells is proposed for the Service Sector Plan. These training cells will be selected from ITIs/ ITCs, private training institutes/ NGOs, or industry; the criterion of their selection as training provider would be their technical and administrative capability to provide requisite training, as well as their ability to conduct training on a self-sustaining basis. The project would have to contract Indian regional agencies for training project management, for selection of training cells, for organizing training of the trainer workshops and for program supervisions and controlling. The support to be provided by regional agencies to training cells will, in addition to training their instructors through ToT programmes, consist in providing them guidance through hand-held training and monitoring of their training activity.

Considering that each training cell will be in a position to impart training to one technician each from nearly 400-450 servicing firms during the implementation stage, the number of training cells required to be created for covering all the nearly 36,500 CFC12 consuming servicing firms has been computed at table 7. The training cell need is computed on the basis of the overall need for training, of which the Service Sector Plan covers only a part. The costs for several of the training cells will be spby the Swiss HIDECOR project. as shown in chapter 6 "incremental costs".

It is seen from table 7 that a significant number of training cells shall be established. All 80 cells including those to be established under HIDECOR project, shall have the capability to train the base course in domestic & commercial refrigeration. From among these cells, 11 training cells shall get additional trained to acquire the capability to train good practices in car AC servicing. 5 training cells additionally acquire the capability to train good practices in other specialized sub-sectors (namely, cold storage & food processing, industrial refrigeration, and chillers). All these 16 specialized training cells shall also get the capability to conduct training in Recovery & Recycling (R&R).

Training cells, upon training their RAC trainers, are to be equipped with requisite training equipment. The needed training material is to be developed or updated based on existing training material from the implementing/bilateral agencies in 2003/2004 and to be translated into the 12 major local languages. It is planned to have the training courses certified by the All India Council of Technical Education, AICTE, which is highly regarded in India and will further increase reputation and inherent value of the training and thus the interest of service enterprises to participate in the programme early.

Table 7: State-wise Training Cells

State	No. of training-Cells needed as per target group distribution	Already existing/likely under HIDECOR	Additional training cells required in the State	No. of special training cells for MAC	No. of special training cells for others	Total no. of special Training. Cells
Maharashtra	11	3	8	2	1	3
Uttar Pradesh (+Uttanchal)	12	0	12	1	1	2
Delhi	5	2	3	1	1	2
AP	6	2	4	1	1	2
Gujarat	6	2	4	1	1	2
TN	6	2	4	1	0	1
West Bengal	5	1	4	1	0	0
Karnataka	4	2	2	1	0	1
Punjab*	3	0	3	1	0	1
Kerala	3	0	3	0	0	0
Rajasthan	4	0	4	0	0	0
Madhya Pradesh	5	0	5	1	0	1
Chhatisgrah	1		1			
Haryana	2	0	2	0	0	0
Bihar (+ Jharkhand)	4	0	4	0	0	0
Orissa	1	0	1	0	0	0
North East	1	0	1	0	0	0
Remaining States	1		1			
<b>TOTAL</b>	<b>80</b>	<b>14</b>	<b>66</b>	<b>11</b>	<b>5</b>	<b>16</b>

\* Even though Chandigarh is not included above, it may be considered as a joint geographical area along with Punjab & Haryana.

Considering the different background and qualification of trainers, the training of the trainer courses (ToT) shall include teaching/instruction techniques as well. Hand held training sessions organized with training cells following the ToT, are an important element of quality assurance. Training materials and methodologies will be standardized throughout the country. All trainers shall receive the base course training in domestic and commercial refrigeration. 16 cells will participate in additional TOT for specialized sectors. These TOTs would also be standardized across the different implementing agencies providing the funding.

The identification of training cells will be based on an assessment of the potential training providers based on pre-defined criteria. Respective guidance will be received from the steering committee. The selection criteria may include technical qualifications of the instructors, the entrepreneurial skills and mindset of the training cell key staff, quality of tools and equipment available with the training provider, quality of teaching facilities available and ease of access for the target group.

The types of training programmes to be provided by different training cells in a State will be based on the presence of main business in the State. According assessments have been carried out during the preparation of this Sector Plan.

#### **5.3.7 Role of Regional Management Organizations and Organizers**

Regional Management Organizations responsible for training and outreach, RMOs, will be selected. Those will be local organizations to be contracted by the respective Implementing/Bilateral Agency, to identify suitable Training Cells and Organizers (see below), perform training quality management and handle the fund flow to both Organizers as well as Training Cells.

Along with training cells "Organizers" shall be recruited. The Organizer is throughout implementation of training as well as equipment supply the project's interface for interaction with the enterprises. This includes recruiting and determination of eligibility of the enterprise, program information dissemination as well as collecting, assembling and reporting of monitoring information to the State Departments of Environment. A coherent selection process for those organizers will be formulated, decided upon by the Steering Committee and subcontracted to RMOs. It is foreseen that each organizer will work with 1 to 2 training cells depending on the local circumstances, in particular the envisaged distribution of training cells.

#### **5.3.8 Training the Informal Sector Service Technicians**

74.6% of the surveyed firms use from 1 to 50 kg of CFC per annum. Almost all of these are micro- and small enterprises or informal sector firms. The service technicians in these firms are poorly educated with negligible English language skills. The service sector strategy has to be sensitive to the needs of this sector, and innovative solutions to reach out with training to this sector need to be developed and implemented. Effort has to be made in developing training

material that is easily comprehensible for this target group. Under the HIDECOR project, an exercise was undertaken to develop such an easily comprehensible training material for domestic and commercial refrigeration sector; and presently, the same is being translated into three local languages. The materials available from HIDECOR will have to be updated and similar exercises will have to be undertaken to make available training material related to other sub-sectors, namely, MAC servicing, cold storage and food processing equipment servicing, transport refrigeration servicing and industrial refrigeration servicing/small-scale manufacturing / assembling. The training cells operating under HIDECOR project have been mainly targeting informal sector servicing firms, and have been able to successfully meet the training needs of the domestic and commercial sub-sector. An important limitation identified is that the service technicians from the informal sector are willing to join the training programmes during off-season period only. Similar approach shall therefore be made effective in this sector plan as well.

### **5.3.9 Equipment Support for Govt. Training Institutes**

Since ITIs/ITCs are the key training institutes concerned with training of future technicians, it is vital that these institutes develop the capability to impart training in the areas identified above for all servicing sub-sectors. HIDECOR project has already supported/ is supporting them through RAC syllabus revision, instructional material development, and training of their master trainers; however, it is not providing training equipment support to the ITIs. Provision of this support through the Service Sector Plan will enable these institutes to effectively deliver training for future technicians, with that activity actually contributing significantly to the technology change in the overall technician population. The importance of these institutions for having a sufficient share of trained technicians within the overall technician population is demonstrated in table 8 "Bridging the skill gap ..." (chapter 5.3.11). This table is actually showing the important impact of 20'000 technicians to be trained by the ITIs.

### **5.3.10 Other Training related Investments**

To launch the training strategy a significant effort in terms institutional development will be required. The institutions built up for training purposes (RMO's; Organizers) will also have a role to play in identification of firms for equipment support and the recovery recycling programme.

Presently, market forces determine whether training provided by the training institutes has value or not. Development and implementation of a simple certification system be a key instrument to establish credibility of training. Certification shall thus be an effective way to ensure the sustainability of one time effort undertaken now. Presently it is envisioned that this certification scheme should be on a non-mandatory basis, proving to the customer of the service enterprise the principle ability of this enterprise to provide adequate service based on both skills developed and equipment available. Details of the certification process shall be established during the initial years of programme implementation.

The build up of a monitoring system as specified will influence the costs associated with the implementation of training. In particular, the necessary interaction with the State level through the Organizers will absorb resources and capacities also on the side of the institutions directly involved in training implementation (Organizers as well as the next management levels above, i.e. Implementing/Bilateral Agencies and RMOs).

### 5.3.11 Model of Skill Formation through the Service Sector Plan

A spreadsheet model of skill formation through training under the Service Sector Plan in addition to training from other sources is presented in table 8. According to this model, 52% of all RAC service technicians will be trained by the year 2009. The model makes the following assumptions:

- a) Base level of no. of service technicians is taken as 77,000 (as per horizontal survey projections)
- b) New entrants to the labour market every year will include ITI pass-outs, pass-outs from private training institutes and unskilled persons elevated as full-fledged technicians.
- c) It is known that several of the ITI pass-outs pick up other avocations than RAC servicing.
- d) It is known there is a natural attrition from the servicing business and on the other hand an inflow of trained personnel from the larger appliance manufacturers.
- e) The turn-out from ITIs per year is taken as 4000 (based on training capacity of ITIs)
- f) HIDECOR main phase – under Swiss co-financing - shall train about 1750 persons per year with a dedicated focus on new refrigerant related skills including one session on retrofitting in domestic/commercial sub sector (7000 over 4 yrs).
- g) Training through the sector plan will start from the year 2004 onwards, and will gradually gain momentum
- h) A few private training providers and/or industry will on their own initiative start training activities at a modest level
- i) It is projected that totally 32,000 persons will get trained under the sector plan, in addition to those trained under e, f and h. Nearly 27,000 of these will be trained under good practices: CFC, and the rest for specialized training (MAC R&R etc.)
- j) Training for nearly 21,000 persons will be fully-funded through the sector plan. The remaining 11,000 will be trained on a self-sustained training basis (market-based outreach).

The model can be further refined during the implementation stage.

**Table 8:** Bridging the Skill Gap for CFC Phase-out in RAC Servicing Business

Year	2002	2003	2004	2005	2006	2007	2008	2009
<b>Total numbers (January 1st)</b>	77000	74800	76020	73918	75226	76403	77463	78417
Existing no of technicians already trained(January 1st)	0	1750	3629	6242	12156	21345	32607	46760
Existing no of technicians yet to be trained (January 1st)	77000	73050	72391	67676	63070	55058	44856	31657
Percentage of technicians trained	0%	2%	5%	8%	16%	28%	42%	60%
<b>New untrained entering trade</b>								
New untrained added from ITIs	0	4000	0	0	0	0	0	0
New untrained added from other sources - e.g. unskilled workers, apprentices getting elevated; pass-outs of private training institutes	5500	5371	5237	5036	4611	3963	3185	2220
<b>Untrained leaving trade</b>								
Attrition due to retirement/ change of business of existing technicians (10% of existing technicians)	7700	7480	7602	7392	7523	7465	7384	7218
Fresh ITI pass-outs opting for other businesses (20% of ITI pass-outs each year)	0	800	0	0	0	0	0	0
<b>New trained entering trade</b>								
Trained by ITIs (For new labour market entrants from 2003 onwards)	0	0	0	4000	4000	4000	4000	4000
New trained added from other sources - e.g. unskilled workers, apprentices getting elevated; pass-outs of private training institutes	0	129	263	464	889	1537	2315	3280
<b>Existing being trained</b>								
Trained through HIDECOR	1750	1750	1750	0	0	0	0	0
Trained under sector plan - fully funded	0	0	400	1400	3500	4600	5500	5500
Trained by sector-plan funded training providers - self funded	0	0	200	350	1100	1600	3000	5000
Trained by private providers/industry etc.	0	0	0	500	500	500	500	500
<b>Trained leaving trade</b>								
Attrition due to retirement/ change of business of existing technicians (10% of existing technicians; earliest 3 a after training)	0	0	0	0	0	175	362	624
Fresh ITI pass-outs opting for other businesses (20% of ITI pass-outs each year)	0	0	0	800	800	800	800	800

### 5.3.12 Approach to Training of Trainers (ToT)

It is envisaged that ToT trainers will be identified from within the country, and groomed through established senior trainers such as IIT Delhi and NCL Pune. Besides, expatriate senior trainers will also be involved in training of ToT trainers for MAC/R&R. Two pools of ToT trainers will thus be formed, who will then be responsible for conducting ToTs in their respective geo-focus areas (North/East; South/West). These pools of trainers have been designated as ToT Cells.

The preparatory activities, before a ToT programme can commence, include:

- a) Identification and selection of (technician) training cells and identification of organisers in each State
- b) Identification of ToT trainers
- c) Training of ToT trainers
- d) Provision of equipment to ToT cells
- e) Provision of Equipment to technician training cells
- f) Conduct of ToTs
- g) Conduct of Hand-held training
- h) Authorisation to training cells to do autonomous training

Obviously, these preparatory activities have to be done in a phased manner.

The total number of ToTs required is estimated to be 18, considering that one ToT can train 16 trainers, and that each training cell will nominate 3 trainers. Thus, one ToT will prepare trainers for 5 training cells. An attrition rate of 15% for training cells has been considered, i.e., it is assumed that 15% of the training cells may opt out or fail to meet standards of training, despite having been trained. It is envisaged that out of the above 18, four ToTs will be related to MAC, other specialized groups and R&R

Ideally, all ToTs should be conducted at the earliest possible. However, this is unrealistic because the preparatory activities have their own lead time and the key trainers are a limited resource. During the period up to 2007 the ToTs shall be as evenly spread as possible, which will ensure that the preparatory activities can also be suitably phased in accordance with priorities amongst different States. Also, it will be easier for ToT cells to suitably pace their ToT activities. Accordingly, the proposed phasing of ToTs is as per table 9.

**Table 9: Proposed phasing of ToTs**

Period	No. of CFC-GP ToTs	No. of MAC/R&R ToTs	Remarks
2003	1	1	The number of ToTs in these time intervals can be adjusted according to the pace of other activities such as identification of training cells, provision of equipment to them etc.
2004	3	1	
2005	3	1	
2006	4	1	
2007	3		
<b>Total</b>	<b>14</b>	<b>4</b>	

### 5.3.13 Establishment of Technician Training Cells

The establishment of technician training cells will be carried out as shown at table 10 below:

**Table 10:** Phasing of Training Cells

	2003	2004	2005	2006	2007	Total
Established under Swiss co-financing HIDECOR	11	3				14
TOT cell S/W	2	6	8	9	8	33
TOT cell N/E	2	6	8	9	8	33
To be funded from strategy	4	12	16	18	16	66

This is based on the assumption that 11 training cells under HIDECOR (falling under TOT cell S/W) would be already in operation by the year 2003. In that year, additional 4 training cells can be made operational. These may include one training cell each in certain new States (other than HIDECOR geo-focus) such as Rajasthan, Uttar Pradesh, Punjab, Haryana, West Bengal, Kerala, Madhya Pradesh, Chandigarh and West Bengal. The bulk of the training cells would be made operational during the years 2005, 2006 and 2007.

### 5.3.14 Other Related Issues

#### 5.3.14.1 Use of the Internet

Even today, the internet provides an excellent platform for information dissemination, also in developing countries like India. This sector plan foresees activities for the next seven years. Depending on the development in intensifying Internet use further, even more widespread access to the Internet is likely. It is planned to simplify distribution of information among the key players of the sector plan, i.e. Ozone Cell, the Implementing/Bilateral Agencies, the Regional Management Offices, the Organizers and the Training Cells through a common simple website. Depending on the status of Internet use penetration in the field, the increasing awareness about the sector plan and need for information dissemination, Internet presence up to an online training tutorial is envisaged through fund reallocation within the available budget. In order to have insights into the development needs in this regard, a very basic website for this sector plan will be established shortly, counting the hits and thus allowing informed decision making if indeed a larger Internet presence is meaningful.

#### 5.3.14.2 Training for State Authorities

The implementation of training strategy will require considerable involvement of State Govt. authorities, namely, State Environment Ministries and State Pollution Control Boards, designated as implementing supporting agencies. These authorities have a variety of functions, besides responsibility for coordinating ODS phase-out efforts at the State level. Currently, the concerned persons of these Boards are being imparted awareness on ODS phase-out issues by MoEF. Additional



training of these personnel for effectively supporting the implementation of this sector plan will be another important activity.

#### **5.3.14.3 Linkage to Certification**

Certification linked with training can be an important incentive. The possibility of certifying the training programme under AICTE and further involve public private partnerships (particularly for MAC sectors) needs to be further explored during the implementation stage. This includes the options of linking the certification of servicing firms with labeling efforts in cooperation with industry. It is recommended to approach the issue in a phased manner. Linked with certification is the issue of minimum standards for equipment to be possessed by the certified servicing firms. According measures will be developed based on requests from the Sector Plan Steering Committee.

### **5.4 Enhancing access to Equipment**

The wide spread lack of appropriate equipment and tools among larger segments of enterprises operating in the Indian RAC service sector is seen as a major source of excessive consumption and emissions of CFCs. Wide spread application of inappropriate practices, which can inter alia be attributed to lack of equipment, do include sweep charging, self evacuation, excessive charge line purging, charging by frost line, reverse retrofitting of HFC-systems and venting of refrigerant while opening the system.

The majority of repair and service activities in smaller refrigeration and A/C systems are undertaken by Small and Micro Enterprises (MSEs) in the predominantly unorganized sector with very limited financial resources for upgrading their facilities. In large systems commercial incentives of refrigerant and equipment cost leads to a situation with generally better practices. Strategies enhancing access to equipment are of high relevance in particular for the small scale sector, especially because of its very large share in CFC consumption.

Under the HIDECOR pilot phase project some limited equipment support activities were implemented. Conceptual development for refining these approaches is presently ongoing under the HIDECOR main phase. The HIDECOR project has generated India specific experiences and lessons learnt which are relevant for developing strategies for larger scale equipment support schemes as outlined in the following. This chapter is based on insights gained under ECOFRIG and HIDECOR projects and further inputs received from Indian experts and stakeholders. For R&R aspects the chapter also takes into account international experiences gained under implementation of Refrigeration Management Plans.

#### **5.4.1 Equipment needed by RAC service sector enterprises**

##### **5.4.1.1 General considerations**

The horizontal survey has identified a number of service enterprises in India in the order of 40'000 units. Following findings have relevance for developing a strategy for enhancing access to equipment:

- The top 15% of enterprises with highest CFC consumption account for an aggregate consumption of almost 60% of the total consumption in the service sector

- The top 50% of the enterprises make up for a share of more than 85% of overall CFC consumption
- Only approx. 150 enterprises report annual CFC consumption above 500 kg
- 50% of enterprises with a consumption above 500 kg/a indicate MAC as main line of business. 25% of enterprises with a consumption above 500 kg/a indicate domestic and small commercial refrigeration as main business
- In the category of domestic and commercial refrigeration the majority of enterprises with consumption above 500 kg/a is found to be associated to franchisee networks
- Approx. 55% of total enterprises report consumption below 20kg of CFC per annum, leading to a consumption of approximately 260 tons. More than 20% of the enterprises consume below 10 kg/a. Most of these enterprises have their main business in servicing small appliances such as domestic refrigerators.

The following are some important hypothesis for strategy development:

- The equipment needs of small enterprises in terms of optimum service and minimum CFC consumption to be achieved have to be balanced against both the efficient use of funds and the equity of smaller vs. larger firms. It would be problematic and probably not even effective to provide small companies for no extra costs new equipment worth several times more than the enterprises annual business turnover. Therefore, the principle of cost effectiveness, being an efficient instrument under the MLF, will be used to limit the support to those enterprises. The lowest support level available to the enterprise is determined by the minimum needs for it to continue to stay in business; these needs are the training needs. Consequently, from this group, only insignificant reductions in CFC use can be expected as an outcome.
- Enterprises consuming more than minimum amounts of refrigerant will receive equipment leading to reduction in CFC consumption, based on their individual level of consumption.
- The large majority of enterprises in each segment may require the same set of equipment. There is only limited need and possibility for scaling the equipment packages according to enterprise specific consumption.

#### 5.4.1.2 *Existing equipment*

While manufacturer owned or controlled service networks are generally equipped with equipment and tools which are adequate for achieving good practice with CFCs and also for handling of alternative refrigerants, this is to a lesser extent true for franchised service units and only to a very limited extent – if at all – for the large number of small service and repair workshops from the informal sector. The present status of existing equipment must be assessed individually for the different segments of the sector.

Generally it can be noted that the deficit in adequacy of equipment is highest for the segments of domestic and small commercial appliances, while the segments which deal with larger and higher

value equipment such as MAC and industrial units in general are today relatively better equipped. This is seen as a result of the specific situation for servicing small appliances where high technical requirements exist (vacuum levels, charge accuracy, flushing due to compressor burnout) while at the same time cost sensitivity of the customers and competition in the market is highest and quality consciousness lowest of all segments.

For enterprises which handle domestic and small commercial appliances portability of the equipment is also a major factor. While servicing at customer site is getting more frequent in these small appliance segments, only recently reasonably portable vacuum pumps and charging equipment have entered the Indian market, and still today the smallest available approved refrigerant and nitrogen cylinders are much too heavy for being moved around easily. For refrigerant it is wide spread field practice to decant into (often contaminated) non-approved small cylinders, with all the risks associated to this practice. For the segments which are handling large RAC units and installations, portability of equipment is not a major constraint as servicing equipment is anyhow heavier and often already parked at the installation site. Under this sector plan the portability issue is most relevant for servicing domestic and small commercial appliances.

Most of the informal sector service workshops do not possess a suitable vacuum pump which is capable reaching vacuum levels required for proper quality and, therefore, low failure rate of repaired equipment. Many use old /discarded hermetic or semi-hermetic compressors for evacuation of refrigeration systems or sometimes use the refrigeration system's compressor itself as a vacuum pump. Balances or stills for accurate measuring-in refrigerant charges are very rarely found. The same applies for nitrogen cylinders for flushing and pressure testing. Here a major constraint for wider use persists in prohibitive cylinder deposit charges of INR 3'000 to 5'000 (70 to 120 USD) which a small informal sector enterprise reluctant to invest. It is today a widespread practice to use LPG blow torches for so-called brazing (although the insufficient heat of these torches may often not be able to do more than the much-lower quality, insufficient soldering). The reason for this is the availability of small cylinders of 2kg capacity (portability) and the affordability of LPG. As the quality of LPG used is cooking gas which provides with a normal torch a flame with only about 900 degrees Celsius, this results in very poor joint quality. The use of Swirl jet technology which provides a temperature of approx. 1100 degrees with Indian cooking gas and provides more uniform heating of the tubes is low, but would provide significantly better brazing results. Use of Oxygen-Acetylene is significantly more costly than LPG and cylinder deposits are again high while smallest cylinder sizes are non-portable. LPG is available at any household, in any cylinder size starting from 0.5 kg and at low cylinder deposits.

A significant use of recovery equipment is today prevalent neither in the informal nor the formal sector service enterprises. While in the MAC sector a certain penetration of recovery & recycling (R&R) equipment can be found, especially with brand specific service centers owned by car manufacturers where such equipment is being made available under multinational corporation (MNC) corporate policies. This R&R equipment is dedicated to recycling of HFC-134a, based on environment / HFC policies of MNCs. R&R field surveys however have shown that - even if R&R equipment is available - it is often not being used due to economic reasons.

Over all, there is a significant need for technology upgradation to meet good practice with CFC and ensure ability to implement retrofit options for CFC based appliances and installations. Specific requirements are further elaborated in the following section.

#### 5.4.1.3 Equipment needs

In chapter 5.2.1, an analysis of the unnecessary losses of CFC is given. On the basis of this assessment, a list of equipment has been developed which provides service enterprises with increasingly better skills to improve the efficiency of CFC use and reduce losses. This list has been prioritized according to CFC phase-out associated, keeping in mind the absolute costs per equipment. It is given in table 11.

**Table 11:** Approximated relative CFC phaseout associated with different type of equipment, assuming training is being provided; relative to total use

No.	Equipment	Assumed reduction in CFC use
1	Manifolds + hoses	10.43%
2	Vacuum pump	1.55%
3	Swirl torch	4.92%
4	Charging stills (domestic, small commercial)	14.86%
5	Recovery equipment minimum, consisting of piercing pliers, 2 recovery bags, 1 manual pump, 1 hose, 1 30lb cylinder (no access to R&R)	2.28%
6	Recovery equipment minimum, consisting of piercing pliers, 2 recovery bags, 1 manual pump, 1 hose, 1 30lb cylinder (assuming access to R&R; instead of pos. 5) plus	4.60%
6a	Recovery and recycling set (access for recovery users)	0.00% (4.60%)
7	Nitrogen regulator, nitrogen cylinder deposit	7.25%
8	Oxy/Acetylene brazing kit (instead swirl torch; addtl. costs)	2.01%
9	Recovery and recycling set (instead recovery equipment; addtl. costs)	16.88%
10	Add. To R&R (not for MAC); Refrigerant ID kit, electronic scale, large cylinder	1.25%

### 5.4.2 Organisation of supply

#### 5.4.2.1 Point of departure

- (a) The service sector plan is the final phase out project in the RAC sector. It therefore will have to deal, as regards equipment (and training) with whatever is remaining in the country regarding

smaller and micro scale manufacturing below the threshold serviced by UNIDO/UNDPs “final” commercial umbrella project. Segments such as bus A/C, train A/C or transport refrigeration and a few manufacturers of industrial and commercial refrigeration equipment however may be not or not adequately be covered by manufacturing phase out projects.

- (b) For some segments retrofit schemes are being developed. Equipment needs originating from retrofit activities are included under this strategy.
- (c) Despite the large disparity in annual CFC consumption ranging from some kg/a to 2’400 kg/a, the analysis of the horizontal survey results gives evidence that equipment needs for smallest scale manufacturing and for good practice in servicing are largely identical.

#### 5.4.2.2 *Beneficiaries of equipment support*

Basically there are two different approaches for identifying beneficiaries of equipment support:

##### **Equity focus:**

This approach provides equal and indiscriminate accessibility to support schemes for any size of enterprise, be it small or big. By this specific needs of the informal sector are addressed with high priority. The criteria for determining the order in which applications are being serviced would e.g. be the sequence of submission combined with a basic eligibility screening. Each company, irrespectively of its consumption and income baseline would be offered identical choice of support packages and identical financial conditions. Under the likely situation of inadequate funding volumes for covering all existing needs, a “first come – first served” approach would provide flexibility to balance the required level of subsidy to achieve responsiveness of beneficiaries and overall funding constraints.

##### **Cost effectiveness focus:**

Access to equipment support funds is strictly prioritized according to enterprise specific ODS reduction per USD of equipment support funds received. As a consequence, enterprises with a comparatively larger consumption will be serviced in the first place. Under a likely scenario with limited overall funding for equipment support, smaller informal sector enterprises would be excluded from equipment support.

##### **Combination of cost effectiveness and equity**

Both approaches will be implemented in parallel through a two-phased implementation approach:

- An efficiency focus shall be applied in an initial phase for supporting access to servicing equipment. The first years will selectively focus on “low hanging fruits”. By this it is ensured that the largest CFC consumers are covered. For selection of operators of centralized recycling stations a tender approach on basis of business plan proposals also can be considered.
- In later years an equity based approach shall apply for enhancing access to basic service equipment and tools. Groups of 2000 companies have been defined based on the results of the horizontal survey. For each group, funding is available based on the achievable CFC phase out in that group. This funding is used first to cover the training needs; whatever is left can be used to supply equipment on a first come-first serve basis, rewarding fast moving enterprises and thus

providing an additional incentive. A fair distribution according to equity criteria is ensured with this approach.

Independent of the type of focus applied for identifying beneficiaries there is a need to establish a set of eligibility criteria for enterprises to get access to incentives from equipment support. This is in order to ensure effective use of funds for equipment support. Eligibility criteria are based on:

- Basic tools and equipment:
  - certificate on completion of training workshop on good practice and handling new refrigerants
  - equipment is used for service activities only, no dealing or trading
  - enterprise is handling CFC12 (not only R22) (possibly with minimum quantity requirement)
  - enterprise agrees to provide access for monitoring purposes
  - etc.
- R&R equipment:
  - certificate on completion of training on R&R equipment use
  - enterprise is handling more than a certain amount of CFC-12 per month
  - agreement to report on use of equipment
  - agreement to sanctions in case of ineffective use
  - etc.

The eligibility will be ensured and agreements with the enterprises reached by the Organizers. The details of the setup are described in chapter 5.3.7. above.

The beneficiaries will have to cover a certain amount of the equipment costs themselves, starting with small levels for very basic equipment and increasing with decreasing priority of the equipment. An exemption is the recovery and R&R equipment, which will be almost fully funded in case of centralized R&R stations providing services to smaller enterprises and recovery equipment for these enterprises. The R&R systems used by single enterprises will be subsidized over-proportional to allow for their (from the position of the enterprise) poor cost effectiveness. The reason for sharing the costs with the beneficiaries is not only the saving of absolute costs, but also the issue of responsible use of the equipment provided. Only a model requesting the beneficiary to show clear interest in the equipment support through partial payment of the costs can minimize that equipment is provided which is not being used.

#### 5.4.2.3 Implementation arrangements

This section deals with different options for different dimensions of the implementation arrangements. The following performance criteria should be considered when finally deciding on any particular implementation model:

- Overhead costs for implementation (efficiency)
- Adequate outreach (effectiveness)
- Attractiveness for target group
- Fund flow requirements

- Accountability and auditability
- Synergies with other activities in the field of ODS-phase out (e.g. registration, certification etc.).

The eligibility check and determination of the level of support is being handled by the organizer. In the first years the organizers will have to be active to identify and convince the potential beneficiaries from the group of low hanging fruits, since awareness will still be relatively low. With increasing awareness and the scarcity of CFC being felt, the organizers will have easier access to the target group, but numbers will grow over-proportional, as will the difficulties of determining eligibility and level of support to be given. Identification and determining of eligibility will predominantly be performed before peak season, with training and equipment being actually provided after that peak season. The data from the eligibility determination will provide an important input for the reporting and next annual implementation plan.

After the level of support has been determined, training and equipment will be provided between peak seasons.

#### *Fund flow arrangements for grant component*

Different options will be utilized for handling the grant and arranging the respective fund flow. The solution depends on the target group and the regional circumstances, the actual approaches being defined during implementation.

The following basic options will be considered:

#### I. Post purchase reimbursement to customer:

Reimbursement of grant component is made to individual customers against proof of purchase. Disbursement can be arranged through banks or any agency involved in fund handling and with sufficient outreach to target group. This approach however has some drawbacks: a) the buyer needs cash for making *full* upfront investment and only later will receive refund. This increases the entry hurdle in case of cash constraints significantly and will make the option unattractive in case of high grant levels. b) the beneficiary will expect full security to receive grant reimbursement retrospectively to the act of equipment purchase. This makes overall budget management more difficult unless a real time clearing system is in place. c) it is a multiple window solution.

#### II. Post purchase reimbursement to dealers / vendors:

The setup has characteristics which are similar to option I. above, except that the beneficiary will purchase equipment at already discounted costs and thus requires less cash for effecting the purchase. The lowered cash requirement will *significantly* lower the entry barrier for smaller informal sector enterprises. The dealer / vendor will receive reimbursement for the grant component on presentation of proof of sale and proof of eligibility of customer. This exactly similar to the existing credit card operations, where dealers receive funds only against presentation of credit card slips. To minimize abuse of grant funds, the form shall contain the confirmation by the customer for amount of cash paid as well as address and signature of end user. The grant component (plus additional

handling/interest fee for dealer / vendor) will be reimbursed e.g. at bank counter or through bank transfer to dealer/vendor. For the beneficiary this is a "one stop shop".

III. Off-purchase reimbursement to manufacturer / supplier / distributor against proof of delivery / production records:

The manufacturers / suppliers will have to provide equipment to dealers/vendors at discounted costs which then will be sold at fixed and discounted price or provided free of costs (depending on type of equipment and eligibility) to the beneficiaries. The grant element will be reimbursed to the manufacturer / supplier / distributor upon submission of production or sales/handover records. An auditable system is a prerequisite and a mechanism must be installed to prevent that equipment is sold to end users at normal costs, increasing profits of vendors and thus depriving end user of benefit. Another problem consists in stocks which could be piled up at the vendors for which manufacturer already has received grant contributions. A mechanism of linking payment to some sort of proof of purchase/handover and proof of eligibility of end user would again be required.

IV. Direct delivery of equipment

Equipment can be delivered directly to the beneficiary, provided this turns out to be a cost effective solution in terms of administration and shipping efforts for the different kinds of equipment.

For option I and II above it must be ensured that the end user resp. the vendor / dealer will receive the grant component after effecting the physical transaction of the equipment.

5.5 Conversion of existing equipment

The vertical survey assessed also the population of different types of CFC refrigeration equipment in India, both today as well as a projection for the future. The results of this projection are displayed in table 12.

**Table 12:** Present status of CFC refrigeration equipment and projection into 2010 (without chillers)

	Remaining CFC equipment in 2002 [1000 units]	Remaining CFC equipment in 2010 [1000 units]
Domestic refrigeration	42'210	18'910
Refrigerated cabinets	2'100	1'280
Ice candy machines	1'050	640
Other commercial	350	220
MAC (car)	1'900	1'260
MAC (train)	2.203	1.153



It is obvious that there will be still a significant service demand after 2010. For most segments though, a significant amount of equipment reaches the end of life shortly after 2010, in particular commercial equipment and MAC (car). Other types of equipment are longer lasting and service demand has to be expected for several years after 2010; this refers in particular to the domestic refrigerators (typical lifetime above 15 years) and air conditioning systems for trains (typical lifetime 40 years). It is expected that these systems will be retrofitted or otherwise converted shortly before 2010 or during the first service after 2010.

In order to facilitate this conversion and to ensure that the necessary logistics and know how are in place, a pilot incentive program is planned for the domestic refrigeration sector. Studies have shown component costs of approximately 12 USD to be necessary to convert a domestic refrigerator. The said pilot program will support 25'000 conversions annually from 2007 to 2009, i.e. approx 1% of domestic refrigerators serviced. This is seen as a measure which is meant to facilitate the adaptation of such practices by the service sector.

The refrigerator manufacturers shall also be involved for making commitment on conversion of the CFC based refrigerators manufactured by them and being used in the market for appropriate retrofit scheme to convert them to non-CFC technology even after the warranty period.

## **5.6 Awareness program**

### **5.6.1 Objective**

Awareness on

- restrictions on use of CFCs,
- good servicing practices,
- the phase out schedule and
- regulatory aspects

is needed to facilitate and sustain action for a cost effective phase out in the refrigeration and air conditioning servicing sector.

#### **Guiding principles for the development of the awareness-raising strategy**

- 1) Awareness is a precondition to training. Through improved awareness on aspects of phase out, and the need to adapt to substitutes it is possible to sensitize the concerned personnel to respond to the training initiatives more emphatically.
- 2) Awareness on the sound business sense of proper servicing and maintenance with substitutes in keeping with the overall phase out strategy is critical to motivate action.
- 3) Awareness raising strategies have to focus on specific information needs of the formal and informal servicing establishments of the Refrigeration and Air-conditioning (RAC) sector, to promote good servicing practices
- 4) The media for delivering awareness raising messages to the personnel in the establishments, have accordingly to be developed on the basis of prevailing routes of communication on technical aspects, within and between the formal and informal sectors.
- 5) The role of the general public in encouraging good servicing practices should also be stressed. Appropriate mechanisms for creating awareness in the public and opportunities for their reaching out to the service sector have to be defined. Nevertheless, general public awareness activities as such will be financed through a different MLF funded project (Production Sector Phaseout)

### **5.6.2 Information needs**

Many enterprises are not aware of the technical and commercial challenges in the context of CFC phase out and are technically under-prepared to carry out good servicing. Awareness on the need to employ good servicing techniques therefore has to be created.

The servicing sector has also to be made aware of the phase out schedule, the regulatory aspects, the support (training and equipment) available to the enterprises and the way how to approach in case the support requested.

The information needs accordingly can be broadly classified as:

- (1) technical information