LESSONS LEARNT UNDER ECOFRIG COLLABORATION AND ITS RELEVANCE FOR ADDRESSING OZONE LAYER PROTECTION AND CLIMATE CHANGE

RICHARD GERSTER[1]
Gerster Consulting, Switzerland
Email: richard.gerster@gersterconsulting.ch

ABSTRACT
Ecofrig opened up an environmental-friendly option of Chlorofluorocarbon (CFC) free technology hitherto unknown in India and achieved a level playing field for Hydrocarbons (HCs) vs. Hydrofluorocarbons (HFCs) in view of informed decisions in private industry in implementing the Montreal Protocol. Ten key factors of success are identified, among them (1) the creation of a process leading to *ownership* of the HC-technology with the Indian partners, (2) the commercial *competitiveness* of the HCs, (3) the commitment of all partners at the institutional and human level. Lessons learnt mainly address market failures, the role of the Multilateral Fund (*MF*) and the growing influence of multinational companies (*MNCs)*. Despite considerable relevance of Ecofrig for the protection of the Ozone layer, for the slowing down of climate change and for poverty reduction, there still is unfinished business. The conclusions presented here are based on interviews with Ecofrig programme partners in India, Germany and Switzerland, and a self-assessment by Infras.

1. BACKGROUND

350 million people use refrigeration of any kind in India. In financial terms, the refrigeration market in India has grown by 10% annually since 1992. This growth trend on the demand side is expected to continue for the next 10 years. Liberalisation spurs economic growth but also restructures the Indian economy. With a sharp increase of the presence of Multinational Companies (MNCs) the supply of refrigeration appliances has undergone deep changes in the 1990s.

As a signatory of the Montreal Protocol India is required to phase out ozone depleting substances (ODS). In refrigeration and cooling (domestic fridges, commercial refrigeration, car air conditioning, refrigeration in food and fishing industry, air conditioning of large buildings) India has to replace the Chlorofluorocarbons (CFCs) up to 2010. Until 2005, the use of CFCs should be halved (related to 1995-97). In order to reach this target, the Indian Ozone Regulation 2000 sets a time horizon up to 1 January 2003 for the appliance manufacturing industry to convert to CFC-free technology. The implementation of the conversion is just starting.

The incremental costs of technology change in appliance manufacturing as well as in the service sector are substantial. An educated guessing of the real costs India has to face to phase out ODS by 2010 may arrive at a $ 400-1000 mio estimate. To ease the burden for

[1] The author would like to thank Othmar Schwank, Infras, for sharing his invaluable knowledge. I owe also a lot to the in-depth description and analysis of Ecofrig in Infras (2002).

developing countries the Multilateral Fund (MF) has been created within the Montreal Protocol. India has received so far $ 200 mio from the MF. Compensation payments by the MF cover just a part of the real costs in India. The remaining burden is often passed on to the weakest part in the chain.

There are two competing technology options of CFC-free technologies: synthetic and natural fluids. In a first step the basic requirements of any product have to be fulfilled: Producing a safe, high quality product at a competitive price and demanded by the consumer. Comparing the two technological options, the experts and practioneers interviewed mentioned five advantages in favour of the natural fluids, the Hydrocarbon (HC)-based technology:

- Natural fluids are more environmentally friendly and do neither harm the ozone layer nor do they push the climate change.
- Hydrofluorocarbon (HFC) 134a is a green house gas with a global warming potential of 1'300 CO2-equivalents. HFC 134a is controlled under the Kyoto Protocol. It is a concern of the South that the North will gradually shift to HC refrigerants and that HFC 134a technology would become obsolete (for export) in 10 years from now. So industry would have to convert twice.
- The handling of HFC 134a requires higher standards of cleanliness and moisture control, which is particularly difficult to achieve in servicing. Exposure to higher moisture levels will, in hermetic systems, negatively affect lifetime of HFC 134a appliances; nobody knows reactions under Indian conditions. "None of the Indian companies has fully understood HFC 134a and its handling"[2].
- HC can be produced in India whereas synthetic fluids (HFC 134a) create a new dependence on foreign suppliers; India is too small a market for a production plant of HFC 134a. Even if India could produce competitively on economic grounds, the US technology owner would restrict vital exports.
- Hydrocarbon technology is available in the public domain whereas HFC 134a is a patented technology. An Indian company is reported[3] to have negotiated with DuPont, holder of HFC 134a patents in view of a production licence in India. In addition to a high licence fee ($ 25 mio) strings were attached: either a majority share in the joint venture or export restrictions for the sale of the HFC 134a.

2. THE ESSENCE OF ECOFRIG

Objectives

The principle objectives have been the "transfer of safety-related and technical know-how and information to the Indian industry and to research partners at national level, and to support applied research and pilot manufacturing of appliances and components as needed to make hydrocarbon technology a viable option under Indian conditions"[4]. The project goals of

- Phase 1 (1992 – 1997): Feasibility exploration, conversion of foaming from CFCs to HC and information dissemination;

[2] The quotation marks indicate a statement by one of the personalities interviewed and listed in the annex. For reasons of discretion there is no personal attribution.
[3] Watal (1998)
[4] Infras (2002), 6

- Phase 2 (1998 – 2002): Introduction of HC refrigerants as working fluids, phase out of CFCs from production and servicing of domestic and small commercial refrigeration appliances.

Inputs

During the 10 years of preparation and operation between 1992 and 2002, the Swiss and German Governments have spent SFR 7.67 mio on Ecofrig, including some activities in international networking. In addition, SFR 1.28 mio was spent for the pilot phase of the "Human and Institutional Development in Ecological Refrigeration" (HIDECOR) project. An unknown amount has been spent by the various Indian partners.

Achievements

Ecofrig opened up a second option of CFC-free refrigeration technology. Until 1992/3, only HFC 134a/141a were known. "I would not have known of HC-technology without Ecofrig". "The Ecofrig project was the core part in the process to clear the technical options. Without Ecofrig we would not be where we are". "After initial scepticism I have been convinced of hydrocarbons". "Ecofrig has been of tremendous benefit to the country. It even shaped the thinking of the Ministry of Environment and Forests". "Ecofrig has become a trademark and a point of reference for decision makers". The merits became internationally visible when 1997 Dr. Sukumar Devotta of the National Chemical Laboratory (NCL) in Pune and 1998 Prof. R.S. Agarwal of the Indian Institute for Technology Delhi (IITD) as well as INFRAS received the Stratospheric Ozone Protection Award of the US Environmental Protection Agency.

Ecofrig made a great difference in foaming with Godrej and Voltas taking advantage of that option as a result of Ecofrig phase 1. "Based on the successful experience of the pilot plant Voltas started with large scale production". In fridges 70-80% of total CFC-consumption goes into foam; 20-30% is due to the refrigerant. In the case of a 165 l standard fridge 650gr CFC are used for foaming, 130gr are required as refrigerant. "Ecofrig has encouraged Godrej to run a greater risk in working with HC instead of staying in the mainstream of HFC 134a".

Industrial production of CFC-free fridges – entirely (foam & refrigerant) on HC-basis – in Godrej started in June 2001, being a landmark event in the almost 10 years history of the Ecofrig project. 15'000 fridges per month, 150'000 - 180'000 per year are manufactured with HC-technology on one production plants. The market demand exceeds the manufacturing capacity. The remaining two production plants will be converted between March and June 2002. Mid 2002 the whole fridge production in Godrej will be converted, meeting the Government's requirements half an year ahead of schedule.

3. GLOBALISATION: AN EVOLVING FRAMEWORK

The role of multinational corporations

At the start of Ecofrig in 1992 three Indian companies (Godrej, Voltas, Kelvinator) absorbed about 90% of the Indian market in domestic refrigeration. Kelvinator had manufactured appliances under a trade mark owned by Electrolux and opted right from the beginning for HFC 134a as a CFC-free alternative. General Electric suggested also the HFC 134a road but as minority shareholder in Godrej left the technology decision to the Indian management. "Other companies were bound by agendas and events originating in other countries". US-companies being liable according to their legal system were

afraid that safety concerns could not be fulfilled entirely. On the other hand, HFC 134a requires a high cleanliness which cannot be easily achieved under Indian conditions. "As an Indian company, Godrej is very committed to the obligations of India in the Montreal Protocol", a feeling of responsibility which usually will be absent in MNCs.

Whirlpool, Electrolux, Samsung and LG opted straightforward for HFC 134a. Whirlpool opened in 1998/99 a plant in Pune on HFC 134a basis with a huge US$ 75 mio investment. Electrolux sells hydrocarbon fridges in European markets but sticks to HFC 134a in India. Tecumseh produces HC-compressors in France and Brazil, but so far stayed with HFC 134a in India – following the customers' demand. Interestingly, the hydrocarbon compressors manufactured by Tecumseh in Brazil are sold to Bosch which export their fridges to Germany while selling in Brazil HFC 134a appliances.

Also in commercial refrigeration the key to hydrocarbons is abroad today. Coca Cola, Pepsi and others as dominating customers insist on HFC 134a instead of hydrocarbons. Since Sidney 2000 Coca Cola accepts that HFC 134a has to be replaced by 2004 but the alternative route is not yet outlined. Coca Cola would like to combine the technology choice with energy saving. The saving potential of hydrocarbons is there but not highly significant. Besides Coca Cola also Unilever/Hindustan Lever has committed to go HFC free from 2004 onwards. Hindustan Lever at the moment purchases HFC 134a equipment and has given up the HC blend route on grounds of unavailability of refrigerant and compressors.

The role of the Multilateral Fund (MF)

When India joined the Montreal Protocol in 1991, the MF was used as a joker argument to respond to all the open questions. The experience since then has been quite a sobering one. The technology transfer envisaged did not take place. Most of the modern technologies are in the private domain, owned by a MNC in the North. The technology owner is unwilling or reluctant to give access to his technology at reasonable terms because the MNC will lose the market and prefers to sell the product instead of the technology. Obviously DuPont followed this corporate strategy when offering production licences for HFC 134a compressors at prohibitive terms only. Luckily, hydrocarbon technology dates back to the 1930s and 1990s and was available in the public domain.

The MF is said to be technology neutral. There is, however, no mechanism to evaluate competing technologies. In reality, there was a clear bias in favour of HFC 134a whereas the hydrocarbons had to fight for recognition and a level playing field. "Ecofrig became an important instrument in lifting the HCs up to an alternative option on equal footing and, beyond India, was very much relevant for the Multilateral Fund".

Incremental costs accruing to developing country producers due to the conversion to CFC-free technology are to be compensated. This is the basic idea behind the MF. In practice, the operational definition of incremental costs has been revised several times to bring the volume of potential demand in line with the funds available. "New techniques to deny funds were developed. For example, incremental operating costs were originally to be compensated for five years. Now it is just six months". Technical training institutions are facing difficulties in their laboratories: To allow an effective teaching, they have to replace CFC equipment. From the MF no funds can be expected as teaching does not directly reduce the use of CFCs.

4. THE KEYS TO SUCCESS

Ownership

"Nothing was imposed on us. Demand orientation was a key factor". "In a very mature relationship the Indian scepticism, our doubts were taken up seriously instead of rushing to preconceived conclusions. We had the chance to make our own conclusions". Godrej made a market survey before launching the new CFC-free "pentacooler" series of fridges. The launch is considered as a "success story, and the technology conversion clearly was a Godrej affair". The participating industries were among the driving forces for Ecofrig. They owned and shared a common vision to an extent that made them forget that they were cooperating with competitors.

Competitiveness

"HC-technology is the most cost-effective solution in manufacturing and servicing the fridges". Compressors based on hydrocarbon blend are cheaper than HFC 134a. Voltas claims that in fridge production HC-technology is more expensive due to the electrical parts which require an explosion-proof design. However, "HFC 134a is a temporary solution only affecting climate change, whereas hydrocarbons avoid global warming". Therefore, at a later date, the competitors will face a second conversion when HFC 134a will have to be eliminated under the Kyoto Protocol. "Avoiding that second conversion, Godrej will be ahead of the curve". But also the servicing of HC refrigeration appliances is cheaper than HFC 134a-based fridges.

Training

Throughout the project, training of staff for research activities, for manufacturers and for the service sector enjoyed a high priority, complemented by measures for capacity building in key partner institutions. A sustainable technology transfer can only be reached if local capacities are in place which are in the position to choose a technology, to adapt it to the prevailing conditions and to replicate it.

Institutional commitment

Key Indian partners had a high profile in environmental matters. Godrej's corporate policy gives preference to green options and ensures mainstreaming of environmental concerns. The late owner of Godrej had been Chairman of WWF India. Also Voltas (in Phase 1 of Ecofrig also a key partner) as a member of the TATA group has an environmental commitment. On the other hand, Videocon had no firmly anchored environmental policy and when the Aurangabad plant manager - who had been a close partner in Ecofrig - left, the whole process broke down because the owners of Videocon did not share the commitment. The commitment of the participating research institutions (IITD and NCL) again was far beyond what reasonably could be expected. On the Swiss and German side, it is part of the mission statements of SDC, GTZ and Infras to contribute to sustainable environmental solutions in international cooperation.

Human commitment

The people involved both on the Indian and the Swiss side took a personal interest far above average in finding the best technological option adapted to Indian conditions. "The complete absence of a patronizing attitude made it possible to solve differences of opinion without any bitterness". Ecofrig enjoyed also an extraordinary continuity at the personal level: Many people were involved during almost 10 years. The relevance of this human factor in the Ecofrig cooperation can hardly be overestimated.

Trust
"Trust was the driving force of Ecofrig and a safety net as well". One of the main reasons why trust building was successful was the absence of a hidden agenda. Neither Germany nor Switzerland pursued political or economic interests in the Ecofrig cooperation. The parties involved, therefore, listened to arguments, chose by consensus the supplier considered to be the best option and did not have to favour German or Swiss industries.

Trilateral cooperation
Ecofrig is based on an agreement between the Indian Government (Ministry of Environment and Forests), the German Government (GTZ) and the Swiss Government (SDC). "The trilateral set-up substantially increased the room de manoeuvre in Ecofrig. It created the unique opportunity to break internal rules of SDC or GTZ in case the other donor was prepared to accept". The trilateral agreement reduced the administrative burden of India which could satisfy two donors with one report.

Steering committee
The decision making power of the trilateral Joint Project Review Committee (JPRC) allowed to follow a changing environment in a flexible, effective and efficient way. The JPRC was given the competence to revisit activities and reallocate budgets. It also was a vehicle for innovations. Ultimately, it has taken over decision making power of SDC or the BMZ. A JPRC participant in a consultative status considers the steering mechanism as a "very effective and dynamic coordination".

Flexibility
There was not only space at the institutional level for creative solutions but this space was also used accordingly. More than that, additional funds could be mobilised. "When we needed support, we got it". The Indian side had a say in making the choice of the pilot plant equipment, and Infras/Swiss Development Cooperation (SDC) went along the recommendations of the Indian partners and did not choose the cheapest option but one in which the Indian side had no doubts about the competence of the supplier. There was a proactive management of Ecofrig which e.g. gave birth to the HIDECOR offspring.

Expertise
"In the framework of Ecofrig, India got access to the best know how which has been available worldwide in the refrigeration field". Through its professional networking, Infras identified the most appropriate science and industry partners which in turn were prepared to contribute to this exercise and support the Indian partners. Also the commitment of the private sector outside India was remarkable and beyond expectations in most cases.

5. LESSONS LEARNT

Arguments are not enough, a selling effort is required
Ecofrig was often quoted at the international level as a reference "but there was no real global selling effort from side of the private sector". Whereas the MNCs behind HFC 134a were active, no similar promotion by the German industry took place. Ecofrig staff made a considerable effort to present the arguments and achievements in multilateral fora. Luckily, a global selling effort was undertaken by Greenpeace with national campaigns in Germany, Argentina and Canada as well as the „Green Olympics

Campaign“ which lead to the commitment of Coca Cola and Unilever to phase out HFCs and HCFCs in procurement for their cold chain by 2004.

Market mechanism alone does not induce technology transfer

Government has to care about the environment. This is the case for the Government of India as well as for Switzerland or Germany, which obviously have environmental protection among their foreign policy objectives. Global public goods cannot be left to market forces. How to implement the Montreal Protocol and other MEAs is rather a question of effectiveness and efficiency than a fundamental question. “If you wanted something to happen, there was no other choice left than Government intervention”. All partners interviewed in India rejected the view of Ecofrig as providing subsidies to Indian industry and biasing market forces. Ecofrig was support for research & development but not for commercial implementation, and Ecofrig helped to address safety risks which a private company alone would not have shouldered, and finally, “We have not received any subsidy”.

Public-Private Partnerships are promising

Ecofrig was started before Public-Private-Partnerships (PPP) became fashionable in the international discussion on development policy. The reason behind the PPP proceeding was a pragmatic approach that prevailed throughout the Ecofrig implementation. On the one hand, hydrocarbon technology was accessible in the public domain. On the other hand, the final technology choices are made by the private sector and the consumer and not by government. Therefore, an almost symbiotic cooperation between institutions of the public and private sector was key to success. In many countries the relationship between public research institutions and the private sector is at best indifferent. In the Ecofrig framework a close cooperation between various industry partners and the participating public research institutions (IITD, NCL) took place.

Multilateral policies favour restructuring to the detriment of local industry.

A non-CFC compressor (HC600a) has to be redesigned from the scratch. The MF accepts only the incremental operating costs for 6 months as eligible costs[5]. As a consequence, compressor production in India or the developing and transition countries in general is hampered in favour of the main six large producers in developed countries (see also China’s experience). Under the coverage of the technicalities of a Multilateral Environmental Agreement a global industrial policy to the benefit of the multinational companies of the North and to the detriment of the local industry in developing countries gets support. The lack of cash in the Multilateral Fund and the global overproduction of compressors may have facilitated this policy contrary to the basic idea of the Montreal Protocol.

The bilateral window of the Multilateral Fund facilitates coordination.

The trilateral Ecofrig-cooperation and the MF should be seen as complementary efforts. The option to fulfil up to 10% of the multilateral obligations through a bilateral window facilitates coordination and, moreover, the burden of coordination is shifted more on multilateral shoulders. For weaker developing country governments this is an advantage.

[5] The background of this debate was a choice which the Multilateral Fund forced India to take: Either the MF would on a country wide basis fund compressor conversion cost of the compressor manufacturers (partly identical with domestic refrigerator manufacturers such as GODREJ) or the fund would compensate the incremental operating cost of the appliance manufacturers (considering the compressor as a component). As a number of conversion projects had by 1998 already been approved involving incremental operating cost, this route had been chosen by GOI.

Ecofrig strengthened Indian positions by supporting work on policies and projects which were in negotiation with the MF. A further merit of Ecofrig is to have sped up the conversion process and as such having reduced the potential basket of Indian demands for MF-support which would have been higher at a later date given further growth of the refrigeration sector. This experience is an important lesson for other Multilateral Environmental Agreements (MEAs).

Allocation criteria used by the MF are hardly need based.
The funds put at the disposal by industrial nations remained at much a lower level than planned and required. Irrespective of the real conversion needs of a country, the Multilateral Fund observes a certain political or geographical balance. Total CFC-phase out costs for the MF should not exceed US$ 14 mio for India in the refrigeration and cooling (RAC) service sector. India's upper ceiling of MF-contributions is the amount allocated to China – ignoring e.g. that China's refrigerator manufacturers unlike India do not produce compressors which require conversion. Interviewed people feel that arbitrary allocations are made and the principle "first come, first served" was in place instead of objective criteria.

Technology transfer by Ecofrig was stopped by the process of globalisation.
The choice of technology in the age of globalisation is primarily based on business strategies of global players whereas the merits of technological options in a specific national environment hardly count. In practice industry in developing countries has no choice but chasing after the global priorities of the MNCs. In the case of refrigeration industry in India, MNC involvement did neither stimulate local r&d nor paved the way for an objective examination of different technology options. On the contrary, instead of opening up new horizons, MNC involvement bluntly favoured the technology of the foreign company, irrespective of their environmental deficits or merits. "It was not the question of what is best under Indian conditions but what is good in the US serves as global standard". „The influence of US-MNCs was so deep that there was no choice for Indian producers".

In today's globalised Indian economy, an intervention of the Ecofrig-type would no longer be feasible.
The origins of Ecofrig date back to 1992. At that time liberalisation policies in India were about to start. The dominating Indian companies in refrigeration enjoyed autonomy in decision making; access to alternative options to HFC were lacking. In the meantime the picture changed completely. Whereas 1992 mainly local companies were operating, now MNCs hold a share of two thirds of the market. As the parent company abroad usually has a worldwide technology policy and has got access to technology, in the world of today there would hardly be space for an effective intervention of the Ecofrig type.

Mainstreaming hydrocarbon technology in India requires a global advocacy effort.
In today's globalised landscape in the refrigeration sector, key decision makers are no longer in India themselves but in corporate headquarters in the North, particularly the US. Coca Cola plays a key role and has already admitted at the Green Olympics in Sidney 2000 that HFC 134a is only a temporary solution and will be replaced by 2004. Whatever the final solution will be, the Coca Cola Company might impose on the rest of the world what they consider justified in the US. At the tail's end, Rockwell and other Indian small scale manufacturers have to produce what Coca Cola wants. The only choice they have is to perish or adapt. The shorter the notice of the new technology required reaches the small and medium enterprises (SMEs) in developing countries, the higher the costs for

them, and the more will vanish. On the other hand, a corporate decision by Coca Cola in favour of Hydrocarbons would be a real breakthrough and have a demonstration effect on many other companies, including other MNCs. Ecofrig has always been a lobby project. But now a different kind of advocacy is required. Switzerland, joining hands with Germany, if possible, should in the context of their Rio+10 preparations take a targeted approach to influence the pending decision of Coca Cola in favour of hydrocarbons by September 2002.

Montreal Protocol implementation is not only an ecological affair but also relevant for poverty reduction.

Small service shops of the informal economy are absorbed by their daily fight for survival and are less aware of the on-going technology changes. When told, they may doubt the need to prepare for change because out of their everyday experience they are sceptic about the enforcement of the Indian Ozone Regulation 2000. The small shops visited, however, were clearly interested in understanding the issues and in getting training. They also mentioned the need for support to buy the new equipment required. Advice and training by the Ecofrig offspring HIDECOR strengthens an important part of the informal economy to stand the challenges of technological change in a more promising way. "Instead of being driven out of business, the small service shops learn how to survive under changing conditions". HIDECOR targets 5000 of these service shops. Though being a separate project, the HIDECOR programme would not have been possible without Ecofrig.

India, Germany and Switzerland should offer the wealth of experience in HC technology to other countries.

The global implementation of the Montreal Protocol will still require many years. HC technology is for the reasons mentioned above clearly the better ODS phase out option than HFC 134a. The experience gained at the policy as well as at the operational and service levels during the "Ecofrig decade" is of great value also to other developing and transition countries. India, Germany and Switzerland should share this treasure of lessons learnt and offer assistance at all levels for an effective implementation of the Montreal Protocol.

6. RELEVANCE OF ECOFRIG

Relevance for the protection of the Ozone layer

The relevance of Ecofrig for the phase out of ODS has been identified several times in this analysis and is not to be repeated here. The combined Ecofrig/HIDECOR experience is being used now for the preparation of the all India Strategy for the RAC service sector which will multiply the outreach of the project. Occasionally, the Ecofrig experience was disseminated to other countries, on opportunity which should be seized to facilitate the implementation of the Montreal Protocol in developing and transition countries. The idea of an Ecofrig cooperation with India motivated the German Technical Cooperation (GTZ) to start in the field of HC based refrigeration their successful cooperation with China. This link to China cannot be considered as a project achievement but is a noteworthy side effect. In several stages during the Ecofrig decade, exchanges of experience between China and India took place.

Relevance to reduce climate change

A recent US study[6] shows that the rate of growth of greenhouse gas emissions has slowed since its peak in 1980, with the CFC phase-out being the most important factor for that turnaround. The global cooperative effort of the Montreal Protocol mainly merits of being mentioned here. HFC 134a is a green house gas controlled under the Kyoto Protocol whereas HC is not. This difference signals the ecological relevance of the choice of ODS substitutes. As Ecofrig substantially contributed to the change to HCs, Ecofrig as well as the on-going HIDECOR Project in the service sector are directly relevant for the reduction of climate change.

Relevance for poverty alleviation

Poverty reduction is by law the overarching goal of Swiss development cooperation. Ecofrig expenditure was covered out of the funds for the Global Environment Programme established in 1991. As a pioneering exercise, this particular background allowed considerable flexibility. But the question of direct effects and indirect links to poverty reduction remains an important issue from a Swiss perspective.

In a preventive way Ecofrig can claim relevance for poverty reduction. Technological change brings opportunities and threats to all the countries. Costs of technology change usually are passed on to the weaker players such as small enterprises and service shops. The political decision at the global level to move out of CFC-based processes devalues the substance of industry. These costs should have been born by the MF but in reality compensation payments cover only a fraction of the real incremental costs. In the fight against poverty it is crucial to keep up and strengthen the industrial base of developing countries. Without local r&d capacity and without a proper industrial base foreign MNCs will more and more dominate the Indian market. Erosion of the local capacities will lead to increased dependence, e.g. for compressors and HFC 134a imports. Weakening the economic base of a country leads to further impoverishment. Ecofrig was very well targeted to provide inputs to Indian r&d and the implementation of the results.

The service sector with its 30'000 - 70'000 mostly informal small service shops is directly poverty relevant. The servicing units usually consist of one to five people, larger centres in the formal economy up to 25. A keen competition prevails in the service sector. "Even if we only earn INR 5 with job, we fight for it because we cannot afford to lose the customer", said a micro shop keeper in an interview. "The informal sector survives thanks to its flexibility and capacity to adapt to changing conditions. The challenges that the service shops will have to meet in refrigeration will be great and may result in painful adaptation".

"Awareness, attitude, ability and affordability are the keys to master the servicing of the converted technologies in the refrigeration sector". A trade off between eco-efficiency and targeting the poor cannot be overlooked. Obviously, larger firms are better prepared to face the new challenges. Allocating the limited means at the disposal of HIDECOR requires clear criteria to prioritise between eco-efficient larger service enterprises and the poverty stricken smaller ones.

[6] Hansen/Sato (2001)

7. UNFINISHED BUSINESS

Despite considerable achievements, there is still a long way to go in mainstreaming HC technology in India. There are mainly five fields of unfinished business:

Stimulating demand for HC based refrigeration
"The battle for hydrocarbons in commercial refrigeration has not yet been launched. It will start when at least one big manufacturer picks up". Unlike domestic refrigeration, the sector of commercial refrigeration is shaped by demand regarding technology options. The key to technology conversion is with the customers, mainly MNCs. The key for a break through in commercial refrigeration lies therefore outside India.

Securing refrigerant supply
HCs at the time being are not freely available in India. In order to mainstream HCs, a major element will be to ensure a constant and well dimensioned supply of HC-refrigerants. Some partners think there should be a well targeted Ecofrig intervention. Others believe that all depends whether, in addition to GODREJ, a second big player turns to HC: If there is a market, supply will follow demand. For the service sector availability of HC blend beyond 2010 will be crucial as this opens the option of retrofitting of CFC12 based appliances – a potentially large business. Mainstreaming demand for HC blend would need a large player from the commercial appliance sector to use this technology from 2004 onwards (Coca Cola?).

Mobilising member states of the Indian Union
Monitoring and enforcing the CFC phase-out rests on the shoulders of the member states of the Indian Union. Informing and mobilising their active support will be crucial, in particular regarding the service sector. The two days' conference "Meeting Challenges in Change over to Ecological Refrigeration" in Delhi on 5/6 March 2002 offers a unique opportunity to start and strengthen such processes.

Strengthening the service sector
India's deadline for the CFC phase out is 2010, implying far reaching changes in the RAC service sector. "The conversion of the production lines is nothing compared to the challenge of reorienting the service sector". Looking at the overall life cycle of a fridge the manufacturing consumes only 30% of the CFC refrigerants whereas the service part – lasting 15 – 25 years in India – is responsible for 70% of the CFC refrigerant used. After a pilot phase within Ecofrig, HIDECOR is now offering training and support to the service sector in 6 states up to 2004. These challenges have been neglected by the MF.

Curbing illicit trade in CFCs:
Servicing HFC 134a fridges increases costs, and in the competitive market customers are hardly prepared to accept a price increase. The shops try to avoid the increasing costs and have recourse to CFC 12 which is smuggled mainly from Nepal. 880 tons of ODS – 12% of India's national consumption – are estimated to be smuggled from Nepal to India (eia 2001, p.7). One of the largest production plants for CFCs is located in the Netherlands. As HCs are more service friendly, this mechanism is expected to play a minor role for HC (assuming that HC will be available through out the country). The environmental investigation agency (eia 2001) proposes an effort at the political level to strengthen the enforcement mechanisms of the Montreal Protocol.

ANNEX: List of persons interviewed

India
Ashok K. Gupta, Rockwell Industries Ltd., Hyderabad

Burzin J. Wadia, Executive Vice President, Godrej Appliances Ltd., Mumbai

N.N. Rao, DGM, BPL Engineering Ltd., Hyderabad

K. Venkateshwarlu, General Manager Tecumseh India, Hyderabad

Narendra Sethia, Sethia Appliances Pvt. Ltd. (Landmark), Hyderabad

Nitin T. Desai, General Manager R&D, Godrej Appliances Ltd., Mumbai

R.S. Agrawal, Professor & Deputy Director, Indian Institute of Technology Delhi (IITD), Delhi

R.S Iyer, consultant, Mumbai (RSI)

Surinder Kumar Batra, consultant, Centre for Interactive Management India (CIMI), Delhi

S.N. Tripathi, Executive Director Voltas Ltd., Hyderabad

U Shiv Prakash, General Manager Manufacturing, Voltas Ltd., Hyderabad

Veena Joshi, SDC Delhi, head Energy & Environment, Delhi

Vijay M. Crishna, Managing Director Godrej Appliances Ltd., Mumbai

Germany:
Evangelia Keké, Project Officer India, GTZ, Eschborn

Stefan Sicars, Project Manager GTZ Proklima, Königstein

Klaus Meyersen, TheOtherArtOfConsulting, Mainz

Switzerland:
Othmar Schwank, Managing Director, Infras, Zurich

REFERENCES

BATRA SURINDER KUMAR, Skill Development of the Informal Refrigeration Servicing Sector in India: A Case Study, paper for the SDC-Conference on Work, Skills and Knowledge in Interlaken, 10 – 12 September 2001

ENVIRONMENTAL INVESTIGATION AGENCY (EIA), Unfinished Business. The Continued Illegal Trade in Ozone-Depleting Substances and the Threat Posed to the Montreal Protocol Phase-out, London 2001

HANSEN J.E./SATO M., Trends of measured climate forcing agents, PNAS vol. 28, no. 26, 18 December 2001, www.pnas.org/CGI/doi

INFRAS, The ECOFRIG project: Achievements and Experiences (1997 – 2001), Zurich, February 2002

SCHWANK OTHMAR, Technology Transfer and Multilateral Agreements, Chatham House Workshop, London 17/18 January 2002

WATAL JAYASHREE, The issue of technology transfer in the context of the Montreal Protocol: Case study of India, 1998, quoted in: Khor Martin, Rethinking IPRs and the TRIPS Agreement, Third World Network, Penang 2001, p. 9