ASSESSMENT OF TRAINING AND MANPOWER NEEDS FOR ENERGY CONSERVATION ACTIVITIES

K. Sivasubramaniam
Ceylon Electricity Board
P O Box 540
Colombo
Sri Lanka

Abstract:-Training in general can be defined as an organised procedure which brings out a semi-permanent change in behavior for a definite purpose. This involves the acquisition of knowledge, skills, techniques, attitude, appropriate habits of thought, action and experience, which cause the semi-permanent changes in behavior. The objective of training in "Energy Conservation" is to prepare individuals or groups to optimize the use of Energy in their work places and at homes, without impairing the quality of life or productivity.

INTRODUCTION

We have mostly lived through a period of cheap and abundant supply of Energy until about 1970. Even though Energy now costs more and some Energy resources are scarer, our attitude towards Energy conservation is still one of carelessness and apathy. The price hikes are now accepted as facts of life and its effectiveness as a behavior change - agent lasts generally, in the short run only. Physical controls have generally failed. People are averse to price hikes and physical controls. Under these circumstances, training appears to be the only passive and effective tool to promote Energy Conservation.

Indian experience indicates that a trained Boiler Operator gets 7kg of steam per kg of coal, while an untrained Operator gets only 5kg of steam under like conditions. In the case of training of automobile drivers, the "rate of return on the investment on training could be as high as 10%". However, there were no specific studies to bring out the return on investment in training on Energy Conservation.

It is also known that generally, 10 to 20% of Energy use in an enterprise could be saved purely by adopting "Good Housekeeping", which entails adopting positive habits and attitudes towards the use of Energy than anything else.

This paper approved by the Editorial Committee of the Sri Lanka Energy Managers Association for the publication in the SLEMA Journal.
Paper No. J48902.

In this context, the findings of the ILO training Centre at Turin are very relevant. "The fundamental activity of the Energy management structure is the training of personnel in the enterprise ..... The Energy Management Structure should always be in the front line, operating to create the right attitude in the personnel..... It is the Energy Manager's duty in any case to organise active training of the rest of the personnel on the pertinent aspects of Energy Conservation Philosophy. He carries on this educational job either by himself or with the assistance of internal or external experts" [1]. This emphasises the existence of a high element of training in activities connected with Energy Conservation.

The constraints of training in the Energy conservation area are:-

- lack of awareness of the need for Energy conservation and that training could be one of the interventions.
- lack of validated methodology for assessment of training needs of Energy conservation activities.
- the vastness of participants involved which makes implementation of training programmes difficult.
- the complexity and different levels of training requirements and lack of suitable trainers.
- the high cost and the long time taken to realise the benefits of investment in training and
- lack of sustained effort.

Notwithstanding the above constraints, the importance of training in this field is being recognised and generally preferred to other policy options such as pricing and statutory regulations to modify the behavior of Energy users. This is also a more socially accepted process.

AN APPROACH TO TRAINING AND MAN POWER ASSESSMENTS

The analysis of the National Energy Plan will reveal the economic sectors in which

there is high use of Energy. Energy conservation has to be enforced in such sectors due to the structural changes envisaged in those economic sectors or due to the limitation of Energy resource itself. For example, in Sri Lanka, it is realised that there is a need to conserve fuelwood use in the domestic and industrial sectors, to save the forest cover. There is also the need to substitute fuelwood for imported oil in the industries in order to arrest the increasing consumption of oil in the industrial sector. In the given situation, training in fuelwood conservation and the linkage activities of this Energy sub-sector has to be given high priority. In another country, more conservation effort may be needed in the use of electricity simply because the plant capacity is inadequate.

It is therefore conceivable that, in the different situations as illustrated above, the training needs, the target groups and the technologies involved could be different. The number of persons required to carry out the said tasks, their skills, knowledge and experience too are varied. Fuelwood conservation in the domestic sector in Sri Lanka involves around 2 1/2 million households. The training needs of the improved stoves implementation programmes were identified as [2] :-

(a) Training of potters to make pottery Liners.
(b) Training of stove builders.
(c) Training of extension workers to promote the use of stoves and to provide technical advice.

However, in the case of electricity, the number of households is around one million and the target group consists of men, women and children. The industries which consume about 33% of the electrical Energy are in various sectors of the economy. The training needs of Energy conservation in the industrial sector is therefore highly variable, country and situation specific. So will be the requirements of personnel required to carry out the Energy conservation activities.

The National Energy Plan which is analysed in the first instance to identify the sectors in which Energy Conservation Opportunities (ECO) exists, or need to be enforced due to Energy resource limitation is further analysed to identify the training and manpower needs. The suggested approach is given in figure 1.

In a large country, it is not an easy task to identify the specific economic activity in which the Energy use is high, due to the numbers involved. However, having ascertained the heavy Energy end user economic sectors, a sample survey could be undertaken to locate the specific industries where Energy Conservation Opportunities exist. A specimen of such a survey questionnaire is given in annex 1.

The results of the survey should indicate the core activities that need to be carried out, the likely number of personnel, and the training needs.

The Core and Linkage Activities are likely to be :-

Core Activity :-Assessment of the Potential Energy Conservation Opportunities at the Macro and Micro Level

The linkage activities are :-

(a) Survey or audit of Energy consuming facilities.
(b) Energy conservation consultancies.
(c) Manufacture of energy conservation equipment. Eg: capacitors.
(d) Research and development activities.
(e) Training and manpower development.
(f) Extension work - carrying the message of Energy conservation to end users and providing necessary technical advice.

MAJOR ELEMENTS OF TRAINING PROGRAMMES

Some of the major elements of the desirable training programmes are discussed in brief in this section, while figure 2 shows the full complement of the programmes.

Programme for Energy Literacy and Informed Consumerism

The basic objective of this programme is to educate the population on basic facts about Energy resources, the need for the efficient use of them, the prices of different types and such other things as to enable the general public to select Energy consuming appliances and use Energy intelligently. The fact that the public tends to forget quickly should be borne in mind in developing this programme. Reinforcement training therefore becomes a necessity.

It has also to be mentioned here that in the developed countries, the initial thinking was that the effect of the general Energy literacy and informed consumerism campaign will spill-over to the shop floors and work places. This really did not happen.

Domestic Sector Programme

This programme should be designed to :-

- make domestic consumers know that conventional Energy resources are getting depleted and cost increases due to scarcity is inevitable.
- enable them to select Energy efficient end-user devices and use them efficiently.
- to change the life - style generally to that of less energy intensive path, etc.

The target group is large and reaching them even through the mass-media might be difficult. Hence a "Bottom up approach" involving grass-root level officials, extension workers (change - agents) has to be adopted. The training of the change-agents will itself be difficult as the required general level of education will vary. Training is also made difficult in view of the fact that production and utilisation in most cases occur in the same premises without any outside intervention - government or otherwise. In this situation, it will be appropriate to follow the approach similar to the one adopted by preventive health care services. In order to sustain the effort, a Mass Media Campaign is positively desirable.

Sensitization Programmes

Some of the identified constraints of implementation of Energy conservation programmes are [3],

(a) A perception that Energy inputs are not important cost factors in a firm's operating economics.
(b) Management is often unfamiliar with Energy conservation technology,
(c) High priorities are assigned to other investments,
(d) Resources for evaluating conservation opportunities are in short supply and
(e) It is difficult to obtain financing for Energy conservation efforts.

These programmes are designed to ameliorate this situation and are targeted at owners, top managers, bankers, importers, etc. A noteworthy programme in this connection was carried out by Secretary of State for Energy (UK) Mr. Peter Walker in a series of "Breakfast Talks" whereby he addressed thousands of British Top Managers across the length and breath of United Kingdom. This also gave an indication of the "political will" of the government to carry through the Energy conservation programme.

Industrial Sector Programmes

This will be yet another complex programme, not only because of the numbers, but also in view of the different types of industries, processes and technologies involved. This also will be the largest sector, and would provide the greatest scope for Energy conservation and therefore a greater need for manpower. To assess the training and manpower needs of this sector, it will be necessary to categorise the industries, according to end user appliances. Eg: Boilers, Dryers, Motors, etc., and then build up courses on a modular basis, making it easy and inexpensive to undertake training. The ILO Training Centre at Turin has developed and tested detailed training modules required for training Energy conservation at the industry level. They have also developed programmes for training of trainers in Energy management.

Energy Conservation in this sector will necessarily need high investment and will require varied knowledge and skill. Training in this sector need to be provided at different levels with different objectives. Eg:- Top Managers will require sensitization programmes, while operators will require specific training in operation of plant and developing of positive habits. There will also be the need to have new cadres, such as Energy Managers, Energy Auditors, Energy Trainers, etc.

Transport Sector Programme

The Training needs of this sector, probably the largest oil user, will be complex and will depend on the vehicle stock, ownership etc. The training requirements will range from training of drivers to those who design automobile bodies, motor mechanics etc.

Commercial & Agricultural Sector

The training needs of this sector will be diverse and will depend on the buildings, the machinery used etc.

Programmes for Students

For a successful and sustained Energy conservation programme, an Energy conservation training programme for students is important, but is often over looked. Under this programme, the subject of Energy will have to be introduced in the curriculum of primary, secondary, vocational and technical schools, and the universities. In regard to vocational training an attempt has been made by Daniel Dunham to define it as "Education for work related to increasing the Energy supply, utilizing energy resources efficiently or to conserve energy". He also made the following comment which is still valid; "we have concluded through some studies that it is not enough to focus only on Energy related technologies, i.e. new and emerging Energy related occupations. We must first move to modify the present curriculum in all occupational areas and remodel instructional practices at the secondary schools, colleges and other post secondary school institutions to the end that it results in Energy related skills and occupations".

Programme for Mass Media Personnel

It would have been noticed that in most of the programmes, the element of publicity and propaganda predominates. Obviously, this calls for closer co-operation with the mass media personnel. At least in Sri Lanka, the rapport between the Energy sector and mass media has yet to be developed as evidenced by the paucity of write-ups about Energy related matters in the daily press. It is also a fact that there are not many journalists and copy writers who are well informed of the intricacies of the Energy sector in general and Energy conservation in particular, and could consistently pass the message of Energy conservation in non-technical language to the masses. It may be that the journalists/copy writers need to be trained in the first instance on Energy aspects.

IDENTIFICATION OF MANPOWER DEVELOPMENT ISSUES

The main Manpower Development Issues are,

Should the managers, professionals, technicians' and the skilled workmen, required for Energy conservation be developed as a separate category or should the available personnels knowledge and skill of the be upgraded to perform these additional tasks as well? This is a relevant question that needs to be answered.

Analysis of the knowledge, skills, experience and attitudes of those involved in Energy conservation, indicates, that the basic knowledge needed by them is nothing more than what they already have. What is required is training in some specialised aspects, in order to provide new skills, which are sometimes specific to the Energy conservation technology. Newer analytical techniques and equipment are now available which are specific to this technology.

Taking the case of Mechanical or Electrical Engineers, they need only be equipped with additional know how, in order to specialize in Energy conservation. For example, saving of waste heat is an engineering subject, which Mechanical Engineers would be able to handle. Saving of electrical Energy is a matter, which traditional Electrical Engineers, with their background can handle. Boilers and furnace analysis have been subjects of University under-graduate courses. The present day Energy Manager may be able to point his finger to the exact problem(s), in much less time and with a greater accuracy, than those engineers trained at the University [4]. This is due to the special training received by them in collecting and analysing data regarding Energy usage, use of special equipment for analysing Energy usage, the inter-disciplinary approach of cost reduction in Energy, communication skills etc.

It would also be seen that in the development of manpower required for Energy conservation activities, there is a predominance of training element to those who are already employed, than creating new cadres of staff. The need to build up special cadre of staff, specifically for Energy conservation, cannot be generally justified in most cases. It is true that in some countries it is mandatory to employ Energy Managers in institutions , which use more than a specified quantum of Energy. Generally, the training required will be to equip people with special knowledge concerning the operation and maintenance of specific equipment, used for diagnosis of Energy consumption, etc. and interpret the results given by them. These categories of staff should also possess adequate communication skills as well.

THE CATEGORIES OF MANPOWER REQUIRED

Generally, the categories of Manpower required are:-

- Managers and Professionals, Eg: Energy Managers etc.
- Technicians and supervisory staff
- Skilled workmen. Eg: Potters
- Extension Workers in Rural Areas

OTHER RELEVANT ISSUES

(a) What should be the optimum number of persons to be developed over a given period of time? This depends on the approach that is to be adopted in regard to their selection, placement and the pace at which Energy conservation is to be achieved. Are we thinking of having trained personnel at each of the factories or base them area-wise ? May be they are to be stationed at large factories with arrangement to service the small units around them.

(b) Should we develop a core group and expect them to train the others or should we train all those involved in Energy conservation?

(c) Should we train them locally or in foreign countries or should we get expatriates to train them locally?

(d) How are these personnel to be motivated ? Should they be paid incentives or special benefits.

(e) What categories of personnel have to be developed? Will developing Energy Managers, and Energy Auditors and Trainers as a separate Cadre be necessary or not ?

(f) Should extension workers be those already in the field of agriculture or agro-forestry or similar activities and those who are in contact with the masses, trained to carry the Energy conservation message as well or should Energy Conservation have its own cadre of extension workers ?

These are some of the issues that will have to be faced and resolved.

PROBLEMS OF MANPOWER DEVELOPMENT FOR THE ENERGY CONSERVATION PROGRAMMES

1. Historical data of manpower employed in Energy conservation sector is not likely to be available. This poses planning problems such as projecting the required number of trained personnel for the future.

2. Each mode of Energy conservation technology will be prevalent at different times with different success rates depending on the energy situation and the investment made in Energy conservation. This would mean that there could be quick changes in technologies and hence manpower requirements.

3. At the first glance, the traditional methods of manpower projection does not appear to be applicable in the field of Energy Conservation. This need has to be studied and relationships established. They could be country, sector or industry specific.

4. In the non-commercial Energy sector, Energy conservation has to take place in millions of homes and as such, direct intervention by Government policy makers and management becomes difficult.

5. High turnover of trained personnel (at higher levels) is likely to occur due to promotions and placement etc. Information in this regard need to be collected and studied and some means of stopping such a situation has to be devised.

6. It is also known that a good proportion of persons who are trained abroad on Energy conservation at great expenses are not utilised and their knowledge is wasted. Tracer studies will have to be undertaken to identify the reasons for such a situation. This could may well be due to the awarding agencies not specifying the right selection criteria for training programmes.

INSTITUTIONAL ARRANGEMENTS

The Energy related activities are being undertaken by several agencies. The responsibility for assessment of Training and manpower needs tends to be carried out in a disintegrated manner, resulting in duplication and waste. Experience shows that when the related agencies undertake such activities, they tend to optimize the sectoral objectives Eg. An Electricity Utility will undertake a vigorous Energy conservation campaign when faced with capacity shortage to meet the demand and

forget about it when it has adequate capacity to meet the demand. There is a need for a high level body comprising of representatives of all agencies involved in the Energy sector, as well as representatives of the Ministries of Education, Policy and Planning, etc., to handle this aspect. This is to ensure a co-ordinated approach in laying down policies and plans and to monitor their effectiveness. This body should also maintain a Data Base of Energy Conservation Opportunities that are available in various sectors, the capital requirements, the personnel and training requirements and the progress achieved by each organisation. This body should also liaise with international agencies, NGOs involved with Energy related activities, so as to direct offers of assistance to the relevant and deserving organisations.

It has also to be decided as to which of the institutions are to develop training programmes for different categories of staff. Should there be a central training institution or should each enterprise in the Energy sector have its own training centre?

The role of voluntary bodies to undertake training and other related activities should be fostered and encouraged. Perhaps the role played by Sri Lanka Energy Managers Association (SLEMA) is unique in this respect, in this region.

CONCLUSIONS

(1) It is admitted that there is an urgent need to assess the training and manpower needs for the Energy Conservation activities and this aspect is to receive the full attention it deserves.
(2) It is necessary to ascertain whether methodologies have been developed by countries in this region to assess training and manpower requirements of the Energy conservation activities. Validity of those existing methodologies has to be established. If they are not valid, new methodologies are to be developed and validated.
(3) Catalogue the training facilities available for Energy conservation activities.
(4) The international assistance offered to the developing countries in the form of training is not effectively utilised. Tracer studies in this regard has to be undertaken.
(5) The Energy Conservation activities undertaken by organisations involved in Energy production, conservation aspects are subverted to their own organisational objectives rather than a common objective or long term benefits of the nation. Hence the need to established a central body to undertake or monitor these activities are to be considered.
(6) It has also become necessary to develop methodologies for ascertaining the "return on investment" on training in Energy conservation activities.

REFERENCE

[1] "Management of Energy Resources and Energy Saving Training Programme" - ILO Centre, Turin, 1984.

[2] "Integrated National Energy Planning and Management", Mohan Munasignhe, 1988.

[3] Report on Asia/Near East Workshop on Energy Conservation and private Power Generation, SLEMA Journal, June 1988.

[4] SLEMA Journal, June 1988, Prof. K.K.Y.W. Perera.

Mr. K. Sivasubramaniam (Siva) joined the Department of Government Electrical Undertakings (DGEU) in 1952 as an apprentice and has served in various positions in the DGEU and subsequently in the Ceylon Electricity Board (CEB). He presently serves Manager (Systems and Organisation Development). Mr. Sivasubramaniam was involved in the Energy Conservation Campaigns of the CEB and has followed the "Management of Energy Resources and Energy Saving" course at the International Training Centre for Advanced Technical and Vocational Training - Turin, Italy and "Energy Conservation Training Programme at Tennesse Valley Authority - USA.

Mr. Sivasubramaniam is a Corporate Member of SLEMA and was the first Editor of the SLEMA Journal.

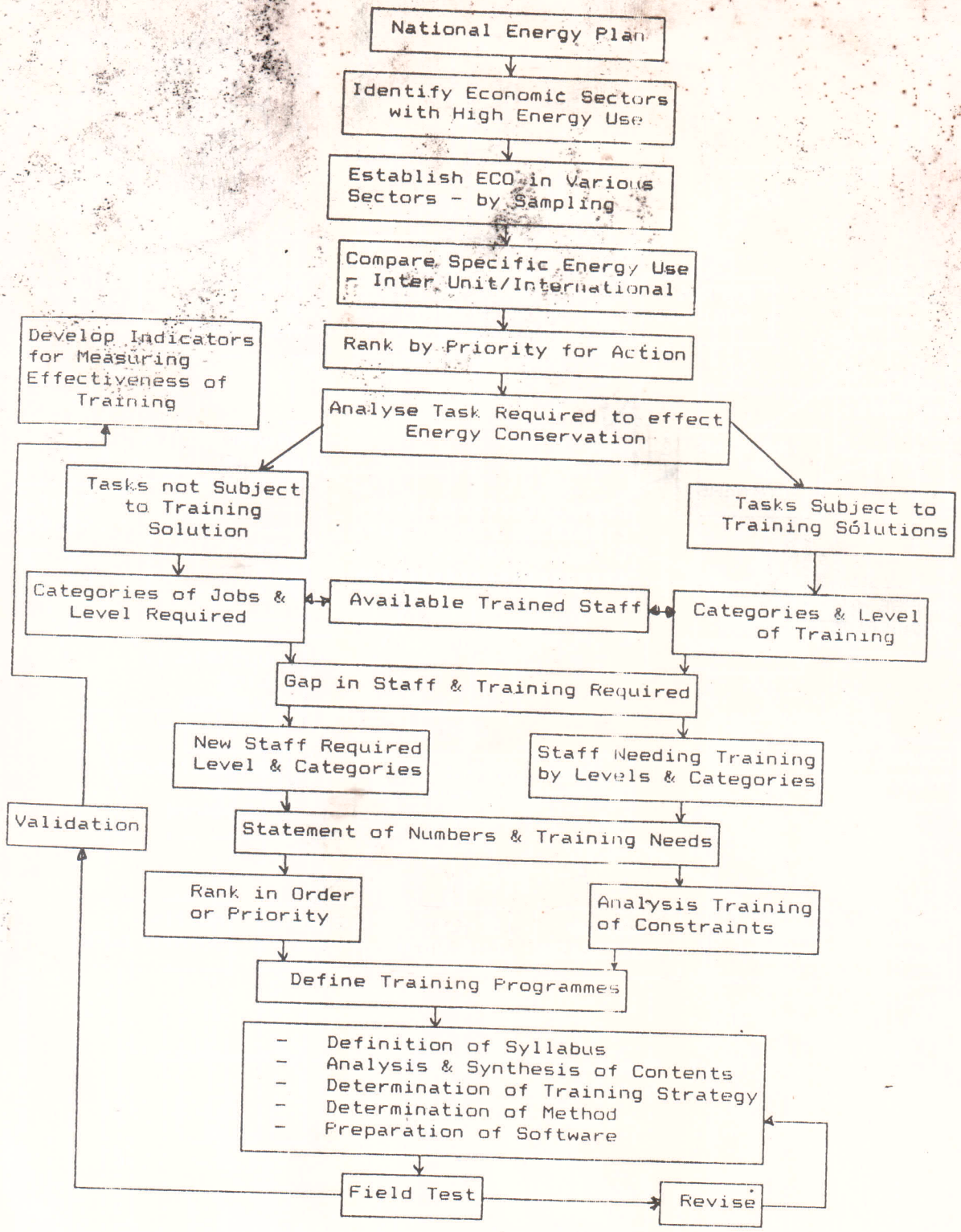

Fig 1 - Manpower and Training Needs Assessment - Energy Conservation

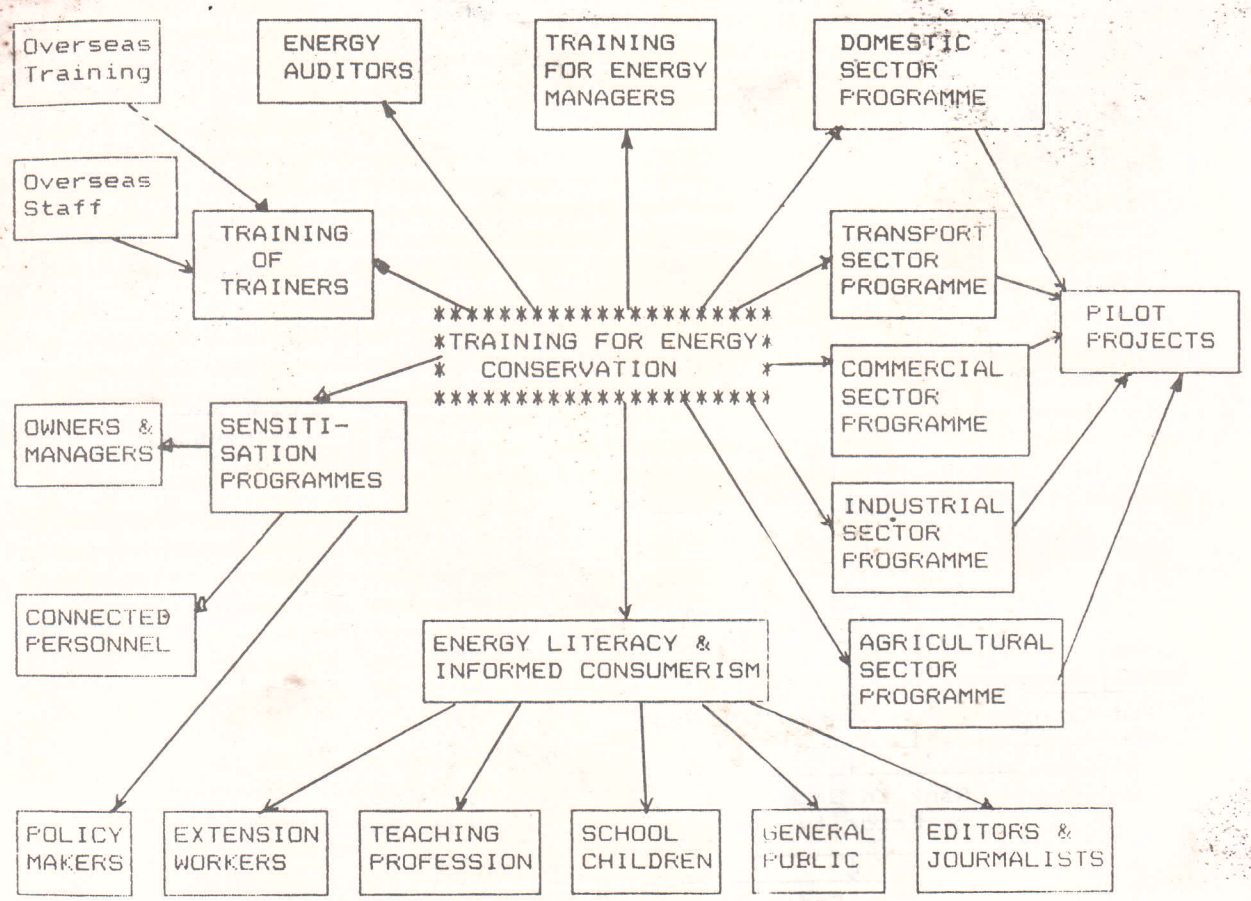

Fig 2 - Elements of Training in National Energy Conservation Programme

SLEMA Journal, Vol 3, No 1&2, December 1989

ANNEX 1

SHORT ENERGY AUDIT QUESTIONNAIRE

A. Identification

1. Company
2. Address
3. Contact at plant
4. Telephone
5. Number of employees
6. Date commissioned

B. Processing Activities

Major	Quantity/year (incl. units)	Comments
Major raw materials		

Brief process description

Attach simplified flowsheet if available.

C. Energy Supplies

Complete table for all energy supplies consumed; if no use, enter zero.

Energy Type	Quantity/year	Units	Cost per year	Source
Electricity				
Natural gas				
Coal				
Wood				
LPG				
Kerosene				
Dist Fuel oil *				
Resid Fuel oil *				
Others (specify)				

*specify grade/specification of fuel oil

Is electricity purchased or self-generated?

Kwh/year purchased

Kwh/year self-generated

b. Boilers and Steam System

Complete the following table for each boilder :

	Units	Boiler	Boiler	Boiler
Type/model				
Steam Capacity				
Steam Pressure				
Steam temperature				
Fuel Type				
Fuel Consumed				
Steam				
Estimated efficiency				

	Quantity	Units
Total boiler feedwater consumed		
Percentage of condensate re-used		

SLEMA NEWS

* The SLEMA Training Course on Steam Generation for Boiler Operators and Technicians was inaguarated by Prof. K.K.Y.W. Perera on 9th December 1989. There are 38 participants in the course. The course will be concluded on 20. January 1990. Mr. N.A.J. Perera, Chairman, Ceylon Electricity Board will be invited to award the certificates to participants. (See page 20 for photograph.)

* Prof. Mohan Munasinghe, President Emiritus, SLEMA, delivered a SLEMA public lecture on "Energy, Environment and Global Climate Change" on 28th December 1989 at SLAAS Auditorium. (See picture below)

FUTURE EVENTS

* SLEMA MEMBERS DAY 1990 will be held on Saturday, 27th January 1990. This is a full-day gathering for all members and their families.

* A round-table discussion on "Air Conditioning and Refrigeration" will be held on 9th February 1990. The event is only for SLEMA members.

* One-day workshop on co-generation has been re-scheduled for March 1990.

Further details on above events will be circulated among members. Please direct any inquiries to Joint, Secretary, SLEMA. The address appears on the inside of front cover page.