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THE ROLE OF THE
TABBIN INSTITUTE FOR
METALLURGICAL STUDIES (TIMS)
AS A LEADING CENTRE FOR
ENERGY CONSERVATION IN INDUSTRY
(CASE STUDY)*

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INTRODUCTION:

Tabbin Institute for Metallurgical Studies (TIMS) is a scientific establishment affiliated to the Ministry of Industry in ARE. It started its activities in November 1968, which include upgrading of industry specialists, carrying out research works and sharing in technology transfer to Egyptian Industry.

At the present time, energy conservation related questions within the Ministry of Industry are dealt with at TIMS.

This paper illustrates the role of TIMS as a leading national Institution for energy conservation. The experience gained and the lessons learned are also considered.

I. Background:

Energy plays an important role in Egyptian development, and its contributions to Gross National Product and export earnings have increased dramatically over the past ten years. This role is much affected by the balance between supply and demand. So, energy conservation or the increase of energy productivity must go side by side with the efforts aiming to increase the national energy production.

In Egypt, energy prices are highly subsidized and energy conservation is considered as a matter of top priority leading to substantial savings and resulting in improved balance of payments. It has been declared that the Government supports all efforts leading to saving in energy, as it will increase the export of oil at international prices.

Industry in Egypt, as in many other countries, is heavy energy consumer. Concerning electric energy, industrial sector consumes about 60% of its total local production and about 30% of oil consumption in the country. The high annual increase in energy consumption

in the country as a whole, amounting to 15% and the inefficient utilization of energy lead to the increase of energy demand.

It is well known that through the implementation of Industrial energy conservation measures, a considerable improvement in energy situation can be achieved.

As an example, voluntary energy efficiency improvement targets were developed in USA jointly by industry and Government for energy intensive industries for the period from base year 1972 to January 1980, and these ranged from 9 to 24%. The targets were estimated for each industry to include both technically and economically feasible conservation measures. The equivalent target for the ten industries as a whole, calculated as a weighted average of the individual targets, was about 14 percent. By the end of 1979, the average improvement actually achieved by the largest consumers in the energy-intensive industries was 15.4%, with some industries already reporting a much greater improvement than their 1980 target.

Accordingly, the energy conservation measures can compensate the growth of energy demands in industry.

Since the oil crisis in 1973, the Ministry of Industry and national scientific and technical organizations began to give awareness for benefits of energy conservation in industrial sector.

In 1980, TIMS organized the first joint Egyptian French symposium on Energy Conservation in Iron and Steel Industry.

After that date a number of seminars, conferences, and symposia were organized by the initiative of industrial and petroleum organizations which gave a number of recommendations to start a national programme for energy conservation.

One of these recommendations was to create an energy conservation centre, capable of implementing such a programme.

As a result, the Ministry of Industry has taken a number of measures to improve the energy situation in the industrial sector.

Moreover, intensive contact has been made with international organizations for technical cooperation to assist in the creation of such energy conservation centres in the country.

Fortunately, ^{the} UNDP office in Cairo expressed its support and interest in the creation of this centre and a UNDP/UNIDO supported project was signed in 1983 for this purpose.

In the context of this project the Government has decided to establish this Industrial Energy Conservation Centre (IECC) within the TABBIN INSTITUTE FOR METALLURGICAL STUDIES (TMS) in Cairo to assist public and private industries in the efficient use of energy. The Institute is equipped in terms of facilities and staffed to provide an excellent base for the new Centre. The Institute's technical staff is experienced in the design and operation of industrial pilot plants and can apply this knowledge to the technology of energy conservation.

The project's immediate objective was to establish and operate an Energy Conservation Centre in Industry in TMS responsible for assistance to public and private industries in the efficient use of energy.

The most important activities of the project included preparation of highly qualified industrial energy specialists from public and private companies in modern energy management techniques, establishing research and testing facilities for the purpose of evaluation of energy savings technologies and their application, organization and

implementation of seminars, workshops and conferences on energy conservation and promotion of national and international contacts with energy conservation centers, ministries, universities, companies, agencies and organizations.

During the period 1983-1987 the Centre has established its own main framework, and was equipped with its own energy audit facilities, a comprehensive set of instruments for energy measurements, and a useful set of Video-audio training aids.

Training Facilities:

The centre is now equipped with laboratories for training purposes, library, lecture rooms and audio-visual educational means, as to the following:

- Portable video camera and monitoring unit.
- 16 mm movie projector
- 20 educational films in different energy fields.
- Over-head and slide projectors.
- A set of personal and pocket computers for energy calculations .

Measuring Equipment and Audit Facilities:

UNDP and UNIDO supplied TIMS with the required equipment and facilities for the normal running of IECC.

These facilities include a mobile diagnostic energy unit (Energy Bus) equipped with different instruments for energy measurement, photocopier and a refrigerator, and a complete package of measuring devices and instruments for IECC laboratories to assist in the execution of training programmes.

The supplied equipment included the following types:

1. Temperature measuring instruments

- Thermocouples and their recording instruments;
- Radiation Pyrometers (up to 2000°C);
- A special radiation pyrometer which measures the temperature and defines the heat losses directly.

2. Waste-gas Analyzers:

- CO, CO₂ , O₂ , temperature and combustion efficiency instruments,
- Hand-hold O₂ , temperature and combustion efficiency meter;

3. Flow Meters:

- Ultrasonic flow meter;
- Pitot tube (to be used in low pressure pipes)

4. Open Stream Velocity Meters:

- Rotary type anemometer (for gas)
- Thermal anemometer (for air)
- Turbine meter (for liquids)

5. Pressure Gauges:

The pressure gauges can be summarized in the following types:

- Hand-hold digital differential pressure gauge;
- Precision bourdon tube manometers.

6. Electrical Energy Measuring Instruments:

- Voltmeter; ammeter; power factor meter; watt meter;
- Microprocessor-based energy monitor.

7. Special Purpose Measuring Instruments:

- Noise meter; Humidity meter; Light meter; PH meter;
- Salt content meter; Steam detector; Vibrometer; Thickness meter.

8. Data Loggers and Computers:

- 4 - channel multi-purpose portable data logger;
- 4 - channel temperature data logger;

- 10- channel temperature data logger with thermo-printer;
- Epson portable computer; 64 K.B.
- Two sinclair computers; 64 K.B. each.
- PERQ - 2 Computer, 1 M.B.

Technical Consultancy Services:

UNIDO also supplied TIMS with the necessary consultancy in the field of waste heat recovery, electronics and energy measurement instruments, training programmes, computer applications and data processing, energy conservation techniques in metallurgical, textile, glass and building materials.

Achievements:

The IECC started its operation by preparation of its core staff and organization of and its framework. This was followed by organization of seminars, conferences and workshops in order to increase the awareness for energy conservation and to introduce to the industrialists the techniques of energy conservation.

After the supply of energy bus and measuring devices, plant visits and energy audits were started in 1985 and still continue until now

The main outputs produced by the IECC during the period 1983-1987 could be summarized in the following:

1. 20 trained core staff of the Centre.
2. More than 250 trained engineers, managers and other staff from the 6 industrial sectors.
3. Training programmes, materials and manuals on energy conservation instruments and measures.
4. More than 30 industrial companies have been visited by the energy bus. The results of testing and adjustment of steam boilers and furnaces in these companies resulted in saving about 10,000 tonnes

of mazout annually which can be evaluated as 1,000,000 US\$ per year. Other saving potentials still exist, which require capital investment.

5. Electric power factor has been estimated for the companies visited and it has an average value of 0.61, which is corresponding to 37% loss in electric energy (30600 MWH/Y and its improvement will lead to 8800 T.O.E./Y savings. Equivalent to 8.8 million US\$/Y.
6. More than 15 workshops, 10 UNDP expert missions, 14 seminars, 6 UNDP study tours for industrial specialists and core staff.
7. 70 industrial energy reports, 6 detailed plant surveys, conference on mobile diagnostic energy unit (energy bus) and 4 minor investment project proposals for energy conservation in glass, metallurgical and engineering industries were prepared and have served as the base for the ongoing energy conservation industrial projects.
8. Initiation of an energy consumption data bank for some selected industries.
9. Bilateral donors (US AID and CIDA) have considered the modules for executing energy conservation applications on cost sharing basis is worthy to pursue.
10. Bilateral donors have selected TIMS to perform joint energy conservation activities.
11. Awareness for energy conservation has been promoted through the project activities in the industrial sector.
12. Bilateral and multi-lateral relations and linkages have been created and developed with national and international companies, organizations and institutions in energy conservation measures and programmes.

Energy Conservation Projects:

From the results of energy audits and studies carried out in the industrial companies, it was recorded that considerable potential for energy conservation can be achieved through minor capital investment. UNDP has agreed to assist in the implementation of such projects on a cost-sharing basis.

A second UNDP/UNIDO supported project entitled "Energy Conservation in Metallurgical, Glass and Other Industries" was eventually approved at the end of 1985. It is clear from the title that the project can cover different industrial sectors in the country.

This project included the implementation of the following technology applications:

1. Improvement of the thermal efficiency of the billet reheating furnace in the Egyptian Copper Works (ECW).
2. Improving of the burning efficiency in the glass melter unit No 2 at Nasr Glass & Crystal Co. (NGCC).

The development task in ECW and NGCC was to change the whole burning system with an advanced and automatically controlled one and to increase the degree of waste heat utilization through the installation of air recuperator.

The UNIDO technical assistance covered the supply of equipment and technical consultancy services for equipment selection, procurement, erection and commissioning.

The 2 projects have been successfully finished in November 1988 and the operation results show that energy savings and productivity increase have exceeded the predetermined figures.

The 2 projects achieved the following:

- annual saving of about 6500 tonnes of mazout.
 - increase of the productivity of the reheating furnace by 40% and increase of the product quality.
 - increase of the glass melter productivity by 25%.
3. Computer process control of Basic oxygen furnace (BOF) No.1 in the Egyptian Iron & Steel Co. (EISCO), the biggest steel producer in the country.

It is anticipated that this project will be finished at the end of 1989 or the beginning of 1990.

The implementation of the recommended modern BOF control system will give rise to save energy for hot metal and oxygen production and to decrease the heat time. This means not only energy saving, but also increasing the steel output and steel quality.

In addition, two more projects for power factor improvement in 2 companies are now under consideration.

The progress achieved by IECC in energy conservation encouraged international donors to support the energy conservation programme suggested by the Ministry of Industry and fulfilled by IECC.

The United States Agency for International Development (US AID) assisted this programme by a US\$50 million grant. The project purpose is to accelerate the adoption of improved commercial technologies, processes and practices in order to save energy and increase energy efficiency ; and to improve Egyptian Institutional capabilities at promoting and implementing energy-saving technologies that enhance productivity.

It is anticipated that TIMS will fulfill 25 - 30 technology applications in public sector companies during the 8 years duration of the project.

Findings and Lessons Learned:

During and after the establishment of the IECC in TIMS, the following findings and lessons learned can be outlined:

1. The frame of the Energy Conservation Centre has been completed and the Centre is now serving as the head in pointing the areas of energy conservation in the industrial sector.
2. More than 250 industrial specialists and energy managers are taking their places, after upgrading and training in more than 50 companies, they will use the gained knowledge and experience in promoting energy conservation measures in their working place, resulting in extra energy savings.
3. Organization of the training workshops in the field of energy conservation on sectoral industrial basis (metallurgical, chemical, textile...) and linking the fellowship training with the evaluation of the so called "The Workshop Energy Project" improved the level of seniority of the trainees.
4. The educational films and manuals delivered by UNDP, side by side with other training facilities, gave a good background for the training programmes for industrial specialists.
5. In selected industrial companies about 10000 T.O.E/Y (1000,000 US\$/Y savings have been realized during the intensive operational programme of the energy bus, i.e. the bus has within the last two years redeemed its cost 7 times.
6. The budget of UNDP/UNIDO assisted projects has increased from nil at 1985 year to about 1.5 million US\$ at 1988. Taking into consideration that this budget has a cost sharing basis, one can conclude how much the industrial beneficiaries are supporting the project objectives.

7. Extending the activities of IECC to many small industrial areas is not less important than the concentration of efforts in a few big energy conservation projects.
8. Burners and combustion techniques in industry are the major causes of energy losses. Measurements, analysis and even adjustment without continuous monitoring and maintenance programmes can give only limited results. It is necessary in this connection that the capabilities of IECC be strengthened with regard to a combustion technology centre or department. Such a centre will direct its activities towards the improvement of the design, the performance and the maintenance of burners in the industrial companies.
9. UNIDO reported in its reports that IECC in TIMS should be considered a centre of excellence according to its performance and services.

CONCLUSIONS :

The operation results of the IECC points out the importance of creation of such national institutions in developing countries, which could be considered as focal centres for efficient use of energy in industry.

The experience gained could be extended to African and other countries. This could cover training of industrial specialists and energy managers, technical consultancy and implementation of energy conservation and efficiency projects.