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17694-E

Distr. 276
LIMITED

ID/WG.494/1(SPEC.)
17 August 1989

ENGLISH
ORIGINAL: FRENCH

United Nations Industrial Development Organization

Regional Workshop on Energy
Conservation in Industry

Cairo, Egypt, 1-5 October 1989

**ENERGY POLICY AND ENERGY MANAGEMENT
IN ALGERIAN INDUSTRY***

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48/5

* The views and opinions expressed in this document are those of the authors and do not necessarily reflect the views of the UNIDO Secretariat. This document has been translated from an unedited original.

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PRESENTATION OF THE REPORT

The purpose of this report, which the representatives of Algeria have the honour to submit to this workshop, organized by the Al-Tabin Institute for Metallurgical Studies (TIMS) under the auspices of UNIDO, on energy conservation in industry, is to describe Algeria's energy policy from an overall perspective, as well as in terms of one of its most important aspects, namely, that of energy use rationalization.

We hope that this report will prove interesting to the participants, since, in writing it, the authors have sought not so much to present results as to suggest ideas for reflection regarding the rational use of energy in industry, and secondly - and this is perhaps the most interesting aspect - because its purpose is to discuss the problems of energy management in a developing country that is both a producer-exporter and a major consumer of energy.

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A. THE RATIONAL USE OF ENERGY IN ALGERIA: AN OVERALL SURVEY

1. National energy policy: basis, principles, objectives

Energy problems in Algeria are of a particular and specific nature because of their effects on the supply of energy to the economy and the importance of natural gas and petroleum exports in the country's foreign trade performance.

The fact is that the energy sector, which still accounts for 97 per cent of export revenues, continues to play a major role in the country's accumulation efforts.

Internally, energy consumption, which, sparked by the implementation of the country's economic and social policy, has grown in a very sustained manner since the early 1970s, represents an aggregate factor of critical importance in the national energy balance.

In point of fact, national energy consumption rose from 5 million tons oil equivalent (toe) in 1972, or 0.3 toe/inhab., to 22 million toe, or 1 toe/inhab., in 1987.

Recent long-term projections point to further sustained growth in national consumption (to 1.6 toe/inhab. by the year 2000).

The current magnitude of the country's energy requirements has led to the need for a permanent trade-off between, on the one hand, the task of guaranteeing the nation's energy supply over the medium and long term and, on the other, the ever-present responsibility for the financing of development. This principle is at the heart of the national energy policy.

That policy, adopted in 1981, rests on the following objectives:

- To guarantee, as a priority objective, the national energy supply on a permanent basis;
- To increase the national energy potential;
- To adopt strict conservation measures in respect of hydrocarbon deposits;
- To promote and rationalize the internal use of energy through the introduction of a national consumption model.

As a key feature of the energy policy, the consumption model, adopted by the Government in 1983, is designed to provide a framework for the promotion and rationalization of energy use. Its aim is the satisfaction of the full range of energy requirements and the harmonization over the long term of the country's energy demand and resources through:

- The wider use of the more available forms of energy;
- Energy savings and measures to combat wastage;
- The design of a rates policy for energy products;
- The formulation of national and regional master plans for the distribution of energy.

The basic choice adopted in the consumption model; in light of the composition of our hydrocarbon resources, is to favour the wider use of natural gas in meeting the national demand.

The other choices envisage:

- The substitution of LPGs for petroleum products in conjunction with natural gas;
- The orientation of electric power towards specific applications;
- Energy conservation and savings, both at the stage of energy production and transformation and at the stage of use;
- The promotion and development of new and renewable energy sources.

II. Instruments for the implementation of the national energy consumption model

The implementation of the energy policy choices described, evaluated and quantified in the energy consumption model has led to concrete plans and strategies in the areas of:

- Measures of a legislative and financial nature or designed to provide technological guidance and promote energy savings;
- Energy rate schemes consistent with the energy choices;
- Energy distribution.

These measures are based on a number of institutional, economic and financial instruments.

2.1 The institutional framework: APRUE

The work conducted in 1982-1983 under the terms of the national energy policy resulted in the need to establish an agency that would be responsible for promoting the activities and measures involved in the implementation of the consumption model.

The National Agency for the Promotion and Rational Use of Energy (APRUE) has been given the task, in conjunction with the other organizations concerned, of formulating, proposing, backing and co-ordinating the activities designed to give concrete form to the consumption model described.

As part of this effort, the Agency:

- Collects, exploits and disseminates information specific to its area of activity, notably regarding the supply of, and demand for, the various forms of energy and the cost of making them available to the consumer;
- Analyses the consumption of different energy products in different sectors and for different applications, and studies alternative modes of consumption;
- Prepares supply and demand predictions regarding the different forms of energy, and proposes programmes of measures to ensure that supply and demand remain in balance over the short, medium and long term;

- Studies and proposes the subsidy schemes designed to contribute to the rational and efficient use of energy;
- Studies and proposes the pricing systems for energy products intended to encourage the growth of the energy sector, energy conservation and the substitution of certain forms of energy for others;
- Studies and proposes all other measures of an economic, legislative, financial or technological nature capable of contributing to the aforementioned objectives.

In addition, the Agency participates in the formulation and evaluation of investment programmes for energy-sector enterprises in the areas of production, transport and distribution, and sees to it that these programmes are mutually consistent. In performing evaluations of this kind, APRUE takes into account the programmes for the introduction and development of new and renewable energy sources, as well as those for the construction of hydraulic dams.

Through this work, APRUE's role is to provide key services of analysis, management and planning with a view to providing more effective control over the process of developing the national energy system.

At present, the Agency, whose organizational phase is approaching completion, with its structures nearly in place, is in the process of finalizing a number of study contracts dealing primarily with the measures decided on by the Government for the rational use and conservation of energy.

2.2 The pricing policy

The pricing policy, introduced in 1980 after a long period during which the price system was frozen, has made it possible to address a number of energy policy objectives.

The actions taken since then, which involve an extension of the measures recommended under the national energy policy, were intended:

- To promote a price restructuring consistent with the choices made as part of the consumption model;
- To encourage, by raising the price level for certain products, the rational use of energy, eliminating the overconsumption that continues to occur in the case of certain energy sources;
- To assist enterprises to achieve a balanced financial position;
- To ensure better quality service in the marketing area.

These actions concerned the following products:

Natural gas and electricity

A decree calling for the readjustment of electricity and natural gas rates has been proposed for the purpose of:

- Placing the National Electricity and Gas Enterprise on a balanced financial basis;

- Setting up a new rate system consistent with the approaches adopted for rationalizing the use of energy.

Petroleum products

The readjustments introduced have affected various price components (production price, retailers' margin, taxation) and have been aimed at putting into place a price structure consistent with the energy policy choices, rationalizing the use of energy products, and ensuring better remuneration for those involved as agents in the transactions. To this end, the measures taken have involved:

- Raising the butane price, the consumption rate for this product having accelerated considerably. The purpose of this measure was to encourage certain users to convert to propane and natural gas;
- Eliminating the low rates for gas oil (abolition of the FOD fund) and for agricultural petrol;
- Boosting the price of lubricants so as to eliminate the wasting of these products;
- Increasing the distribution margins for fuels (LPG fuel, petrol and gas oil).

III. Measures for the rational use of energy

The policy of promoting a maximum reliance on natural gas and, in a complementary capacity, on LPGs has taken the form, in addition to energy-saving actions, of a number of programmes and measures that have been carried out to promote the use of the most available energy sources, to convert from one form of energy to another and to substitute one for another, all for the purpose of bringing the demand into line with the supply pattern.

3.1 The development of the public distribution networks

The programmes for the development of the public gas distribution mains have pursued three objectives:

- The supply of towns located near the natural-gas distribution system but not yet served;
- The expansion of the public distribution networks where systems of this kind already exist;
- The supply of propane gas through pipelines to towns that do not have access to natural gas.

These programmes made it possible to bring natural gas to approximately 400,000 households between 1980 and 1987 and to treble natural gas consumption in the domestic sector from 386,000 toe to 1.1 million toe (180 communities are connected to the gas system, including four supplied with propane gas over pipelines).

3.2 Energy conversion and substitution programmes

The focus of the natural gas conversion programmes has been on industrial production units technically capable of being converted, and on clients in the tertiary sector. These programmes are based on a policy of commercial incentives, the essential elements of which are the spreading of payment over a period of time, the billing of the operation at cost price, and continuous customer assistance.

Since the launching of the programme, 110 industrial units have been converted to natural gas out of a total of 200 units on record in the zones where this form of energy is available.

In the tertiary sector, a major conversion programme affecting 3,500 customers has been initiated, with the objective of connecting 200 customers to the natural gas system in 1987.

The effects of the propane conversion campaign can be seen in the fact that between 1980 and 1986 slightly more than 8,000 installations were carried out, boosting consumption from 28,000 to 46,000 tons.

In the transport sector, the programme for the conversion of vehicles to LPG fuel resulted in the equipping of 7,000 vehicles for this purpose during the period between 1984 and 1987.

However, the results achieved in the area of conversion are poor, considering the objectives set for the wider use of natural gas and the promotion of propane. The reasons for this lie in:

- The modalities for the financing of the conversion operations, which, while advantageous for the customer, burden the enterprise with the financing of the equipment;
- The severe lack of credit funds with which to import the equipment required for the conversion.

The substitution action that has had the most spectacular impact - its objective being to correct the existing imbalance between the supply and demand - is the increase in the price differential between premium gasoline and regular gasoline, the effect of which has been to reverse the trend in consumption: premium gasoline consumption declined from 660,000 tons in 1980 to 320,000 tons in 1987, while for regular gasoline consumption increased from 552,000 tons to 1.64 million tons during the same period.

The consumption of illuminating oil (kerosene), which is a product mainly used for home lighting and heating, is rapidly decreasing owing to the general introduction of electricity and the wider use of natural gas and the LPGs.

3.3 Energy savings and measures to combat wastage

Energy savings have been regarded as one of the principal aspects of the national energy consumption model in view of the energy gains that can be achieved in this area.

3.4 Information

A number of measures aimed at rationalizing the use of energy have been accompanied by large-scale publicity programmes.

These publicity campaigns, which have been concerned with the promotion of LPG fuels, the wider spacing of oil changes and the use of propane in agriculture, have had a great effect on the general public.

Specifically, these campaigns have taken the form of:

- Lengthy advertisements in the printed media and on television;
- The publication of brochures;
- The circulation, for promotional purposes, of buses and other vehicles running on LPG fuel.

"Customer advice" services have also been extensively developed by energy sector operators at industrial units to promote the use of natural gas and LPGs.

3.5 Financing

For the purpose of supporting the measures aimed at rationalizing the use of energy, the State and the public utilities operators have come forward with a number of investment aids.

Among the programmes fully subsidized by the State, the following may be mentioned:

- The programmes for the public distribution of gas;
- The rural electrification plan.

The public energy distribution enterprises have put into effect incentive policies involving:

- The partial assumption of the investment costs of connection to the mains system or of conversion;
- Attractive prices for the equipment used in the connection or conversion, and the possibility of spreading the payment over time.

3.6 Research and development

As part of the work to prepare the plan covering scientific and technical research in the energy sector, a number of areas and approaches have been identified that may contribute to research aimed at rationalizing the use of energy.

These research areas and approaches are the following:

- The analysis of the structure of energy consumption in the past and research involving predictive energy demand models;
- The formulation of energy supply optimization models (supply models);
- The analysis of the impact of energy choices on the economy as a whole (the macro-economic repercussions of the energy options adopted).

Other research approaches, linked to the implementation of the energy consumption model, have also been identified:

- Research in the area of combustion;
- The extension of LPG fuel experiments to diesel engines, and experimentation on the use of natural gas as an automotive fuel;
- Development of the components required for the rational use of energy (heat pumps, heat exchangers, equipment for the regulation and control of industrial processes);
- Research and experimentation in the habitat sector (meteorology and climatology, insulation);
- Research in the area of new energy sources.

In the area of research and development, apart from the research units that exist as part of the large enterprises of the energy sector, there are two research and training institutes operating in the energy field (the Algerian Petroleum Institute and the National Institute of Hydrocarbons).

In addition, a "Hydrocarbons and Derivatives Research Centre" was established in 1985, its mission being to carry out research and development work on industrial processes and products for the purpose of improving their quality.

This year has seen the establishment of a "Materials Research and Exploitation Centre" that is to be responsible for conducting research activities of every sort aimed at developing the use of new energy sources.

3.7 Conclusion

Although they do reflect progress in keeping with the choices made in the adoption of the consumption model, still, when compared with the objectives set in 1983, the results achieved in recent years with respect to energy promotion and rationalization are poor in terms of the consumption and promotion of the various energy forms.

The economic crisis and its repercussions on the funds available for financing the import of equipment have led to a considerable scaling back of the programmes formulated. With respect to the measures and actions recommended for the promotion of energy and the rationalization of its use, this is reflected in the fact that the decisions taken have been implemented only partially and with delays.

A number of measures in this connection were decided on by the Government in 1984:

- Improvement of the efficiency of the energy transformation processes;
- Upgrading of the heat insulation properties, and redesign and renovation of the hot-water or air-conditioning systems, of residential buildings and other structures;
- Formulation of heat insulation and hot-water equipment standards for new buildings;
- Recovery and recycling of products having a high energy content, such as oils and plastic waste;

- Technological research concerned with improving the efficiency of energy transformation.

Up to now, not all of these proposed measures have been translated into concrete action. Still, a number of them have been initiated and, although limited in scope, have produced interesting results:

- The spacing of oil changes, accompanied by price incentives, has resulted in a stabilization of demand around 150,000 tons a year;
- A used-oil recovery programme, which began in 1986, made it possible to recycle 6,000 tons during that year and 12,000 tons in the year thereafter. This recovery level, which is still low, should gradually rise so as to reach 30 to 40 per cent of the volume sold, or approximately 60,000 tons;
- The use of residual gases by a number of industrial units for the in-house generation of electricity or for thermal applications (furnaces and boilers).

The recent inauguration of the National Agency for the Promotion and Rational Use of Energy (APRUE) and the fresh impulse that has been imparted to research and development activities with the establishment of a number of centres and the introduction of new areas of training (energy economics and energy forecasting) hold out the hope, however, that in future national concerns regarding the rationalization of energy use will be more effectively addressed.

B. THE RATIONAL USE OF ENERGY IN INDUSTRY: ALGERIAN EXPERIENCE

I. The national energy balance and the position of industry

National consumption has risen sharply in Algeria, at an annual growth rate of approximately 8 per cent. This has been due mainly to:

- The industrial sector (8 per cent);
- Non-energy consumption (14.9 per cent);
- The increase in energy-sector consumption (7.2 per cent).

National consumption of energy (millions of toe)

	<u>1980</u>	<u>1986</u>
Final consumption	8.49	13.48
of which (in per cent)		
- Industry	31	34
- Transport	30	29
- Households and others	39	37
Non-energy consumption	0.62	1.34
Energy consumption	4.85	7.36
National consumption	13.96	22.27
Production of primary energy	70.59	90.17

This consumption is characterized by an increasing use of natural gas (from 47 per cent in 1980 to 57 per cent in 1986).

With respect to industrial consumption not subsumed under final consumption, we can observe considerable growth in non-energy consumption, i.e., of energy sources used as raw materials.

Although encouraged to develop, the chemical and petrochemical enterprises, that account for this consumption are nevertheless the subject of particular attention with a view to maximizing their use of natural gas while at the same time seeking to eliminate process-related wastage.

Finally, consumption within the energy industry itself is a major concern, given the fact that the Algerian economy is still highly dependent on this industry. There is a need, therefore, to seek ways of reducing internal consumption through improved efficiency, and to endeavour to increase the role of natural gas in electricity generation (the target being 40 per cent by the year 2000 in comparison with 30 per cent at the present time).

The actions taken are aimed at reducing extraction-related consumption in the fields (3 per cent of gross hydrocarbon production), at curtailing substantially the amounts consumed at the gas liquefaction plants (so as to lower the figure from 23 per cent to 19 per cent beginning in the 1990s), and at cutting energy consumption during pipeline transport and distribution (4 per cent) and refining (5 per cent).

II. The significance of energy management in industry

Algeria's economic policy requires that we endeavour to achieve several objectives at the industrial level:

- To reduce the direct consumption of energy;
- To recover and recycle waste materials;
- To promote the manufacture of energy-saving equipment;
- To encourage the manufacture of consumer goods operating on gas.

It is our hope that, through the achievement of these objectives, industry will be able to assume the role of a driving force in the economy, since it is possible to couple the attainment of energy efficiency with the creation of a climate conducive to research and engineering.

Accordingly, efficient energy management in the context of Algerian industry takes on several meanings, namely:

- Control over the mode of consumption (better consumption through the selection of the most available energy source);
- Control over the level of consumption (less consumption through continuous improvements in process efficiency);
- A mastery of engineering and the invigoration of industry and research.

III. The role of the National Agency for the Promotion and Rational Use of Energy (APRUE) in Algerian industry

APRUE's role as a service agency in the area of industrial energy auditing is only temporary, pending the transfer of this activity to more appropriate organizations of the consultancy and engineering bureau type.

Under the mission assigned it, the Agency has a far more important role, namely, that of ensuring a convergence of the interests of the business community, on the one hand, and the general interest, on the other.

The general interest, as far as energy is concerned, consists in using the resource that is most available and hence least costly to the public, and in providing for the essential linkages between the production, engineering and research communities.

This is no easy task.

In effect, what is involved is assisting the business sector to achieve better production costs while at the same time minimizing the social costs, specifically those associated with the depletion of non-renewable resources or with the degradation of the environment, to mention only two.

Should action be taken through price leverage?

The first need in this case would be to define the cost of the social assets represented by the non-renewable resources. While it is easy to act on prices, their effects on inflation must also be controlled.

Should action be taken through information?

This involves the entire dialectic relationship between the economic sphere and the political and social spheres. Which is the dominant or determinative one? Here we come face to face with the problem of the human dimension of management, a problem that involves the demystification of this tool as it is taught in the developed nations and subsequently applied in the developing countries.

Should action be taken through directives?

To adopt this course would be to return once again to centralized planning with all its rigidities and its consequences in terms of a worsening of relationships between the planning and decision-making authorities, of the same kind that has led to the application of a narrow dirigiste approach to the production sphere on the part of the administrative authorities or, worse yet, to total breakdowns due to the adoption of conflicting decisions in the areas of planning and production.

At present, drawing on the experience of a number of foreign countries, APRUE is in the process of devising an action-oriented strategy for its various areas of activity, each of which has its own specific characteristics, taking into account the Algerian economic policy (enterprise autonomy) in its following aspects:

- Energy (the safeguarding of national resources);
- Industry (locomotive effects and access to technology);
- Finance (the impact of the fall in petroleum revenue).

At the same time, the Agency is conducting diagnostic energy studies in industry for the purpose of identifying the scope of the opportunities still available for energy management (savings and substitutions) and of promoting the use of untapped possibilities costing practically nothing (sometimes involving simply the cleaning of the machines!).

This energy auditing activity is already producing good results even though it has made it clear to us that despite the fact that our production facilities are of relatively recent date, they were nevertheless designed and built, for the most part, at a time when energy was cheaply priced on the international market.

It is, therefore, a simple matter to transfer the improvements which have been made to this same kind of plant and equipment abroad that could not be foreseen at the time the equipment was acquired and that we are still unable to introduce by ourselves for the reason that our study capability has not kept pace with our operating capacity.

This is unfortunately true of a number of developing countries, which have lost sight of the fact that the "savoir-faire" ("know-how") concept is based on the twin notions of "savoir" ("know") and "faire" ("do").

With respect to Algerian industry, APRUE has identified a number of objectives, indicated as follows in order of priority.

1. To seek the substitution of natural gas (the distribution network for which is very extensive) for petroleum products;
2. To optimize the operating rhythm of the production facilities (plants and factories), particularly in activities requiring heavy financial investments;
3. To ensure the operation of the production facilities under "normal conditions" by adhering to the energy specifications laid down at the time their equipment was acquired;
4. To monitor technological developments and adopt, whenever economically advisable, such modifications as involve an improvement of the energy factor, i.e., a lowering of the energy content of the products.