

Enea and the Developing Countries

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Introduction

ENEA (The Italian Agency for Research and Development of Nuclear and Alternative Energy Sources) has the principal task of promoting nuclear energy and other sources alternative to oil, while protecting health, safety and the environment.

ENEA cooperates with other institutions and operators in the implementation of the National Energy Plan and in promoting the technological progress of Italian industry.

Specifically the agency:

- conducts research and development of interest in industry in its own centres;
- develops the capabilities of Italian industry to achieve economic production of nuclear power stations, components and services relative to the entire nuclear fuel cycle;
- designs, builds and runs demonstration plants and experimental nuclear reactors;
- engages in research and experiment in the most advanced fields of nuclear science and technology, such as fast breeder reactors and, in a longer term outlook, nuclear fusion;
- collaborates with national industry in the design and realization of components and demonstration plants for the development of non-conventional technologies and processes in the energy sector;
- performs research on health protection and environmental protection related to the siting of energy plants;
- develops and promotes technology for the exploitation of renewable energy sources, such as thermal application and photovoltaic conversion of solar energy, wind power, biomass conversion;
- promotes energy saving by the development of suitable technology and measures to foster reduction in energy use in industry, building and agriculture;
- takes care of the diffusion and transfer, particularly to small and medium-sized industry, of the technologies developed in the course of its activities;
- provides consulting and technical evaluation to Italian institutions on problems connected with energy production and use;
- disseminates information about energy problems and organizes training courses on the rational use of energy;

- collaborates with other countries and international organizations in the energy sector, in conformity with Italy's international commitments.

ENEA is also responsible for the supervision of nuclear safety, health protection and environmental protection. These tasks are accomplished by the Directorate for Nuclear Safety and Health Protection.

ENEA has a staff of about 4,700, working in eight Centres throughout Italy.

In order to achieve the programmatic objectives of ENEA's fifth five-year Plan (1985-89), the Italian Government has allocated about 5,340 billion lire (BL), equivalent to about \$ 3.56 billion US dollars.

ENEA'S Activities in the Field of Renewable Energy Sources

On *renewable energy sources*, ENEA has given special attention to photovoltaic conversion and to thermal uses of solar energy, to biomass, and to wind power.

As concerns *photovoltaic conversion*, ENEA's research centres are engaged in materials development and improvement of the production process for cells, panels, structures and other components of the photovoltaic system.

The most significant of ENEA's projects involving photovoltaic conversion of solar energy are:

- the 300-KW DELPHOS photovoltaic plant under construction in Puglia, which will feed its output into the national power grid;
- the pilot photovoltaic plant built on the isle of Giglio, with the financial assistance from the European Economic Community (EEC); this 45-KW plant will power a refrigerator cell and an ozone sterilizer for drinking water;
- the 70-KW photovoltaic plant in the Veneto region, used to power the lifting systems of a pumping station.

ENEA's projects in *thermal uses* of solar energy include:

- design and improvement of hot-water solar collector;
- development of low-cost hot-air collectors and their application in food processing (drying of raw foodstuffs);
- the generation of process heat with concentrated solar energy.

Solar energy is particularly well suited for certain simple options most appropriate to developing countries, such as water pumping and desalination. Such systems are under study, and ENEA'S programs include the design and production of:

- a DEWAL solar-powered water pumping unit with no moving mechanical parts, capacity one cubic meter per hour;
- a solar distiller with a capacity of 300-500 liters a day;
- a reverse-osmosis desalination plant.

ENEA is working together with other Italian agencies and firms on *wind power*. Activities include:

- anemometric studies to determine the wind-power potential and the optimum characteristics of possible sites for wind-power stations;
- experimental programs on wind powered motors with automatic data acquisition system;
- quality trials with demonstration windmill-powered generators;

- collaboration with Aeritalia in a program to develop a prototype windmill generator with a capacity of 200 to 300 KW;
- a project, begun in cooperation with ENEL, for a 2-4 MW wind-powered generator, to be constructed by a consortium of Italian industries (Aeritalia, Fiat Aviazione, Ansaldo).

On windmill powered motors for water pumps, ENEA has undertaken a series of projects of both slow (multivane) and fast windmills. The most important initiatives concern the use of new material (fiberglass), developing lighter components, and improving the performance of the windmill-pump system. Some existing plants have been reactivated and a series of trials conducted to explore continuity of operation and maintenance methods.

In *biomass conversion*, ENEA is focusing primarily in plants for biogas production, on improved direct combustion of wood and waste biomass and gasification and pyrolysis of agricultural waste, hydrolysis and fermentation to transform cellulose agricultural wastes into alcohol. Specifically, ENEA is working on systems to keep construction and operating costs of these plants to the minimum. It has designed and built a low-cost biogas generation plant using the «plug-flow» type of anaerobic digestion of cattle manure (the digester has a working volume of about 60 cubic meters of biogas a day).

As to the use of woody or cellulose biomass to generate gaseous fuels, ENEA is engaged in studies to develop specification for small-scale wood-fueled gasifier-generators (15-20 KW) suitable for supplying electricity to isolated villages. ENEA has constructed a fluid bed gasifier for agricultural residues with a potential of 30 cubic meters an hour.

In *energy saving*, ENEA develops energy conservation methodologies and devices and promotes their application in industry, building and in the services sector, where the greatest consumption of course comes in transportation.

In industry ENEA's action for energy saving has involved a number of energy diagnoses and training courses for energy specialists. ENEA is also actively engaged on the supply side, promoting diesel and gas turbine cogenerators and heat recoverers for smoke and other waste heat.

ENEA is also active in *agriculture*, working to raise productivity in cereals, fruit and vegetable output, developing and introducing innovation in agriculture. Especially significant here are higher-yield crop varieties developed in ENEA's laboratories, which have quickly found practical application, such as the «Cresus» variety of wheat, whose introduction has increased the value of Italian output by more than 100 billion lire yearly (the average rise in production being of 0.7 ton per hectare).

In agriculture energy saving can come from genetic improvements, i.e. the creation of new crop varieties that need less chemical fertilizer, farm mechanization, and irrigation, as well as from new techniques of fertilization, use of organic wastes, and the use of solar energy for greenhouse crops and for the post-harvest treatment.

ENEA's Activities in the Developing Countries

As part of Italy's policy of cooperation with the developing countries, ENEA collaborates on projects for strengthening scientific and technical research facili-

ties and for developing and exploiting energy sources alternative to oil.

In this framework ENEA also helps to promote Italian industry in the markets of the developing countries, which offer interesting prospects for technology to exploit non-oil energy sources.

To this end ENEA:

- takes part in the implementation of programs and projects sponsored by the Department for Development Cooperation (DIPCO) of the Italian Ministry of Foreign Affairs and by international organizations. DIPCO has entered into an agreement with ENEA assigning the agency consulting functions for cooperation projects in the energy field;
- promotes projects to enhance the developing countries' technical and scientific capacities in accordance with Italian cooperation policy and in the framework of bilateral agreements;
- awards fellowships and gives training courses for researcher and technicians from developing countries, in order to enable them to improve their ability to manage facilities and carry out research in their own laboratories;
- holds conferences, exhibitions, and seminars aimed at spurring the introduction of the most appropriate technologies in developing countries for the exploitation of local energy sources and for energy saving;
- carries out, in its own laboratory facilities and in collaboration with Italian industry, programs of research, realization and testing of system and devices adapted to the particular operating conditions of developing countries;
- tests components and energy systems to finalize design of products for export to developing countries.

Within ENEA's International Affairs Directorate a new unit in charge of coordinating the promotion and cooperation activities with developing countries has been established.

The following is a summary of the most important development cooperation programs in which ENEA is participating. The programs were all launched between 1980 and 1985. They are grouped by geographic area and then by country. Programs not divisible in this fashion are listed separately.

AFRICA

Cape verde - Exploitation of renewable energy sources (photovoltaic and wind power).

Egypt - Egyptian energy development organization center for the development of renewable energy sources.

- Cooperation with the atomic energy establishment.

Kenia - Kenyan energy training centre (KETC) for new and renewable sources of energy.

Morocco - Photovoltaic rural electrification.

Senegal - Office for energy saving.

Somalia - Water for the nomads.

Regional - African international consulting consortium.

- Africa chairs of technology.

LATIN AMERICA

Brazil - Cooperation with the Commissao Nacional de Energia Nuclear (CNEN).
Jamaica - Energy and water development program.

ASIA

China - Cooperation with the Ministry of Nuclear Industry.

- Wind energy development.

India - Photovoltaic and thermal solar project.

Indonesia - Enhancement of the serpong nuclear research center.

- Applications of technologies appropriate for rural areas.

Iraq - Cooperation agreement with the Iraqi Atomic Energy Commission.

Pakistan - Cooperation agreement with the Pakistan Atomic Energy Commission.

Not divisible

- Training in planning national programmes for wood-based energy.

- Supply of renewable energy equipment.

- Program for identification and promotion of industrial investment projects in new and renewable sources of energy (NRSE).

- Innovative technology for potato cultivation in developing countries.

Conferences, exhibitions, seminars.

- The integration of new technologies in traditional sector.

- Energy for survival and development.

- bioclimatic architecture exhibition.

- Cooperation between Italy and Latin American on new and renewable sources of energy.