







**Multiannual Programme  
of the Joint Research Centre  
1980 - 1983**

# 1981 Annual Status Report

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**Provision of scientific and  
technical services**

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## PROVISION OF SCIENTIFIC AND TECHNICAL SERVICES 1981

Research Staff:	26
Budget:	2.534.000 ECU
Projects:	
— Technical Evaluations	
— Technical Assistance	

Programme Manager: **C. RINALDINI**  
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### 1. INTRODUCTION

Two kinds of objectives are pursued at the JRC in direct support of the various General Directorates of the Commission: Technical Evaluations where system analysis techniques are mainly employed and Technical Assistance where laboratory measurements, technical expertises and management of projects are provided.

#### Technical Evaluations

One of the tasks of the services of the European Communities is to study the Community's policy in various sectors, to forecast developments or to indicate targets. This is especially true for the industrial, scientific and technological policy, for the energy policy and for the policy on the resources and the environment. In these fields it is desirable to have some tools available for the analysis, to enable the Commission to get the right overview of the necessary information. System analysis is a helpful approach for the purpose, including techniques such as computer modelling and data handling, system optimization and simulation, cost benefit studies and technical assessments. The multidisciplinary competences available and the specific competence in treating data enables the JRC to execute this kind of research in various fields.

The JRC therefore acts for the Commission as a source of technical advice, taking active part in setting up and running an

information network. The work for this project is done upon specific request of the various services of the Commission. The detailed programme for each action is established yearly by an Advisory Committee of General Directorates representatives which makes a choice of the various needs and sets up priorities. Although the field of possible applications of system analysis techniques is large, three outstanding important aspects, which fit particularly well with the competences of the JRC, should be mentioned:

- Resources (e.g. model of regional development, studies on agricultural production patterns, raw material problems)
- Energy (e.g. analysis of the energy system, evaluation of technological progress, studies on energy conservation)
- Environment (e.g. collecting and updating information concerning ecological models, providing scenarios of the geographical distribution of pollutants emission).

#### Technical Assistance

An important and expanding activity of the JRC consists in providing the Commission with technical and scientific assistance in analysing technical problems required e.g. by the implementation of new regulations, by evaluating research proposals, by collaborating in the technical management of contracts, by comparing and synthesizing results etc.

These activities may involve collaboration with a number of national laboratories as well. On the other hand, the requirements of independency and secrecy which often are needed for the execution of the work, can be best satisfied in a laboratory operated by the Commission like the JRC.

The activity is splitted into two main parts: the first dealing with laboratory analyses and development of experimental techniques and the second concerning the technical assistance to project management and the provision with scientific advices.

## 2. RESULTS

### TECHNICAL EVALUATIONS

In 1981 the activity for the project «Technical evaluations» was mainly concentrated in the energy field, covering chapters on «Energy savings», «Nuclear energy strategy studies», «Analysis of the energy system». In addition some work was also carried out on «Special transport problems», on the «Utilization of local resources in Developing Countries», on some «Assessments on pollution problems» and on studies of the «Perception of technological risk».

#### Energy savings

##### *Energy Bus Programme*

Following the adoption of the European Energy Bus Programme by some of the Member States, the «European Data Service for Energy Savings» was established at the JRC Ispra. The service was set up to aid those participants who are in the pre-operational fase of their respective energy bus programme and to link all the energy savings programmes in such a way that each country benefits from them as a whole.

The activities were concentrated upon data base and software developments and upon computer program exchange.

##### Data Base

The data regarding energy use and savings collected by the various energy bus programmes of the Member States are sent to the JRC, where they are elaborated on a Community wide basis. The initial data base structure, based to a large extent upon the requirements of the original Canadian software, was defined and modifications introduced according to the type of the collected data. In order to manage the data stored on the data base, a certain amount of software was written which will allow correlations to be calculated and the compilation of aggregate statistics.

Now the data base provide general information including, for each industrial sector, data referring to energy consumption, energy savings, gross sales and levels of employment. Indications can also be given regarding energy use as a function of different parameters: the resource use patterns indicate which type of resources are most commonly found in the industrial sectors which have been visited.

Data quantifying resource use will also be presented as well as the various energy saving methods in terms of potential energy savings and the ratio between energy savings and energy consumed.

#### Software developments

The major support to any energy bus programme is the computer program system developed in Canada for Canadian Energy Bus Programme. Due to the impossibility of standardizing the hardware used by the different participants, the computer program system has been translated into a language of widespread use and has been distributed to the interested participants. At present this first version is being optimized and modifications regarding units of measure and the interrogation language are being carried out.

#### Computer Program Exchange

A total of four computer programs were made available for exchange between the participants to the Energy Bus Programme.

##### *Industrial process analysis*

The study on the brick and tile manufacturing at low specific energy consumption, which was aimed at analysing the possibilities of energy savings through optimisation of the tunnel kiln process and annex dryer, was brought to an end. Information on the processes in use at this branch of industry was acquired through bibliography search and by visiting a clay products research center. The general conclusion was that energy audits or energy bus visits can contribute to obtain potential energy savings for only the group of installations for which renovation and innovation of the production process can be economical feasible.

Another study was dedicated to energy saving possibilities in the textile finishing industry, in particular as for dryers. Four items had been tackled in an exploratory way, as an introduction to a possible more substantial study, with the final goal to obtain design and handling specifications for running drying machines under lowest specific energy consumption conditions.

An investigation was also started on appropriate measures to assist an elevated number of enterprises in the copper and copper alloy branch with energy assessments, since this sector has been individuated as a major energy consumer and as having a spread of one order of magnitude in energy consumption per tonne of product.

##### **Nuclear energy strategy studies**

This chapter covers a number of studies which provide elements of judgement for the medium and long term energy policies in Europe, with particular reference to nuclear energy. Three of these studies have now reached conclusion.

The first one concerned the transport of radioactive materials and was dealing with the requirements in terms of transport, storage and reprocessing for a system of countries, based on the available capacity of power stations and reprocessing plants. The second study was dealing with the adoption of the computer program TOTEM, developed at Ispra, for satisfying the requirements of the Euratom Supply Agency. This program evaluates the electrical power plant policies once the energy production as a function of time, the load diagram and a number of constraints are given. The third study concerned the assessment of long term prospects for the installation of Fast Breeder Reactors in Europe and was carried out in cooperation with the International Union of Electric Power



Producers (UNIPED). The results of the work were reported at the BNS Conference on Fast Breeder Reactors in London, November 1981.

Another study in this chapter, which is still in course, is aiming at identifying elements of judgement concerning the possible penetration of nuclear energy in the European energy system, by analysing the role of energy saving and of various alternative energy sources. Four alternative scenarios were analysed and the role of coal and nuclear energy as primary sources for electricity production was in particular studied.

### Analysis of the energy system

Under this heading two studies have been conducted, the technical analysis of the energy system in the household sector and the contribution to the EC Energy Model.

The study on the household sector started in 1980; some results were presented at the Conference on Energy Use Management, in Berlin, October 1981. The results show in detail for three Countries (U.K., France and Italy) the ranking of the various saving measures, (e.g.: roof, wall and window insulation) according to increasing pay-back time and as a function of the total investment. In performing this study collection of many statistical information on building characteristics and their distribution and on climatic conditions was needed; an evaluation of the adequacy of such information was made with the purpose of giving an indication of the areas in which higher is the need for statistical data. In addition, in view of the validation of mathematical models of the building energy balances, a number of models was studied. Two of them were chosen, those developed by the Laboratoire Physique des Bâtiments of the Liège University and by the Italian Consiglio Nazionale delle Ricerche. Finally, as solar radiation through windows is a major aspect of energy conservation, a study was carried out on the potential of semi-reflecting roller blinds using plastic film on the inside of single glazed windows. A managed blind system of this type would seem to offer many advantages as a retrofitting measure in existing buildings. Considering the heating season only, its performance is at least as good as triple glazing. In air conditioning buildings it would also offer big savings in the cooling season.

The contribution to the EC Energy Model is aiming at creating at the JRC a competence for the implementation and diffusion of such model developed through contractual action by DG XII and at providing support for its validation, improvement and use.

The reporting period has been devoted to the study of the model, in preparation of its implementation on the JRC computer. At the same time, an analysis of the labour content of products has started by means of the labour I/O matrix for France, provided under contract by CEA. The availability of this matrix as well as the development of new ideas may lead to set up a methodology for assessment of the impact of energy policies (notably conservation) on employment. This effort is very preliminary and results are not yet available.

### Shipbuilding Data Bank

The activity dealing with a shipbuilding data bank continued and consisted of improvements and changes in response to the requirements. This data bank contains information on

ships on order and under construction as well as on ships already placed on the service throughout the world. The available information is subdivided into three groups and put into different files, such as the type of the ship (general cargo, bulk carrier or oil tanker), with a more specified classification according to its cargo, on the shipbuilding countries, as well as on the specifications of the ship (dimensions, horse power, speed, tonnage, capacity etc.).

General and specific information can be obtained both from each individual file (classification) and from partial or global network.

Under contract with the Commission, Lloyd's Register at London is providing regularly data, which are reproduced for use of the Commission services.

### Utilization of local resources in developing Countries

The JRC contributes with technical expertises, mainly in the energy field, to the support of Developing Countries provided by the European Commission. To this scope, ad hoc few weeks visits were paid to Countries, where the main problems were analysed and in collaboration with national and local authorities and organizations technical advices were reported. A visit was paid to refugee camps in Somalia from April 1st to 14th. Since the period of very effective emergency help comes to an end and no guaranteed future development concept on the refugee situation is available, new short term approaches of help have to be found in particular in the energy field.

To guarantee the survival rate of drinking water of 5 litres/person/day, the most reliable and long term cheapest pumping technique which should be installed is the photovoltaic solar pump for which tests were already made. For larger quantities of water, like irrigation and washing where longer storage periods do not introduce sanitary problems, windmotor-pumps can be envisaged in appropriate zones and positions.

The cooking problem is as urgent since almost all wood is gone, even within the greater surroundings of the camps. Solar cooking seems to be the only practicable way out, although it conflicts heavily with traditions. In particular, solar cooking boxes (Indian type) and solar heating panel steam cookers (Nairobi UNICEF-Village type) might be the best answer to this most urgent problem. A combination with retained heat cooking boxes or similar simple arrangements would help to save heating energy and to be more independent with meal times from solar hours.

To clear up technical aspects, contacts have been made between the Commission expert and the United Nations High Commissioner for Refugees.

In conclusion it can be said that the artificial life situation in the camps requires complete different approaches than generally encountered.

A second visit was paid to Ethiopia from April 27th to May 26th, which has been used to extend the investigations for the implementation of renewable energies to other geographical zones of the country in the farer West, North and East of Addis Abeba.

A very interesting and promising aspect, which finds full backing by the Government, is the energy support of the new cooperations, where the private initiative of the farmers is found to be rather high and better motivated than in many of the settlement projects. An integrated village project proposal is furthermore in preparation.

## Assessment on pollution problems

### Aircraft Noise Nuisance

An aircraft noise nuisance computer program is under development to study actual noise contours at and around airports in the E.C. as well as the impact of possible noise reduction measures. In a first stage an additional program was written at Ispra in order to compare the Southampton University's with the Ispra version of the Canar Aircraft Noise Nuisance program and to eliminate program differences. This was an essential step before, in a second stage, further developments of the Canar program as effectuated at the Southampton University, could be implemented at Ispra. These new program developments permit aircraft noise calculations based on the methods in use in each of the single member states of the E.C. Additional work consisted of subroutine developments to produce also graphics output.

Although the second phase of the work could not yet completely be finished due to anomalousness in the results obtained following the noise calculation methods of a certain number of single Member States, a start has already been made with the third phase of the activity, to which belongs the implementation of another program development, which will permit the user to compute the number of persons exposed to a certain noise level, based on statistical data available on the number of persons living around the airports.

### Trace Metals in Fertilizers

The study on the possible contribution of heavy metals present in phosphate fertilizers for soil improvement to the heavy metal contamination of ground and surface waters was partly dealing with improvements of the migration model. These improvements regard in particular the introduction of effects which influence the element transport soil - ground waters - surface waters such as: rainfall runoff, soil erosion and inter-connected ground water movements.

In addition to this, the impact of the application of phosphate fertilizers for soil improvement as the only man-made heavy metal source of agricultural soils on the quality of ground and surface waters has been analyzed for cadmium and arsenic.

It appears that by considering a normal average application rate of phosphate fertilizers of 300-350 kg/ha/y, over a period of 100 years, the maximum permissible cadmium respectively arsenic concentration for drinking water will never be reached in ground and surface waters.

If one would consider an average quantity of phosphate fertilizers of 1000 kg/ha/y necessary to cultivate wild soils and if one would leave the application period of such a relative high average quantity an open question, the maximum permissible arsenic concentration for drinking water would not be reached in ground and surface waters due to the relative high mobility of arsenic in soil. In the case of cadmium the maximum permissible concentration would only be reached after 40 years.

### The pathway of cadmium

The activity consisted of a continuation of the participation in the meetings of the working group of the Commission Services on cadmium as well as in those of the Scientific Advisory Committee on the Ecotoxicology of Cadmium in order to review on request of the Commission the scientific data on cadmium and to determine whether or not there was or would be a problem on Community level, and whether action should be taken to

reduce cadmium exposure. Based on certain trends regarding the use of cadmium in the Community over the next 10-20 years, a particular contribution was given in analysing the future impact of cadmium on the environment (air, soil, river water and river sediments), by using a simulation model for the pathway of cadmium in the E.C. set up some years ago.

In order to extend the investigation to the cadmium exposure of man, at the same time a start was made to include in the simulation model also the compartments «world's oceans» and «food» (vegetables, live-stock and fish). A preliminary report on the validation and characteristics of the model results of the past and present daily intake of cadmium by man in the E.C. was already presented to the competent Commission's Service in Brussels and will serve as a basis for the analysis of the possible future trend of the daily intake of cadmium by man.

### Perception of Technological Risk

Social opposition to technologies is not new, however the reasons for it have differed from case to case, reflecting a complex constellation of concerns related to morals, religion, political ideology, power, economics, psychological well-being and physical safety.

In the framework of the project «Forecasting and Assessment in the field of Science and Technology», so called FAST, the JRC contributes to general overview of the problems of social acceptability of new technologies.

The responsibility has three-fold implications:

- production of individual studies related to the general theme;
- active participation in other specific projects within the FAST projects, which bear on the technological risk acceptance problem;
- expert contribution to the evaluation of other FAST projects.

Under the first heading several papers have been presented for publication, such as: «Judgements of Technologies and their Risk», «Reflections on Risk Perception» and «Acceptable Risk: on the Social Acceptability of Technology».

Active participation in other Fast projects has been concentrated on two areas: the major role of the JRC in the meetings of the inter-university group charged with implementing the Fast contract on «Risk and benefits of the information society» and the integral role within the continuing workshop established to provide inputs under Fast research items on «The social acceptability of biotechnology».

The main evaluative work in question involved the participation in an expert seminar on the report «Adhésion ou résistance au changement technique?»

## TECHNICAL ASSISTANCE

### Laboratory Analysis

The main activities developed in 1981 concerned besides the JRC contributions to the COST - actions 61a bis and 64b bis on the physico-chemical behaviour of atmospheric pollutants respectively on the analysis of organic micropollutants in water the studies on diary products, on fertilizers, on radioprotection of the marine eco-system and on the COST-action 68 bis «Characterization, treatment and use of sewage sludge».



### *Diary products*

The work performed on request of the General Directorate for Agriculture consisted of the critical evaluation and the improvement of the spectrophotometric procedures for the selective determination of the whey content of milk-powder. A simple analytical method had to be found to be used as screening method, which has a relative high accuracy and reproducibility and which does not introduce adulterations of the pure milk powder.

The free sialic acid content can be considered as a useful tracer to detect whey in the milk powders due to the suitable relationship between the content of sialic acid and total proteins.

Three different analytical procedures, all of them based on two different spectrometric determinations of tracers of sialic acid as component of the whey powder, have been tested and applied to pure sialic acid, to various samples of milk powders and to the relative mixtures of both. One of them has been judged simpler, more practical and reproducible. The results show that the selected analytical procedure can successfully be applied for the determination of traces of free sialic acid in the skimmed milk powders.

An external report on «Determination of free sialic acid in skimmed milk, rennet whey powders and their relative mixtures» was issued.

The possibility to extend this determination to various samples of buttermilk is under study.

### *Radioprotection*

This activity forms part of an investigation on a larger scale of the man-made contribution to the different trace element concentrations of aquatic ecosystems along the Italian coast, in particular of existing and future nuclear sites. Several sediment samples have been collected from a well defined area (Gulf of La Spezia, rivers Magra and Vara and the Massociuccoli lake) and are analyzed.

Scope of the JRC contribution is the development of a fast and reliable method for the determination of the concentrations of a number of trace elements in the collected sediment samples. Total heavy metals and total sulphur concentrations in the lake and river sediments were determined, whereas for some of the sea sediments leaching of the heavy metals were studied.

For these determinations three different methods have been used so far, depending upon the type of element and upon its concentration in the sediment. These are: atomic absorption spectrometry, inductive coupled plasma spectrometry and X-ray spectroscopy.

Additionally, a mineralogical analysis of the lake, river and sea sediments in the same area were also carried out.

### *Fertilizers*

The activity involved the participation of the JRC both as EC laboratory and as EC expert in the meetings of the various working groups of the International Standard Organisation, in order to submit EC analytical procedures for the determination of various components of different types of fertilizers and to let accept them on a larger international basis.

To this end, analytical methods are tested, improved or developed.

Based on the results obtained from interlaboratory exercises, the most reliable analytical method is selected and accepted as standard method. The determinations dealt with during the

year 1981 concerned among others, the ureic-nitrogen and the available  $P_2O_5$  fraction of complex phosphate fertilizers, the oil-retention in some ammonium nitrate fertilizers and the total organic carbon content of organic mixed fertilizers.

### *Cost - Action 68 bis*

The use of sewage sludge in agriculture and in connection to this, the accumulation of micropollutants in soil and their unavoidable enrichment in the food chain, led to research activities on pathways, accumulation factors, uptake mechanisms and toxicity of two groups of micropollutants: toxic trace elements and organic trace components.

Starting point of this research was the identification of a set of reliable test methodologies for the determination of the different pollutants concentrations in both sewage sludge and the members of the food chain - soil and crop materials. To this end the JRC contributed to the production of sewage sludge reference materials in their most representative ranges of composition (low to high polluted) and that of the most representative members of the food chain, as well as the organization and evaluation of interlaboratory exercises.

The most reliable method in the certification of the trace metal content of sewage sludge obtained from the interlaboratory comparison exercises resulted to be the Aqua Regia technique, which was selected and is at present applied as standard method.

Subject of the 3rd Interlaboratory comparison exercises was the determination of the total and the mobile or «plant available» heavy metal content of sewage sludge amended soil. Contrary to the results obtained for the total content, the data obtained for the mobile fraction showed considerable differences at different soil pH values.

Therefore it was decided to repeat and at the same time to limit the interlaboratory exercise to two less complex Ispra reference soil materials. This study, in which 56 laboratories participate is still under way.

### **Scientific / Technical Advices**

#### *Support to the Custom Union Service*

The activity is dealing with the formulation of technical/scientific opinions for the Committee of Exemption of Custom Duties (UNESCO) on the qualification of instruments produced outside the Community and to be imported duty free.

To this end a computer code has been set up for the cataloguing of the decisions of the Commission in matters of exemption of custom duties. An extended use of the code has already been made in order to test the good running of the code itself under every possible condition. At the same time the most recent decisions of the Commission has been catalogued.

#### *Eurelios project*

Within the framework of the Solar Energy Research and Development Indirect Action Programme, the Commission of the European Communities sponsored on the basis of a 50% cost share - the other 50% being born equally by the three participating member countries France, Germany and Italy - the design and construction of the experimental 1 MW (el) Helioelectric power plant named Eurelios.

The JRC heads technically the project as support to the Indirect Action of the Directorate General XII.

The construction of the plant was completed by the end of 1980 and it was connected to the grid of the Italian National Electricity Generating Board, ENEL, at Adriano, Sicily (Italy) in April 1981.

The project is in a two years experimental phase since January 5th, 1981, the purpose of which is the optimization of the plant and its operation to the grid. The first part of the experimental programme has been carried out and consisted of the bringing up of the plant to full power and the setting up of a detailed work programme for the second part.

### 3. CONCLUSIONS

This programme is aiming at providing support to the Commissions services in the various fields where the JRC has a competence. By doing this, the JRC contributes with its technical and specific work to a better fulfillment of the tasks of the Commissions services in a number of sectoral policies.

The project Technical Evaluations correspond to two types of work: general system studies, computer modelling and technical assessments. The activities in this project were mainly concentrated on problems concerning the energy sector, which is of high importance today and which requires thorough analysis in preparation of any decision making. In particular, the modelling of the energy system and the contributions of nuclear energy were dealt with.

Energy saving problems were also analyzed. This work is closely connected with the Commissions indirect research action and with the actions of the Commission services responsible for energy and for industry and includes a collaboration

with a number of national institutes in the Member Countries active in this field.

Besides the activity on the Shipbuilding Data Bank which is aiming at providing the competent Commission Services regularly relevant information on shipbuilding, another activity in course concerned the utilization of local resources in developing countries and is performed on request of and in tight connection with the competent Commission Services and the local authorities of the interested countries. This activity relates the competence of the JRC in the energy field with the real energy needs of developing countries.

In the field of the protection of the environment, a number of specific research activities was aimed at providing a direct scientific and technical support to the competent Commission service, such as those on aircraft noise nuisance, on the heavy metal pollution of agricultural soils by phosphate fertilizers and on the pathway of cadmium in the environment. A contribution was also given to the FAST project which aims to explore the long term future of the scientific and technical evolution of our society.

The second project of the programme, Technical Assistance, consisted of specific experimental work on, among others, fertilizers, dairy products, sewage sludge and the aquatic environment. The scope of it is to develop or to select reliable analytical determination methods and to let them be accepted as standard method on a large international scale.

Another part of this project is dealing with technical consultations, such as the contribution to the Commissions services for the qualification of scientific instruments produced outside the Community for a duty free import and the leadership of the experimental helioelectric power plant project Eurelios.

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