



THE REGIONAL (EUROPE) PROJECT ON STUDY OF ENERGY OPTIONS USING THE IAEA PLANNING METHODOLOGIES

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Abstract

As a means to assist developing IAEA Member States in the Europe region in the broad area of energy, electricity and nuclear power planning, a new project has been implemented as part of the IAEA Technical Cooperation Programme. This paper describes the major objectives of this regional TC project and the activities to be organized in order to provide the required assistance. Focus is made on the present workshop and the current activities sponsored by the IAEA for further development of the IAEA planning tools for energy, electricity and nuclear power planning with emphasis on the Energy and Power Evaluation Program (ENPEP) and the Wien Automatic System Planning (WASP) packages.

I HISTORY OF THE PROJECT

The Regional (Europe) Technical Co-operation Project on *Study of Energy Options Using the IAEA Planning Methodologies* (RER/0/012) has been implemented by the IAEA starting in 1995 and with a duration of four years. The principal aim of this project is to improve national capabilities for energy, electricity and nuclear power planning and to promote regional co-operation in the exchange of experience in the use of the IAEA planning methodologies among the participating countries.

For the purposes of IAEA Technical Co-operation, Member States of the Agency are grouped into geographical regions. The regional project was originally designed in 1993 as a so-called TC model project that was intended to cover all countries of the former Europe and Middle East region of the IAEA. By the time the project was finally approved, in 1994, a new regional TC coverage had been decided for these countries, which were split into two newly created TC regions, namely:

- *Europe*, and
- *West Asia*

Consequently, the original budget was split into two separate regional projects with the same title, one for each of the regions listed above.

Over a four-year period, different countries in the Europe region will host regional and national training courses and regional workshops to be organized with Agency assistance. In organizing these events, the expertise already accumulated by some of the countries in the region will be utilized as much as possible.

Countries in Europe that are recipients of Agency technical assistance will participate in the project. Similarly, developed Member States in the region, having experience in the IAEA planning methodologies, will also be invited to provide inputs to the various activities in order to further promote regional co-operation.

The main idea behind the design of this regional project was to provide a framework to attend current needs for assistance in improving energy and electricity planning procedures and methodological approach.

Many East European and former USSR States that are also included in the Europe region of the IAEA are going through a transition period from centrally planned to market oriented economies which requires a new approach to energy planning. To assist Member States in the region to build up their capabilities for decision making on future developments in national energy and electricity systems, the Agency would like to introduce its energy planning methodologies. These methodologies, such as MAED, WASP, ENPEP and DECADES, have been developed for energy, electricity and nuclear power planning, and permit the analyses necessary for making sound decisions on the future evolution of the different energy options. These methodologies which are adapted mainly to planning analyses under market driven conditions, include the following.

MAED (Model for Analysis of Energy Demand) is a simulation model for medium and long term evaluation of energy and electricity demand;

WASP (Wien Automatic System Planning) is a system of computer programs to determine economically optimal long term expansion of an electricity generation system;

ENPEP (ENergy and Power Evaluation Program) is a set of PC-based tools for conducting integrated energy and electricity planning with due consideration to the impacts of alternative development strategies of the energy and electricity systems in terms of their resource requirements and environmental impacts;

DECADES (Data bases and methodologies for comparative assessment of different energy sources) provides information on electricity generation chains and permits their comparison for expanding electric power systems.

II. PLANNED ACTIVITIES

In order to meet the project objectives, several activities will be organized throughout the next four years, including:

- Short training workshops or seminars aiming at providing the participating countries with first hand-on experience in the use of some of the IAEA models, in particular MAED and WASP;
- The training is to be complemented with national training seminars to be carried out by the trainees that participated in the regional training course. These national training seminars would need relatively small input from the Agency;
- Field missions would also be organized with the objective to follow up on the effectiveness of the course and the impact on the country's planning procedures;

- Finally, to the extent possible, some ad-hoc missions to the participating countries that cannot be supported by the on-going national TC projects, would be accommodated as part of the regional project.

Special emphasis will be made in trying to use as much as possible the expertise available within the region. In addition and whenever applicable, coordination will be maintained with similar activities to be organized under the regional TC project for West Asia.

The specific activities under the Regional project for Europe during 1995 aim at two groups of Member States:

- a) Countries with experience and training on the IAEA planning tools, i.e.: *Belarus, Bulgaria, Croatia, Cyprus, Hungary, Greece, Poland, Portugal, Romania, Russia, Slovenia, Turkey, Ukraine.*

The present workshop is being organized for the above countries.

- b) Countries with very limited experience in the IAEA planning models and for which it is necessary to establish contacts with the local organizations involved in energy and electricity planning for the country, i.e.: *Albania, Armenia, Czech Republic, Estonia, Georgia, Latvia¹, Lithuania, Moldova¹, Slovak Republic, Macedonia.*

For these countries, field missions are being organized.

III. WORKSHOP OBJECTIVES

The workshop on "Practical issues related to the use of IAEA planning methodologies with emphasis on the ENPEP package" has been organized with the following objectives:

- (a) To discuss particular problems encountered by countries in the region while applying the IAEA's ENPEP package in the conduct of national studies.
- (b) To discuss the future activities to be organized within the project and to make suggestions and/or recommendations in this regard.

In order to meet objective (a) above, during the workshop, accepted participants will present a paper describing the problem. All papers will be discussed thoroughly during the Workshop with the aim of finding practical solutions to the problems.

Owing to the variety of proposals of presentations made by the participants, it has been decided to group them into topical sessions in order to concentrate the discussions on a given topic. Three topical sessions have been defined:

- 1) *Energy and electricity demand planning and problems related to the organizational structure in the country.*

¹ These countries are not Member States of the Agency and must be supported by extrabudgetary funds.

- 2) *Primary energy allocation with due account to environmental considerations and resource requirements.*
- 3) *Electricity and nuclear power planning.*

It is intended to publish the Proceedings of the Workshop as an IAEA report for future reference by ENPEP users.

Regarding objective (b), participants are requested to make suggestions and proposals for the type of activities to be organized in the future under the present TC project, including not only the type of activities for which the project was originally designed, but also recommendations concerning further enhancements to the ENPEP methodology.

Regarding organization of training events, participants are requested to provide suggestions not only for the possible topics to be covered, but also to make specific proposals for hosting some of the activities.

In giving the recommendations, participants are requested to keep in mind the relatively limited resources available for the project so that the countries are welcomed to contribute to the project in the form of providing cost-free experts for participation in field missions or training activities in other countries, hosting some of the workshops, etc.

In relation to the recommendations for model enhancements and in order to avoid suggestions for improvements that are already being implemented, a lecture by Argonne National Laboratory (ANL) will be presented to describe current enhancements being introduced in ENPEP at ANL. For the same reason, it is necessary to describe the current efforts of the IAEA for further development of the WASP model (ELECTRIC Module of ENPEP). These are discussed in the next section.

IV. THE WASP-IV MODEL

A new version of the WASP program, called WASP-IV, is being developed with the help of two Member States and institutions:

Greece: *Public Power Corporation & National Technical University of Athens*

Hungary: *Hungarian Power Companies Ltd. & Computer and Automation Research Institute (Academy of Sciences)*

Under this co-operative effort, the national teams are responsible for development of separate algorithms and computer coding, while the IAEA provides overall coordination of the project.

The principal enhancements introduced in the WASP-IV model with respect to the earlier version (known as WASP-III Plus) are as follows:

- Treatment of group limitations that may apply to the electricity production by one or several power plants (e.g., limits on fuel, ceilings for amount of energy generated, constraints on emissions, etc.) Up to five different types of limitations

can be applied in the program, whereas WASP-III Plus only allows the treatment of fuel limitations for a group of plants.

- Modeling of pumped storage as a separate power plant which will take the place of one of the composite hydro plants for simulation purposes. The WASP-III Plus version does not consider explicitly such type of plant and its representation can only be approximated by external manipulation of the input data, which requires large efforts by the planner.
- Control by the user of the maintenance schedule of thermal power plants. In previous versions of the WASP model the maintenance schedule is determined by the program.
- Increase of the dimensions of several variables:
 - Number of thermal plants (98 against 58 in WASP-III Plus).
 - Maximum number of configurations accepted in a single run (500 per year and 5000 for the study, against 300 and 3000 in WASP-III Plus)
- Overall program update.

DEVELOPMENT SCHEDULE FOR THE WASP-MODEL

Currently the individual developments of the algorithms and computer coding by the Greek and Hungary teams are being finalized and some documentation of the new algorithms have already been prepared.

The next phase will be the integration of both developments into a single package. This will require considerable efforts not only to combine different portions of the code, but also in developing a wide variety of case studies to verify the functionality of the code. A new User's Manual should also be developed.

Conclusion of these activities is foreseen for November 1995 when the final product would be presented to the consideration of the participants in a WASP Advisory Group Meeting in Vienna. Their recommendations would be used as a basis for the final development. Conclusion of all development activities, including the program documentation and User's Manual is foreseen for 1996.

V. CONCLUSIONS

The Regional TC project for Europe on the IAEA methodologies is expected to make a valuable contribution in building up national capabilities for energy, electricity and nuclear power planning in the participating countries.

The exchange of experience in the use of these methodologies and computer models will be very useful in avoiding duplication of efforts to solve a particular problem being faced in the application of the models to local conditions. This exchange of experience will increase

as more countries in the region become users of the models and new approaches to address certain problems are found.

The overall success of the project will be highly dependent on the effective participation by the interested countries and the support to be provided for the continuation of the project. The large number of participants in the present workshop is a good indication of such interest and support and thus anticipates, an excellent start for the project.