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OPTIMIZATION OF ELECTRIC POWER SYSTEMS

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CHILE

Technical report: Computer Aided Engineering Education
for Chile's Electric Power Systems*

Prepared for the Government of Chile
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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1. Introduction

The UNIDO project is concerned with the development and optimisation of the national system for the generation, transmission and distribution of electrical power in Chile, and with the educational and training infrastructure necessary to support this development. The three main areas of project activity can be classified as:

- (a) academic
- (b) industrial
- (c) training.

My visit was associated with the impact of computer technology in each of these areas, with particular emphasis upon the need to develop the academic infrastructure, by analysing problems associated with the incorporation and development of Computer Aided Education, Computer Aided Engineering and Computer Aided Design facilities. The principal objective was to determine the present availability of computing expertise and computing equipment in the Universities collaborating in the project, both in respect of computational procedures relating to the design and optimisation of the electrical power supply system and to the adequacy of computer support facilities for associated education and training.

The visit included the following activities:-

- (1) discussions with engineers from the Universidad Catolica School of Engineering on current activity and future plans in Computer Aided Education and Computer Aided Design.
- (2) similar discussions with engineers from the Electrical Engineering Department, Universidad de Chile.

- (3) presentation of a 12 hour course of lectures on "Computer Aided Engineering Education and Design".
- (4) participation in a workshop at Universidad Catolica de Chile on the development and organisation of a computer based learning service.
- (5) discussions with engineers and other academic groups at Universidad Tecnica Federico Santa Maria on current activity and further plans in Computer Aided Design Education.
- (6) presentation of a seminar at Universidad Tecnica Federico Santa Maria on "Modern Trends in Computer Aided Engineering Education".
- (7) discussion with engineers from Chilectra Metropolitana followed by the presentation of a seminar on "Developments in Computer Aided Engineering Education and Training".

Throughout this full programme of activity I was given every possible support by the academics concerned with the UNIDO project and received at all times a warm and courteous welcome.

2. 12-hour course on Computer Aided Engineering Education and Design

The 12-hour course of lectures, which was prepared especially for the UNIDO project, provided:-

- (a) a state-of-the-art review of the uses of computers in engineering education and design.
- (b) a rationale for the use of computer simulations in engineering education, based upon more than a decade of experience at Queen Mary College (University of London, England).
- (c) an introduction to the techniques of design of computer based learning software.

- (d) a discussion of the considerations involved in setting up a computer based learning service in a university environment.
- (e) a review of the uses of computers in industrial training.

The course was attended by 85 participants, approximately half from industry and half from universities. Ten universities were represented.

The course presentation included videotape extracts from computer based learning programs in use at Queen Mary College and examples of use in industrial training, together with a comprehensive range of illustrative viewgraphs; a booklet containing a wide ranging selection of reference material was also provided.

3. Workshop on "The Development and Organisation of a Computer Based Learning Service"

The Workshop was held at Universidad Catolica and was attended by representatives of interested departments and the Computer Service Centre. A wide ranging discussion was preceded by an analysis of experience in providing a computer based learning service at Queen Mary College for more than a decade; the following aspects were covered:-

- (a) the need for applications software designed to meet identified educational requirements, and the central role of academic staff in specifying these requirements.
- (b) the need for support staff with skills in applications programming and in computer based learning software design (including graphics design).

- (c) the management, operational and systems advisory infrastructure.
- (d) the selection of suitable computer systems hardware and software to support the activity.
- (e) the relative merits of developing separate facilities within individual departments or an integrated central service.

There was broad agreement that the current level of provision at Universidad Catolica of computing facilities and, in particular, of support staff, was inadequate to maintain the development of an effective central computer based learning service, and that substantial resources should be sought to facilitate such a development.

4. Visits to academic departments and Computer Centres and associated discussions.

At the three universities involved in the UNIDO project I was given the opportunity to visit engineering departments and Computer Centres and to discuss with staff the level of computing provision. At Universidad Catolica and Universidad de Chile I was shown examples of computer aided design project work, and was impressed by the quality and skilful design of the computer aided design procedures which were demonstrated.

Throughout these visits, and in each of the three universities, there was ample evidence of high levels of skill and enthusiasm in developing computer aided design related research projects, but in many departments it was evident that progress was restricted by a low level of provision both of computer

resources and tenured support staff. This applied to both departmental and central provision and was most evident in departments concerned with electrical and electronic engineering and computer science.

Whilst computers are used in the educational process both in undergraduate project work and in teaching programming languages and computer science, there was little evidence of the use of computer based learning procedures to teach the principles of engineering, with the notable exception of the Electrical Engineering Department at Universidad Catolica, where computer simulations are used to teach some aspects of electrical power systems courses. There is considerable scope for development in this area in all the universities visited.

5. Seminars

During my visit to the Universidad Tecnica Federico Santa Maria in Valparaiso I presented a seminar on "Modern Trends in Computer Aided Engineering Education", attended by an audience of about 80 members of the University. The presentation was concerned principally with the current state-of-the-art in the United Kingdom in this field, with particular emphasis upon the wide range of computer based learning activity at Queen Mary College.

A second seminar was given in Santiago for some 60 engineers from the Chilectra Metropolitana electrical power distribution utility, which has well-established links with the Universidad Catolica. The seminar, which was preceded by a discussion with senior utility staff, addressed the topic of 'Developments

in Computer Aided Engineering and Training', with particular emphasis upon computer based industrial training procedures which could be relevant to the needs of the utility.

6. Recommendations

- (a) Computer Aided Engineering Education comprises both Education in computer aided engineering and Computer Aided Education in engineering. The universities should analyse their needs in both of these areas.
- (b) Education in computer aided engineering requires the acquisition of computer aided design software currently in use in industry so that students can become familiar with the procedures they will meet later in their careers. The universities should take steps to acquire examples of such software and, where appropriate, the computer hardware which is required for its implementation,
- (c) Computer Aided Education in engineering requires the provision of computer software which addresses specific topics within the engineering curriculum, using the computer as a medium for more effective education. There is an international exchange library of such software at Queen Mary College which may meet some of the needs, but the Universities should also consider setting up procedures to develop their own software in this area.
- (d) Discussions at the Universidad Catolica indicated that there is a level of interest within the academic community which would justify the setting up of a computer based learning service. Such a service would be of direct interest and support to

the UNIDO project and it is strongly recommended that serious consideration be given to its establishment. It is unlikely that the initial funding to establish such a service could be found from local resources so that external funding support would be required.

- (e) Whilst skills in computer program design and computer graphics design exist within the Universities, the design of computer based learning software demands particular skills of which there is little experience in Chile. Developments in this area could benefit from experience in the United Kingdom and the Universities should consider secondment of staff to appropriate centres in the United Kingdom to acquire these skills.
- (f) The general level of provision of computing facilities in the Universities is low compared with the United Kingdom. The Universities should take advantage of recent developments in micro-processor technology which permit rapid expansion of computing capability at relatively modest costs. There is also a general need for enhanced graphical display facilities.

7. Conclusions

In a short visit with a full program of activities it was not possible to examine in depth the capabilities of the universities visited in respect of all aspects of computer aided engineering, but a good overview was obtained, on the basis of which specific recommendations have been made.

The UNIDO project is providing an important stimulus to improving the technical capabilities of the universities, and the development of computer based learning procedures is an example. There is a high degree of interest within the academic community and an excellent opportunity is offered to take advantage of the experience gained and to avoid the problems which have been met and solved elsewhere.