

# HYDROELECTRIC PLANNING AND OPTIMISATION SYSTEM

## INTRODUCTION

The Hydroelectric Planning and Optimization System assists in the planning of the hydroelectric production. Once the planning is defined the system also provides the strategy for its optimal execution. The global integrated system is composed by the following modules:

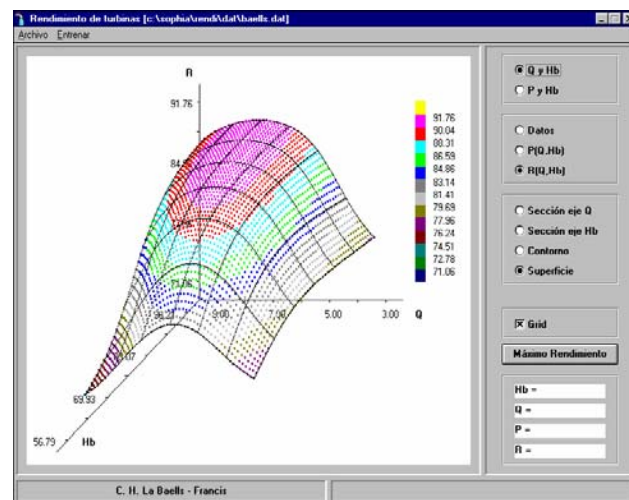
- Performance curves learning using neural networks.
- River reservoir inflows forecasting
- Optimal short, medium and long-term planning using dynamic programming. Takes into account: ramps, in and outflows constraints, maintenance schedules, etc.
- Generation of optimal economical strategies once a planning has been established.

## MODULES

### Performance Curves Estimation

This module uses equipment builder information as well as historical performance information in order to generate the best possible estimated performance curve for the different types of generating units.

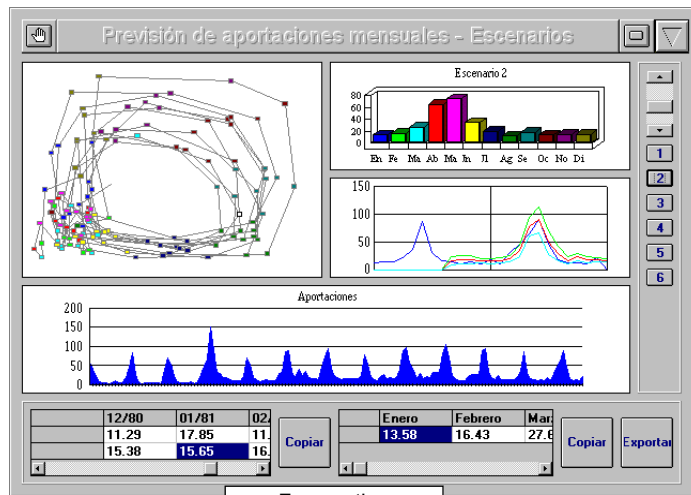
The technique used is the pattern learning approach given by neural network techniques.



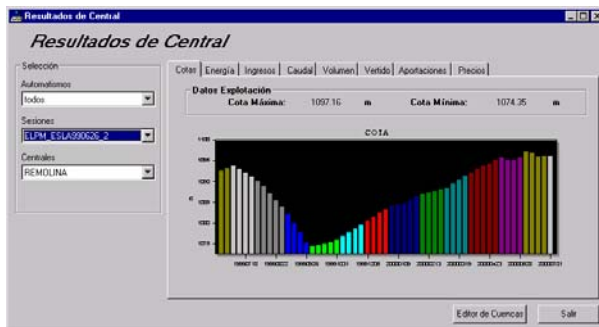
Performance Curves

## Forecasting Short and Long-Term Inflows by River Reservoir

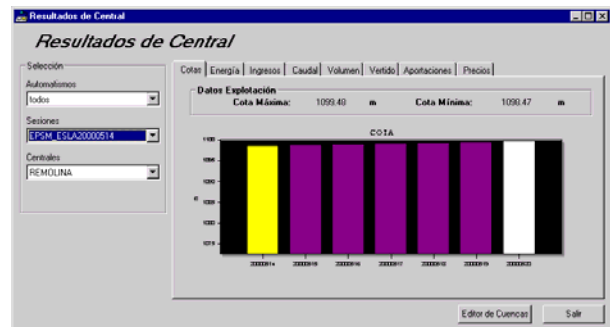
Specific learning algorithms via fine tuning of parameters are implemented in order to use neural networks for river reservoir inflows forecasting. The system generates specific inflows profiles.



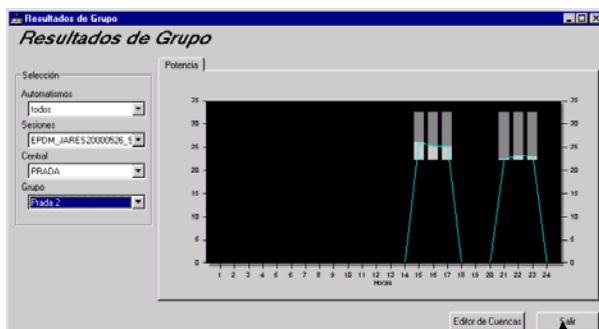
Forecasting



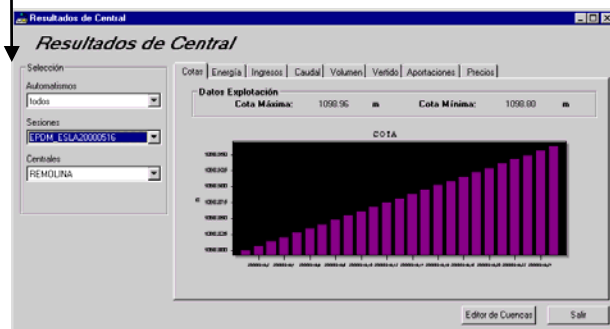
Long term



Medium term



Desegregation



Short term

### Optimal Planning

Red : Total Power  
Green: Total Profit

Yellow : Head  
Cyan : Regulated Power margin

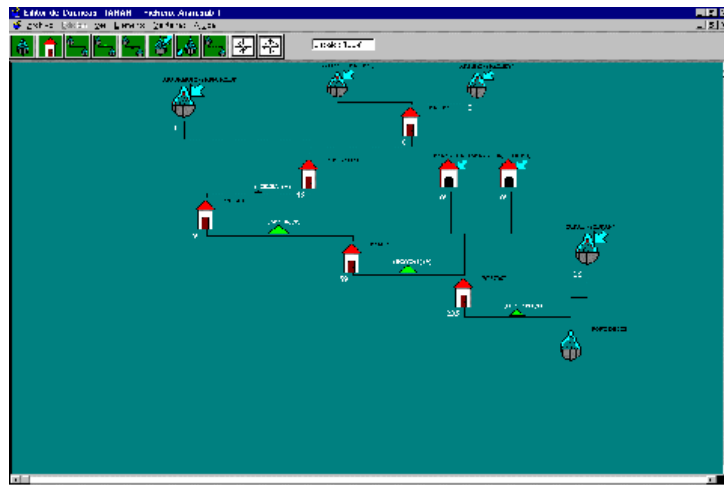
Blue: Total Flow  
Generator Hourly Status

## Optimal short, Medium and Long Term Generation Planning

The optimization is based on information of the performance curves of the equipment, river reservoir inflows forecasts, etc., A proprietary variation and extension of dynamic programming techniques is used to solve the optimization of generators groups planning.

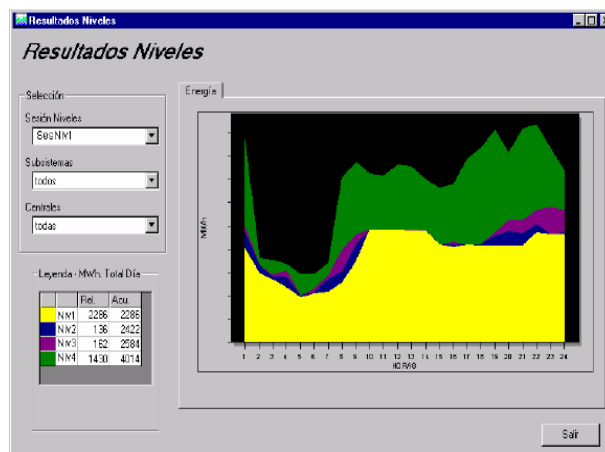
## Optimal Desegregation

This module can perform as a stand alone module. Given a generation planning it produces the optimal economic management strategy for the hydroelectric generation (Coordination with thermal generation could be added as an optional future module).



## LEVELS

The LEVELS module gives a reflection of the impact that deviations from the expected price would have on the optimization, using a water stratification that has been selected as optimum. It can be seen as a measure of the risk over the clearing of the water offered





GRUPO AIA

Transforming information into knowledge

Transforming

## Reprogramming

The reprogramming is the optimization process for a specific Hydroelectric Generation Unit (HGU) while fulfilling specific energy and ancillary orders.

As a result, the hourly energy levels are obtained for each generation unit in each of the generation groups of the HGU.

## HARDWARE/SOFTWARE PLATFORM

The application runs on any PC under Windows.

ENERGY  
KNOWLEDGE

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