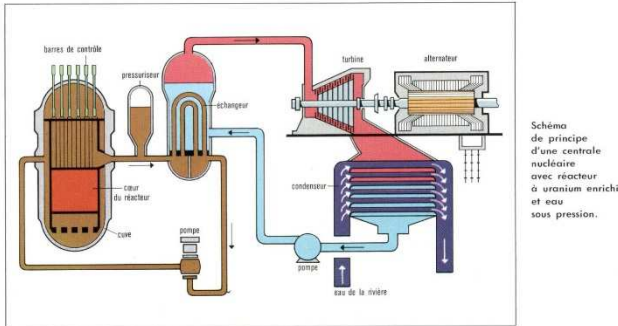


Sherpa Engineering has many years of modeling and simulation experience with industrial power plant systems. We provide in-depth support of our customers who develop complex power plant simulators with our strong skills on energetics, advanced control, energy optimization, and component design.



Power Plant simulators can be used in the fundamental processes for engineering TPP system such as:

- Energy optimization and sizing.
- Design, tuning and analysis of the control system
- Development of optimized calibrations and tests verification
- Controller verification on a virtual bench test (Hardware in the Loop-HIL)

## POWER PLANT ACTIVITIES

### Specification

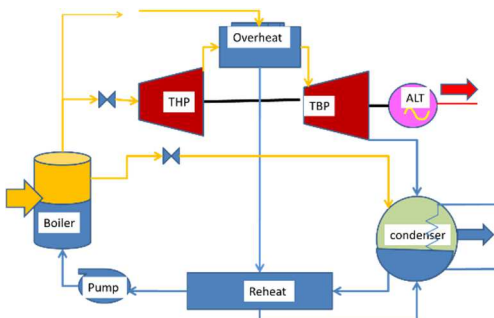
Functional and technical specifications of a TPP simulator

### Data collection

- collection of steady-state reference data for comparison model/reference and component parameter characterization
  - collection of components parameters by subsystem
- All the input/output data are organized by excel sheet

### Physical Model development

Example of standard loop:



### Control system development

Management of different operating modes: start-up/stop, speed control, load control, synchronization/desynchronization to the electric network, open/closed loop and so on.

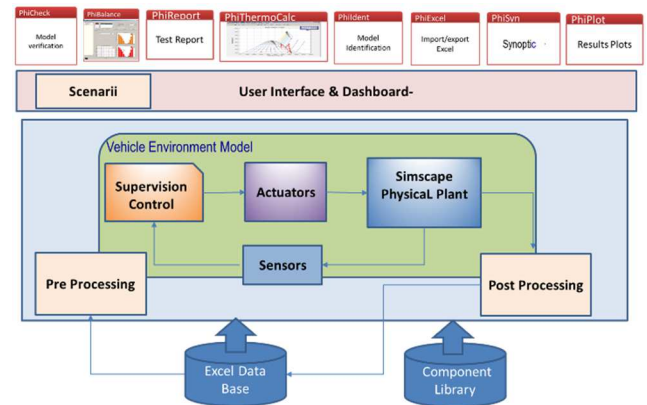
Development of the following control-command models including calibration:

- Speed or power control
- Boiler Tank Level and pressure control
- Overheat temperature control
- Condenser pressure control
- Separator Tank Level

### Human Interface and dashboard

- System configuration: normal or degraded or fault, architecture and control options.
- Simulation configuration: protocol selection.
- Tests reports
- Synoptic design: numerical results in all plans
- On line Mass & energy balances, mass & power graphics.
- On line or replay thermodynamic cycles (T-S, P-H) on diagram background

### Simulator Integration



### Verification process

- Mass and energy balances check
- Modeling rules check

### Validation process

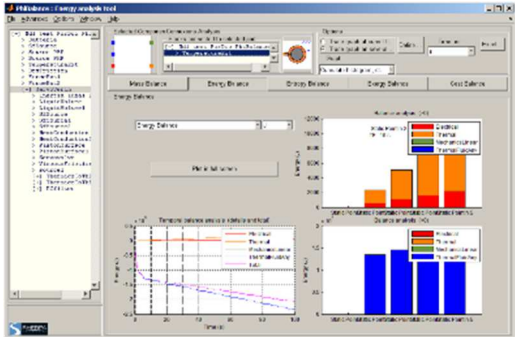
Hierarchical decomposition for preliminary bench tests to validate subsystems before the final validation of the entire system

- Comparison steady state reference/model points export in excel

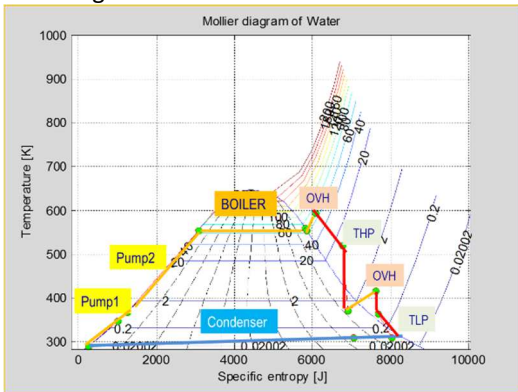
## Support Tools

Several MATLAB® scripts associated to the library have been developed to automate common tasks such as:

- Data import/export from/to excel by labels
- Parameters identification scripts for static or dynamic parameters.
- on line plot
- mass and energy balances



Thermodynamic cycles (T-S, P-H) plotting on diagram background

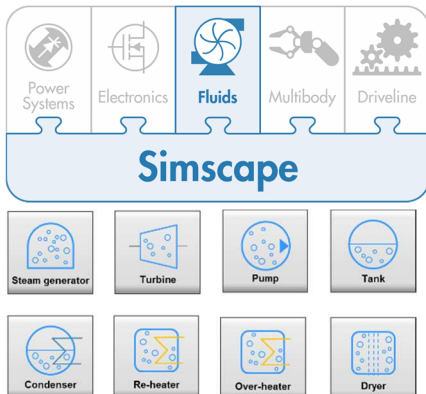


## TPP SYSTEM LIBRARY

The power plant system library extends Simulink® and Simscape™ capabilities with tools for modeling, characterizing, simulating and optimizing Thermal Power Plant (TPP) systems.

The super elements of the library enable users to build an operational system model and its control system, while validating performance and safety requirements.

Library elements include *boiler, turbine group, overheat subsystem, condenser, re-heater, turbo-pump, separator tank, evaporator, fluid line, simplified alternator* and so on.



This library of modular components allows users to quickly assemble complex networks.

## SERVICES

### Technological Transfer

The aim is to transfer know-how to your engineers:

#### 1/ Simulator Software + Tools

*A standard design, representative of industrial systems currently in use, is selected from different options that we provide.*

*Standard Data base in excel file: all reference and components data are supplied in organized way. All data and model has been defined by Sherpa in generic way.*

*Scenarios programming: sequencing of elementary scenarios*

*User Dashboard to configure the model, the control and the exploitation scenarios and the modes*

*Reference physical thermal plant model*

*Simplified control model: controllers to run the model in closed loop and manage the different operating modes*

*Pre-processing: Model parameterization, Initial states, configuration parameters*

*Post processing: on line synoptic, on line results plot & import/export in excel.*

*Documentation: On line technical documentation + User Manual*

#### 2/ The training enables users to:

- Understand a standard application of the model and simulate the behavior of Power Plant Model
- Adapt the standard application to specific needs.

The details of the 3 days training are presented in an educational sheet.

#### 3/ Technical assistance

Up to 100 hours of technical assistance from SHERPA engineers with professional modeling and software experience are provided to support application developers or users.

Typical tasks include:

- Adaptation of the generic model to the client model.
- The exploitation of test data
- Static and dynamic parameter identification and model calibration
- The comparison of the simulated results with the test results
- Any assistance expertise concerning the generic model

### On-demand services

For data exploitation or additional fluids or specific adaptation of model to the customer's needs, some work can be subcontracted to SHERPA by client. In this case, a work load evaluation will be assessed by SHERPA on the basis of Specification of Work document.

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