The Unit Commitment, UC, is used to determine the minimum production cost schedule for thermal generating units. Operating fuel costs, maintenance costs and start up costs are accounted for in the calculations. An extensive set of constraints may be imposed on the schedule. A unit commitment schedule extends up to one week. Chaining of schedules to provide longer time horizons is possible.

Benefits
Unit Commitment provides the following benefits:

- Minimization of the production cost
- Consideration to dispatchable power transactions with interconnected utilities
- Optimal utilization of fuels with limited supply

Functions

The Unit Commitment function provides the operator with a versatile working environment for scheduling. The base for the commitment schedule is either the load forecast or the traded power.

- Different execution modes.
  Three different execution modes are provided which make it possible to combine the result of the optimization algorithm with the operator’s own judgments and decisions.
  - Basic mode
    Unit Commitment determines the minimum cost generation schedule compliant with the specified input data.
  - Operator participation mode
    The operator may modify a previously determined commitment schedule and initiate an UC execution. The specified commitment schedule is retained in the calculations; the economic dispatch is however recalculated.
  - Fixed dispatch mode
    In this mode the Unit Commitment simply evaluates the generation schedule specified by the input data. No optimization is performed.

- Save cases
  Unit Commitment maintains a library of save cases. The operator can transfer data between the different save case files and the files used by the scheduling programs.

- Chaining of UC executions
  In order to extend the examination to periods greater than 168 hours, Unit commitment executions can be chained together, i.e. the resulting unit status of one UC run is retrieved and used as input to next.

- Alternative commitments
  The operator can select an alternative commitment logic that evaluates whether the exchange of a large unit with smaller units at certain hours would lower the cost.

- Fast and efficient state-of-the-art Lagrangian relaxation algorithm.
Functions, continued

Unit Modelling
UC provides flexible unit modelling capabilities. Different types of units as well as different unit statuses can be represented. Multiple fuel units are modelled.

Unit types and operating modes
- Cycling units
  Units that can be switched on and off and generate between their economic high and low limits.
- Peaking units
  Peaking units can be defined to generate at the economic high limit or to be dispatched between the economic low and high limits. No start up constraints are applied to peaking units.

It is possible to specify units as must-run or unavailable for part of or for the whole study period. In addition deration of the unit capability can be specified.

The units are classified with respect to the fuels possible to use as
- Single fuel units
- Multiple fuel units that can burn two fuels simultaneously. UC will automatically dispatch the fuel that results in the most economic operation.
- Multiple fuel units that can burn two fuels simultaneously and where the mix is fixed.

Determination of the production cost
The production cost is determined as the sum of the operating fuel costs, the operating and maintenance costs and the start up costs.

Two operational, one supplemental and two start up fuels can be assigned to a unit. The operational and supplemental fuels are used when the unit is on-line; the latter only when the unit is operating below a designated level.

The unit modelling determines how many and which fuels are applicable to a specific unit
- Operating fuel cost – The operating fuel cost simply is the sum of the costs of the fuels burnt
- Operating and maintenance cost – The operating and maintenance cost comprises two components
  - A base cost incurred whenever a unit is on-line
  - An incremental cost which is a function of the unit’s generation level
- Start up costs – The start up costs depends on the status of the unit. If the unit is banked with the boiler in hot standby condition, a hot start up cost is incurred. If the unit is in cold standby, a cold start up cost is imposed when a unit is started. The cold start up cost depends on the time from shutdown of the unit.

In addition to the limits shown in the figure, it is possible to assign special generation limits to units with silica problems. The silica limit is the maximum generation of the unit as a function of time from that the unit has become ready for control (refer to figure).

Operating Constraints
A number of constraints may be imposed on the unit commitment solution in addition to the individual unit generating limits, e.g.
- Spinning and operating reserves – Minimum limits for the spinning respectively operating reserves can be specified
- Generating margin at minimum load – The generation margin contribution for a unit is the difference between its generation and capacity low limit. The total generation margin of the system must exceed the specified requirement.
- Minimum up, down and ramp time – Limits can be specified for the unit minimum up, down and ramp times
- Plant start up constraints – The number of units in a plant that can start in a single hour can be limited. Alternatively, the minimum number of hours between start ups in a plant can be limited.
- Fuel consumption constraints – Upper and lower limits can be specified on the amount of a given fuel used by a selected group of units. The limits can be for fuel usage over the hour, day, and study period.

The user can include or exclude each type of constraint by entry in a VDU picture.