



## SDDP VERSION 10.2.2b

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### New features and fixes in the model

- Fixed an error that occurred in cases with transmission network and with thermal plants presenting (i) more than one segment for the specific consumption function and (ii) generation capacity equal to zero in some stages (which might be the case of future and/or under maintenance thermal plants). The error in these cases was in the construction of the constraints of transmission limits associated to the compact formulation of the transmission network.
- Fixed an error in the exhibition of the error message related to the use of sensitivity factors for gauging stations data, which occurred specifically during the policy calculation of a coordinated case or when sensitivity factors were defined for a gauging station that has not been defined in the configuration data.
- The BigCut version of SDDP is now able to run cases with transmission losses represented by the linearized method.

### New features and fixes in the graphical user interface

- Fixed an error in the thermal operative costs visualization feature of the interface, which occurred specifically when the fuel cost data used by the thermal plant or the specific consumption data were defined implicitly; i.e., when the values were left blank. This error occurred uniquely in the visualization of the costs via the interface, not affecting at all the results of the model.
- Fixed an error that occurred when the main fuel of a thermal plant was changed. The error caused the exclusion of the modification data associated to the thermal plant whose main fuel was changed.
- Fixed an error in the inclusion of a DC link. The interface exhibited incorrectly the data of the FROM and TO buses of the new DC link.
- Added a special treatment for an error that occurred solely when a plant was removed from the configuration and had an empty maintenance file in the data directory.

## SDDP VERSION 10.2.1a

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### Important fixes

- Fixed an error that has been introduced in version 10.2 in the thermal configuration screen. This error only happens for the thermal plants that had their data modified by the interface of version 10.2. When the thermal configuration data was saved by version 10.2 interface, all blanks in the specific consumption fields were replaced by zeros. When the specific consumption is not explicitly defined for all load blocks (i.e., some are left blank), the model internally considers the specific consumption value defined for the first load block should be repeated for the following blank blocks. This error introduced by the interface makes the model consider the specific consumption for the other blocks as zero, which affects the plants' cost and consequently their generation.

When loading the case, the interface of version 10.2.1 will identify possible errors introduced by version 10.2 and will present a screen with suggestions of fixes for the possibly affected data. It is required that the user revises carefully the suggestions given by the interface and corrects each of them - if a fix is needed – so that at the end the interface can apply the changes.

- An inconsistency has been observed between the name of the field “CO<sub>2</sub> emission reduction coefficient” of a thermal plant and the way that this data is internally used by the model. The name of this field was changed to “CO<sub>2</sub> emission coefficient” in order to be compatible with its implementation. This coefficient is used exclusively for the calculation of emission costs. A coefficient equals to 1 p.u. means that the plant will emit all CO<sub>2</sub> from the fuel burning. Values between 0 and 1 p.u. indicate that there is a filter which reduces the CO<sub>2</sub> emission. For example, a coefficient equals to 0.8 p.u. indicates that the thermal plant will emit 80% of the CO<sub>2</sub> resultant from the fuel burning.

We request the users that represent CO<sub>2</sub> emissions to revise their data to ensure that the CO<sub>2</sub> emission coefficient of thermal plants really reflects its expected behavior.

If you have any doubt, please contact us at [sddp@psr-inc.com](mailto:sddp@psr-inc.com).

### New features and fixes in the model

- Created a new output called “Total flow per bus” presenting the total injected (or withdrawn) power per bus.
- The description of the gas model and of the objective function for the representation options for the thermal costs and costs of gas production nodes have been included in the methodology manual.
- The output “Load per bus” has been modified in order to present the results only for the buses with load. Analogously, the outputs “Deficit per bus” and “Flag for bus deficit” have been modified in order to present the results only for the buses selected for load shedding. The purpose of these

modifications is to reduce the size of the output files, since the result for all other buses is, by definition, equal to zero.

- Fixed an error that happened in a particular case of representation of dead storage filling up. The error prevented the execution of a simulation, with a policy previously calculated, when the simulation study horizon did not contain the period of dead storage filling up.
- Fixed an error in the dead storage filling up model in the specific case of the most downstream hydro plants of the cascade. Up to SDDP 10.2, the way it was modeled did not oblige the upstream plants to release water in order to assure that the dead storage of the plant will be filled up during its filling period.
- Modified the verification of infeasibility due to excess of renewable sources in order to allow the execution of cases with benefit thermal plants.
- Fixed an error in the outputs international circuits for the cases where the transmission losses were represented by the linearized method. The affected outputs were: flow, losses and marginal cost.
- Fixed an error that happened only in cases with more than one system with the representation of transmission losses by the iterative method. In these cases, the bus marginal cost calculation did not consider the contribution of the circuits between systems, possibly introducing imprecisions. This error could affect the outputs “Load marginal cost”, “Bus marginal cost”, “Hydro Gen. x Bus MargCost”, “Therm Gen. x Bus MargCost”, “Renewable source x Bus MargCost”, “Circuit income” and “Total income - multinodal”.
- Fixed an error building the optimization problem that happened uniquely in coordinated studies for the particular case where the policy calculation of a system without hydro plants was carried out immediately after the policy of a system with hydro plants and representing irrigation constraints.
- Fixed the unit of the output “Export&Import by area”. The values were being written in GW, when should be in GWh.
- Increased the maximum number of generation constraints from 100 to 300.

## **New features and fixes in the graphical user interface**

- The feature to preview the thermal operating costs via the interface has returned to the Thermal configuration screen. It has been removed in version 10.0 due to its lack of consideration of expansion data. The new implementation of this feature available now in version 10.2.1a is considering all involved data.
- Fixed an error in the hydro modification screen filter, for the plants with representation of the dead storage filling up. When selecting in the filter a hydro plant, the initial and final years for the dead storage filling up period were being presented as duplicated.
- Fixed an error in the screen of directory selection. The number of load blocks in the case was not presented correctly.
- Fixed an error reading the thermal configuration file. If a fictitious thermal plant associated to an alternative fuel of a multi fuel plant was defined in the file before the main thermal plant, the interface was treating it as an independent plant. This problem only happened if the case was not defined using the interface, since the interface preserves the correct order of the elements in the file.
- Fixed an error in the thermal modification screen that hid the field to define the emission reduction coefficient (p.u.) considered by the model. With this error, each thermal modification created by the interface left a blank in the value of the column of emission reduction coefficient in the modification file. Due to that, the model considered, from the modification date, that there was no emission for the plant, ignoring any associated cost.

## SDDP VERSION 10.2

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### New features and updates

- The Xpress optimization package has been upgraded to version 7.1 (latest release).
- Added new feature that allows informing the costs (fuel costs, O&M, transportation) and penalties for each system, as well as the interconnection costs, in different monetary units. SDDP will apply the exchange rates defined by the user in the interface and will produce the results in the reference monetary unit, also defined by the user. For further information, see the User Manual section 9.
- Added new feature that allows the definition of the inflows for the initial conditions (six previous stages) of the ARP hydrological model in an external file, as an alternative for the current option where the initial conditions are obtained from the historical inflows file. This external file can be imported from a previous execution or defined by the user.
- Added new option to represent, in the relaxation scheme of the iterative method for transmission network, the constraints for the tie-line circuits (between systems) that does not have a cost associated to the flow. In previous versions of SDDP, in its linear and mixed-integer programming problems, the tie-line circuits' flows were explicitly represented with decision variables, due to the fact that these flows could have associated costs to be included in the objective function. Nevertheless, the explicit representation of these variables increases the computational time and is only needed in case that there are costs associated to the flows of the tie line circuits. The new option allows that tie-line circuits be considered in the relaxation scheme and that their constraints in compact form be added to the problem in case of violation of circuits' limits, as for every monitored circuit. It is important to notice that these circuits will be monitored when the option to monitor all circuits is used or, alternatively, if they belong to the group of selected circuits for monitoring.
- Added new report for identifying isolated busses and its corresponding islands in a case with network representation.
- Added a protection against infeasibility in cases with network representation when the load shedding in selected busses is used and there is a bus not selected for load shedding in a congested zone of the network.
- Added an automatic check for SDDP updates. The graphical interface checks if there is a newer version of SDDP available for download and, according to the user's choice, opens the download page of SDDP at PSR's website.
- Modified the choice of how SDDP is executed via the interface. From this version, the mode can be chosen in the *combo-box* on the right of the execution button. This modification allows, for example, the alternation of Sequential and Parallel runs of SDDP without needing to change the cluster configuration that has been previously defined.

### SDDP iFeedback – We want to hear from you to make SDDP more efficient

Your direct feedback in training courses and e-mail support services has always been very important for our continuing efforts to improve SDDP's efficiency and to design new features. With the wide-

spread availability of Internet-based communications, we saw an opportunity to hear from you more frequently and in more detail, but **without using any of your precious time.**

The SDDP iFeedback is a new feature that collects automatically the following information on how you use SDDP:

- Program version, optimization solver's version, platform and license id;
- Execution parameters;
- Case dimensions such as **number** of hydro and thermal plants, **number** of hydrological scenarios, **type** of network representation and other similar information. **No study-specific data such as names, commissioning dates, power limits etc. is ever collected;**
- Optimization problem size (number of linear variables, number of constraints, number of integer variables);
- Execution times;
- Execution status (success or problems encountered).

At the end of each SDDP run, the collected information will be sent automatically to PSR, if an internet connection is available. All the collected information, although not study-specific, will be treated by PSR as **confidential**, in the same way as any complete data set we receive for support purposes.

The use of iFeedback is of course fully voluntary: you can choose to start or stop participating at any time in the Tools menu. Also, we will not modify the collection procedure above without your full knowledge and consent.

**Please consider using our iFeedback to help us provide a better SDDP service.**

## Corrections and modifications in the model

- Corrected an error in the load blocks aggregation option for the policy phase. In case the user selected the option to aggregate the load blocks in the policy, this error caused, during the *backward* phase, the consideration of the values for the first load block for the data that vary per block – capacity and interconnection cost and thermal consumption factor – from the beginning of the study horizon until the stage that precedes the first stage modification for the related data.
- Corrected an error in the representation of the importation and exportation constraints between electrical areas for cases with losses.
- Corrected an error in the consideration of the filling of the dead storage for run of river plants.
- Added a verification to avoid the use of “TAB” characters in the name of the agents.
- Corrections in the spreadsheets of results:
  - Corrected an error in the calculation of the bus angle in case with renewable sources.
  - Corrected an error in writing the values in column “Future Cost” of the operation costs report (sddpcope.csv) for studies without additional years.
  - Corrected an error in the calculation of the bus marginal cost in cases with circuits’ outages.
  - Corrected an error in writing the values of initial conditions of the inflow output file (inflow.csv) generated by the model. This error occurred while running a simulation case with initial stage after the initial stage of the policy horizon.
  - Corrected an error in the annual average load marginal cost report (sddpcmga.csv). The calculation of the average load marginal cost for the final year of the study considered that the study ended on the last month or week of the year and, thus, the base denominator for the calculation was greater than it should be if the final stage of the study was not the last month or week of the year.
- Corrections for coordinated studies:
  - Corrected an error in the representation of the future cost function cuts for coordinated studies. This error occurred only in cases where the maximum order of the ARP model for the last system in the policy calculation was lower than the maximum order of all considered systems.
  - Corrected an error in the connection of renewable sources to the transmission network in coordinated studies.
  - Corrected an error in the calculation of the limits of the generation reserve constraint when defined in percentage or p.u. in coordinated studies.
- Updates for studies considering circuits’ outages:
  - Corrected an error in monitoring the flow of a circuit sampled for outage. In case the sampled circuit was not selected for monitoring, the model did not consider that its flow limit was zero.

- Added two new spreadsheets with operation results for the outage state of circuits.
  - Circuits' flows.
  - DC link' flows.
- Changes in the **dimensions of version Big:**
  - Maximum number of thermal plants was increased from 500 to 700.
  - Maximum number of buses was increased from 700 to 1200.
  - Maximum number of circuits was increased from 900 to 1300.

### **Corrections and modifications in the graphical interface**

- Added the possibility to define negative values for the evaporation coefficients in the *Hydro configuration* screen.
- Added the feature to include the initial year and number of years in the chronological data tables.
- Corrected an error that occurred when the main fuel of a thermal plant was changed. All data for the new fuel (O&M cost, transportation cost, etc) was set to zero.
- Corrected an error in the system filter in the screen of *Fuel configuration*. When the filter was applied, the attributes *unit* and *price* vanished from the list.
- Corrected an error that occurred when a reservoir was associated to a hydro plant in the *Hydro configuration* screen. The value shown in the *System* field did not correspond to the system to which the reservoir belongs.
- Corrected an error while importing bus data in CSV format.
- Corrected the translation of the spreadsheets listed in the screen of *Output in worksheets* when the language was changed by the user.
- Corrected some errors in the *Renewable source configuration* screen. When the system filter was applied, the interface was incorrectly indicating that modifications have been done and, if the user opted for not saving the data, the interface presented an error.
- Corrected an error that occurred when deleting the values in the field of *Number of units* in the *Thermal modification* screen.
- Corrected an error that occurred when the interface was minimized when the opened in the *System configuration* screen.
- Corrected an error that occurred while saving reservoir operation constraints files in case of hydro plant elimination.