Wind INtegration Simulator
(WINS^{TM})

User Manual

August 2012

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1 Introduction

This manual is to introduce the web-based Graphical User Interface (GUI) for WINS. The Wind INtegration Simulator (WINS) would simulate the actual operation of power systems with the integration of volatile wind generation. The users of WINS are entities with full information of the system, such as the Independent System Operators (ISOs). The ISO has the overall information about the system and the market. In addition, generator and transmission line unavailability is considered in WINS and wind deliverability is analyzed for solutions.

WINS simulates the actual market operations which is based on the security-constrained unit commitment (SCUC) with full AC transmission and voltage constraints considered. The computational engine of WINS is written in Microsoft Visual C++, and the Graphical User Interface (GUI) is written in Microsoft Visual C# and ASP.NET. The database is based on ORACLE and can be extended to include other database formats as well. Microsoft Excel is used for the downloading reports.

WINS was first developed in 2002, when it was called POwer Market Simulator (POMS). However, numerous modifications and improvements have been introduced to the software based on its applications to various industrial projects.

2 WINS Installation

To use the web-based WINS, a user only needs to have an internet browser. The flowing discussion applies to the server side installation.

2.1 Hardware Requirements

- The Demo version of WINS needs at least 300MB of hard disk space.
- RAM: 512MB or higher
- Screen resolution: 1024×768 pixels or higher

2.2 Software Requirements

- WINS runs in Windows 2003 Server environment (32-bit or 64-bit).
- Internet Browser: Microsoft IE, Mozilla Firefox or Google Chrome.
- Microsoft Excel (version 2000 or version 2003) has to be installed.
- Microsoft .NET Framework 2.0 has to be installed.
- Oracle 11g ODAC 11.1.0.6.21 with Oracle Developer Tools (ODT) for Visual Studio has to be installed.

2.3 Install Microsoft .NET Framework 2.0

If the computer has been installed with Microsoft Visual Studio 2005, Microsoft .NET Framework 2.0 is already installed and this step can be skipped. Otherwise, search "Microsoft .NET Framework Version 2.0 Redistributable Package" on WEB and users will find "dotnetfx.exe" on microsoft.com. Download and double click it to install

Microsoft .NET Framework 2.0.

2.4 Install Oracle Data Access Components

Unzip "ODTwithODAC1110621.zip" and double click "setup.exe" to install Oracle Data Access Components. After installation, copy "sqlnet.ora" and "tnsnames.ora" files to corresponding directory. Modify the contents of "sqlnet.ora" and "tnsnames.ora", if necessary.

2.5 Install SCUC

- SCUC exe file: Create "C:\WINS\" directory and put SCUC project in it.
- Data importer: Copy "oracle_ctl.bat", " pre_load.sql", " post_load.sql" and directory "Oracle" which has a lot of "ctl" files to "C:\WINS\" directory.

2.6 Install WINS

- Use Visual Studio WebSetup project to deploy the WINS to the virtual directory to publish the website. The address of WINS is: http://216.47.134.239/WINS

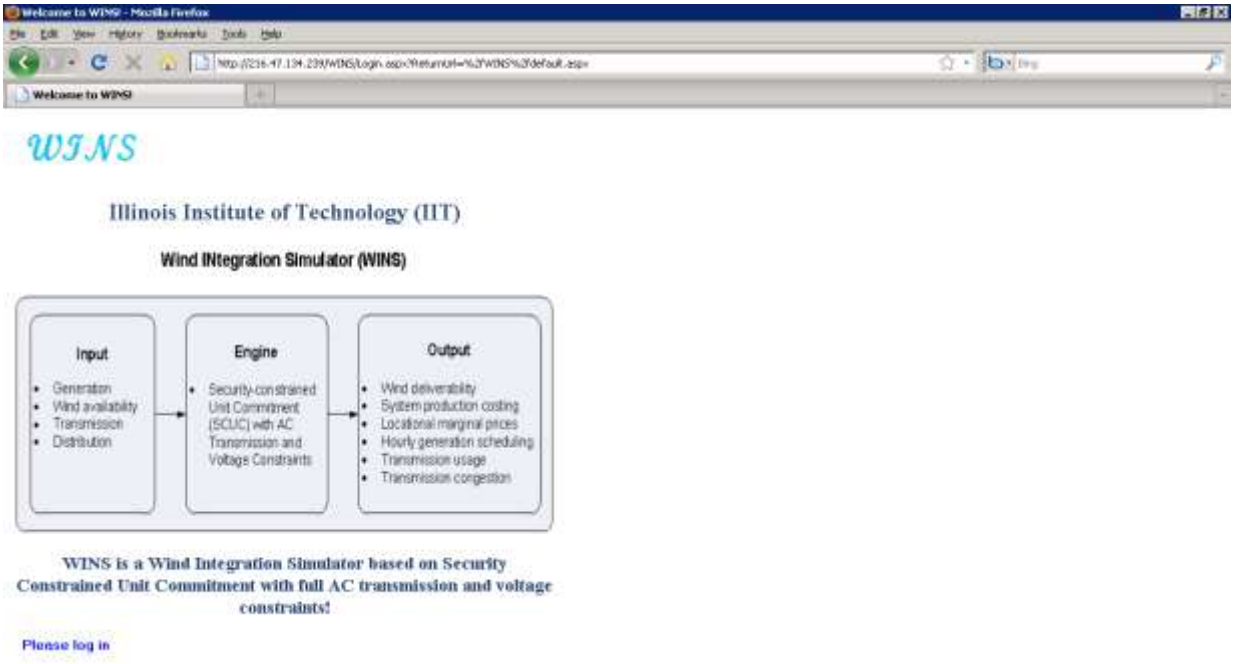
Note: Input data can be entered or modified through either web interface or database management tool. Database in Oracle can be accessed by "SQL*Plus" distributed with ODAC or "PL/SQL Developer" developed by a third company.

3 WINS Functions

Functions in WINS are presented here and various operations are explained.

3.1 Login

Enter "http://216.47.134.239/WINS" in the URL address bar of an internet browser to access WINS. The Login page displays as follows:



By clicking the Please log in Button, a user can go to the case management page with the following log information:

"User Name": doetest

"Password": doetest

3.2 Manage Case

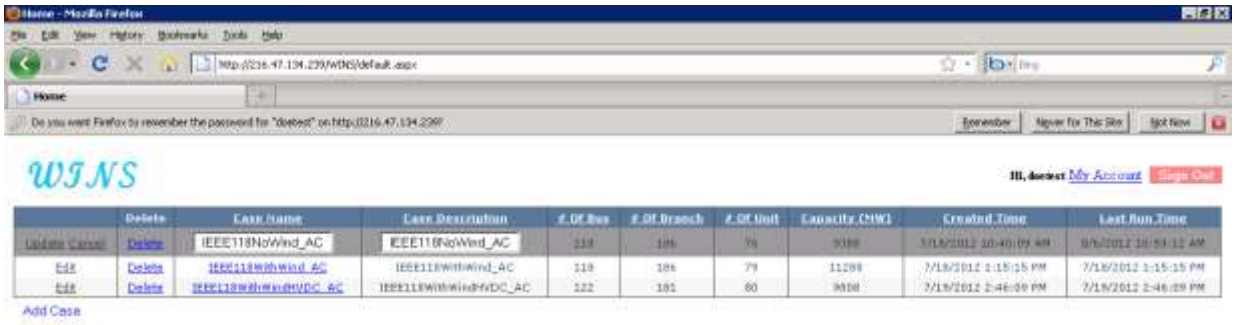
The case management page shown above lists all the cases which can be accessed by the account "doetest". A user can modify the basic case information or delete a case by clicking the "Edit" or "Delete" button in front of each case. By clicking the "Add Case" button, a user can build a new case. By clicking the "Case Name" of each case, a user can choose one case and begin to study the case.

3.2.1 Modify Case

By clicking the "Edit" button of a case, the following two columns of the case could be modified:

"Case Name" ---- name of the selected case;

"Case Description" ---- detailed comments of the selected case;



By clicking the "Update" or "Cancel" button, a user can choose whether or not to accept the modification done before.

The other columns shown below could not be modified in the case management stage, which reflects the actual information during the case study stage.

"Created Time" ---- date when the selected case was created;

"Last Run Time" ---- date when the selected case was executed;

"# of Buses" ---- the total number of buses of the system of the selected case;

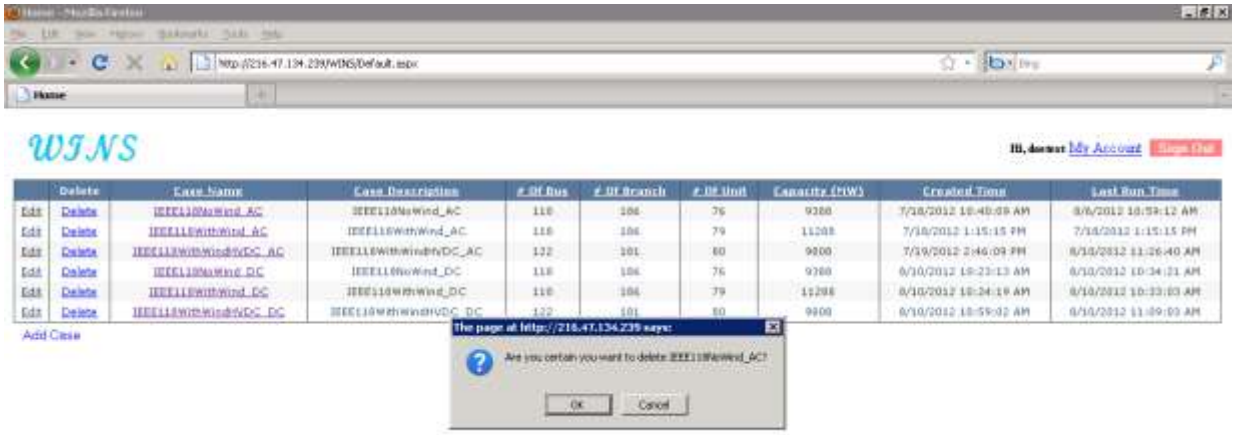
"# of Branches" ---- the total number of branches of the system of the selected case;

"# of Units" ---- the total number of generation units of the system of the selected case;

"Capacity (MW)" ---- the total installed capacity of the system of the selected case;

3.2.2 Delete Case

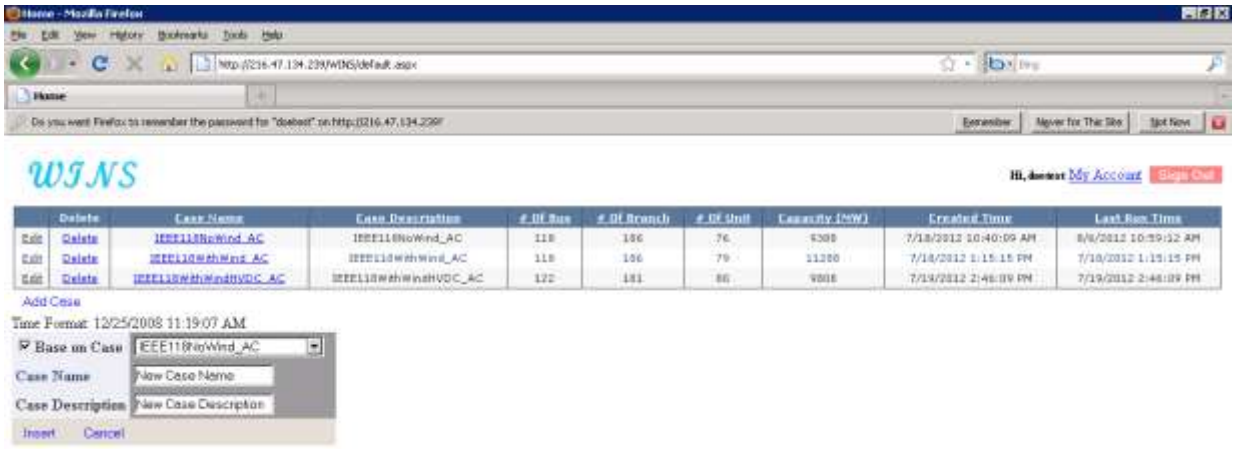
By clicking the "Delete" button in front of a case, a dialog box will pop-up to ask whether a user really wants to delete the selected case as shown below.



A user can click the "OK" button to commit the delete operation, or click the "Cancel" button to cancel the delete operation.

3.2.3 Add Case

Click the "Add Case" button, and input the Case Name and Case Description for the new case. A user can also choose to build a new base based on an existing case by checking the "Base on Case" checkbox, then click the "Insert" button to add the new case to the database. A user can also click the "Cancel" button to discard the new case.

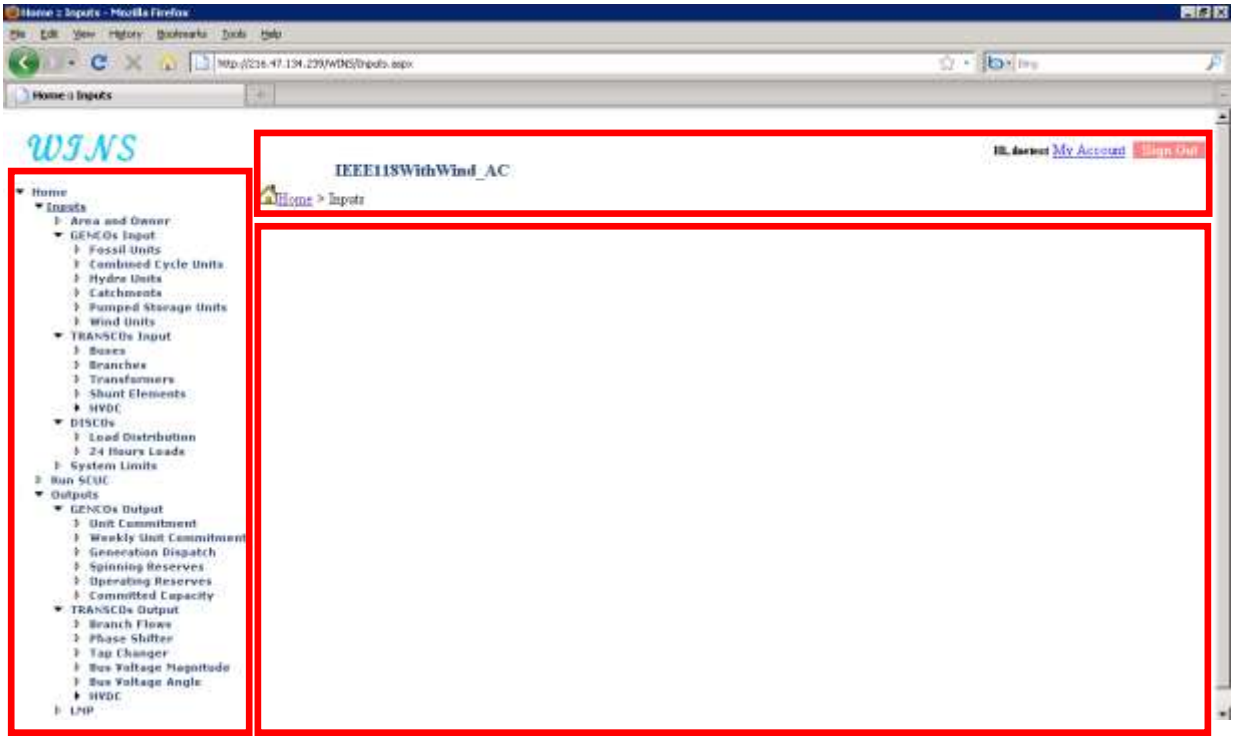


3.2.4 Choose Case

A user can choose a case to study by clicking the "Case Name" of the case, and the detailed case information will be displayed in the corresponding pages.

3.3 Site Map of WINS

The Site Map of WINS includes three areas: TreeView, Basic links, and Main content area. By clicking the "My Account" button, a user can reset the password for the account. The "Sign Out" button is placed on the right top of the site map for a user to log out of the WINS. Below the selected case name shows the site map path of current page, which provides a straightforward guidance for the user to understand the logic relationship of case information.


WINS
My Account
Sign Out
IEEE118WithWind_AC
Home > Inputs
Home
Inputs
Area and Owner
GENCOs Input
Fossil Units
Combined Cycle Units
Hydro Units
Catchments
Pumped Storage Units
Wind Units
TRANSCOs Input
Buses
Branches
Transformers
Shunt Elements
HVDC
DISCOs
Load Distribution
24 Hours Loads
System Limits
Run SCUC
Outputs
GENCOs Output
Unit Commitment
Weekly Unit Commitment
Generation Dispatch
Spinning Reserves
Operating Reserves
Committed Capacity
TRANSCOs Output
Branch Flows
Phase Shifter
Tap Changer
Bus Voltage Magnitude
Bus Voltage Angle
HVDC
LMP

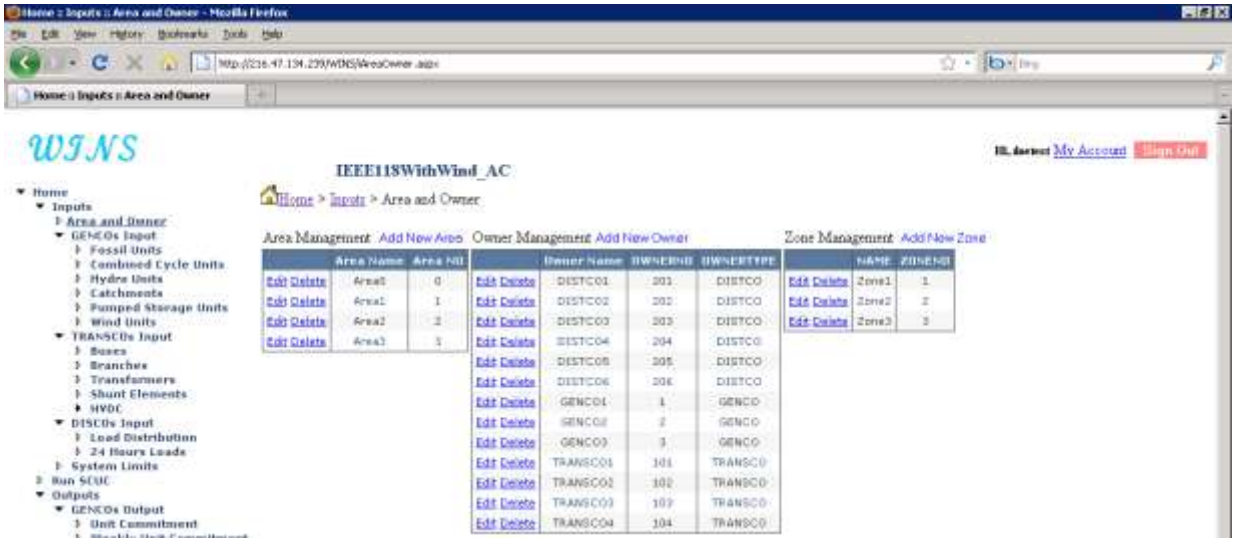
3.4 Inputs

Through the TreeView under the "Inputs" node, a user can view and modify all the following input data of WINS.

- Area and Owner: Area, Owner and Zone information of selected case.
- GENCOs, TRANSCOs, DISCOs Input: information related to market participants (GENCOs, TRANSCOs, and DISTCOs)
- System Limits: hourly system load, loss and spinning/operating reserve

3.4.1 Inputs – Area and Owner

Go to *Home->Inputs ->Area and Owner* to view the list of area, zone, and market participant entities of the system.



The "Add New Area" button allows a user to add more Areas to the current system. The "Edit" and "Delete" buttons in front of each existing area allow a user to edit or delete the chosen area information. The "Edit" operation allows a user to edit the name of the area, while the "Delete" operation will delete the area and all the components such as units, buses, and branches corresponding to the area in the system.

The "Add New Owner" button allows a user to add more Owners to the current system. The "Edit" and "Delete" buttons in front of each existing owner allow a user to edit or delete the chosen owner information. The "Edit" operation allows a user to edit the name, and choose the owner type (GENCO, TRANSCO or DISTCO) of the owner, while the "Delete" operation will delete the owner and all the components such as units, buses, and branches corresponding to the owner in the system.

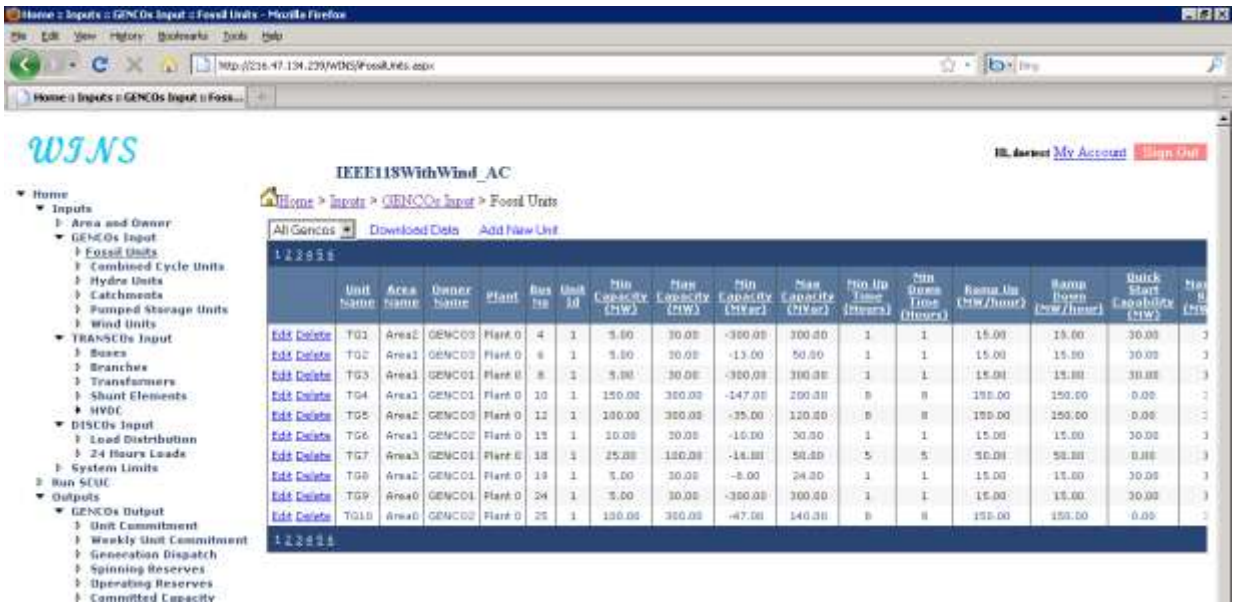
The "Add New Zone" button allows a user to add more Zones to the current system. The "Edit" and "Delete" buttons in front of each existing zone record allow a user to edit or delete the chosen zone information. The "Edit" operation allows a user to edit the name of the zone, while the "Delete" operation will delete the zone and all the components such as units, buses, and branches corresponding to the zone from the system.

3.4.2 Inputs – GENCOs Input

Go to *Home->Inputs ->GENCOs Input* to view the overall information of the GENCOs. Five major categories of units are available: fossil, combined cycle, hydro, pumped-storage and wind units.

This page displays the list of GENCOs, and the statistic information about the numbers of different type of units belonging to each GENCO. The "Download Data" button allows users to download the GENCOs related data listed in the table.

Go to *Home->Inputs ->GENCOs Input->Fossil Units* to view the detailed information on each fossil unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the fossil units table, a user can choose to display the fossil units of individual GENCOs or all the fossil units. The "Download Data" button allows a user to download the detailed fossil units related data listed in the table. The "Add New Unit" button allows a user to add more fossil units to the current system. The "Edit" and "Delete" buttons in front of each existing fossil unit record allow a user to edit or delete the chosen unit information. The "Edit" operation allows a user to edit the detailed information of the selected unit, while the "Delete" operation will delete the unit from the system.

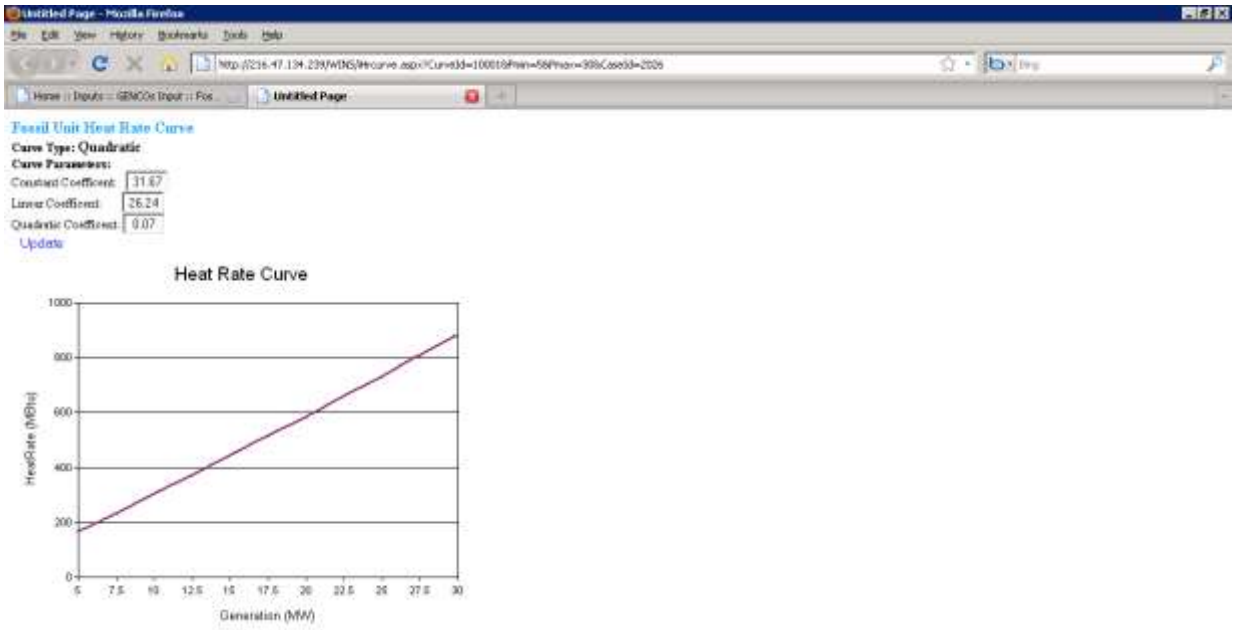


The description of individual columns of the fossil unit table is as follows:

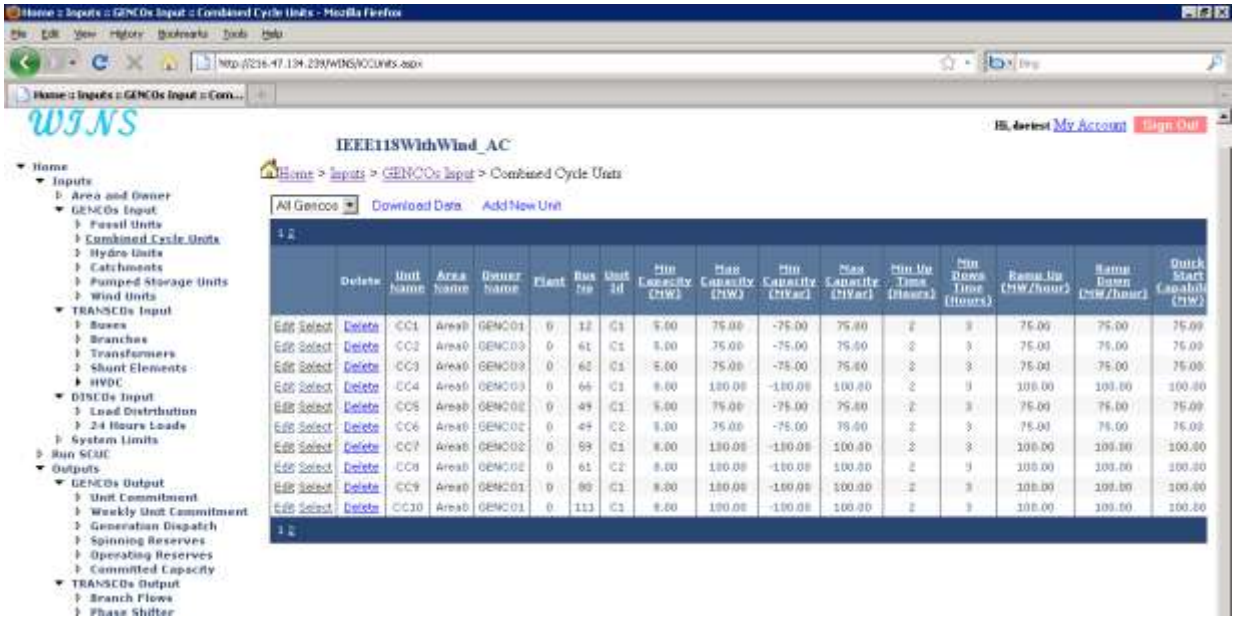
Unit Name	unit name (string, no space)
Area Name	area name (string, no space)
Owner Name	owner name (string, no space)
Plant	plant name (string, no space)
Bus No	bus number where the unit is located (long integer)
Unit ID	unit ID (string, no space)
Min Capacity	minimum real power capacity (MW) (double)
Max Capacity	maximum real power capacity (MW) (double)
Min Capacity	minimum reactive power capacity (MVAR) (double)
Max Capacity	maximum reactive power capacity (MVAR) (double)
Min Up Time	minimum on-operation time (hour, >0) (integer)
Min Down Time	minimum off-operation time (hour, >0) (integer)
Ramp Up	ramping up rate (MW/hour). Less than or equal to MSR (double)
Ramp Down	ramping down rate (MW/hour). Less than or equal to MSR (double)
Quick Start Capability	quick start capability (MW) (double)
Max Sust. Ramp	maximum sustained ramping rate (MW/min) (double)
Number of Minutes	number of minutes for MSR (Minutes) (integer)
Initial Hours	initial operating time (hour, >0 ON, <0 OFF) (integer)
Initial MW	initial operating MW (double)
Fuel Type	fuel type (string)
Fuel Price	fuel price ($/MBtu) (double)
MBtu/MW Curve	heat rate curve index (long integer)
Startup Fuel Type	startup fuel type (string)

Startup Fuel Price	startup fuel price ($/MBtu) (double)
Startup Fuel Curve	startup fuel curve index (MBtu consumption as a function of startup hours) (long integer)
Shutdown Fuel Type	shutdown fuel type (string, take values defined in Sheet "Global Definition")
Shutdown Fuel Price	shut down fuel price ($/MBtu) (double)
SO2 Curve	SO2 emission curve index (long integer)
NOx Curve	NOx emission curve index (long integer)
Ramp Up Curve	ramp up curve index (long integer)
Ramp Up Time	ramp up time (Minutes) (integer)
Ramp Down Curve	ramp up curve index (long integer)
Ramp Down Time	ramp down time (Minutes) (integer)

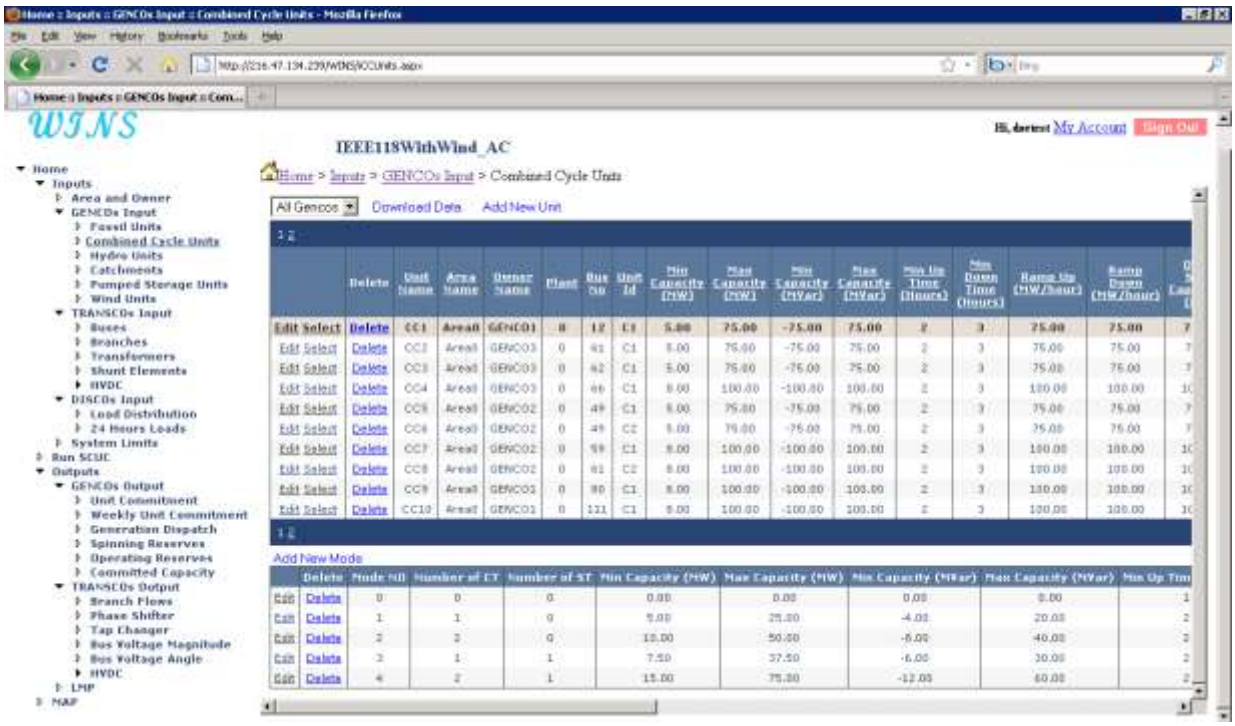
When a user clicks any "curve" data hyperlink in the table, a new page will pop up to show the detailed curve information. For example, by clicking the "MBtu/MW Curve" data "10001", the following new page shows the heat rate curve of Unit "TG1". A user can modify the parameters for the heat rate curve by changing the data in the textboxes and clicking the "Update" button to commit the changes.



Go to *Home->Inputs ->GENCOs Input->Combined Cycle Units* to view the detailed information on each combined cycle unit in the system. Besides, by selecting the different items in the dropdown list on the top left of the combined cycle units table, a user can choose to display the units of individual GENCOs units or all the units. The "Download Data" button allows a user to download the detailed combined cycle units related data listed in the table. The "Add New Unit" button allows a user to add more combined cycle units to the current system. The "Edit" and "Delete" buttons in front of each existing combined cycle unit record allow a user to edit or delete the chosen unit information. The "Edit" operation allows a user to edit the detailed information of the selected unit, while the "Delete" operation will delete the unit from the system.



Different from other units, there is a "Select" button in front of each existing combined cycle unit record. When a user clicks to choose different combined cycle unit, all its modes will be displayed correspondingly in the mode table below the unit table on the same page. For example, by clicking the "Select" button of unit "CC1", the following page shows all the modes that belong to "CC1".



The "Add New Mode" button allows a user to add more modes to the selected combined cycle unit. The "Edit" and "Delete" buttons in front of each existing mode record allow a user to edit or delete the chosen mode of the selected unit. The "Edit" operation allows a user to edit the detailed information of the mode, while the "Delete" operation will delete the mode from the unit.

The description of individual columns of the combined cycle unit table is as follows:

Unit Name	unit name (string, no space)
Area Name	area name (string, no space)
Owner Name	owner name (string, no space)
Plant	plant name (string, no space)
Bus No	bus number where the unit is located (long integer)
Unit ID	unit ID (string, no space)
Min Capacity	minimum real power capacity (MW) (double)
Max Capacity	maximum real power capacity (MW) (double)
Min Capacity	minimum reactive power capacity (MVAR) (double)
Max Capacity	maximum reactive power capacity (MVAR) (double)
Min Up Time	minimum on-operation time (hour, >0) (integer)
Min Down Time	minimum off-operation time (hour, >0) (integer)
Ramp Up	ramping up rate (MW/hour). Less than or equal to MSR (double)

Ramp Down	ramping down rate (MW/hour). Less than or equal to MSR (double)
Quick Start Capability	quick start capability (MW) (double)
Max Sust. Ramp	maximum sustained ramping rate (MW/min) (double)
Number of Minutes	number of minutes for MSR (Minutes) (integer)
Initial Mode	initial operating mode (0 stands for OFF)
Initial Hours	initial operating time (hour, >0 ON, <0 OFF) (integer)
Initial MW	initial operating MW (double)
Number of Mode	number of modes (integer)
Number of CT	number of CT (integer)
Number of ST	number of ST (integer)
Fuel Type	fuel type (string)
Fuel Price	fuel price ($/MBtu) (double)
MBtu/MW Curve	heat rate curve index (long integer)

CT Information:

CT Startup Fuel Type	startup fuel type (string)
CT Startup Fuel Price	startup fuel price ($/MBtu) (double)
CT Startup Fuel Curve	startup fuel curve index (MBtu consumption as a function of startup hours) (long integer)
CT Shutdown Fuel Type	shutdown fuel type (string, take values defined in Sheet "Global Definition")
CT Shutdown Fuel Price	shut down fuel price ($/MBtu) (double)

ST Information:

ST Startup Fuel Type	ST startup fuel type (string)
ST Startup Fuel Price	ST startup fuel price ($/MBtu) (double)
ST Startup Fuel Curve	ST startup fuel curve index (MBtu as a function of startup hours) (long integer)
ST Shutdown Fuel Type	ST shutdown fuel type (string)
ST Shutdown Fuel Price	ST shutdown fuel price ($/MBtu) (double)

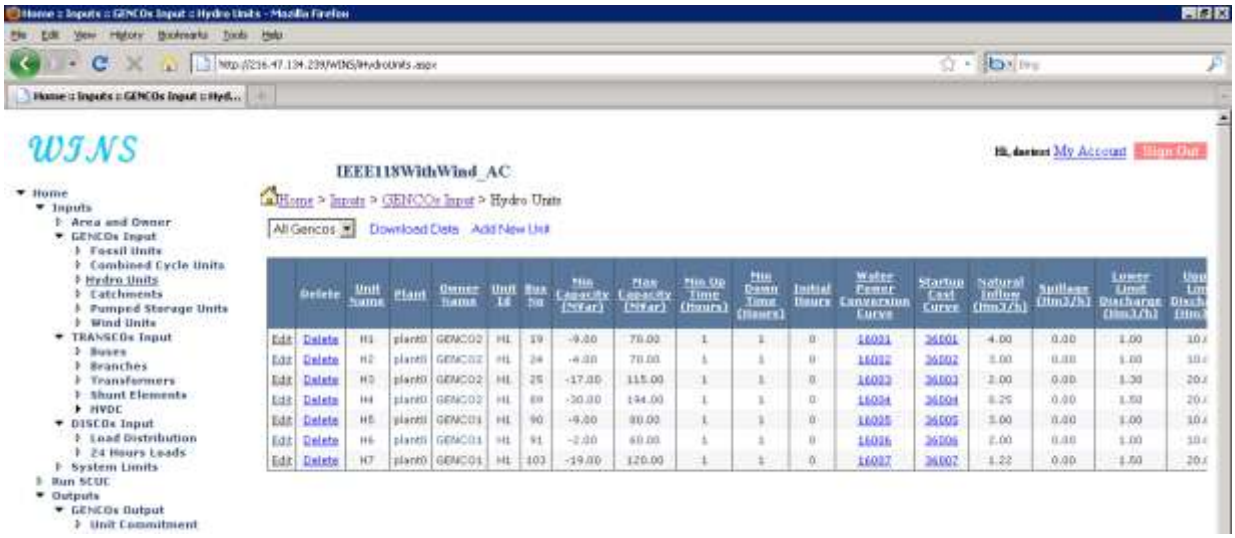
The description of individual columns of mode table is as follows:

Mode No	mode number (integer, positive)
Number of CT	number of CTs in the mode (integer, non-negative)
Number of ST	number of STs in the mode (integer, non-negative)
Min Capacity	minimum real power capacity of the mode (MW) (double)
Max Capacity	maximum real power capacity of the mode (MW) (double)
Min Capacity	minimum reactive power capacity of the mode (MVAR) (double)
Max Capacity	maximum reactive power capacity of the mode (MVAR)

	(double)
Ramp Up	ramping up rate of the mode (MW/hour). Less than or equal to MSR (double)
Ramp Down	ramping down rate of the mode (MW/hour). Less than or equal to MSR (double)
MBtu/MW Curve	heat rate curve index of the mode (long integer)
Nox Curve	NOx emission curve of the mode (long integer)

When a user clicks any "curve" data hyperlink in the table, a new page will pop up to show the detailed curve information. The curve types of combined cycle units are very similar to those of fossil units.

Go to *Home->Inputs ->GENCOs Input->Hydro Units* to view the detailed information on each hydro unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the hydro units table, a user can choose to display the units of individual GENCOs or all the hydro units. The "Download Data" button allows a user to download the detailed hydro units related data listed in the table. The "Add New Unit" button allows a user to add more hydro units to the current system. The "Edit" and "Delete" buttons in front of each existing hydro unit record allow a user to edit or delete the chosen unit information. The "Edit" operation allows a user to edit the detailed information of the selected unit, while the "Delete" operation will delete the unit from the system.

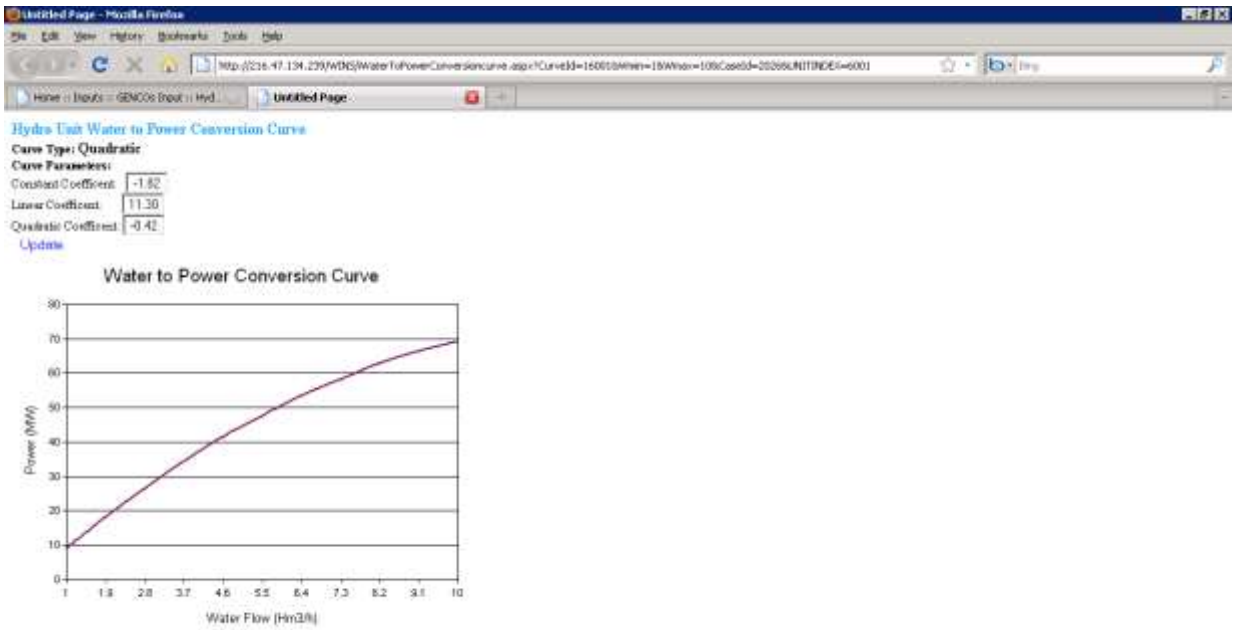


The description of individual columns of the hydro unit table is as follows:

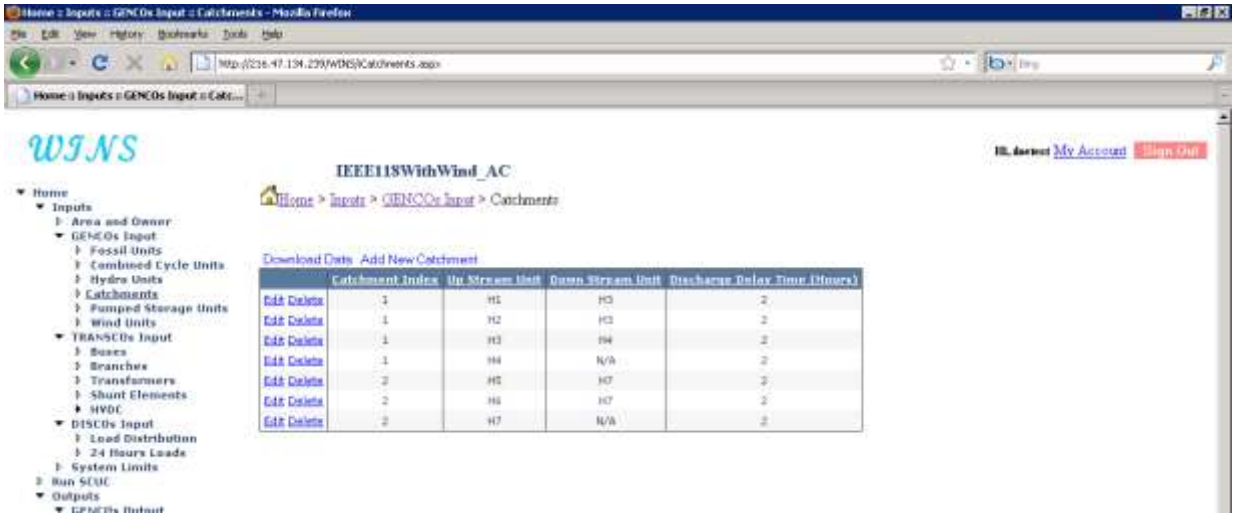
Unit Name	unit name (string, no space)
Plant	plant name (string, no space)
Owner Name	owner name (string, no space)
Unit ID	unit ID (string, no space)
Bus No	bus number where the unit is located (long integer)
Min Capacity	minimum real power capacity (MW) (double)
Max Capacity	maximum real power capacity (MW) (double)
Min Capacity	minimum reactive power capacity (MVAR) (double)
Max Capacity	maximum reactive power capacity (MVAR) (double)
Initial Hours	initial operating time (hour, >0 ON, <0 OFF) (integer)
Water Power Conversion Curve	water to power conversion curve index (long integer)
Startup Cost Curve	start up cost curve index (long integer)

Natural Inflow	natural inflow (Hm3/h) (double)
Spillage	maximum spillage (Hm3/h) (double)
Lower Limit Discharge	lower limit of water discharge (Hm3/h) (double)
Upper Limit Discharge	upper limit of water discharge (Hm3/h) (double)
Initial Reservoir Volume	initial reservoir volume level (Hm3) (double)
Terminal Reservoir Volume	terminal reservoir volume level (Hm3) (double)
Lower Limit Reservoir Volume	lower limit of reservoir volume (Hm3) (double)
Upper Limit Reservoir Volume	upper limit of reservoir volume (Hm3) (double)

When a user clicks any "curve" data hyperlink in the table, a new page will pop up to show the detailed curve information. There is a unique curve of hydro unit: Water Power Conversion Curve, which is a quadratic function showing the relationship between the natural water flow and the power generation of the hydro unit. For example, by clicking the hyperlink "16001", the following new page shows the water power conversion curve of Unit "H1". User can modify the parameters for the curve by changing the data in the textboxes and clicking the "Update" button to commit changes.



Go to *Home->Inputs ->GENCOs Input->Catchment* to view the detailed information on each hydro catchment of the system. The "Download Data" button allows a user to download the detailed catchment related data listed in the table. The "Add New Catchment" button allows a user to add more hydro catchment to the current system, which requires at least two different hydro units existing in the current system. The "Edit" and "Delete" buttons in front of each existing hydro catchment record allow a user to edit or delete the chosen catchment information. The "Edit" operation allows a user to edit the up stream and down stream hydro units of the selected catchment, while the "Delete" operation will delete the hydro catchment from the system.



The description of individual columns of the catchment table is as follows:

Catchment Index	hydro catchment index (integer)
Up Stream Unit	up stream hydro unit name of catchment (string, no space)
Down Stream Unit	down stream hydro unit name of catchment (string, no space)
Discharge Delay Time	discharge delay time from up to down stream unit (Hour) (integer)

Go to *Home->Inputs ->GENCOs Input->Pumped Storage Units* to view the detailed information on each pumped storage unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the pumped storage units table, a user can choose to display each individual GENCO's units list or all the pumped storage units. The "Download Data" button allows a user to download the detailed pumped storage units related data listed in the table. The "Add New Unit" button allows a user to add more pumped storage units to the current system. The "Edit" and "Delete" buttons in front of each existing pumped storage unit record allow a user to edit or delete the chosen unit information. The "Edit" operation allows a user to edit the detailed information of the selected unit, while the "Delete" operation will delete the unit from the system.

The description of individual columns of the pumped storage unit table is as follows:

Unit Name	unit name (string, no space)
Plant	plant name (string, no space)
Owner Name	owner name (string, no space)
Unit ID	unit ID (string, no space)
Bus No	bus number where the unit is located (long integer)
Min Capacity	minimum real power capacity (MW) (double)
Max Capacity	maximum real power capacity (MW) (double)
Min Capacity	minimum reactive power capacity (MVAR) (double)
Max Capacity	maximum reactive power capacity (MVAR) (double)
Min Up Time	minimum on-operation time (hour, >0) (integer)
Min Down Time	minimum off-operation time (hour, >0) (integer)
Initial Loading Status	initial operating state (0: idle, 1: generating, -1: pumping) (integer)

Initial Hours	initial operating time (hours, nonnegative) (integer)
Lower Limit Generation Discharge	generation discharge lower limit (Hm3/h) (double)
Upper Limit Generation Discharge	generation discharge upper limit (Hm3/h) (double)
Lower Limit Pumping Discharge	pumping discharge lower limit (Hm3/h) (double)
Upper Limit Pumping Discharge	pumping discharge upper limit (Hm3/h) (double)
Initial Upstream Reservoir Volume	initial upstream reservoir volume level (Hm3) (double)
Terminal Upstream Reservoir Volume	terminal upstream reservoir volume level (Hm3) (double)
Lower Limit Upstream Reservoir Volume	lower limit of upstream reservoir volume (Hm3) (double)
Upper Limit Upstream Reservoir Volume	upper limit of upstream reservoir volume (Hm3) (double)
Initial Downstream Reservoir Volume	initial downstream reservoir volume level (Hm3) (double)
Terminal Downstream Reservoir Volume	terminal downstream reservoir volume level (Hm3) (double)
Lower Limit Downstream Reservoir Volume	lower limit of downstream reservoir volume (Hm3) (double)
Upper Limit Downstream Reservoir Volume	upper limit of downstream reservoir volume (Hm3) (double)
Water Power Conversion Curve Generation	water to power conversion curve index (generation mode) (long integer)
Water Power Conversion Curve Pumping	water to power conversion curve index (pumping mode) (long integer)
Generation Min ON	minimum operating time in generation mode (integer, positive)
Pumping Min On	minimum operating time in pumping mode (integer, positive)

When a user clicks any "curve" data hyperlink in the table, a new page will pop up to show the detailed curve information. The curve types of pumped storage units for the water power conversion curves in generation and pumping modes are very similar to those hydro units' water power conversion curves.

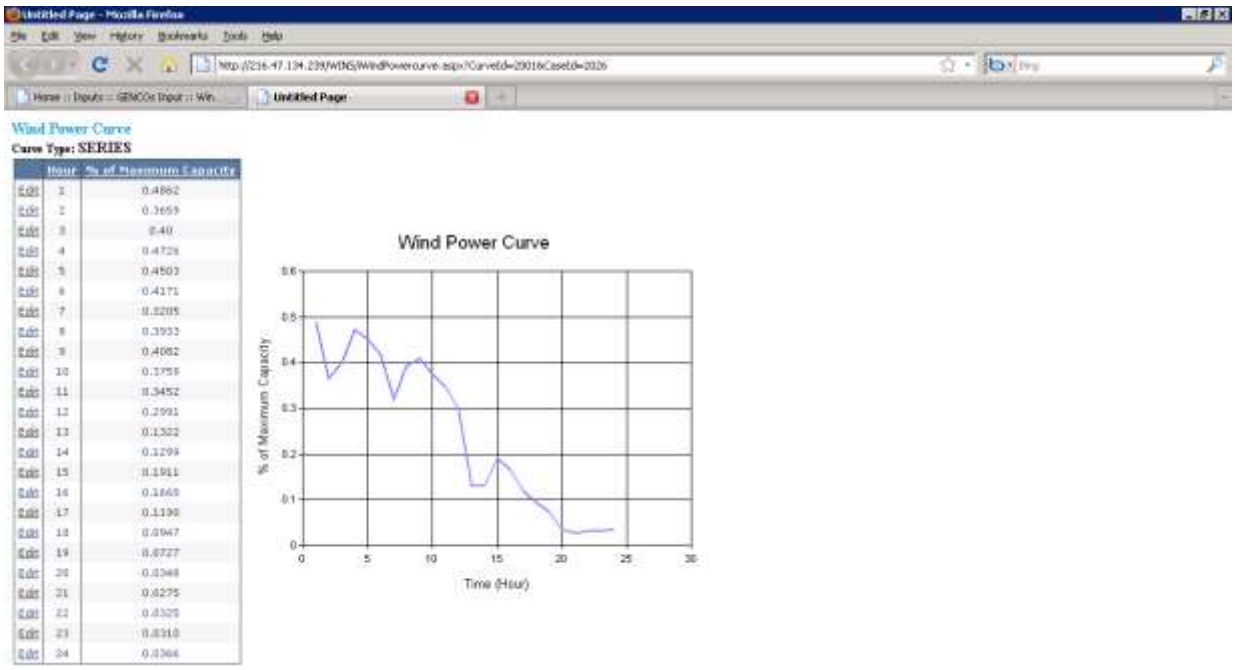
Go to *Home->Inputs ->GENCOs Input->Wind Units* to view the detailed information on each wind unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the wind units table, a user can choose to display each individual GENCO's units list or all the wind units. The "Download Data" button allows a user to download the detailed wind units related data listed in the table. The "Add New Unit" button allows a user to add more wind units to the current system. The "Edit" and "Delete" buttons in front of each existing wind unit record allow a user to edit or delete the chosen unit information. The "Edit" operation allows a user to edit the detailed information of the selected unit, while the "Delete" operation will delete the unit from the system.

Description of individual columns of the wind unit table is as follows:

Unit Name	unit name (string, no space)
Plant	plant name (string, no space)
Owner Name	owner name (string, no space)
Unit ID	unit ID (string, no space)
Bus No	bus number where the unit is located (long integer)
Min Capacity	minimum real power capacity (MW) (double)
Max Capacity	maximum real power capacity (MW) (double)
Min Capacity	minimum reactive power capacity (MVAR) (double)
Max Capacity	maximum reactive power capacity (MVAR) (double)
Wind Power Curve	curve index for the time series of wind power

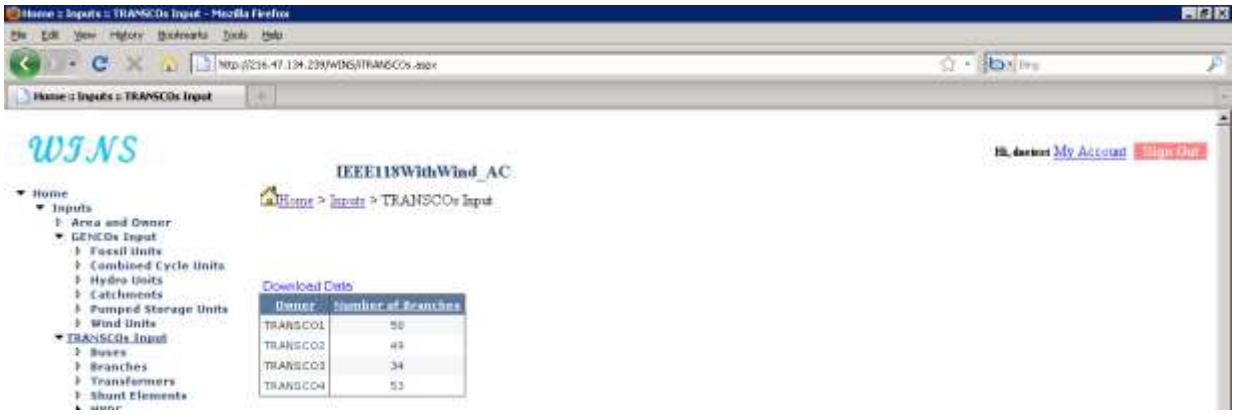
There is a unique curve of wind unit: Wind Power Curve, which is a series of numbers showing the time series of the wind unit power generation percentage of maximum unit capacity. For

example, by clicking the hyperlink "2001", the following new page shows the wind power curve of Unit "W1". User can modify the series data for the curve by clicking the "Edit" button in front of each data record in the table and clicking the "Update" button to commit the changes.

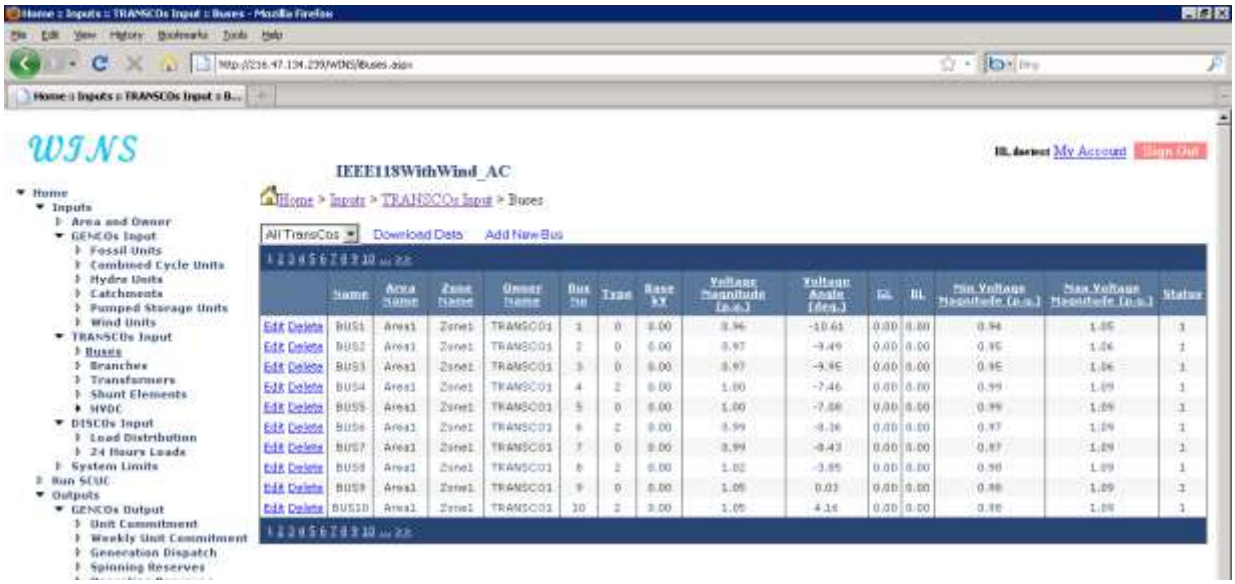


3.4.3 Inputs – TRANSCOs Input

Go to *Home->Inputs ->TRANSCOs Input* to view the overall information of the TRANSCOs. This page displays the list of TRANSCOs, and the statistic information about the numbers of branches that belong to each TRANSCO. The "Download Data" buttons allow a user to download the TANSCOs related data listed in the table.



Go to *Home->Inputs ->TRANSCOs Input->Buses* to view the detailed information on each bus of the system. Besides, by selecting the different items in the dropdown list on the top left of the buses table, a user can choose to display buses of individual TRANSCOs or all the buses. The "Download Data" button allows a user to download the detailed bus related data listed in the table. The "Add New Bus" button allows a user to add more buses to the current system. The "Edit" and "Delete" buttons in front of each existing bus record allow a user to edit or delete the chosen bus information. The "Edit" operation allows a user to edit the detailed information of the selected bus, while the "Delete" operation will delete the bus from the system.

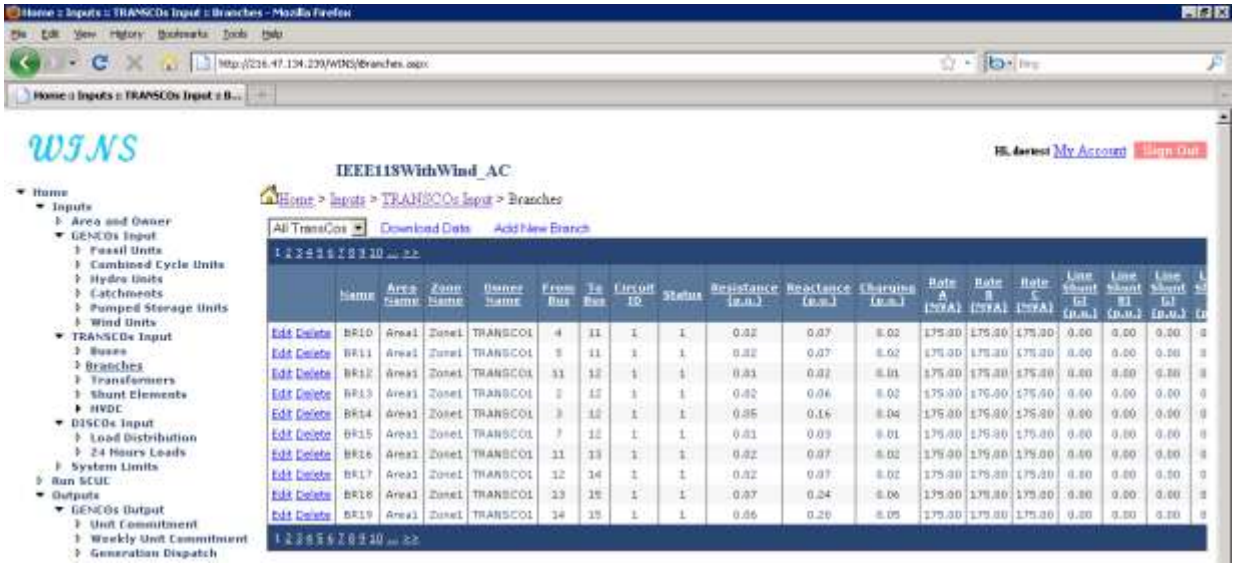


The description of individual columns of the bus table is as follows:

Name	bus name (character, maximum length 20, no space)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
Bus No	bus number (long integer)
Type	bus type (integer, only take the following numbers) 0: unregulated (load, PQ) 2: hold voltage within VAR limits (gen, PV) 3: hold voltage and angle (swing, V-Theta) 4: isolated
BaseKV	bus base voltage (kV) (double, non-negative)

Voltage Magnitude	bus voltage magnitude (p.u.) (double, non-negative)
Voltage Angle	bus voltage angle (degree) (double)
GL	shunt conductance (p.u.) (double)
BL	shunt susceptance (p.u.) (double)
Min Voltage Magnitude	minimum bus voltage magnitude (p.u.) (double, non-negative)
Max Voltage Magnitude	maximum bus voltage magnitude (p.u.) (double, non-negative)
Status	bus status (integer: 0 or 1)

Go to *Home->Inputs ->TRANSCOs Input->Branches* to view the detailed information on each branch of the system. Besides, by selecting the different items in the dropdown list on the top left of the branches table, a user can choose to display the branches of individual TRANSCOs or all the branches. The "Download Data" button allows a user to download the detailed branch related data listed in the table. The "Add New Branch" button allows a user to add more branches to the current system. The "Edit" and "Delete" buttons in front of each existing branch record allow a user to edit or delete the chosen branch information. The "Edit" operation allows a user to edit the detailed information of the selected branch, while the "Delete" operation will delete the branch from the system.

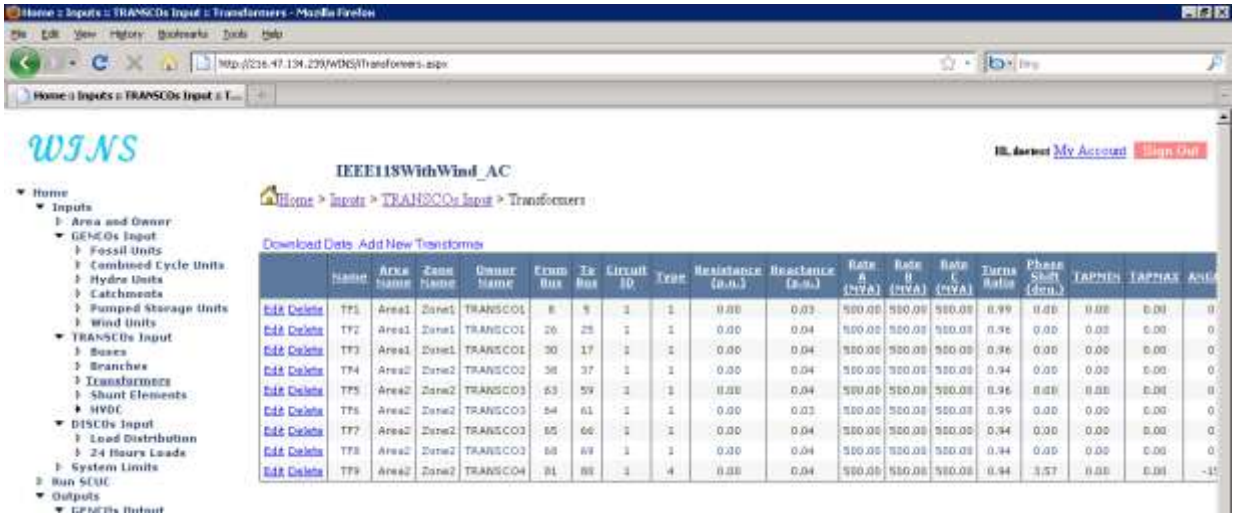


The description of individual columns of the branch table is as follows:

Name	branch name (character, maximum length 20, no space)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
From Bus (I)	from bus number (long integer)
To Bus (J)	to bus number (long integer)
Circuit ID (CID)	circuit ID (character, maximum length 2)
Status	branch status (integer: 0 or 1)
Resistance (R)	resistance (DEAFULT: 0; p.u.) (double)
Reactance (X)	reactance (DEAFULT: must input; p.u.) (double)
Charging (B)	total branch charging (DEAFULT: 0; p.u.) (double)

Rate A	long term rate, flow limit A (default: 0; MVA) (double)
Rate B	short term rate, flow limit B (default: 0; MVA) (double)
Rate C	emergency rate, flow limit C (default: 0; MVA) (double)
GI	line shunt conductance at from bus side (default: 0; p.u.) (double)
BI	line shunt susceptance at from bus side (default: 0; p.u.) (double)
GJ	line shunt conductance at to bus side (default: 0; p.u.) (double)
BJ	line shunt susceptance at to bus side (default: 0; p.u.) (double)
Length	branch length (default: 0) (double)

Go to *Home->Inputs ->TRANSCOs Input->Transformers* to view the detailed information on each transformer of the system. Besides, by selecting the different items in the dropdown list on the top left of the transformers table, a user can choose to display each individual TRANSCO's transformer list or all the transformers. The "Download Data" button allows a user to download the detailed transformer related data listed in the table. The "Add New Transformer" button allows a user to add more transformers to the current system. The "Edit" and "Delete" buttons in front of each existing transformer record allow a user to edit or delete the chosen transformer information. The "Edit" operation allows a user to edit the detailed information of the selected transformer, while the "Delete" operation will delete the transformer from the system.

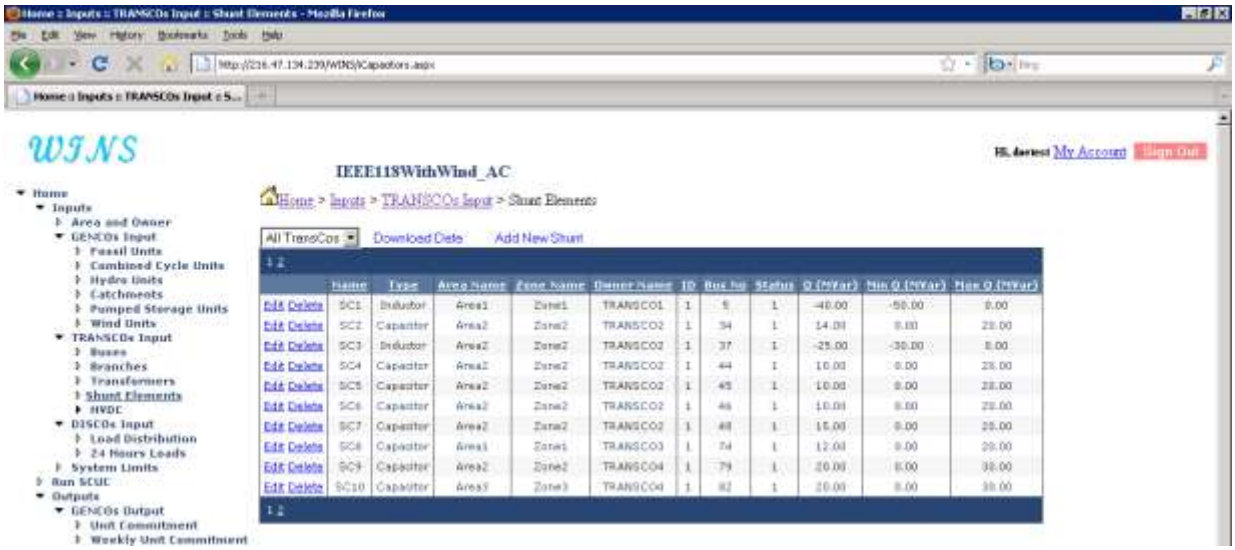


The description of individual columns of the transformer table is as follows:

Name	transformer name (character, maximum length 20, no space)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
From Bus (I)	from bus number (long integer)
To Bus (J)	to bus number (long integer)
Circuit ID (CID)	circuit ID (character, maximum length 2)
Type	transformer type (integer: 1: Tap changer, 4: Phase shifter)
Resistance (R)	resistance (DEAFULT: 0; p.u.) (double)
Reactance (X)	reactance (DEAFULT: must input; p.u.) (double)
Charging (B)	total branch charging (DEAFULT: 0; p.u.) (double)
Rate A	long term rate, flow limit A (default: 0; MVA) (double)

Rate B	short term rate, flow limit B (default: 0; MVA) (double)
Rate C	emergency rate, flow limit C (default: 0; MVA) (double)
Turns Ratio	fixed tap (default: 1; p.u.) (double)
Phase Shift	fixed phase shifter angle (default: 0; degree) (double)
TAPMIN	minimum tap change (double)
TAPMAX	maximum tap change (double)
ANGLEMIN	minimum phase shifter angle (double)
ANGLEMAX	maximum phase shifter angle (double)

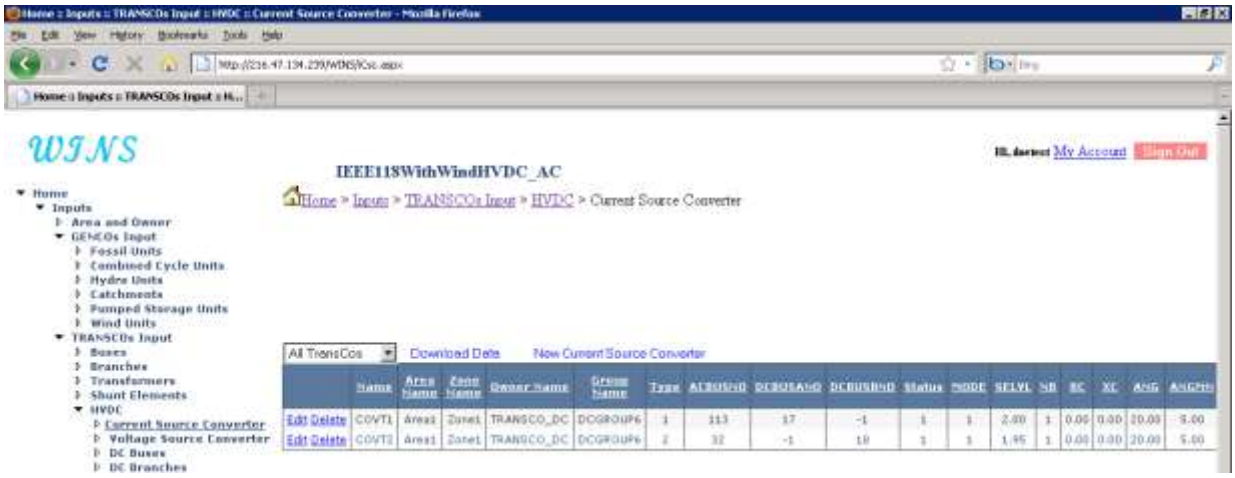
Go to *Home->Inputs ->TRANSCOs Input->Shunt Elements* to view the detailed information on each shunt element of the system. Besides, by selecting the different items in the dropdown list on the top left of the shunt elements table, a user can choose to display the shunt elements of individual TRANSCOs or all the shunt elements. The "Download Data" button allows a user to download the detailed shunts related data listed in the table. The "Add New Shunt" button allows a user to add more shunts to the current system. The "Edit" and "Delete" buttons in front of each existing shunt element record allow a user to edit or delete the chosen shunt information. The "Edit" operation allows a user to edit the detailed information of the selected shunt, while the "Delete" operation will delete the shunt from the system.



The description of individual columns of the shunt elements table is as follows:

Name	shunt element name (character, maximum length 20, no space)
Type	transformer type (string: Capacitor or Inductor)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
ID	shunt element ID (character, maximum length 2)
BusNo	shunt element bus number (long integer)
Status	shunt element status (integer: 0 or 1)
Q	initial shunt capacitance (default: 0; MVAR) (double)
Min Q	minimum shunt capacitance (default: 0; MVAR) (double)
Max Q	maximum shunt capacitance (default: 0; MVAR) (double)

Go to *Home->Inputs->TRANSCOs Input->HVDC->Current Source Converter* to view the detailed information on each current source converter (CSC) of the HVDC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC table, a user can choose to display the CSCs of individual TRANSCOs or all the CSCs. The "Download Data" button allows a user to download the detailed CSC related data listed in the table. The "New Current Source Converter" button allows a user to add more CSCs to the current system. The "Edit" and "Delete" buttons in front of each existing CSC record allow a user to edit or delete the chosen CSC information. The "Edit" operation allows a user to edit the detailed information of the selected CSC, while the "Delete" operation will delete the CSC from the system.

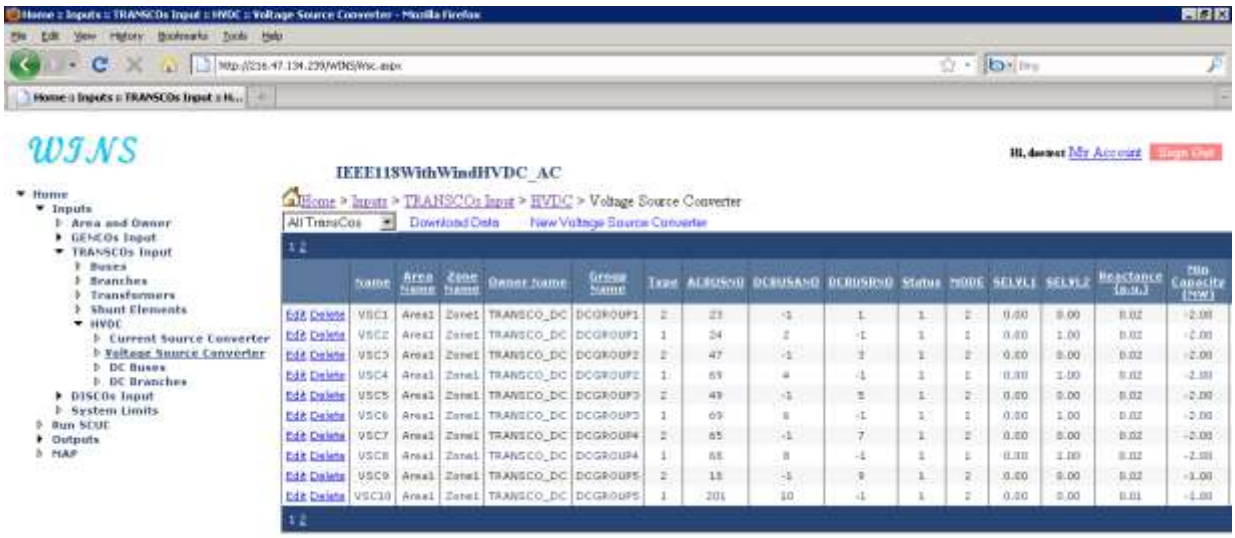


The description of individual columns of the CSC table is as follows:

Name	current source converter name (string)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
Group Name	group name of HVDC lines (string)
Type	CSC type (integer, 1 or 2; 1: Rectifier; 2: Inverter)
ACBusNo	AC bus number of the CSC connected to (long integer)
DCBusANo	DC bus A number of the CSC connected to (long integer)
DCBusBNo	DC bus B number of the CSC connected to (long integer)
Status	CSC status (integer: 0 or 1)
MODE	CSC control mode 1 (integer: 0 to 3; 0: blocked; 1: constant DC current; 2; constant power; 3: constant DC voltage)

SELVL	CSC set point for control mode 1 (double)
NB	Number of converter bridges (integer)
RC	Commutating resistance per bridge (double, p.u.)
XC	Commutating reactance per bridge (double, p.u.)
ANG	CSC firing angle (double, degree, default: 15)
ANGMN	CSC minimum firing angle (double, degree, default: 10)
ANGMX	CSC maximum firing angle (double, degree, default: 25)
Turns Ratio	CSC transformer off-nominal turns ratio (double, p.u., default: 1)
TAPMIN	CSC minimum transformer off-nominal turns ratio (double, p.u., default: 0.51)
TAPMAX	CSC maximum transformer off-nominal turns ratio (double, p.u., default: 1.50)
MODE2	CSC control mode 2 (integer: 0 to 3; 0: blocked; 1: constant DC current; 2; constant power; 3: constant DC voltage)
SELVL2	CSC set point for control mode 2 (double)
Min Capacity	CSC minimum real power capacity (double, MW)
Max Capacity	CSC maximum real power capacity (double, MW)
Min Capacity	CSC minimum reactive power capacity (double, MVAR)
Max Capacity	CSC maximum reactive power capacity (double, MVAR)
DC Min Current	CSC minimum DC current limit (double, p.u.)
DC Max Current	CSC maximum DC current limit (double, p.u.)

Go to *Home->Inputs->TRANSCOs Input->HVDC->Voltage Source Converter* to view the detailed information on each voltage source converter (VSC) of the HVDC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC table, a user can choose to display the VSCs of individual TRANSCOs or all the VSCs. The "Download Data" button allows a user to download the detailed VSC related data listed in the table. The "New Voltage Source Converter" button allows a user to add more VSCs to the current system. The "Edit" and "Delete" buttons in front of each existing VSC record allow a user to edit or delete the chosen VSC information. The "Edit" operation allows a user to edit the detailed information of the selected VSC, while the "Delete" operation will delete the VSC from the system.

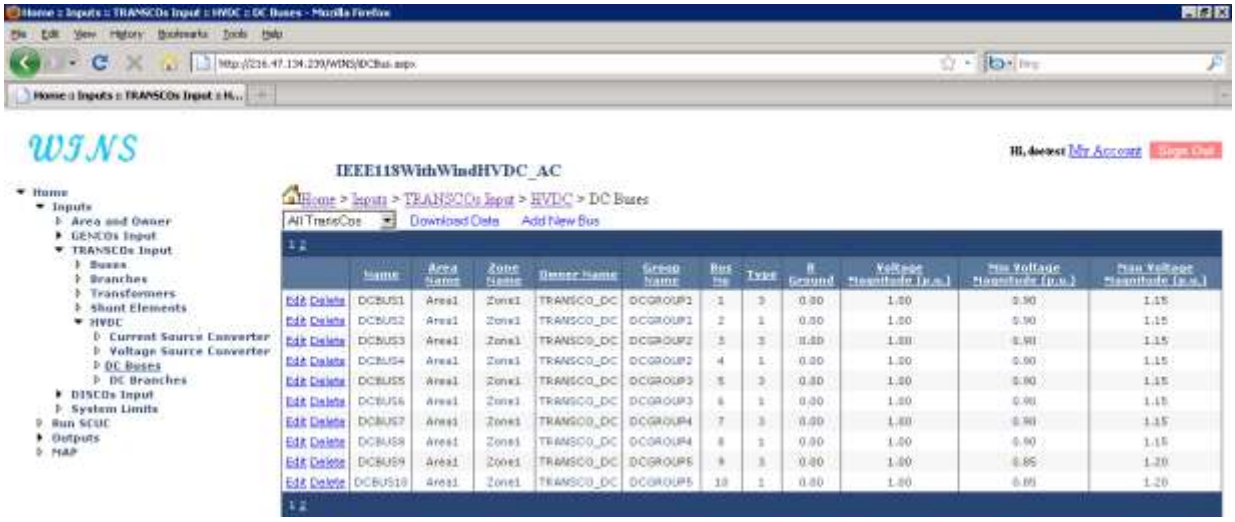


The description of individual columns of the VSC table is as follows:

Name	voltage source converter name (string)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
Group Name	group name of HVDC lines (string)
Type	VSC type (integer, 1 or 2; 1: Rectifier; 2: Inverter)
ACBusNo	AC bus number of the VSC connected to (long integer)
DCBusANo	DC bus number A of the VSC connected to (long integer)
DCBusBNo	DC bus number B of the VSC connected to (long integer)
Status	VSC status (integer: 0 or 1)

MODE	VSC control mode (integer, 1: PQ; 2: PV)
SELVL1	VSC set point for control mode 1 (double)
SELVL2	VSC set point for control mode 2 (double)
Reactance	VSC coupling transformer reactance (double, p.u.)
Min Capacity	VSC minimum real power capacity (double, MW)
Max Capacity	VSC maximum real power capacity (double, MW)
Min Capacity	VSC minimum reactive power capacity (double, MVAR)
Max Capacity	VSC maximum reactive power capacity (double, MVAR)
EACMIN	VSC minimum AC voltage (double, p.u., default: 0.95)
EACMAX	VSC maximum AC voltage (double, p.u., default: 1.05)
DC Min Current	VSC minimum DC current limit (double, p.u.)
DC Max Current	VSC maximum DC current limit (double, p.u.)

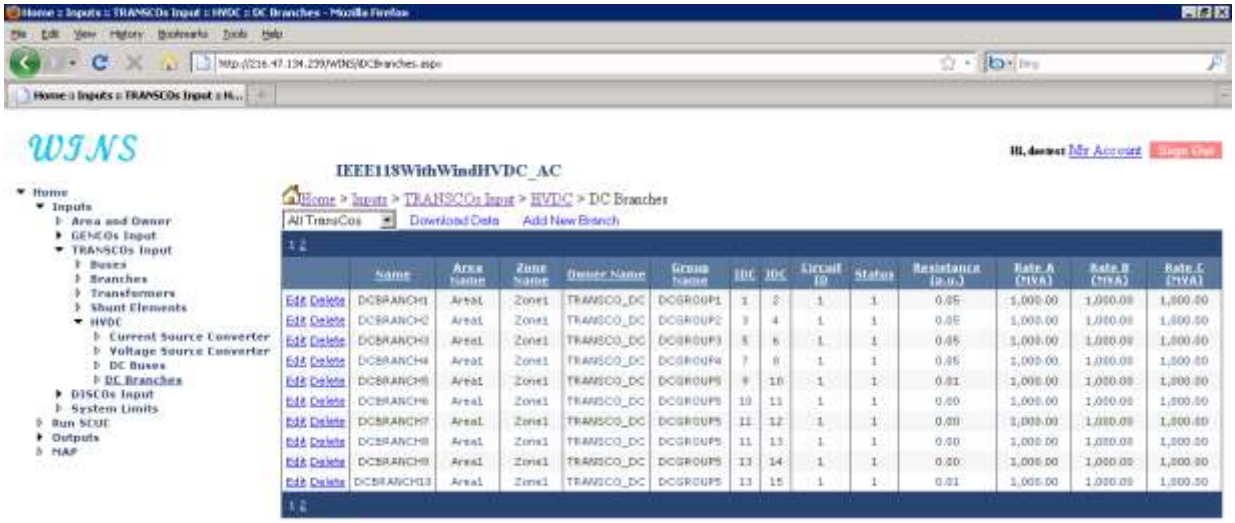
Go to *Home->Inputs->TRANSCOs Input->HVDC->DC Buses* to view the detailed information on each DC bus of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC bus table, a user can choose to display the DC buses of individual TRANSCOs or all the DC buses. The "Download Data" button allows a user to download the detailed DC bus related data listed in the table. The "Add New Bus" button allows a user to add more DC buses to the current system. The "Edit" and "Delete" buttons in front of each existing DC bus record allow a user to edit or delete the chosen DC bus information. The "Edit" operation allows a user to edit the detailed information of the selected DC bus, while the "Delete" operation will delete the DC bus from the system.



The description of individual columns of the DC bus table is as follows:

Name	DC bus name (string)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
Group Name	group name of HVDC lines (string)
BusNo	DC bus number (long integer)
Type	DC bus type (integer, 3 for swing bus that balances losses in the DC network)
R Ground	resistance to ground (double)
Voltage Magnitude	DC bus voltage magnitude (double, p.u.)
Min Voltage Magnitude	minimum DC bus voltage magnitude (double, p.u.)
Max Voltage Magnitude	maximum DC bus voltage magnitude (double, p.u.)

Go to *Home->Inputs->TRANSCOs Input->HVDC->DC Branches* to view the detailed information on each DC branch of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC branch table, a user can choose to display the DC branches of individual TRANSCOs or all the DC branches. The "Download Data" button allows a user to download the detailed DC branch related data listed in the table. The "Add New Branch" button allows a user to add more DC branches to the current system. The "Edit" and "Delete" buttons in front of each existing DC branch record allow a user to edit or delete the chosen DC branch information. The "Edit" operation allows a user to edit the detailed information of the selected DC branch, while the "Delete" operation will delete the DC branch from the system.



The description of individual columns of the DC branch table is as follows:

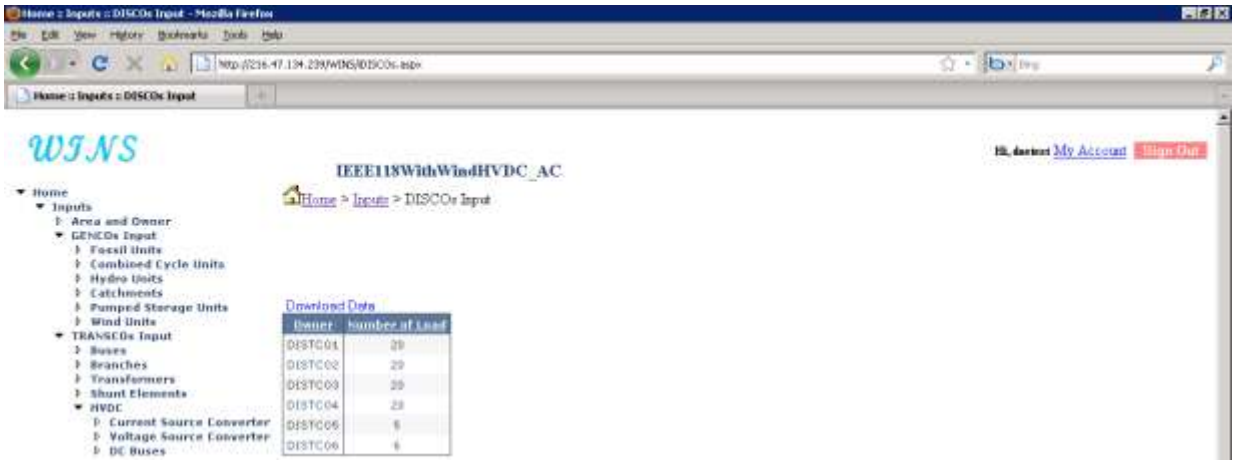
Name	DC branch name (string)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
Group Name	group name of HVDC lines (string)
IDC	from DC bus number (long integer)
JDC	to DC bus number (long integer)
Circuit ID	circuit ID (character, maximum length 2)
Status	DC branch status (integer: 0 or 1)
Resistance (R)	DC branch resistance (double)

Rate A	flow limit A for long term rating (default: 0; MVA) (double)
Rate B	flow limit B for short term rating (default: 0; MVA) (double)
Rate C	flow limit C for emergency rating (default: 0; MVA) (double)

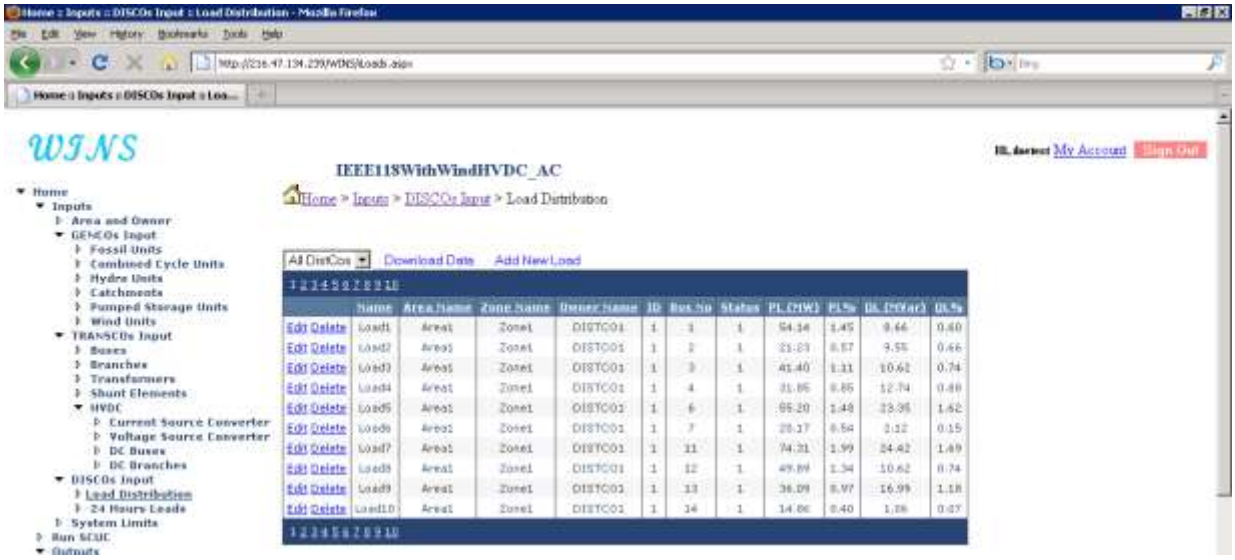
3.4.4 Inputs – DISCOs Input

Go to *Home->Inputs ->DISCOs Input* to view the overall information of the DISCOs.

This page displays the list of DISCOs, and the statistic information about the numbers of loads that belong to each DISCO. The "Download Data" button allows a user to download the DISCOs related data listed in the table.



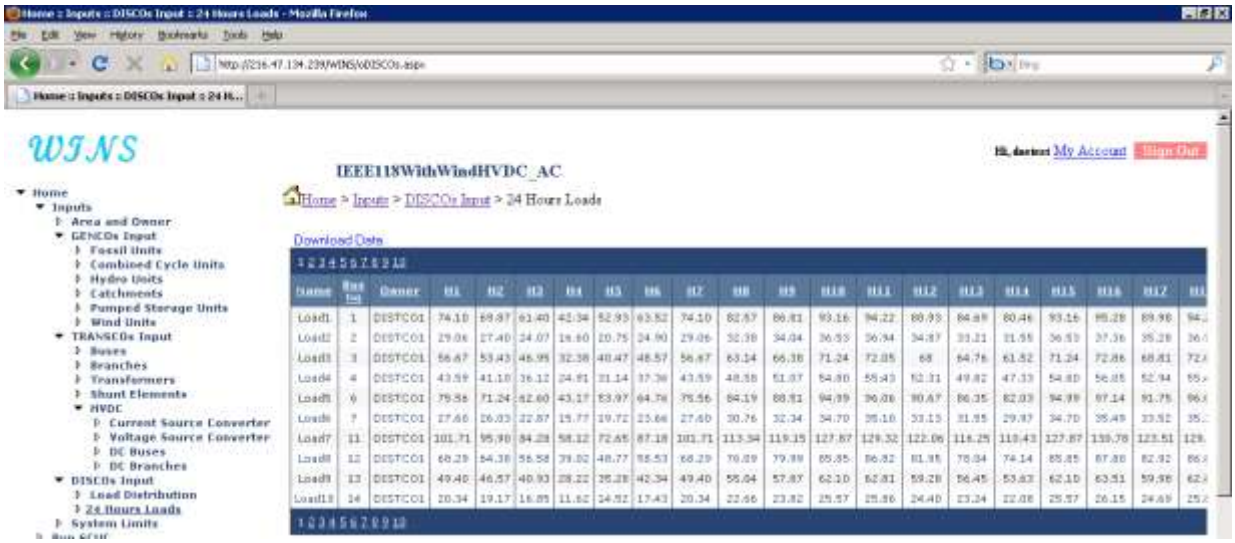
Go to *Home->Inputs ->DISCOs Input->Load Distribution* to view the detailed information on each load of the system. Besides, by selecting the different items in the dropdown list on the top left of the loads table, a user can choose to display the loads of individual DISCOs or all the loads. The "Download Data" button allows a user to download the detailed load related data listed in the table. The "Add New Load" button allows a user to add more loads to the current system. The "Edit" and "Delete" buttons in front of each existing load record allow a user to edit or delete the chosen load information. The "Edit" operation allows a user to edit the detailed information of the selected load, while the "Delete" operation will delete the load from the system.



The description of individual columns of the load table is as follows:

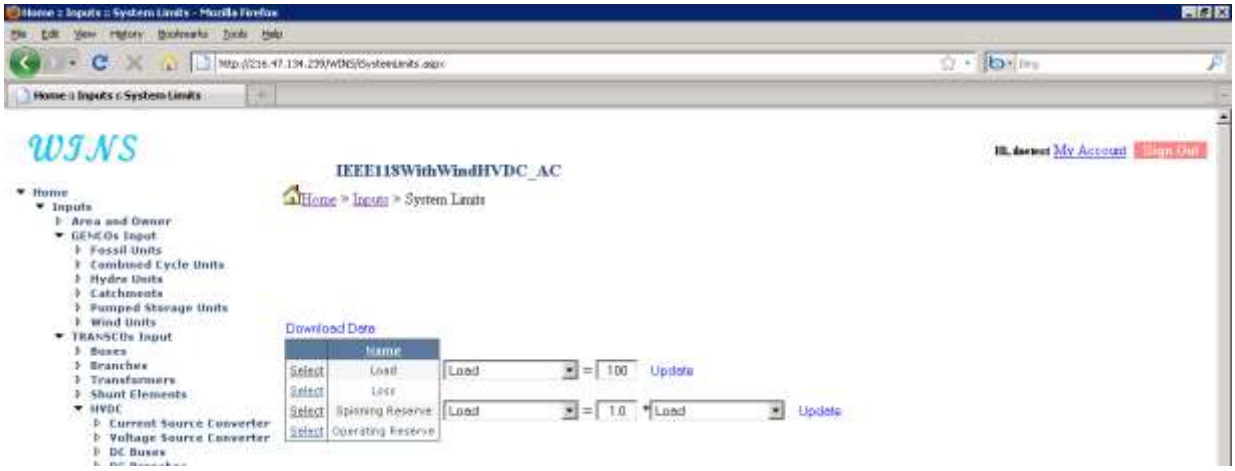
Name	load name (character, maximum length 20, no space)
Area Name	area name (string)
Zone Name	zone name (string)
Owner Name	owner name (string)
ID	load ID (character, maximum length 2)
Bus No	bus number (long integer)
Status	status (integer: 0 or 1)
PL	constant power MW load (default: 0; MW) (double)
PL%	percentage of PL over total load (double)
QL	constant power MVAR load (default: 0; MVAR) (double)
QL%	percentage of QL over total load (double)

Go to *Home->Inputs ->DISCOs Input->24 Hours Load* to view detailed hourly load information of each load of the system.

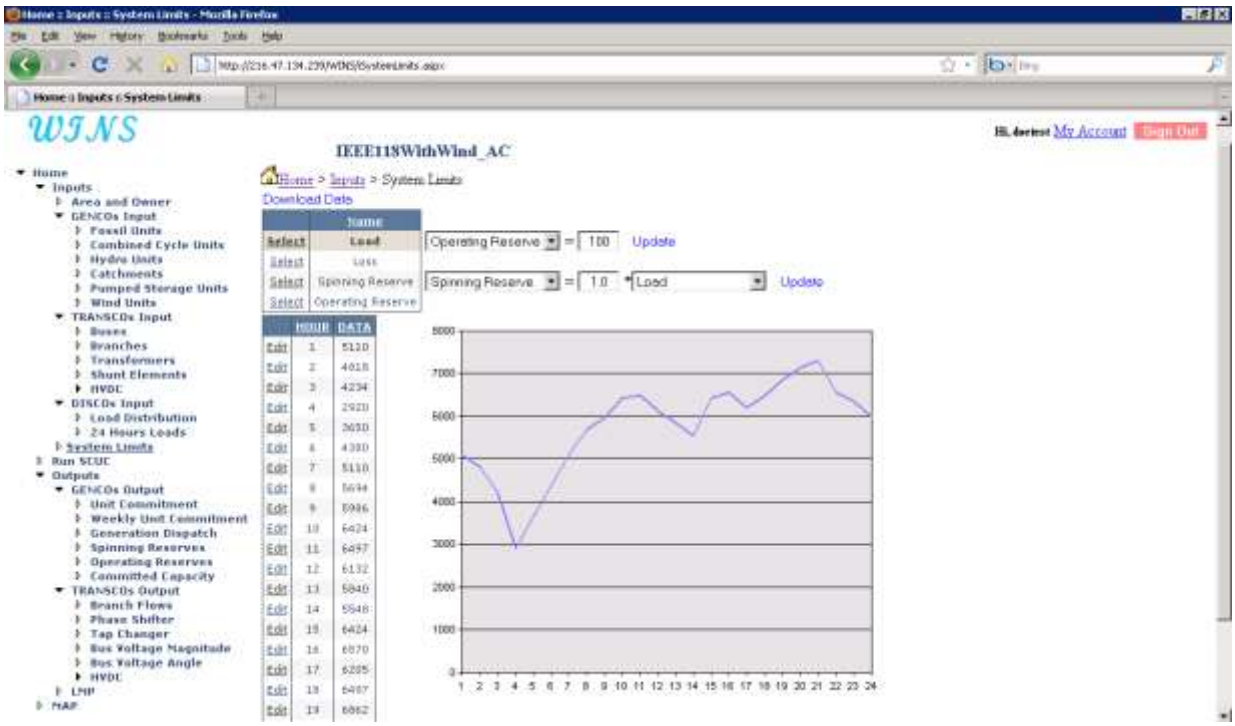


3.4.5 Inputs – System Limits

Go to *Home->Inputs ->System Limits* to view limits on system load, system loss, and system reserve. A user can set the values for each system limit or define the simple linear relationship between each individual system limits using the functions on the right of the system limit table.



A user can also directly change hourly load, loss, spinning reserve, and operating reserve in the corresponding tables by clicking the "Select" button in front of each system limit. For example, the following page shows the 24 hours load limit by clicking the "Select" button in from of "Load". "Edit" button in front of each hourly load limit allow a user to edit the chosen load limit.


WINS
IEEE118WithWind_AC
Home > Inputs > System Limits
Download Data
Operating Reserve = 100 Update
Spinning Reserve = 1.0 Load Update
Home
Inputs
Area and Owner
GENCOs Input
Fossil Units
Combined Cycle Units
Hydro Units
Catchments
Pumped Storage Units
Wind Units
TRANSCOs Input
Buses
Branches
Transformers
Shunt Elements
HVDC
DISCOs Input
Load Distribution
24 Hours Loads
System Limits
Run SCUC
Outputs
GENCOs Output
Unit Commitment
Weekly Unit Commitment
Generation Dispatch
Spinning Reserves
Operating Reserves
Committed Capacity
TRANSCOs Output
Branch Flows
Phase Shifter
Tap Changer
Bus Voltage Magnitude
Bus Voltage Angle
HVDC
LMP
MAP

3.5 Execute SCUC

Go to *Home->Inputs ->Run SCUC* to view all the control parameters used to execute the SCUC program. "Edit" button in front of each parameter allows a user to change the value of the chosen parameter. Click the "Run SCUC" button to execute SCUC. And the whole process is divided into three sub-processes.

1) "SCUC.exe" retrieves the input data from oracle database.

2) "SCUC.exe" executes the SCUC core algorithm and calculates the optimization results.

3) "SCUC.exe" writes the results back to the oracle database.

3.6 Outputs

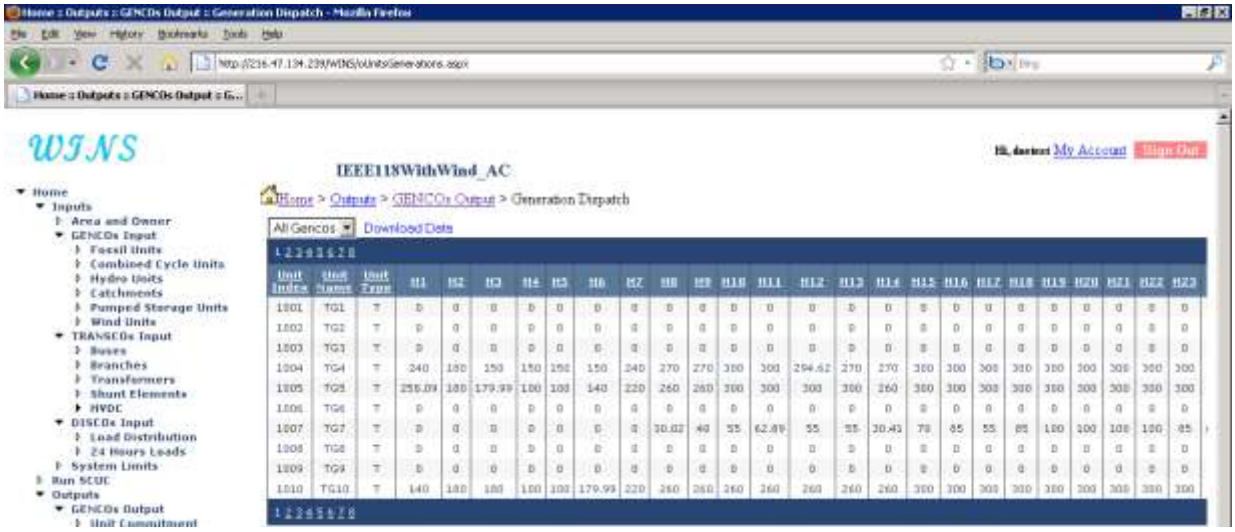
Through the TreeView, under "Outputs" node, a user can view and download result of all modules of WINS.

- GENCOs, TRANSCOs Output: output results related to market participants (GENCOs and TRANSCOs)
- LMP: hourly locational marginal prices

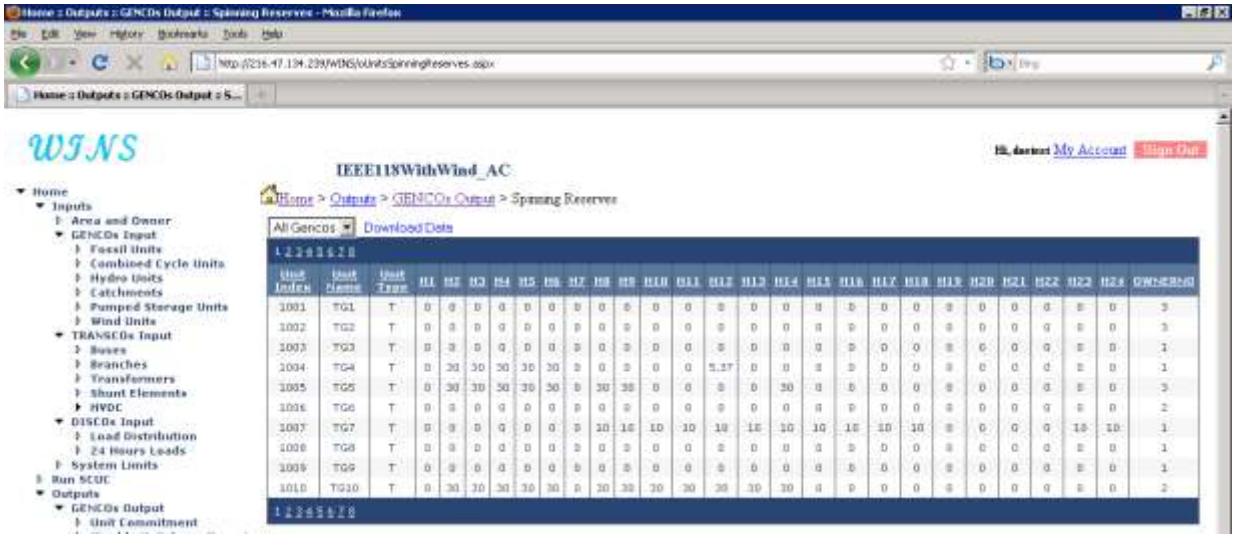
3.6.1 Outputs – GENCOs Output

Go to *Home ->Outputs ->GENCOs Output -> Unit Commitment* to view the detailed hourly commitment status of each unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the unit commitment table, a user can choose to display the unit commitment results of individual GENCOs or all GENCOs. The "Download Data" button allows a user to download the detailed unit commitment results listed in the table.

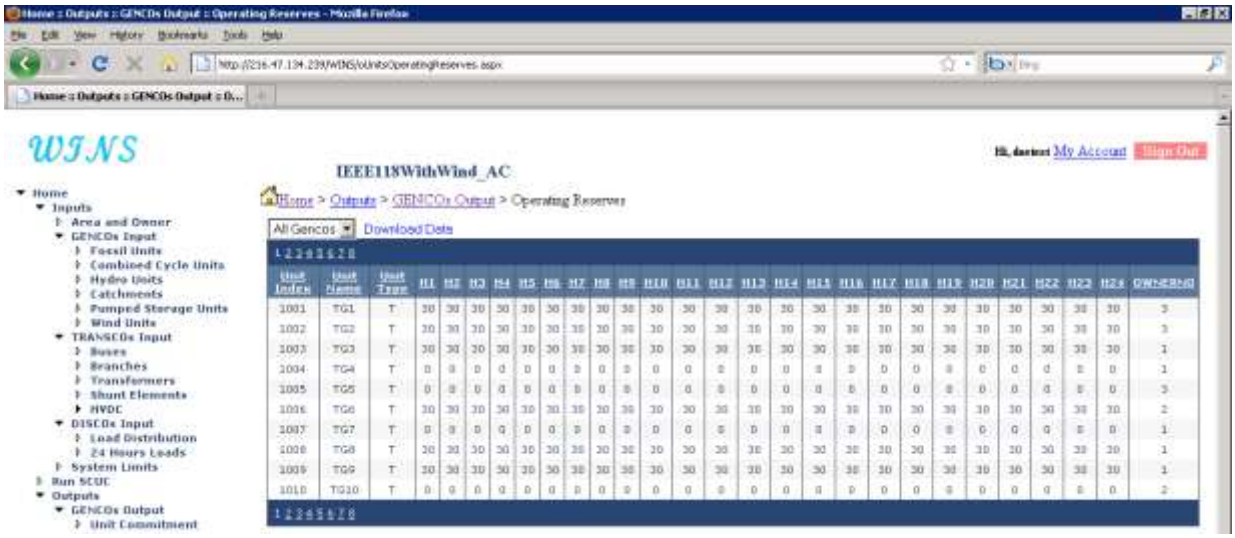
Go to *Home ->Outputs -> GENCOs Output -> Generation Dispatch* to view the detailed hourly generation dispatch of each unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the unit generation dispatch table, a user can choose to display the unit generation dispatch results of individual GENCOs or all GENCOs. The "Download Data" button allows a user to download the detailed unit generation dispatch results listed in the table.



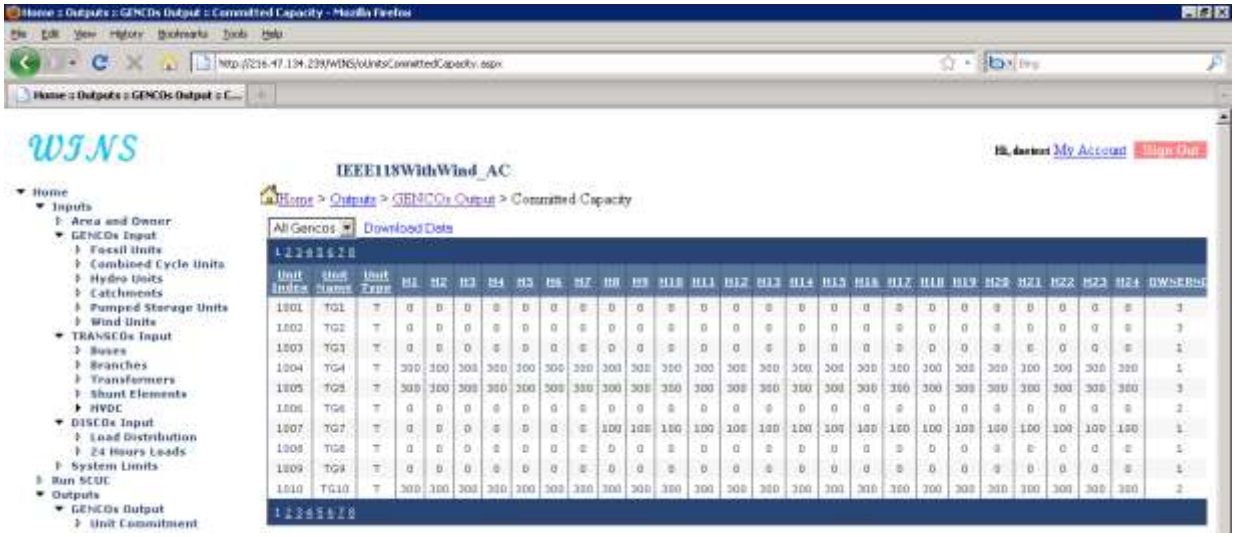
Go to *Home->Outputs -> GENCOs Output->Spinning Reserve* to view the detailed hourly spinning reserve of each unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the spinning reserve table, a user can choose to display the unit spinning reserve results of individual GENCOs or all GENCOs. The "Download Data" button allows a user to download the detailed unit spinning reserve results listed in the table.



Go to *Home->Outputs -> GENCOs Output->Operating Reserve* to view the detailed hourly operating reserve of each unit of the system. Besides, by selecting the different items in the dropdown list on the top left of the operating reserve table, a user can choose to display the unit operating reserve results of individual GENCOs or all GENCOs. The "Download Data" button allows a user to download the detailed unit operating reserve results listed in the table.



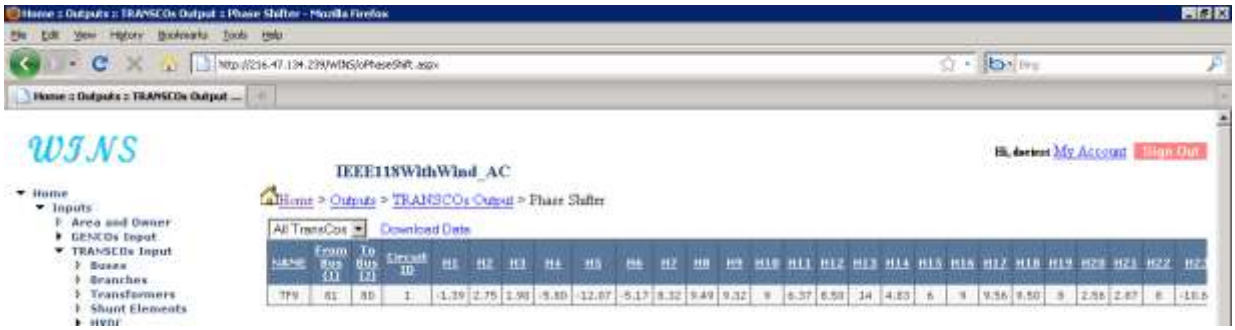
Go to *Home ->Outputs -> GENCOs Output -> Committed Capacity* to view the detailed hourly committed capacity of each unit of the system. When one unit is scheduled ON in the current hour, its committed capacity is equal to its generation capacity in the current hour; otherwise, its committed capacity is equal to zero in the current hour. Besides, by selecting the different items in the dropdown list on the top left of the committed capacity table, a user can choose to display the unit committed capacity results of individual GENCOs or all GENCOs. The "Download Data" button allows a user to download the detailed unit committed capacity results listed in the table.



3.6.2 Outputs – TRANSCOs Output

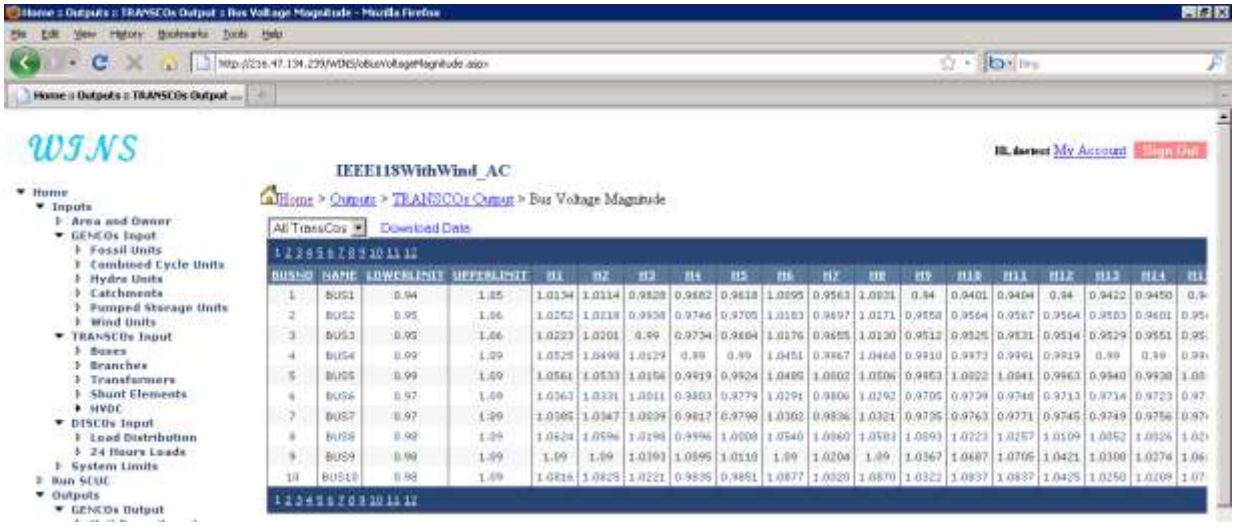
Go to *Home -> Outputs -> TRANSCOs Output -> Branch Flows* to view the detailed hourly flow of each branch of the system. Besides, by selecting the different items in the dropdown list on the top left of the branch flow table, a user can choose to display the branch flow results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed branch flow results listed in the table.

Go to *Home -> Outputs -> TRANSCOs Output -> Phase Shifter* to view the detailed hourly phase shift of phase shifter of the system. Besides, by selecting the different items in the dropdown list on the top left of the phase shifter table, a user can choose to display the phase shift results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed phase shift results listed in the table.

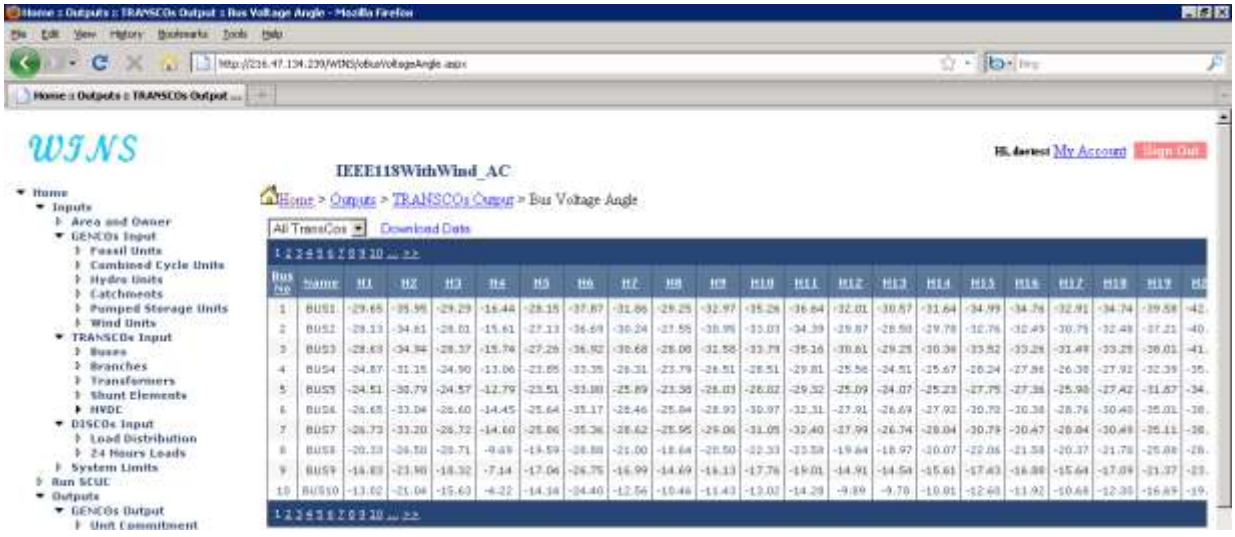


Go to *Home -> Outputs -> TRANSCOs Output -> Tap Changer* to view the detailed hourly turn ratios of transformers of the system. Besides, by selecting the different items in the dropdown list on the top left of the tap changer table, a user can choose to display the tap changer results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed tap changer results listed in the table.

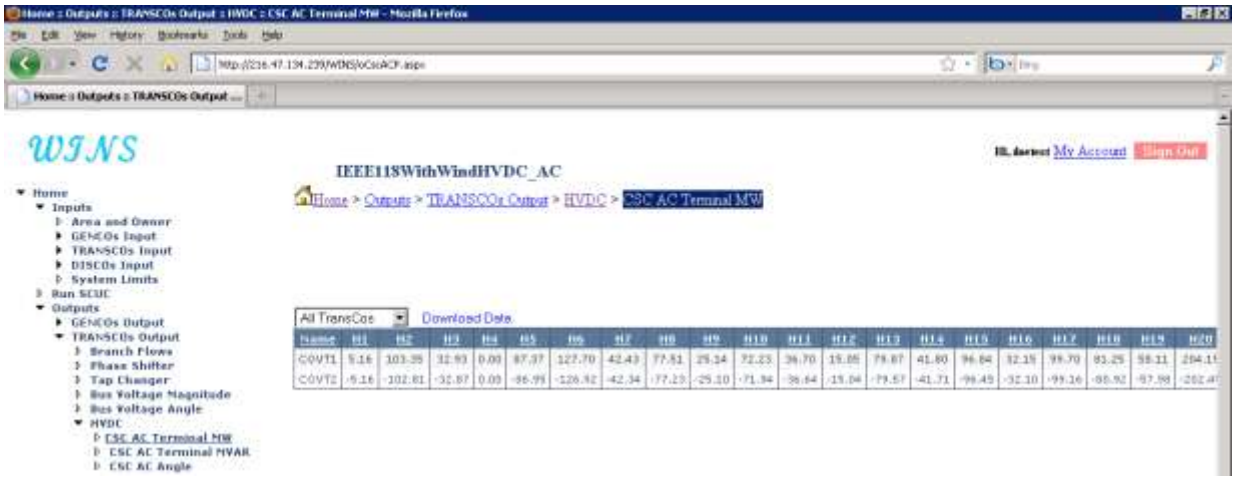
Go to *Home -> Outputs -> TRANSCOs Output -> Bus Voltage Magnitude* to view the detailed hourly voltage magnitudes of buses of the system. Besides, by selecting the different items in the dropdown list on the top left of the bus voltage magnitude table, a user can choose to display the bus voltage magnitude results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed bus voltage magnitude results listed in the table.



Go to *Home -> Outputs -> TRANSCOs Output -> Bus Voltage Angle* to view the detailed hourly voltage angles of buses of the system. Besides, by selecting the different items in the dropdown list on the top left of the bus voltage angle table, a user can choose to display the bus voltage angle results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed bus voltage angle results listed in the table.

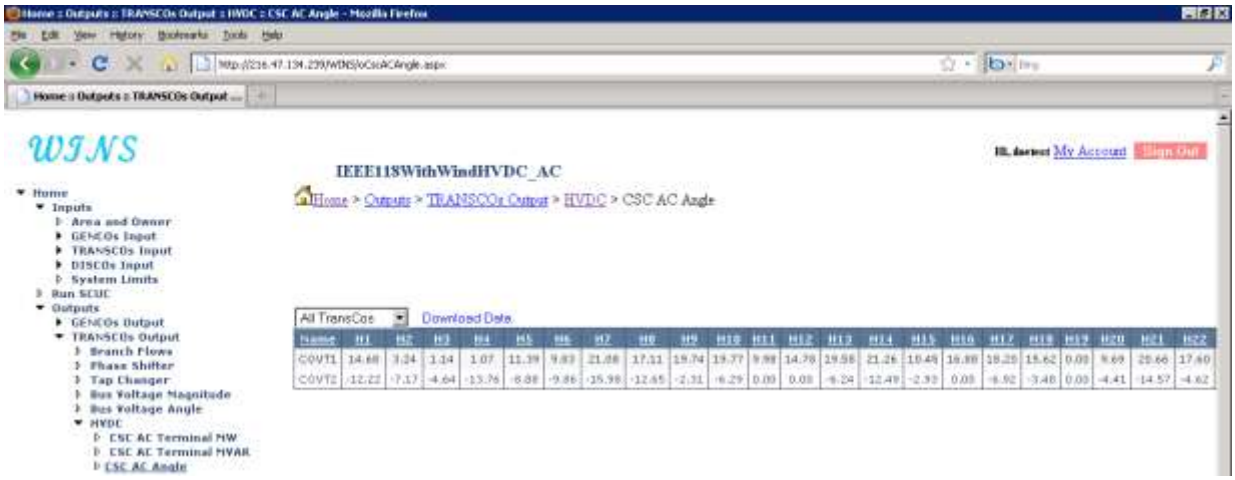


Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC AC Terminal MW* to view the detailed hourly terminal AC real power dispatch of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC AC terminal MW table, a user can choose to display the CSC terminal AC real power dispatch results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC terminal AC real power dispatch results listed in the table.

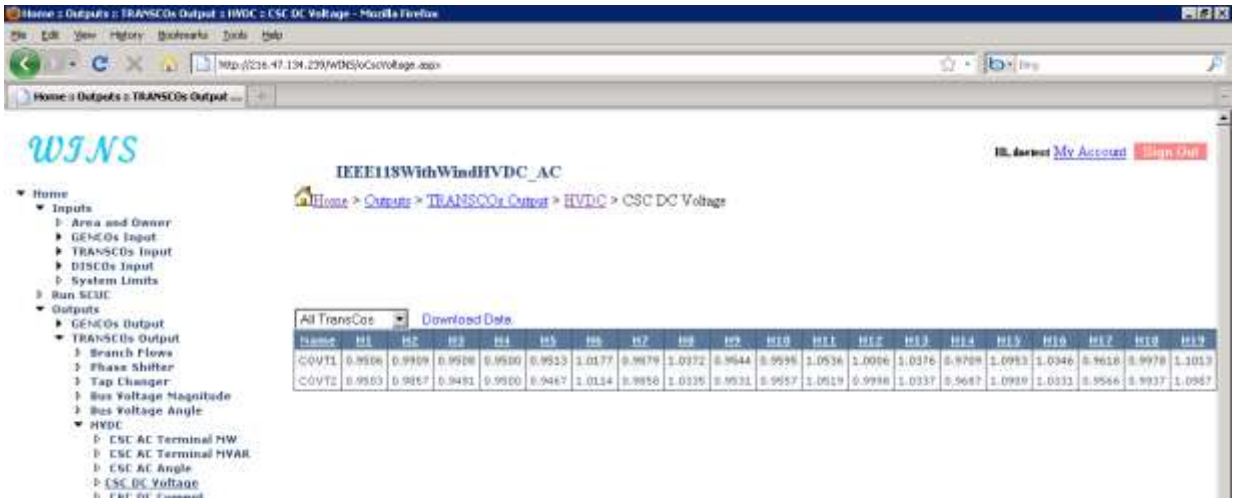


Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC AC Terminal MVAR* to view the detailed hourly terminal AC reactive power dispatch of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC AC terminal MVAR table, a user can choose to display the CSC terminal AC reactive power dispatch results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC terminal AC reactive power dispatch results listed in the table.

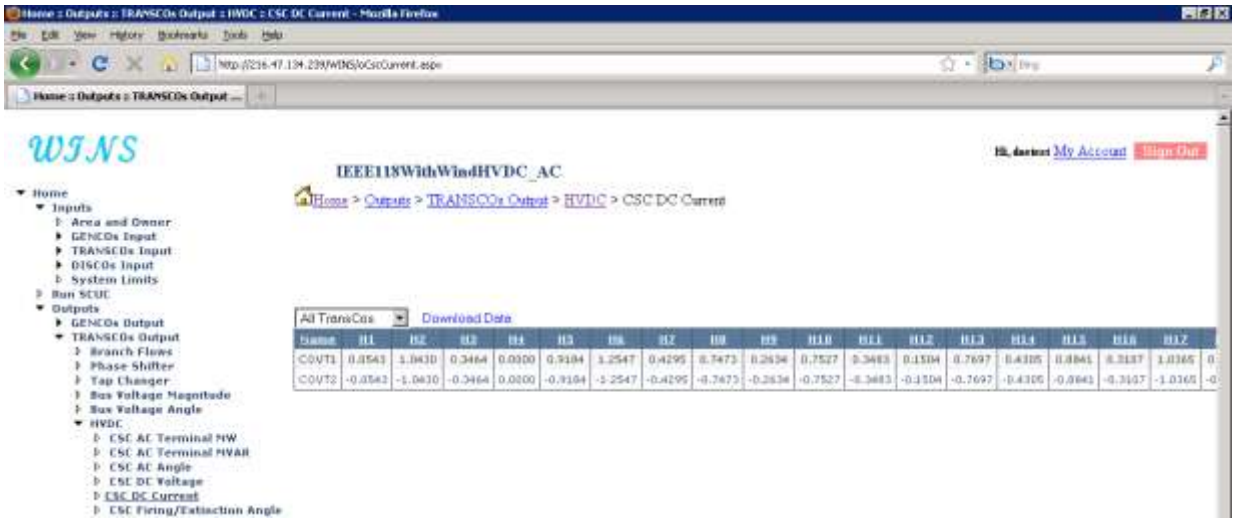
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC AC Angle* to view the detailed hourly AC angles of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC AC angle table, a user can choose to display the CSC AC angle results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC AC angle results listed in the table.



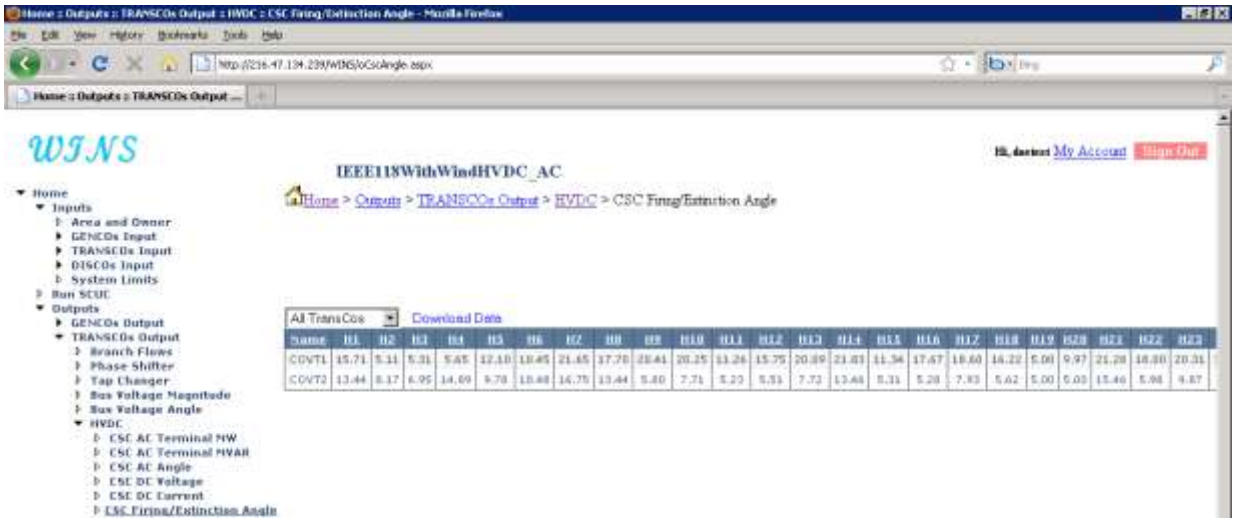
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC DC Voltage* to view the detailed hourly voltages of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC DC voltage table, a user can choose to display the CSC DC voltage results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC DC voltage results listed in the table.



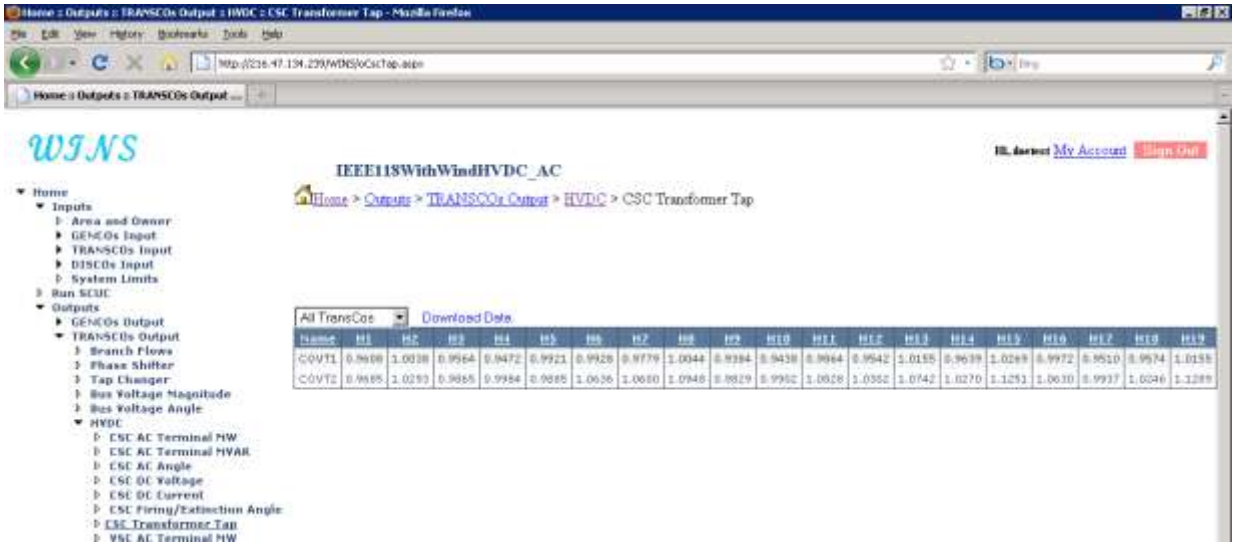
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC DC Current* to view the detailed hourly current of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC DC current table, a user can choose to display the CSC DC current results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC DC current results listed in the table.



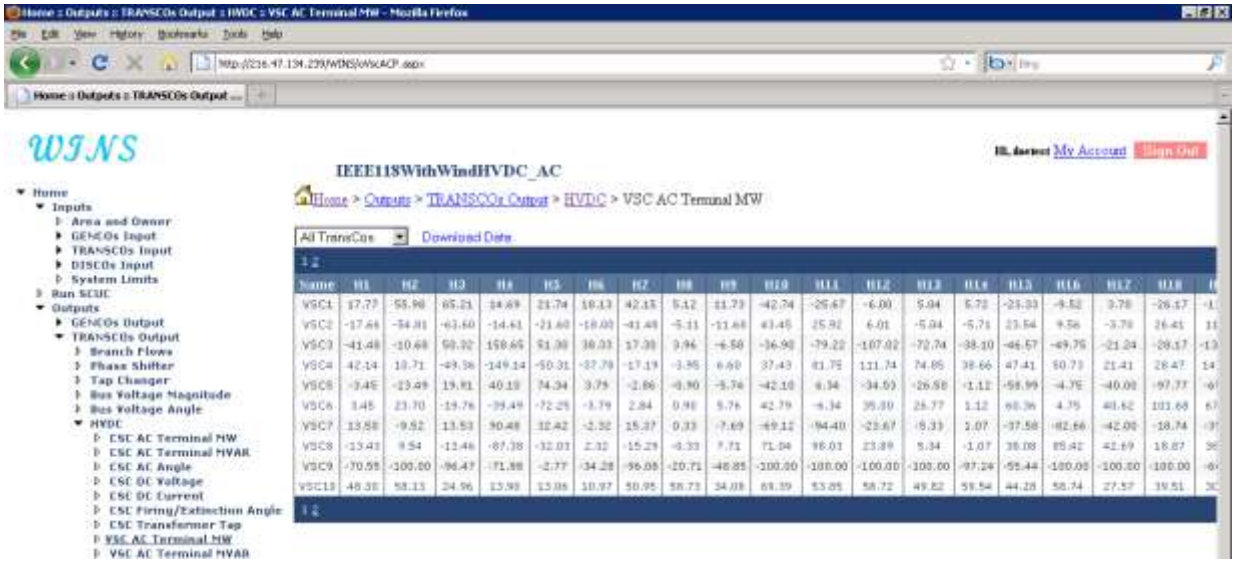
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC Firing/Extinction Angle* to view the detailed hourly Firing/Extinction angles of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC Firing/Extinction angle table, a user can choose to display the CSC DC Firing/Extinction angle results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC Firing/Extinction angle results listed in the table.



Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> CSC Transformer Tap* to view the detailed hourly transformer turns ratio of the current source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the CSC transformer tap table, a user can choose to display the CSC transformer tap results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed CSC transformer tap results listed in the table.



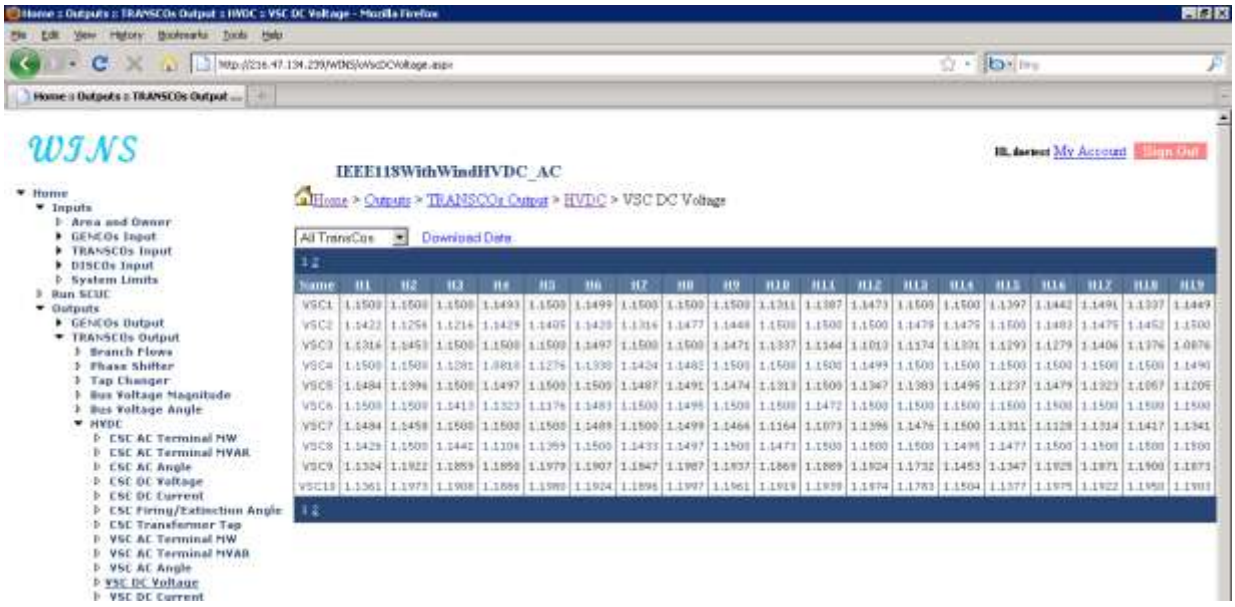
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC AC Terminal MW* to view the detailed hourly terminal AC real power dispatch of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC terminal AC dispatch (MW) table, a user can choose to display the VSC terminal AC real power dispatch results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC terminal AC real power dispatch results listed in the table.



Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC AC Terminal MVAR* to view the detailed hourly terminal AC reactive power dispatch of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC terminal AC dispatch (MVar) table, a user can choose to display the VSC terminal AC reactive power dispatch results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC terminal AC reactive power dispatch results listed in the table.

Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC AC Angle* to view the detailed hourly AC angle of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC AC angle table, a user can choose to display the VSC AC angle results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC AC angle results listed in the table.

Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC DC Voltage* to view the detailed hourly DC voltage of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC DC voltage table, a user can choose to display the VSC DC voltage results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC DC voltage results listed in the table.



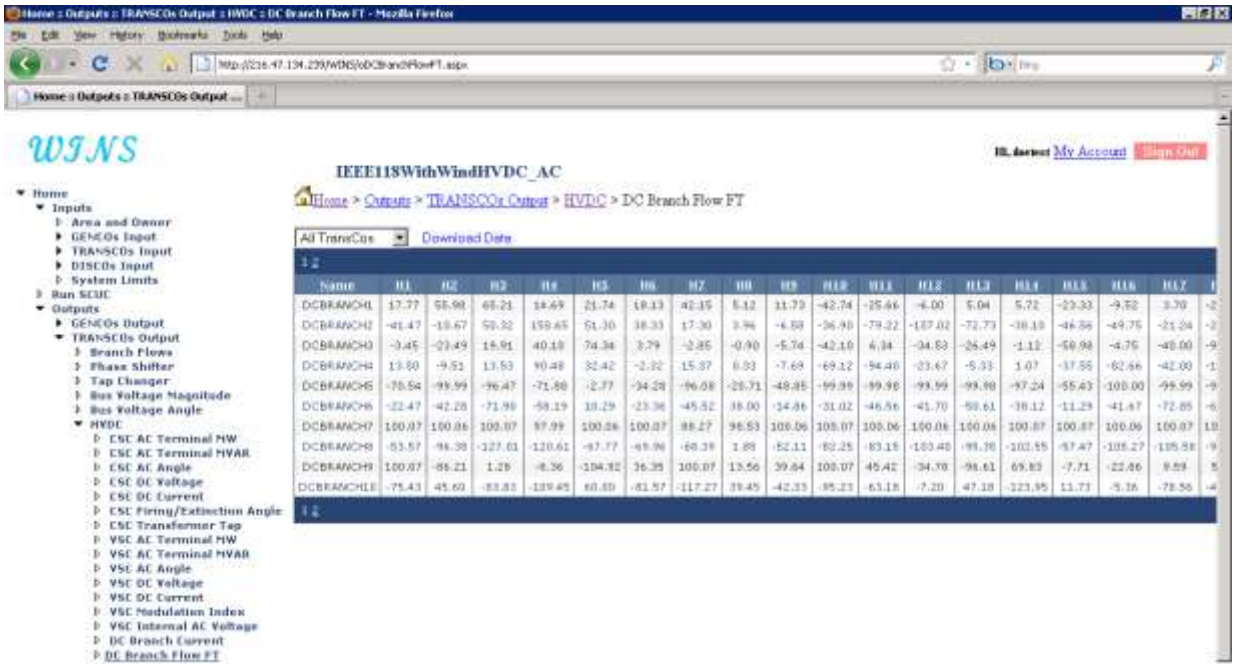
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC DC Current* to view the detailed hourly DC current of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC DC current table, a user can choose to display the VSC DC current results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC DC current results listed in the table.

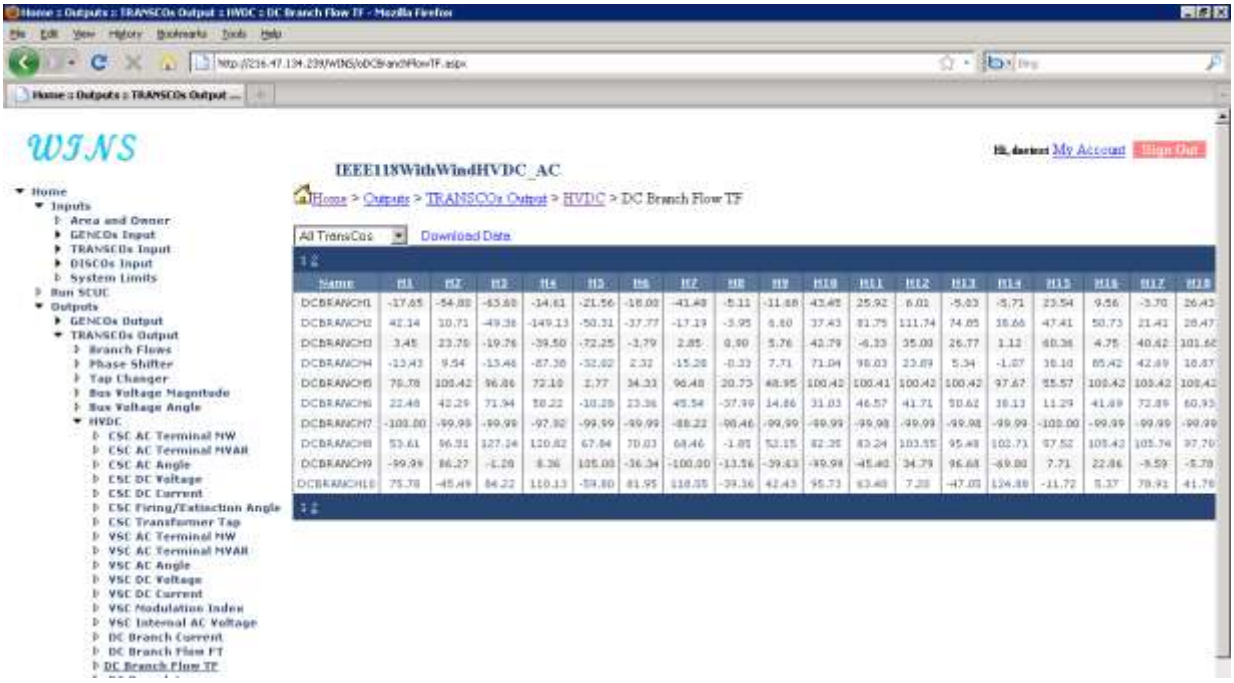
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC Modulation Index* to view the detailed hourly modulation index of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC modulation index table, a user can choose to display the VSC modulation index results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC modulation index results listed in the table.

Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> VSC Internal AC Voltage* to view the detailed hourly internal AC voltage of the voltage source converters of the system. Besides, by selecting the different items in the dropdown list on the top left of the VSC internal AC voltage table, a user can choose to display the VSC internal AC voltage results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed VSC internal AC voltage results listed in the table.

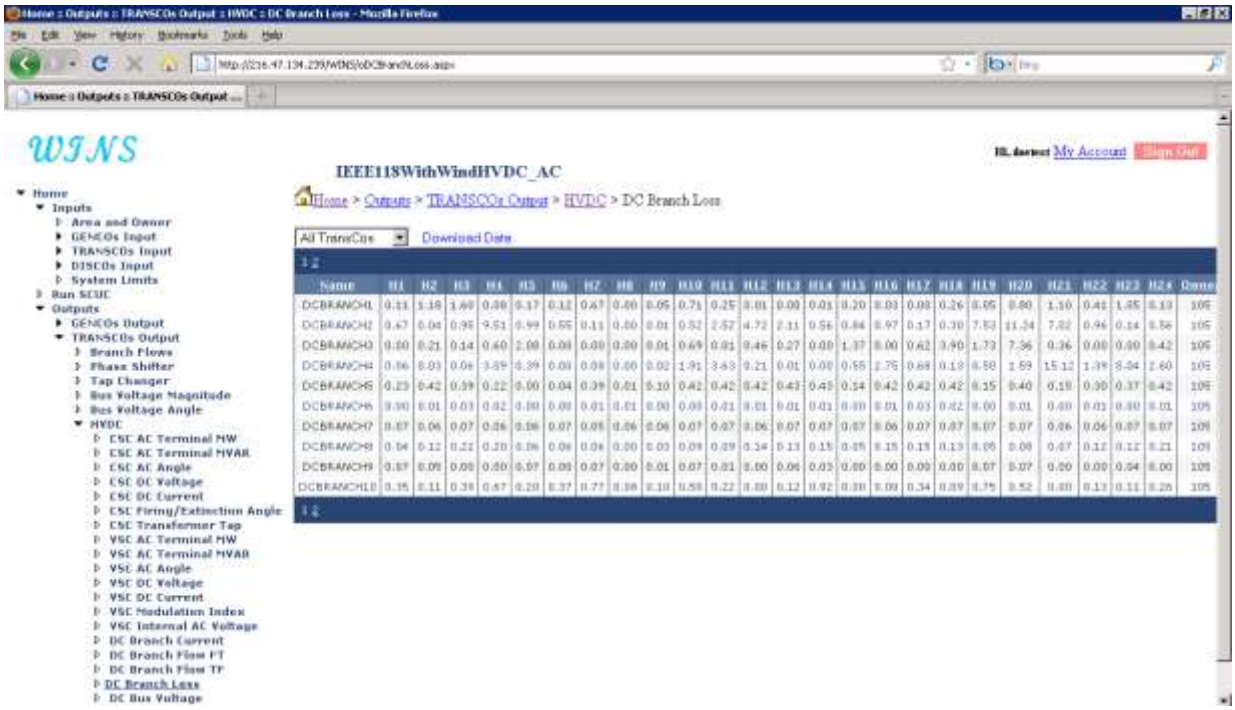
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> DC Branch Current* to view the detailed hourly current of the DC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC branch current table, a user can choose to display the DC branch current results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed DC branch current results listed in the table.

Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> DC Branch Flow FT(TF)* to view the detailed hourly branch flow of the DC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC branch flow table, a user can choose to display the DC branch flow results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed DC branch flow results listed in the table.

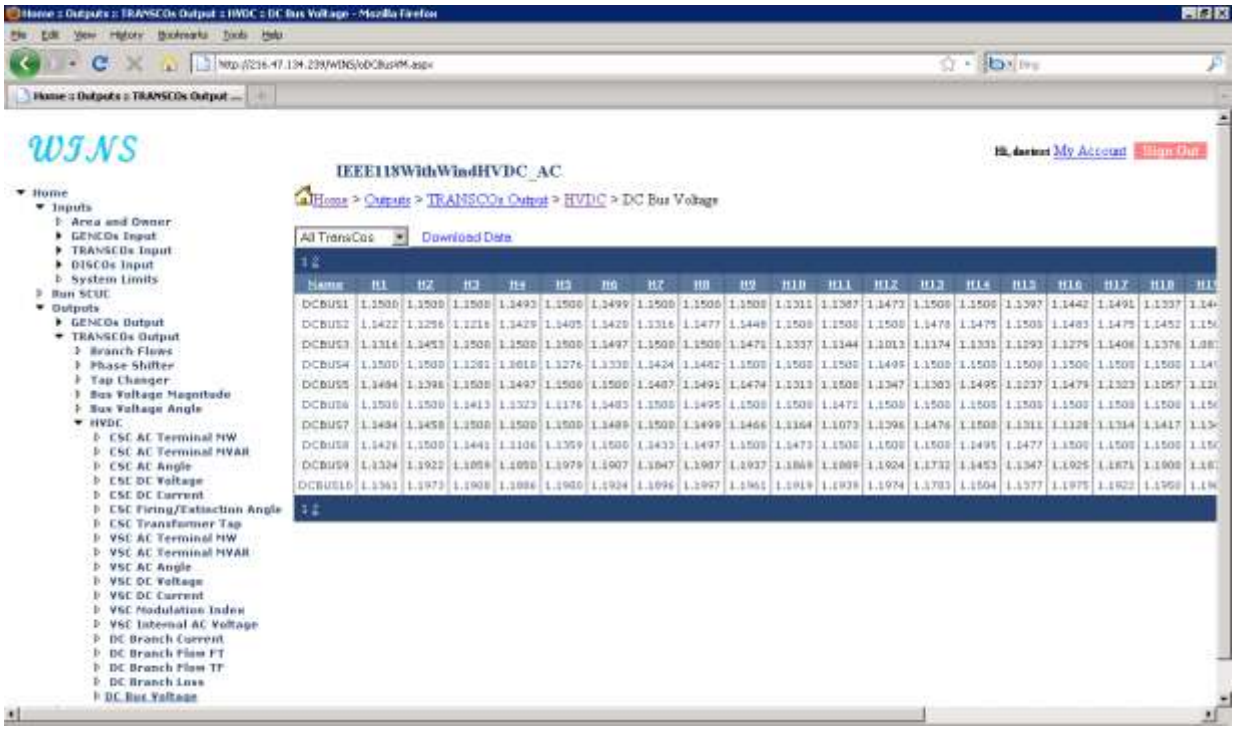



WINS
IEEE118WithWindHVDC_AC
Home > Outputs > TRANSCOs Output > HVDC > DC Branch Flow TF
All TransCos
Download Data
Home
Inputs
Area and Owner
GENCOs Input
TRANSCOs Input
DISCOs Input
System Limits
Run SCUC
Outputs
GENCOs Output
TRANSCOs Output
Branch Flows
Phase Shifter
Tap Changer
Bus Voltage Magnitude
Bus Voltage Angle
HVDC
CSC AC Terminal MW
CSC AC Terminal MVAR
CSC AC Angle
CSC DC Voltage
CSC DC Current
CSC Firing/Extinction Angle
CSC Transformer Tap
VSC AC Terminal MW
VSC AC Terminal MVAR
VSC AC Angle
VSC DC Voltage
VSC DC Current
VSC Modulation Index
VSC Internal AC Voltage
DC Branch Current
DC Branch Flow FT
DC Branch Flow TF

Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> DC Branch Loss* to view the detailed hourly power loss of the DC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC branch loss table, a user can choose to display the DC branch power loss results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed DC branch power loss results listed in the table.



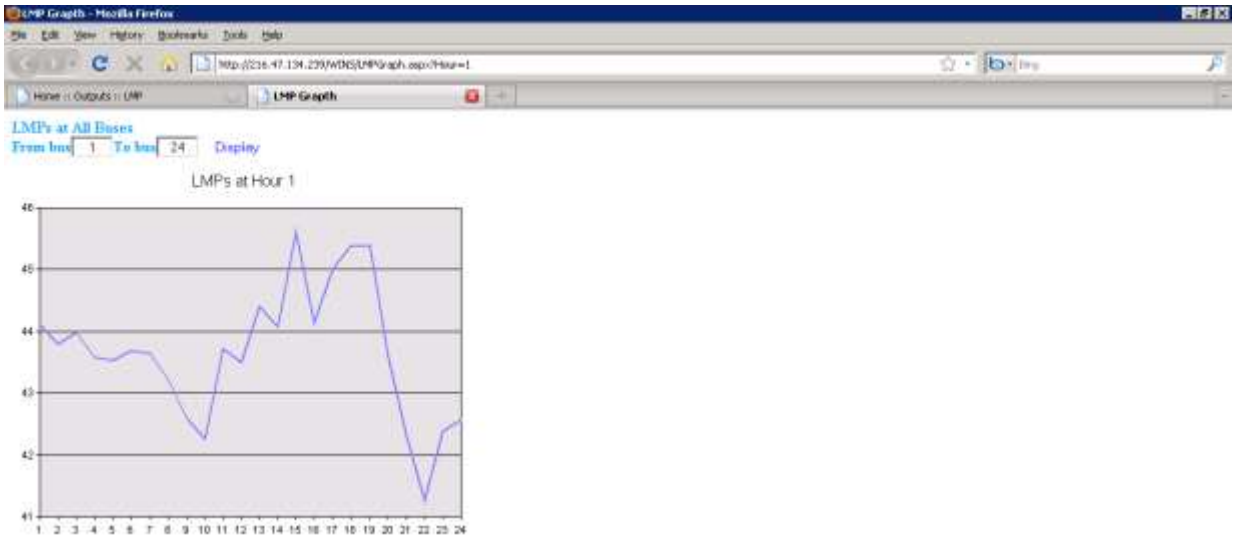
Go to *Home -> Outputs -> TRANSCOs Output -> HVDC -> DC Bus Voltage* to view the detailed bus voltage magnitude of the DC lines of the system. Besides, by selecting the different items in the dropdown list on the top left of the DC bus voltage magnitude table, a user can choose to display the DC bus voltage magnitude results of individual TARNSCOs or all TRANSCOs. The "Download Data" button allows a user to download the detailed DC bus voltage magnitude results listed in the table.

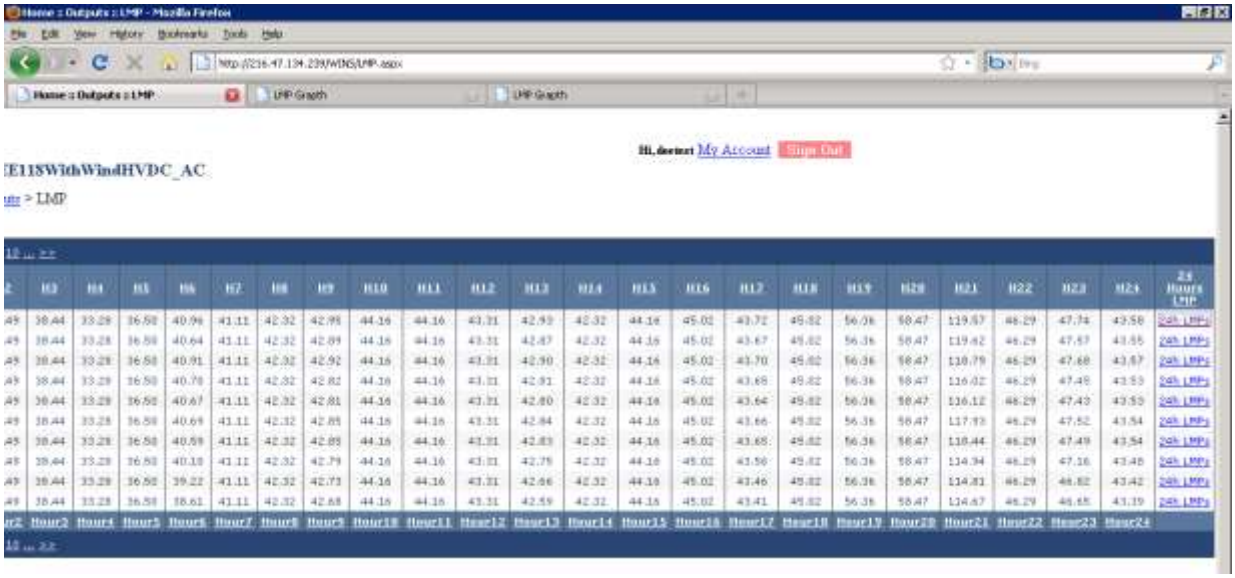


3.6.3 Outputs – LMP

Go to *Home -> Outputs -> LMP* to view the detailed hourly locational marginal prices (LMPs) of the system in both tabular and graphical forms.

When a user clicks on the buttons on the bottom of the table with text from "Hour1" to "Hour24", the single hour LMPs curve of all buses will be plotted, as shown in the following page. A user could choose the range of the buses to be displayed on the graph.





While when a user click on the "24h LMP" button at the end of each record as shown in the above page, the 24-hour LMPs curve of the chosen bus will be plotted, as shown in the following page.