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# **USER** 's GUIDE

## 1. <u>Background:</u>

The power industry today has undergone drastic and irreversible changes. From a monopolistic environment a decade ago when electricity was generated and distributed to consumers who had virtually no say in the prices, electricity is now traded in a competitive market just like other commodities; and consumers today can select and buy electricity from marketers of their choice.

Because electricity cannot be stored in a large quantity, it must be generated to meet the instantaneous demand. The spot market clearing prices of electricity market sometimes can behave quite unpredictably. Quite often, spot market price volatility is attributed to the capacity adequacy and demand conditions of a Control Area. In addition, the underlying transmission network within a Control Area and between adjacent Control Areas can result in price disparity between regions. Limitations of a transmission network often prevent power flow from inexpensive to more expensive regions. As a result, more expensive resource must be dispatched to meet the local demand resulting in higher market clearing price in that region. The challenge is to devise a dispatch algorithm, which maximizes the utilization and value of available resources based on the offer prices to satisfy the demands in different regions while respecting the transmission limitations.

The deregulated electric industry clearly requires a new tool to assist energy traders, asset managers, and system operators. make important decisions in their daily activities. Factors such as generation outages, transmission congestion, volatile fuel costs, load growth and environmental issues/cost must be taken into consideration in forecasting the electricity price.

Furthermore, for some investors who plan for long-term asset acquisitions or divestiture it is important to understand the location impact of the asset on the prices and how it affects their return of the investment. A new tool must be able to simulate the market conditions over a period of 5-10 years with hourly resolution in order to examine in details all possibilities before making such an important decision. In this case the location of the generators in the transmission grid is of paramount importance. The electricity price difference between the two locations is a signal of transmission congestion and it is also a measure of the transmission right value.

SMS Suite, when subscribed with the appropriate Control Areas, is the tool that was developed for these purposes. It is capable of performing network analysis and forecasting electricity spot market prices. It provides also short-term and long-term values of generating assets located anywhere in the Northeastern power network. SMS incorporates variables such as fuel costs, transmission outages, generation outages, weather uncertainty and planned and forced outage rates in order to provide comprehensive answers to some of the difficult questions related to portfolio management and trading decisions. This user's guide will introduce users to various features designed in the SMS Suite and how to use them.

An overview of the SMS input and output relationship is as shown in Figure 1.

# 2. An Overview of SMS Input-Output Relationship



Figure 1: SMS Suite Input Output Relationship

## 3. How To Activate the SMS Suite

MS Suite is developed based on Matlab<sup>1</sup> technology to take advantage of many convenient features such as userfriendliness, rich mathematical algorithms, speed and variety of sophisticated computational platforms. However, users do not need to know Matlab in order to run SMS, although some basic knowledge of Matlab would help them navigate through the inputs and outputs to get the desired answer more quickly.

Input and output data flows in SMS are handled through the EXCEL interfaces.

To run SMS Suite, users must go to the directory where a working copy of the userinterface template (an EXCEL<sup>2</sup> worksheet) is installed and follow the following steps:

- 1. Activate the MS EXCEL workbook named SMS\_Database4Use\_IMOPD
- 2. Activate Matlab,
  - by first going to the **Tools bar** Menu and selecting Macro as shown in the picture below:



<sup>&</sup>lt;sup>1</sup> A Mathworks product: see Mathworks website: www.mathworks.com

<sup>&</sup>lt;sup>2</sup> A Microsoft product: see Microsoft Website: www.microsoft.com

• Click on **Macros** and then type 'matlabinit' (**matlab init**ialize) in the space provided for the Macro Name as in the picture below

Maere			? ×
Macro Name:			
matlabinit		<u></u>	<u>R</u> un
		<u>^</u>	Cancel
			<u>S</u> tep Into
			<u>E</u> dit
			Create
		7	<u>D</u> elete
M <u>a</u> cros in:	All Open Workbooks	-	Options
Description			

Now everything is ready for you to run the SMS application. You must, however, prepare the input case for your particular study before submitting it to a SMS run. The following sections will guide you through the process of data preparations.



There are 7 worksheets in the **SMS\_Database4Use\_IMOPD** workbook; they contain the database that will be used to simulate the spot market price forecasts and transmission right evaluation by the SMS suite. The description of each of these worksheets is listed in the following.

- 1. **NDF4NEpars\_info**: this worksheet contains the processed data of the Northeast transmission network into zones of interest as defined by IMO/ISO. The data in this worksheet should not be changed unless there is a change in the transmission network topologies. This worksheet also contains critical planning flowgates' limits.
- 2. **NDF4pars:** this worksheet contains the operational data for all the phase angle regulators (phase shifters) of the northeast interconnection. All phase angles of the phase shifters are assumed fixed. Users, however, can make changes to a particular phase shifter operation/angle if they have such knowledge.
- 3. **AdjTXLim:** this worksheet contains flowgates limits and facilities. Adjust these limits to reflect prevailing conditions.
- 4. **dailyGenOut:** this worksheet contains generating laminations in each zone and facilities that allow the capacity to be adjusted to reflect the availability.
- 5. **Import\_Export:** this worksheet is used to control the import-export amount of power through each control area during the SMS runs.
- 6. **BID\_ASK:** this worksheet contains information about the zonal generating capacity and offer that are categorized into laminations for fuel types and running cost plus a variety of adders.
- 7. **SMS\_run:** this template prepares the input read and other information like holidays, control of specific period to be forecasted etc.

Except for the transmission network topologies that are assumed unchanged, therefore, data in the **NDF4Nepars\_info** worksheet will not be modified. The network topologies are considered undergone a major change if there is an expansion due to additions of components such as new transmission lines, new high voltage transformers, or new phase shifters that will have a new major yet unknown impact on the transmission system operations and reliability. Minor changes such as element outages (lines or transformers) for maintenance purposes (whose impacts on the system are known) will be taken into consideration by making appropriate changes in the **AdjTXLim** worksheet. In the following sections we will describe how to prepare input data as required for SMS runs.

## 4. How To Prepare Input Data for a SMS Run

Before any price forecasts run using SMS, a natural question comes to mind is whether there are any changes in the transmission network that might affect the spot prices. Any change in the flowgate's control devices such as phase shifters (**NDF4pars** worksheet) or change in the flowgate's security limits (**AdjTXLim** worksheet) due to some transmission line outages during the period of study will likely affect the power flows and hence the spot prices of electricity. If users have knowledge of such changes, then they must make appropriate modifications to reflect these changes or the results will not be accurate.

#### a) Phase Angle Regulator (Phase Shifter) Adjustment:

The default operating conditions of the existing phase shifters are described in the **NDF4pars** worksheet that is partially shown as below

	A	В	С	D	E	F	G	Н		J	K	L	M	N	0	Р	Q	R	S
1					NDF4par:	TEM	LHE	EWFE	D501P	P502X	FN_S	QFW	BLIP	FETT	MH-ON	ONT-M	ONT-M	ONT-NY	NTxON <sup>®</sup>
2					Preflow	178	148	162	0	0	173	264	460	-250	200	0	459	-263	0
3	Агеа	Туре	OrigBN	BusNAM	Pars(MW	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	13	2	99800	LND PR N	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	13	2	99801	LND PR T	-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	13	2	99802	NEM PR N	-351	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	13	2	99803	NEM PR T	350	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	13	2	99804	NES PR N	-351	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	13	2	99805	NES PR N	350	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	13	2	99806	WA1 PR T	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	13	2	99807	WA1 PR N	1	0	0	0	0	0	0	0.259	0.259	0	0	0	0.259	-0.259	0
12	13	2	99808	WA2 PR T	-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	13	2	99809	WA2 PR N	30	0	0	0	0	0	0	0.259	0.259	0	0	0	0.259	-0.259	0
14	13	2	99810	WA3 PR T	-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	13	2	99811	WA3 PR N	26	0	0	0	0	0	0	0.259	0.259	0	0	0	0.259	-0.259	0
16	852	2	99816	MN7 PR N	-110	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
17	852	2	99817	MN7 PR T	110	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
18	852	2	99818	IFLSPR N	0	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
19	852	2	99819	IFLSPR T	0	0.89	0.741	0.81	0	0	0.866	-0.461	0.539	-1.276	0	-1	0.539	0.461	0
20	853	2	99820	BDX PR N	100	0	0	0	0	0	0	-0.081	-0.081	0	0	0	-0.081	0.081	0
21	853	2	99821	BDX PR T	-100	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
22	853	2	99822	MCP1PR N	-57	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
23	853	2	99823	MCP1PR T	58	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
24	853	2	99824	MCP2PR N	-57	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
25	853	2	99825	MCP2PR T	57	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
26	853	2	99826	SCT PR N	-47	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
27	853	2	99827	SCT PR T	47	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
28	853	2	99828	SHE PR N	-67	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
29	853	2	39829	SHE PR T	67	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
30	803	2	99830	WHT1PR N	-100	0	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
31	853	2	99831	WHT1PR T	100	0.89	0.74	0.81	0	0	0.866	-0.461	0.539	-1.276	1	0	0.539	0.461	0
32	853	2	99832	WHT2PR N	-100	b	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	0
33	853	2	99833	WHT2PR T	100	0.89	0.74	0.81	0	0	0.866	-0.461	0.539	-1.276	1	0	0.539	0.461	0

The flowgate that monitors the power flow between Ontario and Manitoba is controlled by the pairs of phase shifters at the White Shell buses as seen in the red circle in the above picture. The model of a phase shifter is described in Part II: Models & Algorithms. For each phase shifter a pair of generators (one positive, one negative) is used. The flow in this flowgate is regulated to around 200MW. Therefore, we can observe there exist 2 pairs or four generators to represent the two phase shifters along this flowgate. To adjust the phase shifter so that it will operate and therefore control the flow in this flowgate at a different value than 200 MW one must adjust to outputs of these generators. The diagram below illustrate the case where the phase shifters are adjusted to control the flow in the flowgate at a value of 150 MW,

30	853	2	99830	WHT1PR N	-75	[	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	
3	853	2	99831	WHT1PR T	75	0.85	0.74	0.81	0	0	0.866	-0.461	0.539	-1.276	1	0	0.539	0.461	
32	853	2	99832	WHT2PR N	-75	Ģ	0	0	0	0	0	-0.082	-0.082	0	0	0	-0.082	0.082	
33	853	2	99833	WHT2PR T	75	0,69	0.74	0.81	0	0	0.866	-0.461	0.539	-1.276	1	0	0.539	0.461	
34	Ade	n	00004		200		0	0	٥	0	0	0	0	٥	٥	٥	0	0	

Note that although in the above example each generator is assumed to contribute 75 MW to make up the total of 150 MW as specified, it may not necessary be the case. If one has a precise knowledge of the actual setting that is used to control the flowgate's flow, then this setting must be used for the phase shifters.

#### b) Transmission Limit Adjustment & Transmission Outage Data:

At any given moment, there are always flows in all the branches of an electrical transmission network unless they are completely taken out of service. To operate the power system reliably, one must observe the amount of flow in some lines or a set of lines that are being identified as critical flow-gates to make sure that the flow should not exceed the pre-established limits called security limits in these flow-gates.

#### What is a Flowgate ?

Flow-gate is a circuit or a group of circuits through which amount of power flow must be monitored and controlled to ensure a safe operation of the power system.

#### Flow-Gates' Definitions

The Ontario-Michigan flow-gate definition consists of the following circuits:

#### **OH-MECS**:

Bus NAME	kV	Bus NAME	kV	Cct. ID	Metered
LAMB L4D	345	19SC67	345	1	Т
LAMB L51	345	19SC67	345	1	F
J5D PS	230	19WTRMN	230	1	F
SCOTT	220	19BUNCE	230	1	Т

This flow-gate contains four circuits. Consider the first circuit as specified in the first row: the first bus name is an Ontario bus of the circuit (line), next is the voltage level of this circuit, 345 kV; the second bus name is a Michigan bus of the circuit, the voltage level (345 kV), and the circuit identification (Cct. ID). Each circuit of this flow-gate will have a meter for monitoring the flow. The last column indicates where the meter is located. For this circuit, the meter is at the 'TO' bus (T). The symbol 'F' means the meter is located at the 'FROM' bus.

A complete set of flow-gate definitions is shown in the Appendix A.

The template for use to modify transmission limits and transmission outage data is as shown in the EXCEL worksheet named **AdjTXLim** that is partially shown as below

_					1	2	3	4	5	6	7	8	9	10
	No	Interface	LoLIMIT	UpLIMIT	5/18/02	5/19/02	5/20/02	5/21/02	5/22/02	5/23/02	5/24/02	5/25/02	5/26/02	5/27/02
	1	ТЕМ	-350	325	0	0	0	0	0	0	0	0	0	0
	2	LHE	-250	230	0	0	0	0	0	0	0	0	0	0
	3	EWFE	-350	325	0	0	0	0	0	0	0	0	0	0
	4	D501P	-1500	1500	0	0	0	0	0	0	0	0	0	0
	5	P502X	-1500	1500	0	0	0	0	0	0	0	0	0	0
	6	FN_S	-1800	1265	0	0	0	0	0	0	0	0	0	0
	7	QFW	-1600	2650	0	0	0	0	0	0	0	0	0	0
	8	BLIP	-2500	4500	0	0	0	0	0	0	0	0	0	0
	9	FETT	-5000	5750	0	0	0	0	0	0	0	0	0	0
	10	MH-ONT	-200	300	0	0	0	0	0	0	0	0	0	0
	11	ONT-MPL	-150	175	0	0	0	0	0	0	0	0	0	0
>[	12	ONT-MECS	-2214	2344	0	0	0	0	0	0	0	0	0	0
	13	ONT-NYPP	-1525	2350	0	0	0	0	0	0	0	0	0	0
	14	NTxONT_STL	-200	400	0	0	0	0	0	0	0	0	0	0
	15	NY_CxE	-3100	2980	0	0	0	0	0	0	0	0	0	0

For each flow-gate, there is a limit for the amount of power flow in one direction and a limit for the flow in the opposite direction. These limits are not necessarily the same due to operating conditions in different areas.

Again, let consider the ONT-MECS flow-gate as marked by the arrow in the above table. The maximum allowable power flow from Ontario to Michigan is 2344 MW whereas the maximum flow from Michigan to Ontario is 2214 MW (-2214 is used to indicate the flow

in the opposite direction). These limits can be modified by directly changing the values of the appropriate cells.

The flow-gates' limits could be varied during the course of the day or week or month due to system conditions. The new limits will be posted by the ISO/IMO as required by market rules to inform the market participants of system changes so that they could take appropriate measures to mitigate the risk created by these changes. These limit changes for various interfaces during days or weeks or months into the future could be captured in the dispatches using the EXCEL table shown above. In the following section, we will demonstrate how SMS utilizes transmission outage information reported daily by the New York ISO prior to its energy dispatch and price forecast runs.

The New York ISO, for example, posts daily transmission limits for various flow-gates throughout the state. A sample of this posting is as shown below.

	Inter://mis.nyiso.com/public/pdf/ttc/ttcf.pdf - Microsoft Internet Explorer            ←	Co Links <sup>™</sup>
	Seasonal Limits NYISO TRANSFER LIMITATIONS Wednesday, June 12, 2002 to Sunday, July 07, 2002	Naw Elowgata's
Circuit	TOTAL EAST 6500MW UPNY CONED 5100MW SPRBRK/DUN SOUTH 4700MW DYSINGER EAST 2850MW TOTAL EAST 2850MW The Total Transfer Capabilities (TTCs) indicated in this report represent predicted values of transfer capability between NYI LBMP zones as limited by either interface stability limits, voltage transfer limits, or individual transmission facility thermal limit Only those transmission facility outages that significantly impact NYISO transfer capability are reported. The DAM and HAM of TTC may differ from the values indicated in this report due to unanticipated NYISO or external control area limitations.	Limit
NAME Effective	WEST CENTRAL       2350MW         Y50       DUNWOODIE 345-SHORE RD 345 KV O/S       CONED-LIPA       New York City-Long Island       800         Sat 05/18/02       to Sat 07/20/02       UPDATED       by LI       06/04/02       Impacts Total Transfer Capability       600         3:12       Continuous 23:59       TTC with All Lines In Service       1400	
O/S dates	31-PR         PORTER         230-ROTTERDAM         230 KV O/S         CENTRAL EAST         Central-Capital/Hudson Valley         54           Mon         06/10/02         to         Fri         06/14/02         Impacts Total Transfer Capability         54           8:00         Continuous         16:00         TTC with All Lines In Service         56	Original Flowgate's Limit
	M54         W.49TH ST 345-E.13TH ST A 345 KV O/S         SPR/DUN-SOUTH         Dunwoodie/Sprainbrook-NYC         3800           Wed 06/12/02         to         Thu         06/13/02         CANCELLED         by CE         06/11/02         Impacts Total Transfer Capability         700           20:00         Continuous 4:00         Work scheduled by CE         TTC with All Lines In Service         4500	MW MW MW
	45       E.13TH ST A 345-FARRAGUT 345 KV O/S       SPR/DUN-SOUTH       Dunwoodie/Sprainbrook-NYC       3800         Wed       06/12/02       to       Wed       06/12/02       CANCELLED       by CE       06/11/02       Impacts Total Transfer Capability       700         20:00       Daily       20:30       TC with All Lines In Service       4500	MW MW
	45       E.13TH ST A 345-FARRAGUT 345 KV O/S       SPR/DUN-SOUTH       Dunwoodie/Sprainbrook-NYC       3800         Thu 06/13/02       to       Thu 06/13/02       CANCELLED       by CE       06/11/02       Impacts Total Transfer Capability       700         3:30       Daily       4:00       TTC with All Lines In Service       4500	MW MW
	PA302         BECK B 345-NIAGARA 3 345 KV O/S         IMO-NYISO         IMOONYISO         1200           Fri         06/14/02         to         Fri         06/14/02         Impacts Total Transfer Capability         1200           9:00         Daily         16:00         TTC with All Lines In Service         2400	MW MW
	14-EN         EDIC 345-NEW SCOTL 77 345 KV O/S         CENTRAL EAST         Central-Capital/Hudson Valley         4425           Sat 06/15/02         to         Sat 06/15/02         to         Sat 06/15/02         Impacts Total Transfer Capability         1225           8:00         Daily         16:00         TTC with All Lines In Service         5650	MW MW MW
	Image: Second	soft
	🛱 Start 🖹 Inbox - Microsoft Out 🙋 NYISO - Open Acces 🖗 http://mis.nyiso.c 🔍 Exploring - C:\abporc 🛛 👿 Microsoft Word - How	👂 💷 🕙 9:41 AM

#### How to use this information:

The first row is the circuit name that connects a bus named DUNWOODIE 345 to the SHORE RD 345KV. The second row shows the effective out-of-service dates. It indicates that between May 18, 2002 to July 20, 2002, the circuit named DUNWOODIE 345 \_SHORE RD 345KV is out of service (O/S), therefore, the flow-gate between CONED and LIPA whose original limit of 1400MW is to be reduced by 600 MW. This information is entered into the **AdjTXLim worksheet** as shown in the following:

				1	2	3	4	5	6	7	8	9	10
No	Interface	LoLIMIT	UpLIMIT	5/18/02	5/19/02	5/20/02	5/21/02	5/22/02	5/23/02	5/24/02	5/25/02	5/26/02	5/27/02
28	NYCxLILCO	-500	250	0	0	0	0	0	0	0	0	0	0
29	WSCHExLILC	-800	1400	-600	-600	-600	-600	-600	-600	-600	-600	-600	-600
30	NPXxLILCO	-100	100	0	0	0	0	0	0	0	0	0	0
31	PJM_WxCAP	-1500	1500	0	0	0	0	0	0	0	0	0	0
32	PJM_ExNYC	-1000	1000	0	0	0	0	0	0	0	0	0	0
33	PJM_WxNIAG	-550	550	0	0	0	0	0	0	0	0	0	0
34	PJM_WxCENT	-1100	1100	0	0	0	0	0	0	0	0	0	0
35	HQxADIR	-2350	2350	0	0	0	0	0	0	0	0	0	0
36	NEPOOLXNY	-1375	1300	0	0	0	0	0	0	0	0	0	0

For each day from 5/18/02 to 5/27/02 (10 days used in the table for illustration purposes), The limit on the interface is reduced by 600MW. Thus, the flow from Weschester to Long Island must be kept at 800MW maximum, and the reverse flow from Long Island to Weschester must be controlled at 200MW maximum. SMS will use these new limits when it dispatches power to serve the load demands. Similarly, other flow-gates' limits must be updated to achieve correct results.

In order for the new daily limit change reported in this worksheet to take effect, one must set the **AdjTxLim** parameter in the **BID\_ASK worksheet** to 1 as shown below

X	Micr	050	oft	Exc	el -	S№	IS_	Da	taB	ase	e4Us	e_IMC	)PD.x	ls										
	<u>F</u> ile	<u>E</u> di	it <u>V</u>	iew	<u>I</u> nse	ert F	= <u>o</u> rm	iat (	<u>T</u> ool	s <u>D</u>	ata <u>V</u>	<u>/</u> indow	<u>H</u> elp											
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Note also that this **AdjTXLim** worksheet contains the flowgates' limit in one direction as defined in the column named **UpLIMIT** (positive direction) and the limits in the reverse direction as in the column named **LoLIMIT** (negative direction). These are operational limits as compared to the planning limits shown in the **NDF4NEpars\_info** worksheet.

To use the planning limits, one must set the **NuTxLimit** parameter in the **BID\_ASK worksheet** to 0, and to use the operational limits set it to 1 (see the below figure).

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For comparison, the two sets of limit (planning limits and operational limits) for the defined critical flowgates are also shown in the following page.

		NDF4	From th NEPAR	ie S_inf	fo wor	·ksheet		AdjT	Fron XLim	ı the worksheet
Pla	nning Flow	gates	Limits		Ope	rational F	lowgate	s' Lim	its	
No	Interface	LoLIMIT	UpLIMIT		No	Interface	oLIMIT	<b>I</b> PLIMIT		
1	TEM	-350	325		1	TEM	-350	325		
2	LHE	-250	230		2	LHE	-250	230		
3	EWFE	-350	325		3	EWFE	-350	325		
4	D501P	-1500	1500		4	D501P	-1500	1500		
5	P502X	-1500	1500		5	P502X	-1500	1500		
6	FN_S	-1800	1265		6	FN_S	-1800	1265		
7	QFW	-1600	1650		7	QFW	-1600	1650		
8	BLIP	-1500	3500		8	BLIP	-1500	3500		
9	FETT	-5000	5750		9	FETT	-5000	5750		
10	MH-ONT	-200	300		10	MH-ONT	-200	300		
11	ONT-MPL	-150	175		11	ONT-MPL	-150	175		
12	ONT-MECS	-2214	2344		12	ONT-MECS	-2214	2344		
13	ONT-NYPP	-1525	2350		13	ONT-NYPP	-1525	2350		
14	NTxONT_STL	-200	400		14	NTxONT_ST	L -200	400		
15	NY_CxE	-3100	3100		15	NY_CxE	-3100	3100		
16	NY_WxC	-2350	2350		16	NY_WxC	-2350	2350		
17	NYxPJM	-3600	3600		17	NYxPJM	-3600	3600		
18	PJM-WEST	-5750	5750		18	PJM-WEST	-5750	5750		
19	PJM-CENT	-4500	4500		19	PJM-CENT	-4500	4500		
20	PJM-EAST	-7000	7090		20	PJM-EAST	7000	7000		
21	FRONT-GENE	-2750	2750		21	FRONT-GENE	-2000	2600	N	
22	GENEXCENT	-2200	2200	$\Lambda_{-}$	22	GENEXCENT	-1300	1770		
23	ADIRXCENT	-2050	2050		23	ADIRxCENT	-1500	2500		
24	CENXCAP_HD	-4650	4650		24	CENXCAP	ID -4650	4650		
25	CAPxNE	-1200	1200		25	CAPxNE	-1200	1200		
26	CAPXWSCHE	-4225	4225		26	CAPxWSCH	E -4225	4225		
27	WSCHEXNYC	-4175	4175		27	WSCHEXITY	-2000	3700	4	
28	NYCxLILCO	-975	975		28	NYCXLILCO	-500	250		
29	WSCHEXLILC	-1175	1175		29	WSCHEXLIL	C -500	1300		
30	NPXxLILCO	-200	200		30	NPXxLILCO	-100	100		
31	PJM_WxCAP	-1150	1150		31	PJM_WxCA	P -1500	1500		
32	PJM_ExNYC	-1000	1000		32	PJM_ExNYC	-1000	1000		
33	PJM_WxNIAG	-1100	1100		33	PJM_WxNIA	-550	550		
34	PJM_WxCENT	-1300	1300	/	34	PJM_WxCEM	IT -1100	1100		
35	HQxADIR	-2350	2350		35	HQxADIR	-2350	2350	4	
36	NEPOOLXNY	-1375	1300		36	NEPOOLXNY	-1375	1300	4	
37	PJM-APS	-1500	4000		37	PJM-APS	-1500	4000		
38	PJM-CEI	-700	700		38	PJM-CEI	-700	700	4	
39	PJM-VP	-2000	2000		39	PJM-VP	-2000	2000		
40	APS_WxE	-5000	5000		40	APS_WxE	-5000	5000		
41	ADIR-VERMN	-125	150		41	ADIR-VERM	-125	150		
42	NYXONT_NIA	-1975	1325		42	NYXONT_NIA	-1975	1325		
43	DECO_CONS	-5324	5324		43	DECO_CONS	-5324	5324		
44	DECO_AEP	-3380	3380		44	DECO_AEP	-3380	3380		
45	CONS_AEP	-4450	4450		45	CONS_AEP	-4450	4450		
40			0		40	COUC ON	60	00		

### c) Daily Generator Outage Data:

Due to the proprietary nature of generator outage data, SMS uses the combined planned and forced outage rates (PFOfactors) for all areas of interest represented in the model. This PFO rate is used as the standard deviation in a Random Normal distribution whose mean value is set to zeros. The set of random numbers generated by this distribution is used to offset the available capacity of generation in each zone so that the overall net capacity achieved the desired level. To use this approach users must set the **GenOutage** Parameter in the **BID\_ASK** worksheet to 0 and the **PFOfactors** to the combined planned and forced outage rates (in fraction). For instance, if the combined planned and forced outage rate is around 15 percent of available capacity in each lamination/zone, then we must set the parameters as shown

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If, however, users have precise knowledge of generation outage for each zone, then this info can be entered manually in the provided **dailyGenOut** worksheet as shown partially in the following diagram.

Each zone in the SMS program contains 10 cells. These cells are also called laminations which are used to classified the type of generations exists in each zone.

Note that each zone shown in the diagram is exactly the transpose of each zone energy lamination described in the **BID\_ASK** worksheet. The reason for the transpose is so that daily outages for each zone lamination can be accommodated.

Suppose, there is approximately 200 MW out of a total capacity of 2850 MW of nuclear power in Zone PS of the PJM market to be out of service for the next 4 days, the information can be entered into the **dailyGenOut** worksheet as shown in the diagram.

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			Zone I	PS of	the				Ι	Daily	amou	nt of	powe	r				
			PJM. I	Each z	zone	has			C	outage	e with	in the	fuel	-type				
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4			BaseMW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
5	1	PS	224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	2	2850	-200	-200	-200	-200	0	0	0	0	0	0	0	0	0	0	0
7	1	3	2042	0	0		U	0	0	0	0	0	0	0	0	0	0	0
8	<u></u>	4	536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	5	5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	6	6		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11		7	949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12		8	4843	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
13	9	9	975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	44		500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	12	2	2648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	13	3	746	0	n.	0	N	n.	, N	N	0			0	n.	n i	n.	
18	14	4	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ŭ
19	15	5	1055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	16	6	1191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	17	7	1058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	18	8	2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	19	9		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	20	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	21	PL	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	22	2	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	23	3	2217	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	24	4	2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- 29	25	5	310	0	0	U	0	0	0	0	0	0	0	U	U	U	U	0

Another way to incorporate outages is to reduce the amount of MW available in the **BID\_ASK** worksheet by moving the generation capacity to a much high price lamination. Usually the last lamination in each zone is set aside for this purpose. Due to high its high price, it will not normally dispatched. Hence, by moving generation capacity to this lamination one is essentially increasing the outage rate for that zone.

### d) Import-Export Adjustment

Optimal power dispatches will result in power flowing from a cheaper zone to a more expensive zone to meet load demands. In practice, free movement of power based on price offer alone is not realistic. Other factors such as dispatch coordination, security and system reliability must also be considered during the dispatches.

Within the authority of an ISO/ IMO it makes sense to assume that normal economic dispatch takes place with some minor adjustment for security reasons. However, power exchange between IMO and ISO or ISO and ISO must be coordinated to ensure proper dispatches. So unless power traders are actively involved in moving surplus cheap power to supply more expensive demand regions, free power movement based on offer price simply does not occur.

In SMS program, import and export feature is facilitated in a worksheet named **Import\_Export** as shown below

<	I <del>SO</del> TIMO CAIEBase	PJM 1000	MECS -600	NY -1300	ON 800	NE -700	800	>+	Use this row to enter data for import (-) or export (+) if one only knows approximately maximum amount
	1	1023	-501	-900	1086	578	881		during the period of study
	2	1147	-503	-878	1195	532	865	1	
	3	1095	-506	-1066	1060	572	974		
	4	868	-547	-1001	1123	648	1023		
	5	1134	-514	-1148	1337	559	871		
	6	967	-458	-1050	1379	567	915		
	7	1066	-457	-880	1186	596	1049		Use the table to enter data for import
	8	985	-478	-992	1384	564	865		(-) or export from each IMO/ISO if
	9	910	-502	-937	1264	633	980		one has daily info of maximum import
	10	1013	-580	-1102	1010	595	932		and export amount in each area
	11	877	-514	-957	1207	578	954	I L	1
	12	1073	-606	-864	1077	662	961		
	13	1032	-578	-1071	1435	630	1186		
	14	886	-489	-1119	1066	638	940		
	15	890	-504	-800	1141	628	968		

In the example shown, during the period of forecast, one would expect that at any hour PJM could export a maximum of 1000 MW, MECS imports a maximum 600 MW, NY could buy up to 1300MW. Ontario could sell up to 800 MW. New England could buy up to 700MW and HQ could sell up to 800 MW.

The table format is designed for a forecast period of 15 days ahead; however, it could be easily extend to any number of days with some minor change.

#### e) BID and ASK Modifications:

One of the challenges in forecasting spot market price is the lack of data concerning bidding strategies. Because of the proprietary nature of how generators offer their energy to the daily or hourly spot markets, one must establish some reasonable criteria based on the public domain information related to the generation characteristics in each IMO/ISO in order to forecast the spot market prices for electricity.

Public domain information such as fuel type, heat rates, and operating characteristics is available for most generators. This information together with the historical price data in various control areas and ISO/IMO published price data can be used to construct a bidding strategy for generators.

The BID\_ASK worksheet shows generator data categorized into fuel type, capacity and the estimated cost per MWh for all generators across the Northeast interconnection.

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5	RefLd	SpotBid	Zone	fwdmk	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	<b>/</b> W 10	GenCap	ASK 1	ASK 2	ASK 3	ASK 4	ASK (	SK 6	SK 7	SK 8	SK 9	SK 10	BidFa
6	-8836	250	PS	0	224	2850	2042	536			949	4843	975	900	13318	12	14	19	24			51	51	85	1500	1.00
7	-7109	250	PE	0	1424	4120	1451	251		43	1520	270	853		9933	12	14	19	27		27	51	43	67		1.00
8	-5884	250	PL	0	289	2184	4571	79		25	35	1853	396		9432	12	14	17	23		31	53	41	74		1.00
9	-6080	250	BC	0	278	1675	2856	124			573	989	347		6843	12	14	19	26			49	53	74		1.00
10	-3584	250	JC	0	200	816	283	98			230	1098	1000	635	4361	12	14	18	23			55	54	79	1500	1.00
11	-3545	250	ME	0	19	393	1447	95			4	262	248		2467	12	14	18	30			68	52	86		1.00
12	-2374	250	PN	0	169	197	3137	23	10		24	213	155		3928	12	14	17	23	26		48	52	68		1.00
13	-5871	250	PEP	0			3100	118		10	1774	1060	572		6634			19	26		5	49	48	73		1.00
14	-1956	250	EA	0		380	1441	75			348	508	243		3094		14	20	25			56	52	74		1.00
10	-3072	250	DECO	0		320	1241	175	40	4070	/00	2459	292	400	40050		14	20	22	20	27	40	47	71	4.500	1.00
17	-10335	250	CONS	0		3955	2478	2000	49	1270	676	2150	1002	420	12200		14	10	20 25	20 26	29	55 55	40	70	1500	1.00
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22	-832	250	E	0	492		53	15	15	20		336			931	12		22	32	26	27		33			1.00
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25	-445	250	н	0		1933						54	47		2034		14						42	87		1.00
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35	-3675	250	EAST	0	1225	1000	3524	372	60	225	500	500	25	680	8111	12	35	11	27	23	20	45	55	60.0	250	1.00
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38	-23185	250	ISONE	0	3282	4333	2806	565	400	550	6624	6801	955	732	27049	5	8	20	29	30	31	32	36	43	75	1.10
39	-9	250	HQ	0	500	200	300	400							1400	26	27	35	67							1

Except for Ontario IMO market where the amount of generating capacity is not classified according to the fuel-type but rather by station, The US generating capacity is listed by fuel type. The order of fuel-type shown is:

- 1. Water or Hydro-electric type
- 2. Uranium or Nuclear type
- 3. Bituminous or Coal-fired type
- 4. Wood
- 5. Refuse or Waste
- 6. Others (Anything else that is not of the type listed)
- 7. Methane Gas
- 8. Natural Gas
- 9. Fuel Oil #6
- 10. Fuel Oil #2 or mixed type

Corresponding to the table of "Energy Bidding Laminations" is the "Price Bidding Laminations" table. The entries in one table are mapped one-to-one in the corresponding table. For ease of discussion, let us consider the very first row of the table shown in the BID\_ASK worksheet as shown below:



As shown in the above diagram, the worksheet contains information about the zonal generating capacity and offer that are categorized into laminations for fuel types and running cost that also includes a variety of adders to account for actual cost plus profit.

SMS suite also allows dispatchable load BIDS. That is, the load can specify up to what price it is willing to pay for the power it consumes every hour. If it happens that the spot market price for some hour is higher than its bid price, some dispatchable load could be shed from the total load to achieve the desired price. This feature is very useful for implementing the demand management strategy to avoid rotating blackout, especially during the energy shortage period.

Although the load reference for each zone is reported in the table, it should not be taken as though the energy consumption is fixed for each zone during the study period. This reference serves as sanity check for the zonal load forecasts and "**Fwdmkt**" modeling that will be discussed shortly. The SMS program requires that hourly zonal load must be supplied for the entire period of the study. This data is read into the program in a separate input file to be discussed later.

The SMS program also provides bidding flexibility for fuel-type base for the entire region. The factors in the very top row of the Price Bidding Lamination table are to be used for the fuel-type based OFFER adjustment, and the factors in the far right column are used for zonal energy OFFER price adjustment. These factors must always be positive.

To increase the OFFER price one must use a factor that is greater than 1 and to decrease the price use a factor that is less than 1. The factor of value 1 is the reference for the OFFER prices as shown in the "Price Bidding Lamination" table.

One final feature from this worksheet that is also worth mentioning here is the "Fwdmkt". The fourth column from the left that was labeled "Fwdmkt" is used to signal whether the generators in a particular zone should be used as "forward" market or not. That is, if the zone is considered as "Fwdmkt" either because we do not have sufficient data for generators in that zone or it is far away and therefore is not of interest, but activities in this zone will have some impact in the network power flow. Therefore we must find a way to incorporate the effect of these zonal activities. By assigning this zone to the "Fwdmkt" type, one basically assumes that the zone has enough supply to satisfy its own load (here summer peak load is used as a reference) and simulates the impact of the power flow in other flowgates of interest as a result. In doing this one at least capture some power flow impact in other critical flowgates in a conservative way rather than not capturing the effect at all that might result in erroneous congestion estimate.

To include a particular zone in the spot market dispatch, one therefore must assign 0 to the corresponding row of the "**Fwdmkt** " column. And the generating data of the zone must be supplied together with the OFFER prices in both "Energy Bidding Laminations" and "Price Bidding Laminations" tables for proper dispatches. On the other hand, if the zone is to be excluded from the spot market dispatch, then a 1 must the entered in the appropriate row. No information about generation needs to be provided.

## f) How to Prepare Primary Demand Input:

Before showing how to run the SMS program, let us consider how the primary demand input should be prepared. Hourly primary demand for each zone must be prepared and arranged in the order as shown in the template below:



The primary demand input may contain as many hours as users want for their price forecast simulation. The SMS Suite does not restrict the size of the primary demand input.

The best way to load the primary demand input into SMS Suite is through Excel Link. Once the data has been prepared in the specified format in an EXCEL worksheet, it can be read in using the Excel Link command **putmatrix**:

- 1. Select by highlighting the primary demand input to be read into the SMS Suite
- 2. Click on the **putmatrix** button shown in the EXCEL sheet that is linked to Matlab Excel Link
- 3. Give the input matrix a name

#### Note:

- 1. If you plan to use the primary demand input many more times in the future runs it is best to save it in a file otherwise it will be lost as you end the SMS run session.
- 2. When subscribed, the SMS also models PJM, New England ISO for accurate representation of power flow, the primary demands for these control areas will be provided in a default database to be used in conjunction with other primary demands prepared by users. This feature will be discussed in the next section.
- 3. At any time, users could replace previous primary demand forecasts by more accurate and recent sources based on the weather actual such as IMO or NY ISO forecasts. The next section will show how this can be done.

## g) Run\_SMS:

Finally, the **Run\_SMS** worksheet is to read into the SMS program all the changes that have been made so far. Here one must also specify the primary demand forecasts that are required as inputs to the program, and whether there is any holiday during the period of study, if so, specify them, and then run the study using the SMS program.

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3 0 Press F2_RETURN: for Current DIRECTORY	
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7 USE IMO PD apd(or NVISO PD (ves/po)	
8	
9 01-Jan-02 Starting Date of the PD Data	
10	
11 31-Jul-02 Starting Date of PRICE Forecasts	
12 15-Aug-02 Ending Date of PRICE Forecasts	
13 [Holiday 05] 14 [05-Aug-02]	
15 18-Apr-03	
16 21-Apr-03	
17 19-May-03 18 01-Jul-03	
19 04-Aug-03	
20 01-Sep-03	
21 Holidays During This Period 04-04-03	
23 25-Dec-03	
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20 27 27 20 20 20 20 20 20 20 20 20 20 20 20 20	
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31	
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35 0 Press E2_RETURN: for Reading Date INPLIT Data	
36 To run SMS, go to Command Window and TYPE:	
37 runSMS	
38	

Although the steps are self-explanatory, let us go through the example shown in details.

Once the SMS Suite has been activated with Excel link ready, the steps to be taken to run the SMS program is as follows:

- 1. Put the cursor in the first yellow cell and press F2 to locate the default directory that is the home of all the input-output data.
- 2. Press F2 with the cursor in the next yellow cell to read network database together with all the changes made.
- 3. Decide whether IMO Primary Demand (PD) forecast should be used or the inhouse PD forecast is the choice. In the example shown here, it is assumed that the in-house PD forecast is supplied for the entire year 2002. Thus, the starting date of the PD forecast is Jan. 1, 2002. One can easily change this date according to the PD forecast prepared for the study.
- 4. Record the starting date and ending date for the study period.
- 5. Record any holidays that might fall between the study periods. This is useful for the program to decide on-peak, off-peak and weekend prices. Also because US and Canada may have different holidays during the course of a month or a year, it is important that the data be input manually to avoid confusion and error.
- 6. Move the cursor to the next yellow cell and press F2 to record input data about holidays and/or the source of PD forecast.
- 7. Go to the Matlab command window and run the SMS Suite by issuing the command "**runSMS**."

However, before issuing this command to execute the program, users may want to decide whether simple simulation run or Monte Carlo simulation run is indeed the choice. To make this choice, you must go back to the **BID\_ASK** worksheet, and under the parameter **MC** (stands for Monte Carlo) enter the desired option: 1 to run Monte Carlo and 0 to make a simple (non-Monte Carlo) simulation run. Further to this choice, one must also enter what level of uncertainty in the PD forecast and the number of iterations required for each hour one wish to entertain. Suppose the PD uncertainty is around 3 % and 10 iterations are needed, then enter in the parameter beneath the cell labeled **MCsd** (stands for Monte Carlo Standard Deviation) the value 0.03, and beneath the parameter cell labeled **MCiter** enter 10. See the diagram below.

**Note:** One must go back to the second yellow cell at the top to read in these changes before issuing the "runSMS" command to run the SMS Suite.

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3. MCsd = 0.03, PD uncertainty is around 3 %, used only when MC = 1.

## 4. <u>SMS OUTPUTS</u>

When subscribed with the appropriate modules, the output of SMS program includes three main sets of power market forecasts: spot market price forecasts, flowgates' flows and transmission right and/TCC value. In the following sections, each of these output feature will be presented in details:

#### a) Spot Market Price Forecasts:

The spot market price forecasts are processed into 4 main blocks (categories) to help users best utilize the SMS output results. They are

- **7x24 Price Block**: Contains simple and weighted average daily prices
- **5x16 Price Block**: Contains simple and weighted average daily prices for the weekdays' hours 7:00 22:00
- **5x8 Price Block**: Contains simple and weighted average daily prices for the weekdays' hours 1:00 6:00 and 23:00 24:00
- **2x24 Price Block:** Contains simple and weighted average daily price for the weekends and holidays

There are two ways to obtain these results from a SMS run. The easiest way is to point the cursor at the yellow cell in the first row of the **SMSSpotPrices** output worksheet and press **F2**. Using this approach users will have all the results printed all at once in the prearranged SMS output worksheet.

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Γ		7x24	Price Bl	ock		5x16	Price Bl	ock		5x8 P	rice Blo	ock		2x24	Price Bl	ock
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	15-Jul-02	63.8	65.1	443	15-Jul-02	79.5	81.5	321	15-Jul-02	32.2	32.3	122	20-Jul-02	36.7	37.2	384
	16-Jul-02	60.7	62.3	415	16-Jul-02	75.5	77.9	298	16-Jul-02	31.0	31.1	117	21-Jul-02	35.0	35.4	376
	17-Jul-02	64.6	66.7	414	17-Jul-02	80.1	83.1	297	17-Jul-02	33.5	33.8	116	27-Jul-02	37.1	37.6	412
	18-Jul-02	79.7	80.5	418	18-Jul-02	101.9	102.9	302	18-Jul-02	35.4	35.6	116	28-Jul-02	32.1	32.3	372
	19-Jul-02	58.8	60.0	422	19-Jul-02	71.6	73.2	305	19-Jul-02	33.2	33.5	117	3-Aug-02	33.0	33.3	384
	20-Jul-02	36.7	37.2	384	22-Jul-02	70.7	72.4	293	22-Jul-02	31.0	31.1	115	4-Aug-02	31.9	32.2	367
	21-Jul-02	35.0	35.4	376	23-Jul-02	69.9	71.6	303	23-Jul-02	32.2	32.4	116	10-Aug-02	2 39.3	40.0	405
Γ	22-Jul-02	57.4	58.7	408	24-Jul-02	74.6	75.4	327	24-Jul-02	34.2	34.4	125	11-Aug-02	2 35.1	35.7	365
	23-Jul-02	57.4	58.5	419	25-Jul-02	71.7	72.2	313	25-Jul-02	31.7	31.8	120	5-A03-02	39.8	40.8	376
Γ	24-Jul-02	61.2	61.7	452	26-Jul-02	66.6	67.4	325	26-Jul-02	31.1	31.2	124				
	25-Jul-02	58.4	58.7	433	29-Jul-02	89.0	89.8	324	29-Jul-02	32.5	32.5	122		$\sim$		_
Γ	26-Jul-02	54.8	55.3	449	30-Jul-02	89.9	93.3	329	30-Jul-02	34.7	35.1	125				
	27-Jul-02	37.1	37.6	412	31-Jul-02	74.0	76.3	292	31-Jul-02	33.0	33.2	115	Tł	his is the Cl	VIC holiday	
	28-Jul-02	32.1	32.3	372	1-Aug-02	88.2	90.2	309	1-Aug-02	36.0	36.3	118	du	iring the pe	riod from	
	29-Jul-02	70.1	70.7	446	2-Aug-02	82.0	84.8	316	2-Aug-02	34.8	35.2	121	Ju	ily 15 - Aug	just 15, 2002	
1	20 1 1 02	74 5	72.0	15.1	0.0	CO C	74.0	202	0.0	24.4	24.2	440				

Sometimes, users would also like the flexibility to store the desired price output in a place other than the pre-arranged worksheet. To accommodate this desire, SMS allows users to select individual price blocks and store at any location of their choice. The names for each individual price block are:

- 7x24 Price Block: MCP7x24
- 5x16 Price Block: MCP5x16
- **5x8 Price Block:** MCP5x8
- 2x24 Price Block: MCP2x24

To store a particular price block at a desire location of an EXCEL worksheet, all one has to do is to follow the steps:

- Go to the location where the data is to be stored and,
- Click on the **getmatrix** button
- Enter the name of the price block to be stored in the menu and hit Enter or the OK button on the MENU

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	13	23-Jul-02	57.4	58.5	419						
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	15	25-JUI-02	58.4	58.7	433						
	10	26-JUI-02	54.0 27.1	55.J 27.G	449						
	18	27-30-02 28, Jul 02	32.1	32.3	412						
	19	29-Jul-02	70.1	70.7	446						
	20	30-Jul-02	71.5	73.9	454						

### b) Flowgate 's Flows:

All critical flowgates as observed by IMO/ISO are defined in Appendix A. The flowgate 's flow results can be obtained by place the cursor at the desired location and follow the same steps as shown in the last section:

- Go to the location where the data is to be stored and,
- Click on the **getmatrix** button
- Enter the name **FinFLOW** (for flowgates' flows) in the menu and hit Enter or the OK button on the MENU



## c) Congested Flowgates & FTR Values:

SMS program also determines hourly what flowgates are being congested and what amount of power flows in each of the congested flowgates. These features are useful for determining the values of the Financial Transmission Rights (FTR) administered the IMO or the Transmission Congestion Contract managed by the New York ISO. The sample picture below shows typical results obtained after each SMS run.

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10		7	QFW			7	2	21	27	29	34	0	0	7	230	2600	3700	1300	1100	0	0
11		8	BLIP			8	2	21	26	27	37	0	0	8	230	1600	4225	3700	-1500	0	0
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17		14	NTXON	T_STL		14	25	26	27	33	37	0	0	14	-1200	4225	3700	-550	-1500	0	Ō
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To obtain a report of hourly congested flowgates, do as follows:

- Place the cursor at the cell just immediate right of hour 1
- Click on the getmatrix button
- Then type **FTRwhere** on the appeared MENU

<b>X</b>	Microsoft Excel - SMSOutPuts.xls																			
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13		10	MH-ONT			10	2	25	26				<b>1</b>		10	230	-1200	+z25	3700	-150
14		11	ONT-MPL			11	2	25	26		Step	o 3	0		11	230	-1200	4225	3700	-150

Similarly, to examine the value of the power flow in the congested flowgates, do the following steps:

- Place the cursor at the cell just immediate right of hour 1 of FTRvalue table
- Click on the getmatrix button
- Then type FTRvalue on the appeared MENU

I	Q	R	S	Т	U	V	W	Х	Y	Z
				FTRv	alue					
	Hrs		CON	GESTI		VERG	Y (MW	/h)		
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	6	230								
	7	230	FTF	Rvalue						
	8	230	2800	4225	3700	- 1500	U	U		

# APPENDIX A: FLOW-GATE DEFINITIONS

The following are the definitions of northeastern interconnection critical flowgates as defined by NERC NPCC and local IMO/ISO. The bus names and bus numbers are based on the NERC base-case loadflow.

Low Tx. LIMI	High T	FROM Bus NAME		TO Bus NAME		Circui IDENT	t IFIER
) -350 ) -350 ) -350	325 325 325	MACKENZI 22 MACKENZI 22 MURILLO 118	20 20 8.05	LAKEHEAD LAKEHEAD BIRCH 1	220 220 18.05	CCT= CCT= CCT=	1 2 1
) -250 ) -250	230 230	LAKEHEAD 22 LAKEHEAD 22	20 20	MARATHON MARATHON	220 220	CCT= CCT=	1 2
) -350 ) -350	325 325	MARATHON 22 MARATHON 22	20 20	WAWA WAWA	220 220	CCT= CCT=	1 2
6 -1500	1500	PINARD	500	PORCUPI	N 500	CTT= 1	
<b>K</b> 6 -1500	1500	PORCUPIN	500	HANMER	500	CCT= 1	
5 -1800 5 -1800 0 -1800	1265 1265 1265	HANMER HANMER OTTO HOL	500 500 220	ESSA ESSA DES JOA(	500 500 C 220	CCT= 1 CCT= 2 CCT= 1	
7 -1600 5 -1600 3 -1600 5 -1600 5 -1600	1350 1350 1350 1350 1350	BECK2 DK BECK2 DK BECK2 DK BECK2 DK ALANJQ30	220 220 220 220 220	NEALJQ2 HANONJ2 NEALJQ2 HANONJ2 MIDDLEP	3 220 4 220 5 220 9 220 T 220	CCT= 1 CCT= 1 CCT= 1 CCT= 1 CCT= 1	
<pre>0 -1500 0 -1500 0 -1500 0 -1500 0 -1500 1 -1500 1 -1500 1 -1500</pre>	3500 3500 3500 3500 3500 3500 3500 3500	DETWEILE DETWEILE MIDDLEPT SALFDJ33 SALFDJ32 WILCJ562 WILCJ563 NANTICOK	220 220 220 220 220 500 500 500	BUCHANA BUCHANA BUCHANA BUCHANA BUCHANA LONGWOO LONGWOO	N 220 N 220 N 220 N 220 N 220 N 220 D 500 D 500 D 500	CCT= 1 CCT= 2 CCT= 1 CCT= 1 CCT= 1 CCT= 1 CCT= 1 CCT= 1	
	Low Tx. LIMI 0 -350 -350 0 -350 0 -250 0 -250 0 -250 0 -350 0 -1500 0 -1500 0 -1500 0 -1500 1 -1500 1 -1500 1 -1500 1 -1500	Low Hign Tx. LIMIT 0 -350 325 -350 325 0 -350 325 0 -250 230 0 -250 230 0 -250 230 0 -250 325 0 -350 325 0 -350 325 6 -1500 1500 8 -1500 1500 8 -1800 1265 -1800 1265 -1800 1265 0 -1800 1265 0 -1800 1265 0 -1600 1350 5 -1600 1350 3 -1600 1350 5 -1600 1350 5 -1600 1350 0 -1500 3500 0 -1500 3500 0 -1500 3500 1 -15	Low         Hign         FROM           Tx. LIMIT         Bus NAME           D         -350         325         MACKENZI 22           D         -350         325         MACKENZI 22           D         -350         325         MURILLO 118           D         -250         230         LAKEHEAD 22           D         -250         230         LAKEHEAD 22           D         -250         230         LAKEHEAD 22           D         -350         325         MARATHON 22           G         -1500         1500         PINARD           K         -1500         1265         HANMER           G         -1800         1265         HANMER           G         -1600         1350         BECK2         DK           G         -1600         1350         BECK2         DK           G         -1600         1350         DETWEILE	Low         High         FROM           Tx. LIMIT         Bus NAME           0         -350         325         MACKENZI 220           0         -350         325         MURILLO 118.05           0         -250         230         LAKEHEAD 220           0         -250         230         LAKEHEAD 220           0         -250         230         LAKEHEAD 220           0         -350         325         MARATHON 220           0         -350         325         MARATHON 220           0         -350         325         MARATHON 220           6         -1500         1500         PINARD         500           6         -1500         1500         PORCUPIN         500           6         -1800         1265         HANMER         500           6         -1800         1265         HANMER         500           7         -1600         1350         BECK2         DK 220           8         -1600         1350         BECK2         DK 220           9         -1600         1350         BECK2         DK 220           9         -1600         3500         DETWEILE	Low         High         FROM         Bus NAME         Bus NAME           0         -350         325         MACKENZI         220         LAKEHEAD         1           0         -350         325         MURILLO         118.05         BIRCH         1           0         -350         325         MURILLO         118.05         BIRCH         1           0         -250         230         LAKEHEAD         220         MARATHON         1           0         -250         230         LAKEHEAD         220         MARATHON         1           0         -350         325         MARATHON         220         MARATHON         1           0         -350         325         MARATHON         220         WAWA         1           0         -350         325         MARATHON         220         WAWA         1           0         -350         325         MARATHON         220         WAWA         1           1         50         PORCUPIN         500         PORCUPIN         500         HANMER           5         -1800         1265         HANMER         500         ESSA           5 <td< td=""><td>Low Tx. 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LIMIT         FKOM Bus NAME         DU Bus NAME         DU Bus NAME         CUCUI Bus NAME           0         -350         325         MACKENZI 220 MACKENZI 220 D -350         LAKEHEAD 220 MURILLO 118.05         CCT=           0         -350         325         MURILLO 118.05         BIRCH         118.05         CCT=           0         -250         230         LAKEHEAD 220 LAKEHEAD 220         MARATHON 220 WAWA         CCT=           0         -350         325         MARATHON 220 MARATHON 220         WAWA         220         CCT=           0         -350         325         MARATHON 220 MARATHON 220         WAWA         220         CCT=           0         -350         325         MARATHON 220 MARATHON 220         WAWA         220         CCT=           5         -1500         1500         PINARD         500         PORCUPIN 500         CTT= 1           6         -1800         1265         HANMER         500         ESSA         500         CCT=           7         -1600         1350         BECK2 DK 220         NEALJQ23         220         CCT=         1           7         -1600         1350         BECK2 DK 220         NEALJQ25         220</td></td<>	Low Tx. 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79875 77111 77111 79825 79826 79826 79805 79805 79810	77444 77110 77463 77447 75892 75893 75893 75893 75995	-2350 -2350 -2350 -2350 -2350 -2350 -2350 -2350	2350 2350 2350 2350 2350 2350 2350 2350	FARMNGTN MORTIMER MORTIMER PANNELLI QUAKER QUAKER CLYDE199 STA 162	34.5 115 115 115 115 115 115 115 115	FARMGTN1 LAWLER-1 LAWLER-2 FRMGTN-4 MACDN115 SLEIG115 SLEIG115 S.PER115	115 115 115 115 115 115 115 115	CCT= CCT= CCT= CCT= CCT= CCT= CCT= CCT=	1 1 1 1 1 1 1
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79801	77400	-2350	2350	PANNELL3	345	CLAY	345	CCT=	1	
79801	77400	-2350	2350	PANNELL3	345	CLAY	345	CCT=	2	
75417	75414	-2350	2350	STOLE230	230	MEYER230	230	CCT=	1	
77111	77110	-2350	2350	MORTIMER	115	LAWLER-1	115	CCT=	1	
77111	77463	-2350	2350	MORTIMER	115	LAWLER-2	115	CCT=	1	
79826	75893	-2350	2350	QUAKER	115	SLEIG115	115	CCT=	1	
79825	77447	-2350	2350	PANNELLI	115	FRMGTN-4	115	CCT=	1	
79810	75995	-2350	2350	STA 162	115	S.PER115	115	CCT=	1	
79826	75892	-2350	2350	QUAKER	115	MACDN115	115	CCT=	1	
75994	75992	-2350	2350	PALMT115	115	BENET115	115	CCT=	1	
79805	75893	-2350	2350	CLYDE199	115	SLEIG115	115	CCT=	1	
79805	77433	-2350	2350	CLYDE199	115	CLTNCORN	115	CCT=	1	
79875	77444	-2350	2350	FARMNGTN	34.5	FARMGTN1	115	CCT=	1	
79875	77447	-2350	2350	FARMNGTN	34.5	FRMGTN-4	115	CCT=	1	
79946	77447	-2350	2350	S168 1	12.0	FRMGTN-4	115	CCT=	1	
§ 23·	ADTR	CEN								
79578	79577	-2000	2000	MASS 765	765	MARCY765	765	CCT =	1	
78017	78002	-2000	2000	DENNISON	11.5	ANDRWS-4	115	CCT=	1	
79590	79585	-2000	2000	MOSES W	230	ADRON B1	230	CCT=	1	
79590	79586	-2000	2000	MOSES W	230	ADRON B2	230	CCT=	1	
78017	78032	-2000	2000	DENNISON	115	LWRNCE-B	115	CCT=	1	
78000	78010	-2000	2000	ALCOA-NM	115	BRADY	115	CCT=	1	
78033	78041	-2000	2000	MALONE	115	NICHOLVL	115	CCT=	1	
* <b>24</b> :	CENXCA	AP-HUD	4650		245	NI 000077	245	0.05	1	
70502	70702	-4650	4650	EDIC MADOX m1	345	N.SCOT77	345	CCT=	1	
79383	70000	-4650	4650	MARCI TI	345	N.SCOT99	345		1	
78460	70000	-4650	4650	PORTER 2	230	ROTRDM.2	230		1	
78460	70126	-4650	4650	PORTER Z	23U 115	ROTRDM.Z	23U 115	CCT=	1	
70447	19130	-4650	4650	E.SPRIIS	IIJ OD11E	INGHAM-E	110 4 111500		L D.70470	
99892 <	99092 (-	-4050	4050	/84/8:INGMS	S-CDIIS	/9136:INGHAN	1-EIISCC	1=1->PF	AR:/84/8-	
75403	79581	-4650	4650	FRASR345	345	GILB 345	345	CCT=	1	
79304	74001	-4650	4650	SHOEMTAP	345	ROCK TAV	345	CCT=	1	
75400	74001	-4650	4650	COOPC345	345	ROCK TAV	345	CCT=	2	
		_								
* 25:	CAPXNE	<b>-</b> 1200	1200	UAAATAV	115	ωνικιταιώστικα	11⊑		1	
79155	70522	-1200	1200	MUTTEUNT	115	DININGIN	115		1	
78980	70325	-1200	1200	DOTIDINAL	730	DDINAMD	730		⊥ 1	
78700	72928	-1200	1200	ALDS3/5	200	MZNX303	200		1	
74344	73117	-1200	1200	PLTVLLEY	345	CTN7308	345	CCT=	1	
11011	/ 311 /	1200	1200		545	CINISSO	545	001-	1	
<b>% 26:</b>	CAPxWS	SCHE								
74002	74331	-5100	5100	ROSETON	345	FISHKILL	345	CCT=	1	
74344	74341	-5100	5100	PLTVLLEY	345	MILLWOOD	345	CCT=	1	
74344	74331	-5100	5100	PLTVLLEY	345	FISHKILL	345	CCT=	1	
74344	74331	-5100	5100	PLTVLLEY	345	FISHKILL	345	CCT=	2	
/4344	74356	-5100	5100	PLTVLLEY	345	WOOD B	345	CCT=	1	
/434/	/4312	-5100	5100	KAMAPO	345	BUCH N	345	CCT=	⊥ 1	
/4340	74313	-5100	5100	LADENTWN	345 115	BUCH S	345 115	CCT=	⊥ 1	
74026	10/62	-SLUU	5100 5100	FISHKILL	115 115	SILVN115	TT2 24E	CCT=	⊥ 1	
14022	/433⊥	-0100	JIUU	C LT2H T	TTO	стоцитрр	343	CC.I.=	1	

### 8 27: WSCHEXNYC % 27: WSCHEXNYC 74420 74533 -4175 4175 DUN NO1R 138 S CREEK 138 CCT= 1 74421 74533 -4175 4175 DUN NO2R 138 S CREEK 138 CCT= 1 74424 74435 -4175 4175 DUN NO2R 138 S CREEK 138 CCT= 1 74424 74435 -4175 4175 DUN SO1R 138 E179 ST 138 CCT= 1 74316 74345 -4175 4175 DUNWODIE 345 RAINEY 345 CCT= 3 74348 74351 -4175 4175 SPRBROOK 345 TREMONT 345 CCT= 1 74348 74354 -4175 4175 SPRBROOK 345 W 49 ST 345 CCT= 1 74348 74354 -4175 4175 SPRBROOK 345 W 49 ST 345 CCT= 2 75047 74505 -4175 4175 V STRM P 138 JAMAICA 138 CCT= 1 75067 74505 -4175 4175 V STRM P 138 JAMAICA 138 CCT= 1 % 28: NYCxLILCO 74505 75047 -550 550 JAMAICA 138 L SUCSPH 138 CCT= 1 74505 75067 -550 550 JAMAICA 138 V STRM P 138 CCT= 1 % 29: WSCHExLILCO 74316 75000 -625 625 DUNWODIE 345 SHORE RD 345 CCT = 174348 79607 -625 625 SPRBROOK 345 DVNPT NK 345 CCT= 1 % 30: NPXxLILCO 73166 75053 -150 175 NORHR138 138 NRTHPT P 138 CCT= 1 % 31: PJM WxCAP 74300 -1150 1150 2 BRANCHBG 500 RAMAPO 5 500 CCT= 1 5028 79302 -1150 1150 WALDWICK 345 SMAHWAH1 345 CCT= 15028 79303 -1150 1150 WALDWICK 345 SMAHWAH2 345 CCT= 1 % 32: PJM ExNYC 5039 74329 -400 400 HUDSON2 345 FARRGUT2 345 CCT= 1 4989 74328 -400 400 HUDSON1 345 FARRGUT1 345 CCT= 1 4996 74371 -400 400 LINDEN 230 GOETHALS 230 CCT= 1 % 33: PJM WxNIAG 47975406-11001100HOMER CY345STOLE345345CCT= 128176527-11001100WARREN115FALCONER115CCT= 136176501-11001100ERIE E230SRIPLEY230CCT= 1 % 34: PJM WxCEN 75457-13001300LAUREL L115GOUDY115115CCT= 175486-13001300E.SAYRE115N.WAV115115CCT= 175413-13001300E.TWANDA230HILSD230230CCT= 1 387 383 382 479 75407 -1300 1300 HOMER CY 345 WATRC345 345 CCT = 1% 35: HQxADIR 8481979578-23502350CHA-NY82765MASS765765CCT= 18937878017-23502350ROSEMT115DENNISON115CCT= 10/S8937978017-23502350ROSEMT-115DENNISON115CCT= 10/S

· 50.	NEPOOL	LXINI							
70511	79602	-1900	1900	GRAND IS	115	plat t#3	115	CCT=	1
70522	79135	-1900	1900	BNNINGTN	115	HOOSICK	115	CCT=	1
70525	79167	-1900	1900	BLISSVIL	115	WHITEHAL	115	CCT=	1
72385	78980	-1900	1900	BRSWAMP	230	ROTRDM.2	230	CCT=	1
72928	78700	-1900	1900	MANY393	345	ALPS345	345	CCT=	1
73117	74344	-1900	1900	CTNY398	345	PLTVLLEY	345	CCT=	1
73166	75053	-1900	1900	NORHR138	1.3.8	NRTHPT P	1.38	CCT=	1
									_
<b>% 37:</b>	PJMxAI	PS							
3	20105	-1500	4000	BRIGHTON	500	01DOUBS	500	CCT=	1
11	20104	-1500	4000	KEYSTONE	500	01CABOT	500	CCT=	1
11	20116	-1500	4000	KEYSTONE	500	01YUKON	500	CCT=	1
473	20253	-1500	4000	BLATRSVL	138	01SOCTAL	138	CCT=	1
571	20174	-1500	4000	BROOKVLE	138	01ELKO	138	CCT=	1
571	20224	-1500	4000	BROOKVLE	138	01N BETH	138	CCT=	1
375	370	-1500	4000	FARM VLY	115	TWOMILE	115	CCT=	1
283	20175	-1500	4000	FOREST	230	01ELKO	230	CCT=	1
472	20170	-1500	4000	CARRETT	115	01CARRET	115	CCT=	1
409	20220	-1500	4000	GROVER	230	01MOSHAN	230	CCT=	1
214	20220	-1500	4000	LEWISTWN	230	01SHINGL	230	CCT=	1
285	20240	-1500	4000	PINEY	115	01BIIRMA	115	CCT=	1
200	20131	-1500	4000	ROXBURY	138	01GREENE	138	CCT=	1
200 Л10	20220	-1500	4000	SHAWVI 1	230	01MOSHAN	230	CCT-	1
376	20220	-1500	4000	COLD	115		115	CCT-	1
135	20234	-1500	4000	SHAWVI 2	230	01FLKO	230	CCT-	1
435	20173	-1500	4000	SHAWVL 2 SUAWVI 2	230	01SUINCT	230		⊥ 1
433	20240	-1500	4000		130	01TANEV	130		⊥ 1
7002	20405	1500	4000	GERMANIN	100		100		1
7002	20450	-1500	4000	STATIONH	230	01AQUEDI 01DOUDC	230		1
1002	20439	-1300	4000	STATIONH	230	UIDOUBS	230	UU1-	T
<b>% 38</b> ∶	P.TMxCI	ст							
302	21475	-700	700	ERIE W 34	5	02AT 34	45	CCT= 1	
					-				
8 39:	PJMxVI	2							
19	14922	-2000	2000	BURCHES	500	8POSSUM	500	CCT=	1
7001	14072	-2000	2000	DICKERSN	230	6PL VIEW	230	CCT=	1
8 <b>4</b> 0:	APS_W	кE							
<b>* 40:</b> 20104	<b>APS_W</b> 11	<b>«E</b> -5000	5000	01CABOT	500	KEYSTONE	500	CCT=	1
<b>40:</b> 20104 20116	<b>APS_W</b> 11 11	<b>kE</b> -5000 -5000	5000 5000	01CABOT 01YUKON	500 500	KEYSTONE KEYSTONE	500 500	CCT= CCT=	1 1
<b>40:</b> 20104 20116 20103	<b>APS_W</b> 11 11 20101	<b>∝E</b> -5000 -5000 -5000	5000 5000 5000	01CABOT 01YUKON 01BLACKO	500 500 500	KEYSTONE KEYSTONE 01BEDNGT	500 500 500	CCT= CCT= CCT=	1 1 1
<b>40:</b> 20104 20116 20103 14917	<b>APS_W</b> 11 11 20101 20105	<b>E</b> -5000 -5000 -5000 -5000	5000 5000 5000 5000	01CABOT 01YUKON 01BLACKO 8MT STM	500 500 500 500	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS	500 500 500 500	CCT= CCT= CCT= CCT=	1 1 1 1
<b>40:</b> 20104 20116 20103 14917	APS_W3 11 11 20101 20105	<b>E</b> -5000 -5000 -5000 -5000	5000 5000 5000 5000	01CABOT 01YUKON 01BLACKO 8MT STM	500 500 500 500	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS	500 500 500 500	CCT= CCT= CCT= CCT=	1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41:</pre>	APS_W3 11 11 20101 20105 ADIR3	<b>×E</b> −5000 −5000 −5000 −5000	5000 5000 5000 5000	01CABOT 01YUKON 01BLACKO 8MT STM	500 500 500 500	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS	500 500 500 500	CCT= CCT= CCT= CCT=	1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602</pre>	APS_W3 11 20101 20105 ADIR3 70511	<b>E</b> -5000 -5000 -5000 -5000 <b>EVER</b> -125	5000 5000 5000 5000	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11	500 500 500 500	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 11	500 500 500 500	CCT= CCT= CCT= CCT= 1	1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602</pre>	APS_W3 11 20101 20105 ADIR3 70511	<b>×E</b> -5000 -5000 -5000 -5000 <b>×VER</b> -125	5000 5000 5000 5000	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11	500 500 500 500 5	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 13	500 500 500 500	CCT= CCT= CCT= CCT= CCT= 1	1 1 1
<ul> <li>* 40:</li> <li>20104</li> <li>20116</li> <li>20103</li> <li>14917</li> <li>* 41:</li> <li>79602</li> <li>* 42:</li> </ul>	APS_W3 11 20101 20105 ADIR3 70511 NY*ON	<b>kE</b> -5000 -5000 -5000 -5000 <b>kVER</b> -125 <b>F_NIA</b>	5000 5000 5000 5000 140	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11	500 500 500 500	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 13	500 500 500 500	CCT= CCT= CCT= CCT= CCT= 1	1 1 1
<ul> <li>* 40:</li> <li>20104</li> <li>20116</li> <li>20103</li> <li>14917</li> <li>* 41:</li> <li>79602</li> <li>* 42:</li> <li>79584</li> </ul>	APS_W3 11 20101 20105 ADIR3 70511 NY×ON 81509	<b>kE</b> -5000 -5000 -5000 -5000 <b>kVER</b> -125 <b>F_NIA</b> -1900	5000 5000 5000 5000 140	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345	500 500 500 500 5	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A	500 500 500 500	CCT= CCT= CCT= CCT= 1 CCT=	1 1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602 % 42: 79584 79584</pre>	APS_W3 11 20101 20105 ADIR3 70511 NY×ON 81509 81508	<b>kE</b> -5000 -5000 -5000 <b>kVER</b> -125 <b>F_NIA</b> -1900 -1900	5000 5000 5000 140 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345	500 500 500 500 5 345 345	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK A	500 500 500 15 345 345	CCT= CCT= CCT= CCT= 1 CCT= CCT=	1 1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602 % 42: 79584 79584 79584 76665</pre>	APS_W3 11 20101 20105 ADIR3 70511 NY×ON 81509 81508 81515	<b>xE</b> -5000 -5000 -5000 <b>xVER</b> -125 <b>F_NIA</b> -1900 -1900 -1900	5000 5000 5000 140 1900 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345 PACKARD2	500 500 500 500 5 345 345 230	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK B BP76 REG	500 500 500 15 345 230	CCT= CCT= CCT= CCT= 1 CCT= CCT= CCT= CCT=	1 1 1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602 % 42: 79584 79584 76665 79592</pre>	APS_W3 11 20101 20105 ADIR3 70511 NY*ON 81509 81508 81515 81516	<b>xE</b> -5000 -5000 -5000 <b>xVER</b> -125 <b>F_NIA</b> -1900 -1900 -1900 -1900	5000 5000 5000 140 1900 1900 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345 PACKARD2 NIAGAR2W	500 500 500 500 5 345 345 230 230	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK A BECK B BP76 REG PA27 REG	500 500 500 500 15 345 230 230	CCT= CCT= CCT= CCT= 1 CCT= CCT= CCT= CCT= CCT=	1 1 1 1 1 1 1
<ul> <li>* 40:</li> <li>20104</li> <li>20103</li> <li>20103</li> <li>14917</li> <li>* 41:</li> <li>79602</li> <li>* 42:</li> <li>79584</li> <li>79584</li> <li>76665</li> <li>79592</li> </ul>	APS_W3 11 11 20101 20105 ADIR3 70511 NY×ON 81509 81508 81515 81516	<b>xE</b> -5000 -5000 -5000 <b>xVER</b> -125 <b>F_NIA</b> -1900 -1900 -1900 -1900	5000 5000 5000 140 1900 1900 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345 PACKARD2 NIAGAR2W	500 500 500 5 345 345 230 230	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK A BECK B BP76 REG PA27 REG	500 500 500 15 345 230 230	CCT= CCT= CCT= CCT= 1 CCT= CCT= CCT= CCT= CCT=	1 1 1 1 1 1 1
<pre>% 40: 20104 20116 20103 14917 % 41: 79602 % 42: 79584 79584 79584 76665 79592 % 43:</pre>	APS_W3 11 11 20101 20105 ADIR3 70511 NY×ON 81509 81508 81515 81516 DECO_C	<b>xE</b> -5000 -5000 -5000 <b>xVER</b> -125 <b>F_NIA</b> -1900 -1900 -1900 -1900 <b>CONS</b>	5000 5000 5000 140 1900 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345 PACKARD2 NIAGAR2W	500 500 500 5 345 345 230 230	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK A BECK B BP76 REG PA27 REG	500 500 500 500 15 345 230 230	CCT= CCT= CCT= CCT= 1 CCT= CCT= CCT= CCT= CCT=	1 1 1 1 1 1 1
<ul> <li>* 40:</li> <li>20104</li> <li>20103</li> <li>20103</li> <li>14917</li> <li>* 41:</li> <li>79602</li> <li>* 42:</li> <li>79584</li> <li>79584</li> <li>79584</li> <li>76665</li> <li>79592</li> <li>* 43:</li> <li>28727</li> </ul>	APS_W3 11 11 20101 20105 ADIR3 70511 NY×ON 81509 81508 81515 81516 DECO_C 28328	<b>xE</b> -5000 -5000 -5000 <b>xVER</b> -125 <b>F_NIA</b> -1900 -1900 -1900 -1900 <b>CONS</b> -3000	5000 5000 5000 140 1900 1900 1900 1900	01CABOT 01YUKON 01BLACKO 8MT STM PLAT T#3 11 NIAG 345 NIAG 345 PACKARD2 NIAGAR2W 19CUSTR	500 500 500 5 345 345 230 230 120	KEYSTONE KEYSTONE 01BEDNGT 01DOUBS GRAND IS 1 BECK A BECK A BECK B BP76 REG PA27 REG 18WHTNGA	500 500 500 500 15 345 230 230 230	CCT= CCT= CCT= CCT= 1 CCT= CCT= CCT= CCT= CCT=	1 1 1 1 1 1 1 1

28741	28247	-3000	3000	19HUNTC	120	18HMPHLD	120	CCT= 1	1
28745	28309	-3000	3000	19JEWEL	345	18THETFR	345	CCT= 1	1
28747	29321	-3000	3000	19LARK	138	18WSHTNJ	138	CCT= 1	1
28754	28285	-3000	3000	19MAJTC	345	180NEIDJ	345	CCT= 1	1
28754	28314	-3000	3000	19MAJTC	345	18TOMPKN	345	CCT= 1	1
28774	28245	-3000	3000	19PONTC	345	18HAMPTO	345	CCT= 1	1
28815	28198	-3000	3000	19ATLAN	138	18ATLNTJ	138	CCT= 1	1
8 <b>44:</b>	DECO A	EP							
28750	21465	-2000	2000	19LULU	345	02ALLEN	345	CCT= 1	1
28754	21460	-2000	2000	19MAJTC	345	02LEMOY	345	CCT= 1	1
28761	21455	-2000	2000	19MON12	345	02BAY SH	345	CCT= 1	1
응 45:	CONS_A	ΔEΡ							
28197	22670	-2500	2500	18ARGENT	345	05ROB PK	345	CCT= 1	1
28197	22675	-2500	2500	18ARGENT	345	05TWIN B	345	CCT= 1	1
28289	22652	-2500	2500	18PALISA	345	05BENTON	345	CCT= 1	1
28289	22654	-2500	2500	18PALISA	345	05COOK	345	CCT= 1	1
<b>% 46:</b>	CONS_C	CIN							
28200	28017	-200	200	18batavi	138	17brtnlk	138	CCT= 1	1