

# Integrating Automation with Aurora

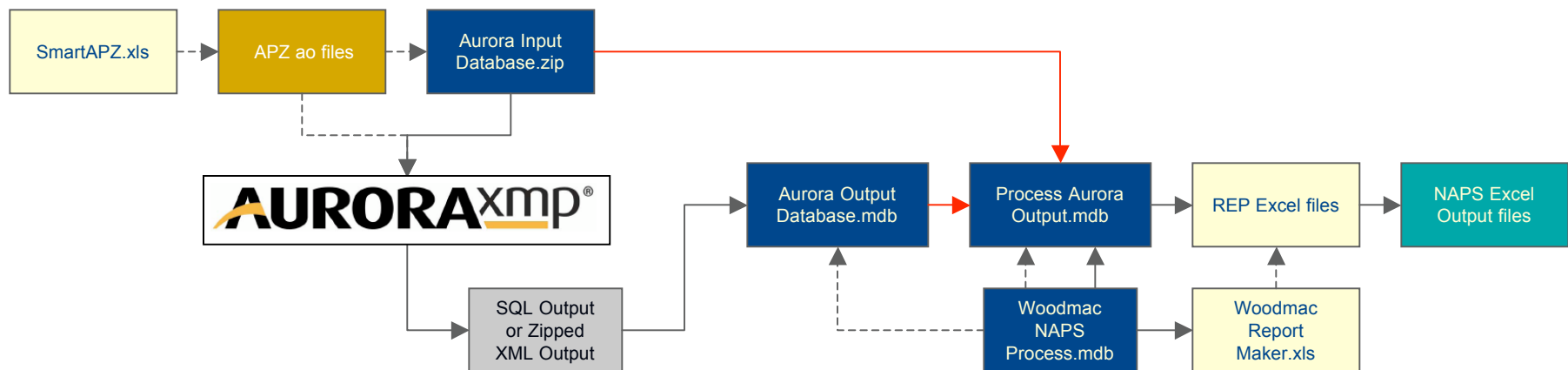
Setting Up Runs, Working with Outputs, Creating Automated Reports

Matthew Jennings

September 14, 2007

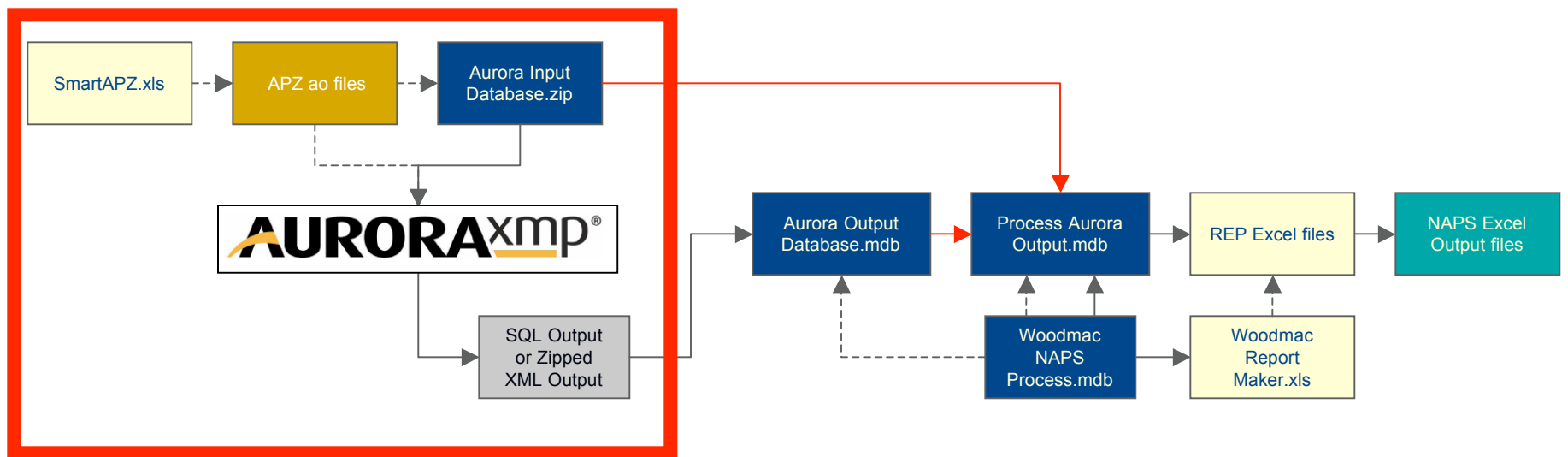


## Woodmac NAPS Process – Basic Steps



# Setting Up Runs

## Woodmac NAPS Process – Setting Up a Run



## Challenges to Setting Up An Aurora Run

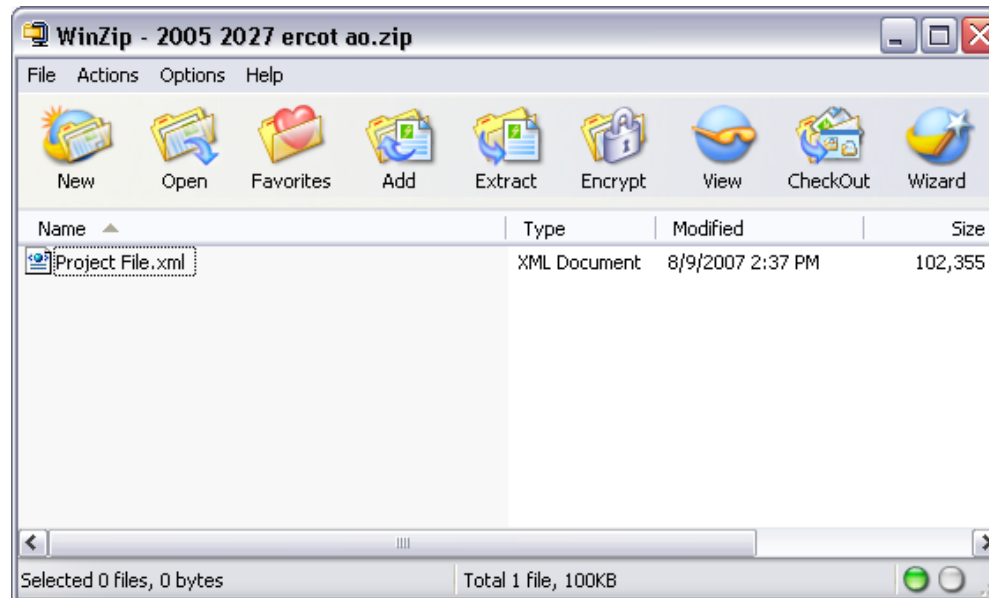
- › Tons of data to worry about in the Aurora Input Database
- › Long setup times in kicking off a series of runs
- › Lots of details to be concerned with in your APZ files
  - Making sure APZ file is pointed to the correct Aurora Input Database
  - Making sure APZ file is putting output in the correct place
  - Making sure the run dates are setup correctly in the APZ file
- › Keeping track of multiple Aurora projects in different folders all across the company network and across various machines in different locations

## Use Existing Business Tools

- › Utilizing the applications and tools that all of us use in our normal daily business can take care of these issues.
- › One approach to tackle this problem is to combine Microsoft Excel, WinZip (with Command Line Editor) and Visual Basic for Applications (VBA) to create a quick and easy app to run just prior to kicking off an Aurora run.
- › A working knowledge of macros and VBA in Access and Excel is assumed.

## Breaking Down the APZ

- › **Breaking down the APZ:** The APZ is actually a zipped XML file that contains all of your run set-up information.
- › **Simply change the extension of the “.apz” file to “.zip” and open the zip file.**
- › **Inside the zip file you’ll see a file called “Project File.xml”**
- › **This is key to manipulating the APZ file with VBA code.**



## Items to Automate in APZ File

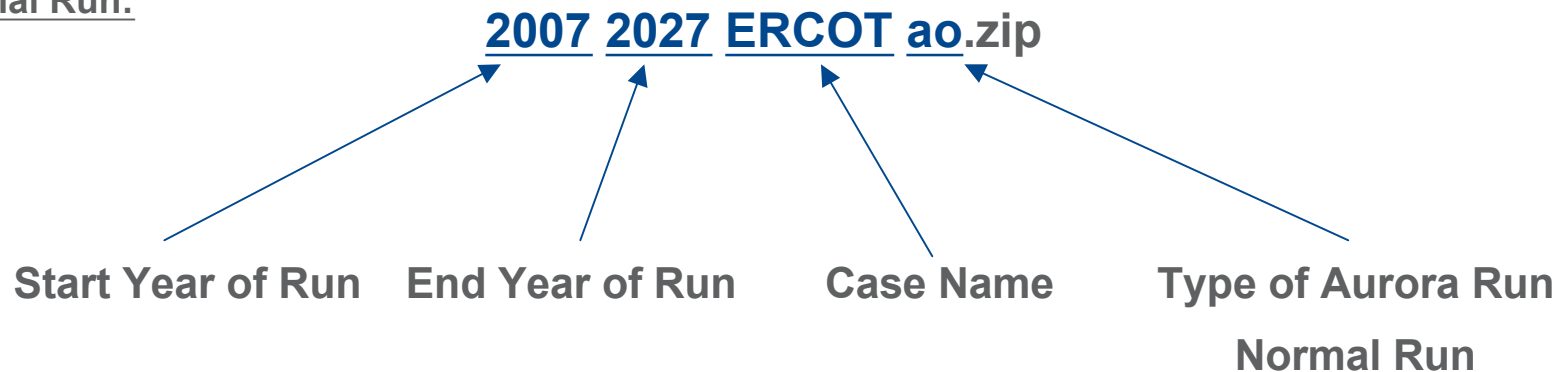
- › Name and Path of Input Database
- › Name and Path of Output Database
- › Start and End Years of Aurora Run

Automating these items will allow you to put your Aurora Input Database and your APZ files into any folder on your network and be able to quickly setup your Aurora runs.

## Utilize a Naming Convention for Your APZ Files

- › At Wood Mackenzie, we have three basic APZ files corresponding to the three major transmission breakouts of NERC: ERCOT, Eastern Interconnect, Western Interconnect. Below is an example of our ERCOT APZ file.

Normal Run:



## Deriving Information from File Name

### › Name and Path of Input Database

- Always 'Aurora Input Database.mdb' in the same folder that APZ resides in (working folder). Or for 64 bit Aurora the name would be 'Aurora Input Database.zip'

### › Name of Output Database

- For Zipped XML Output: Always exact name of APZ file, but with the '.zip' extension.
- For SQL Output: Output database name is created from the current time so that it is unique. For instance, September 14, 2007 6:42:59 a.m. would give a name like 'Aurora\_2007\_9\_14\_6\_42\_59'.

### › Start and End Years of Aurora Run

- Found in APZ file name.
- First 4 digit year is start year and second 4 digit year is end year. If no second year is present, a 1 year run is assumed.
- Start month and day is always '1/1/xxxx' and end year day is always '12/31/xxxx' with the exception being for our supply stack month run (August); '8/1/xxxx' and '8/31/xxxx', respectively.

## What's Going On in the Background of SmartAPZ.xls?

### □ Variables are Loaded from the APZ name

- The current path of the APZ files is loaded
- The name of the Aurora Input Database is hard coded (or could be a variable)
- The output filename is created from the APZ name (xml) or from current time (sql)\*.
- The years of the study are loaded from the name of the APZ file.

### □ APZ is Manipulated

- Working folder is scanned for APZ file
- APZ is renamed to ZIP and unzipped
- Project File.xml is opened as a text file within Excel
- 'Find and replace' is utilized to edit the xml file (searches for xml tags for the lines to be edited).
- XML file is saved, zipped back up and renamed to original APZ name.

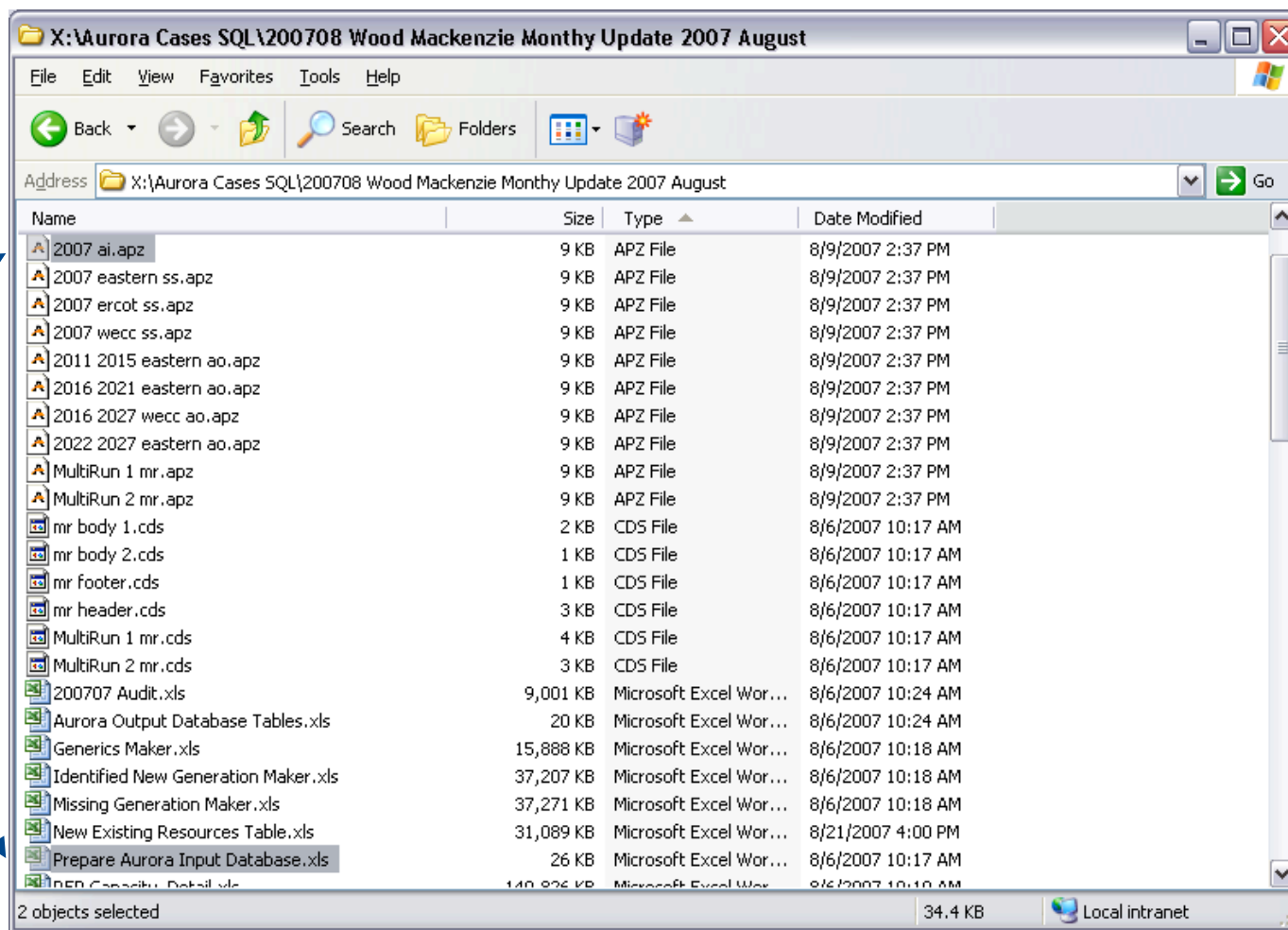
### › Above is repeated until all APZ files have been modified.

\* (SQL Only) Utilizing VBA, a unique text file is created to be used as a variable that will be used later for processing this SQL output from this folder's run.

## Converting Aurora Input Database.mdb to Zipped XML

- In the 64 bit version of Aurora using an Access file for input is no longer supported. A quick step is needed to automate this prior to running on a 64 bit system.
  1. Create a dummy '.apz' file that will only be used to open the current Aurora Input Database.mdb file.
  2. Use VBA to write code to open that apz file using the 32 bit Aurora executable. (Send an email to [matthew.jennings@woodmac.com](mailto:matthew.jennings@woodmac.com) for an example of this if you would like.)
  3. Once open, click on 'Input Data', then click on 'Save as XML' and save file as a zip file in the proper location.
  4. Close Aurora.
- At this point, all APZ files are now pointing to this newly created Aurora Input Database.zip file.

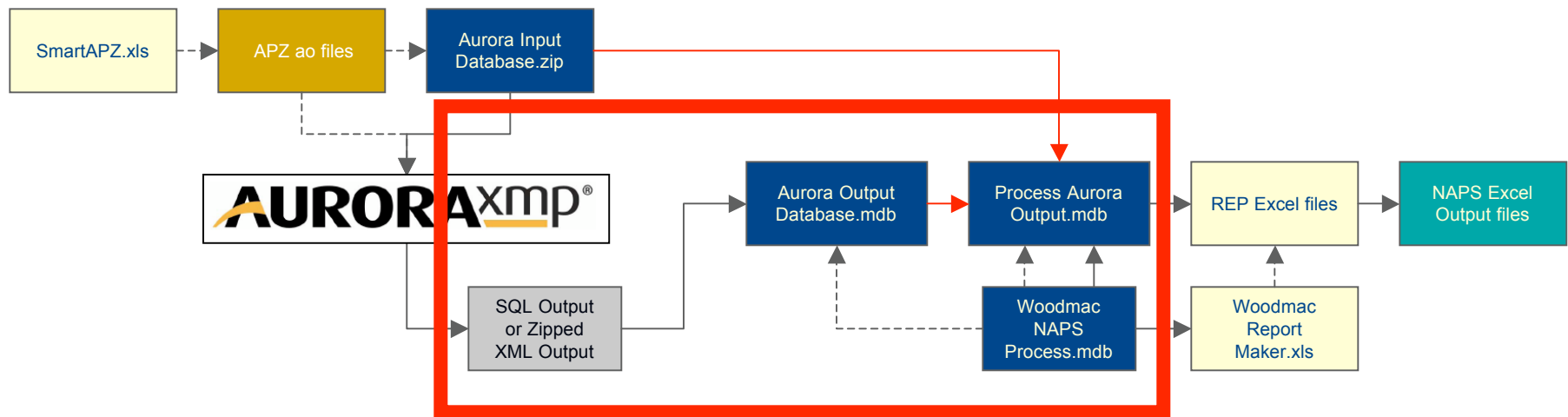
## Files Used in Converting Aurora Input Database.mdb to Zipped XML



Dummy APZ  
Code that opens  
32 bit Aurora

# Working with Outputs

## Woodmac NAPS Process – Working with Output



## Converting all Aurora Outputs to one Aurora Output Database

- › Some Aurora users have multiple Aurora outputs (many zipped xml files) that they need to combine into one database to do reporting.
- › This can be accomplished with Access and VBA macros.
- › Also, to reduce multiple queries for multiple studies, it is necessary to bring all studies (ERCOT, WECC and Eastern Interconnect) into one set of Aurora Output Tables.
- › 2007 2027 ERCOT ao.zip, 2007 2027 East ao.zip and 2007 2027 WECC ao.zip all need to be unzipped and imported into one set of appended tables into one Access file.
- › For SQL output, a slightly different process is needed to import SQL database to an Access Database to utilize existing reporting structure. *(This is much faster than importing XMLs into Access!)*

## Converting all Aurora Outputs to one Aurora Output Database

- › VBA and WinZip (with Command Line Editor) can be utilized to write a loop that will scan the working folder to find all files ending with ‘ ao .zip’. This alleviates unzipping other normal zipped files in the same directory.
  
- › In this loop, it finds the zipped xml, unzips it, then begins importing the xmls into the Access database in the following method:
  - 1. All xml files that end with “1.xml” get imported as structure only tables.
  - 2. All xml files regardless of their ending number get appended to those initial imported tables.
  - 3. For example, ResourceYear1.xml gets imported to a table called WMAO ResourceYear, where WMAO stands for Wood Mackenzie Aurora Output.
  
- › Once all tables in a zip file have been imported, all unzipped xml files are deleted, the loop goes to the next zipped xml file and checks to make sure there are no new table structures needed, then repeats the above process of importing.
  
- › This process continues until all zipped xml files have been imported and all unzipped xml files have been deleted. The original zipped xml file remains intact.

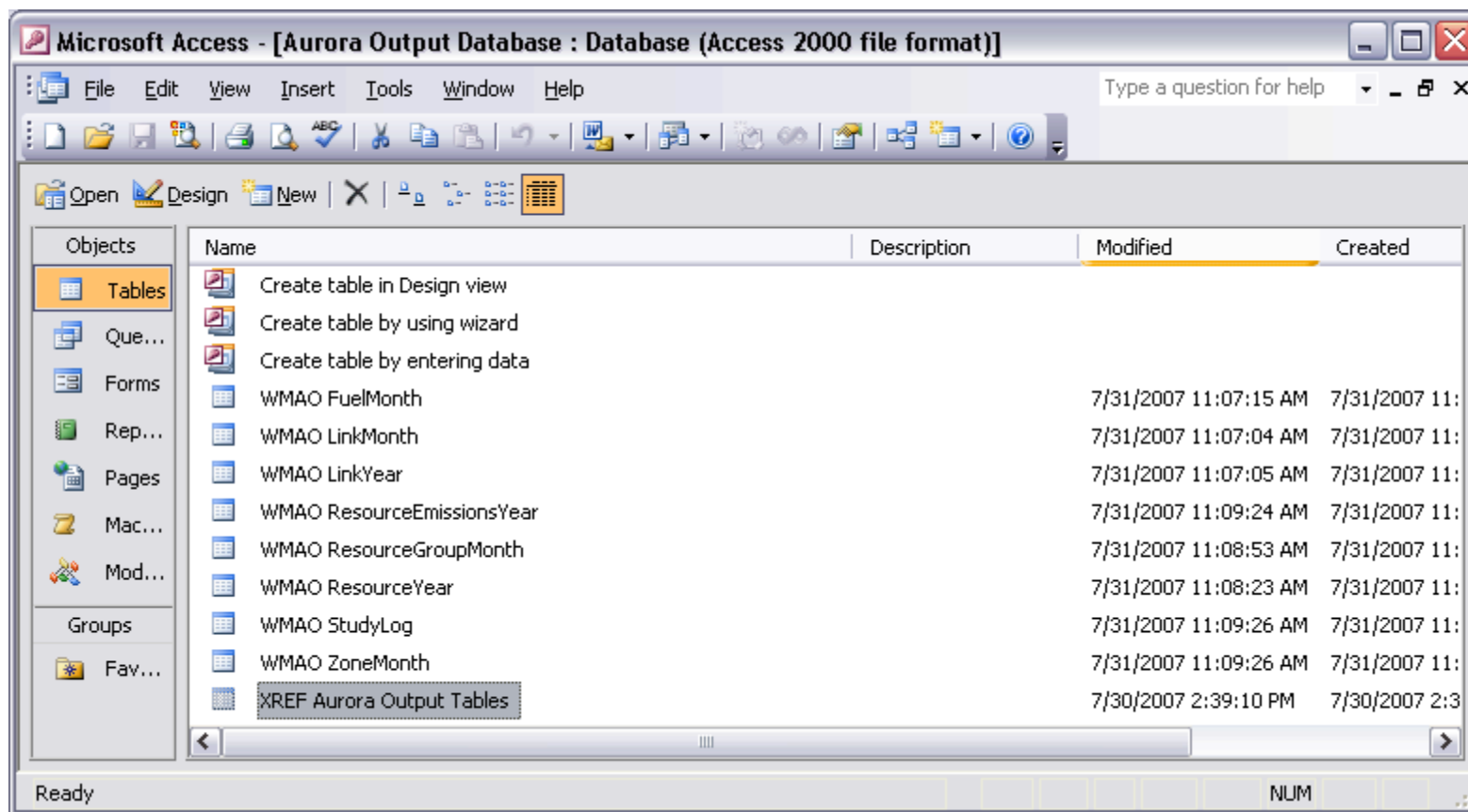
## Converting all Aurora Outputs to one Aurora Output Database

- › **There are a few caveats to importing XML files into Access.**
  - Importing data for all of North America for a 20-21 year run takes approximately 35-40 minutes depending on machine speed.
  - Re-importing to same database for a rerun will cause the Access file to possibly grow beyond the 2 Gb size limit. Code should be included to delete existing Aurora Output tables and compact and repair the Aurora Output Database.mdb file prior to re-importing the next set of Aurora outputs.
- › **Send an email to [matthew.jennings@woodmac.com](mailto:matthew.jennings@woodmac.com) for an example of this if you would like.**

## Converting Aurora SQL Database to one Access Aurora Output Database

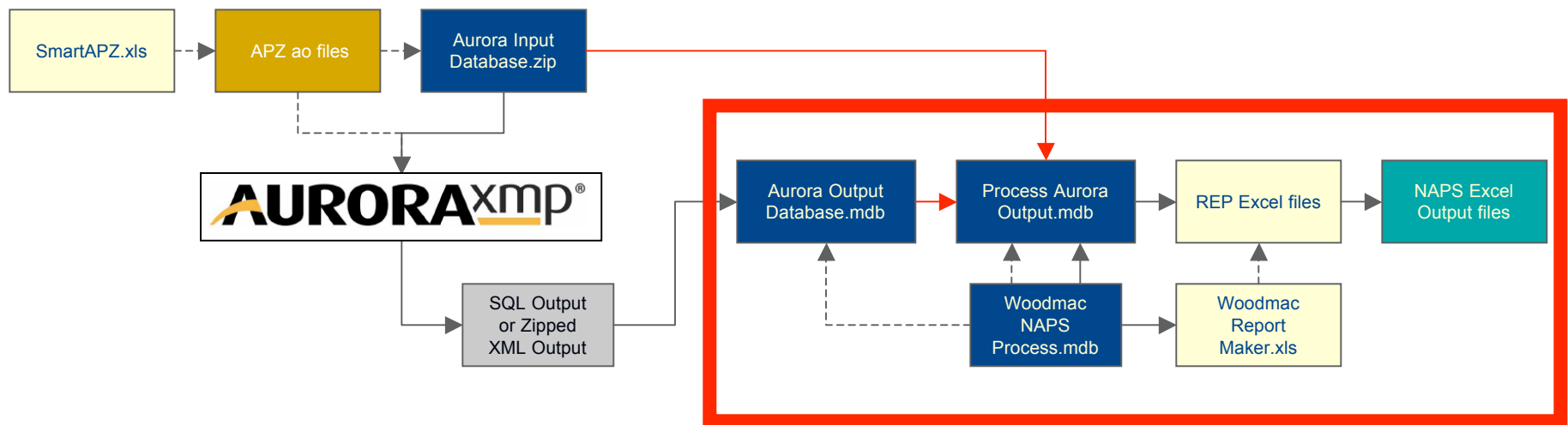
- › Using VBA and Access, the SQL database name to connect to is retrieved from the working folder text file that was created by the SmartAPZ.xls file.
- › Also using VBA, an ODBC connection is created with that database so that the individual tables can be imported to the Aurora Output Database.mdb file. Once all tables have been imported, VBA closes and deletes the ODBC connection.
- › Send an email to [matthew.jennings@woodmac.com](mailto:matthew.jennings@woodmac.com) for an example of this if you would like.

## End Result – One Aurora Output Database.mdb



# Creating Automated Reports

## Woodmac NAPS Process – Creating Reports



## Using VBA, Access and Excel to Create an Automated Report Making Solution that is Easy to Expand

### › Most people

- Have several reports that they need out of every Aurora run
- Require specific formatting
- Have to create new reports on-the-fly, based on special project requirements

### › Do it Faster

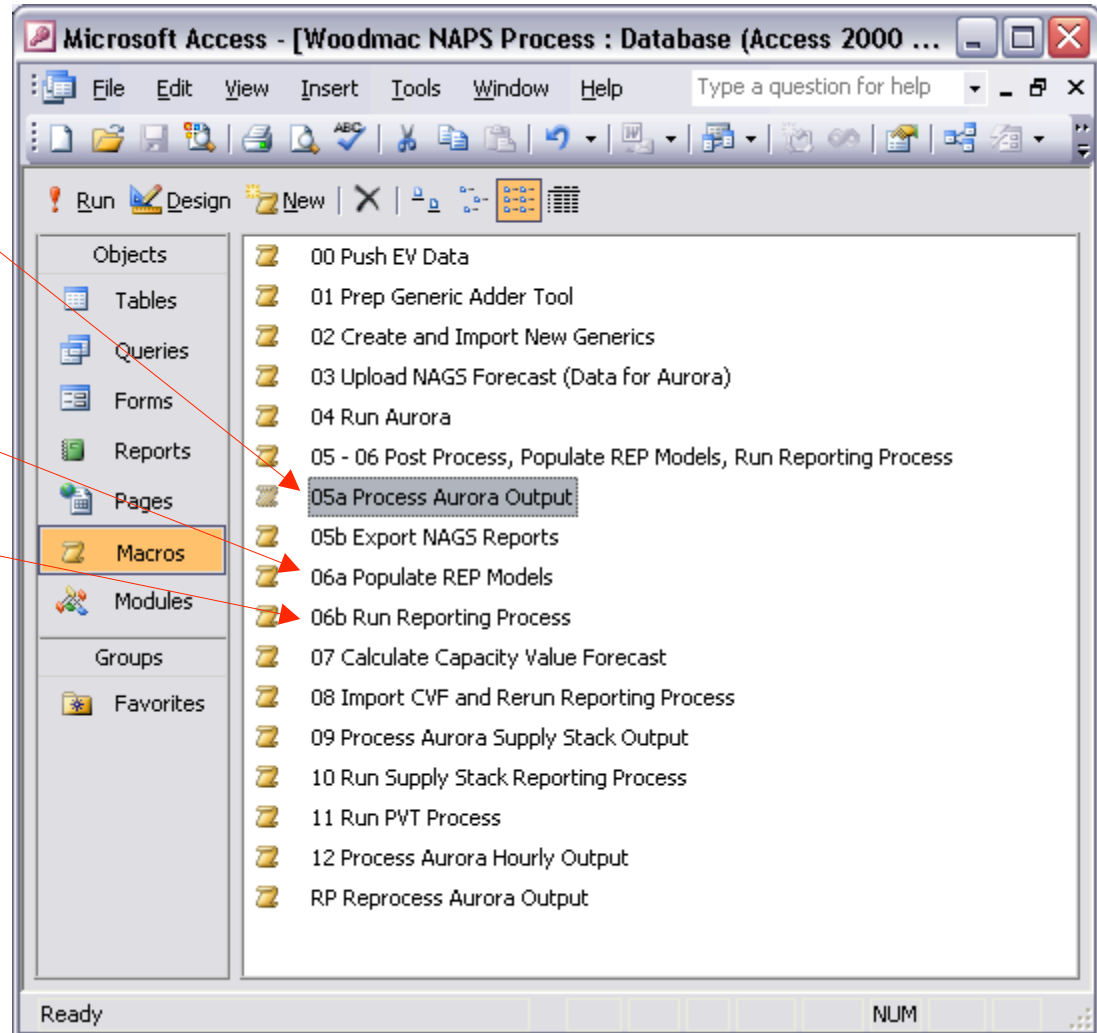
- Create one control file for the reporting process.
- Create one Access file that contains specific queries and filters that are all based upon the tables that are in the Aurora Output Database.mdb and Aurora Input Database.mdb files.
- Name the queries accordingly so that each report has a “named linkage” to the queries that go into it.
- Write the VBA macros that make all of this happen.

## Wood Mackenzie's "Control File"

Macro to kick off the Processing of the Aurora Output Database as mentioned in earlier section.

Macro to export REP queries into REP files.

Macro to create clean, values only reports



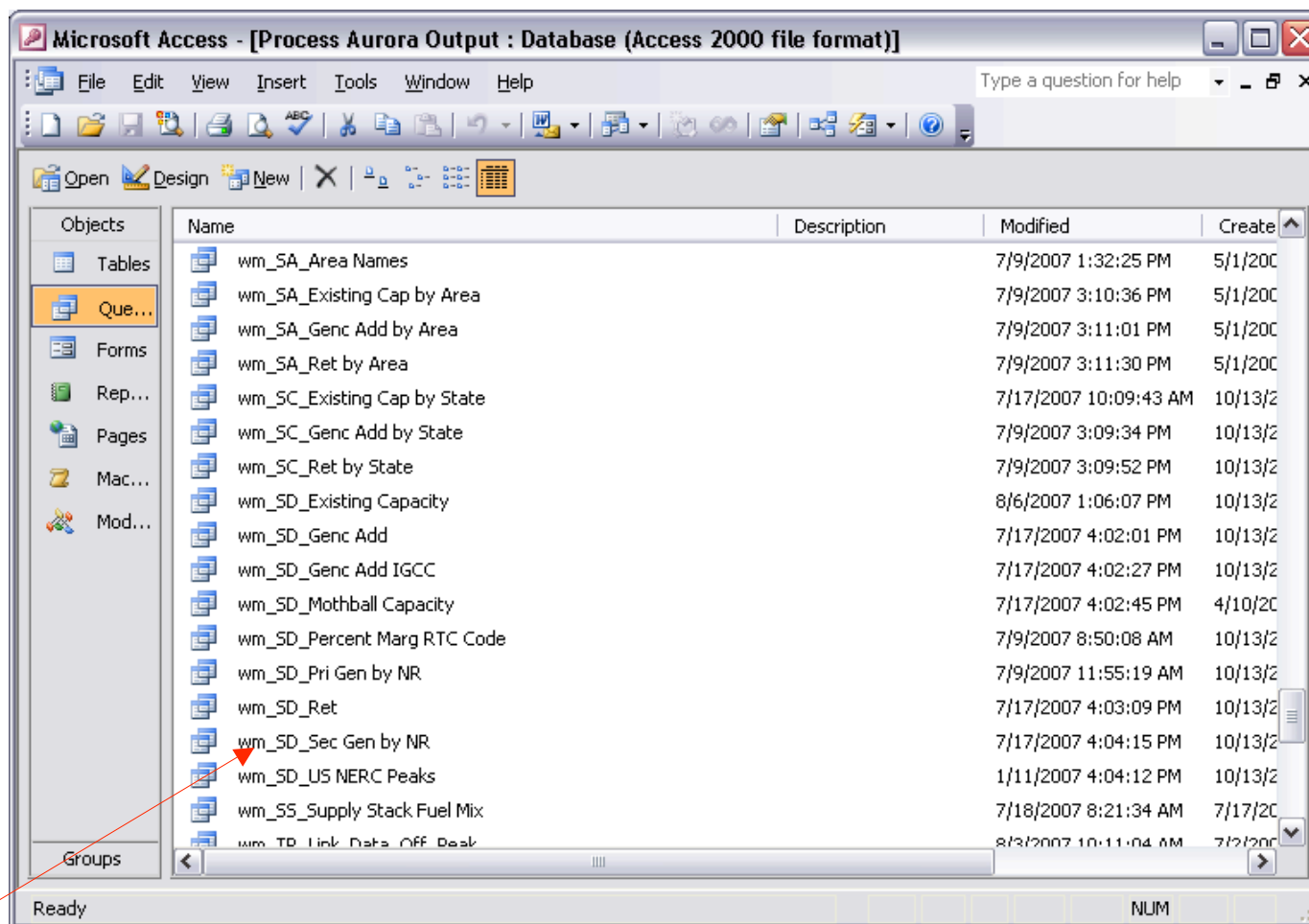
## Reports Table (Study Attributes)

Used as Query Identifier in Process  
Aurora Output.mdb file

Defines which "REP" file to export  
query results to

Include	Report ID	Case Name	Report Date	Default	Study Prefix	Report	Report File Name
<input checked="" type="checkbox"/>	PC	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Total Production Cost and Revenue	Production_Costs
<input checked="" type="checkbox"/>	ZS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Zonal Sparks	Zonal_Prices_Sparks_IHR
<input checked="" type="checkbox"/>	CD	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Capacity Detail Report	Capacity_Detail
<input type="checkbox"/>	CP	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Capacity Prices Report	Capacity_Prices
<input checked="" type="checkbox"/>	DF	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Delivered Fuels Report	Delivered_Fuel_Prices
<input checked="" type="checkbox"/>	NU	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Non-US Report	NERC_Non-US_Detail
<input checked="" type="checkbox"/>	PR	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Prices Report	Prices_Sparks_IHR_Darks
<input checked="" type="checkbox"/>	SD	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	S&D Report	Supply_Demand_Energy
<input checked="" type="checkbox"/>	SC	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	State Capacity Report	Supply_State_Level
<input checked="" type="checkbox"/>	LR	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Loads Report	Load_Forecast
<input checked="" type="checkbox"/>	GS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Generics Supply Demand	Generics_Supply_Demand
<input checked="" type="checkbox"/>	CV	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Capacity Value Calculator	Capacity_Value_Calculator
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
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<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix

## Process Aurora Output.mdb File (has all the queries)



For example, let's assume I am running my Supply Demand Report (SD). These are the queries that will be exported to my Excel REP file, REP Supply\_Demand\_Energy.xls. Each Report has its own REP file and queries.

## Process Aurora Output.mdb File (linked to Aurora Output Database.mdb and Aurora Input Database.mdb)

WMAI Tables are linked to Aurora Input Database.mdb

WMAO Tables are linked to Aurora Output Database.mdb

Name	Description	Modified	Create
WMAI CVF IDs		8/6/2007 1:05:37 PM	8/6/2007
WMAI Fuel		8/6/2007 1:05:38 PM	8/6/2007
WMAI Generic Unit Size Defs		8/6/2007 1:05:38 PM	8/6/2007
WMAI Link		8/6/2007 1:05:38 PM	8/6/2007
WMAI Monthly Shape Factors		8/6/2007 1:05:38 PM	8/6/2007
WMAI MX NERC Peaks		8/6/2007 1:05:38 PM	8/6/2007
WMAI NAGS Monthly Forecast		8/6/2007 1:05:38 PM	8/6/2007
WMAI Resource Groups		8/6/2007 1:05:38 PM	8/6/2007
WMAI Resources		8/6/2007 1:05:38 PM	8/6/2007
WMAI US NERC Peaks		8/6/2007 1:05:38 PM	8/6/2007
WMAI Zones		8/6/2007 1:05:38 PM	8/6/2007
WMAO FuelMonth		8/6/2007 1:05:39 PM	8/6/2007
WMAO LinkMonth		8/6/2007 1:05:39 PM	8/6/2007
WMAO LinkYear		8/6/2007 1:05:40 PM	8/6/2007
WMAO ResourceEmissionsYear		8/6/2007 1:05:40 PM	8/6/2007
WMAO ResourceGroupMonth		8/6/2007 1:05:40 PM	8/6/2007
WMAO ResourceYear		8/6/2007 1:05:41 PM	8/6/2007
WMAO ZoneMonth		8/6/2007 1:05:41 PM	8/6/2007

\* I have written some VBA code that will relink any linked files to the current working folder in the background so that linking doesn't become an issue. Send an email to [matthew.jennings@woodmac.com](mailto:matthew.jennings@woodmac.com) for an example of this.

## Example REP File (REP Supply\_Demand\_Energy.xls)

Using VBA, the results of the corresponding “wm\_SD” queries are placed in the REP file below. The next step is to create the final report . Make a copy of this REP file. Convert all tabs to values only. Delete all tabs that begin with “wm\_”. Save as a name specified in the Reports Table in the control file (this one is something like ‘NAPS\_Supply\_Demand\_Energy\_6\_30\_2007.xls’) - This is all handled by a few macros placed in the right files.

	A	B	C	D	E	F	G	H	I	J	K
1	Code	NERC Reg	Primary	Peaking Y	Capacity(MW)						
2	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	404						
3	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	222						
4	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	196						
5	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	230						
6	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	94						
7	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	264						
8	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	8						
9	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	131.2						
10	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	347.4						
11	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	619.7						
12	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	953.09						
13	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	560.5						
14	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	108						
15	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	353						
16	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	130						
17	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	102						
18	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	124						
19	ECAR_Co:ECAR	ECAR	Coal/IGCC	2000	391						

## Steps to Create a New Report

They are completely dependent on the contents of the Reports Table so additional reports are easily created: 1. Add a new row, 2. Create the new queries, 3. Create the new REP file

Done!

Include	Report ID	Case Name	Report Date	Default	Study Prefix	Report	Report File Name
<input checked="" type="checkbox"/>	PC	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Total Production Cost and Revenue	Production_Costs
<input checked="" type="checkbox"/>	ZS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Zonal Sparks	Zonal_Prices_Sparks_IHR
<input checked="" type="checkbox"/>	CD	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Capacity Detail Report	Capacity_Detail
<input type="checkbox"/>	CP	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Capacity Prices Report	Capacity_Prices
<input checked="" type="checkbox"/>	DF	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Delivered Fuels Report	Delivered_Fuel_Prices
<input checked="" type="checkbox"/>	NU	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Non-US Report	NERC_Non-US_Detail
<input checked="" type="checkbox"/>	PR	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Prices Report	Prices_Sparks_IHR_Darks
<input checked="" type="checkbox"/>	SD	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	S&D Report	Supply_Demand_Energy
<input checked="" type="checkbox"/>	SC	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	State Capacity Report	Supply_State_Level
<input checked="" type="checkbox"/>	LR	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Loads Report	Load_Forecast
<input checked="" type="checkbox"/>	GS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Generics Supply Demand	Generics_Supply_Demand
<input checked="" type="checkbox"/>	CV	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input checked="" type="checkbox"/>	NAPS	Capacity Value Calculator	Capacity_Value_Calculator
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
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<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix
<input checked="" type="checkbox"/>	SS	Wood Mackenzie Base Case Forecast August 200	8/31/2007	<input type="checkbox"/>	NAPS	Supply Stack Fuel Mix Report	Supply_Stack_Fuel_Mix

## What's Actually Happening in the Background?

1. Macro tells Process Aurora Output.mdb to load REP files as dictated in the Reports Table with the latest query results.
  2. Macro makes copy of REP file and converts all tabs to values only.
  3. Macro deletes all tabs that begin with "wm\_" in the copied REP file.
  4. Macro saves copied REP file with name designated in Reports Table.
  5. Macro let's user know that Reports have been completed.
- This gives nice, clean, formatted reports ready to send automatically.
  - Eliminates formulas that you don't want to confuse a client with.
  - It standardizes your output files.
  - Gives you more time for analysis and less time cutting and pasting!

# Example Reports

(Automated Outputs of Reporting Process)

## Example Final Reports that comes out Automatically from Process

Supply/Demand Report

Microsoft Excel - NAPS\_Supply\_Demand\_Energy\_7\_31\_2007.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

Arial 10 B I U

A1

Wood Mackenzie North American Power Service

**Wood Mackenzie Base Case Forecast July 2007**  
July 31, 2007

**Retirement Summary**

**Nuclear Retirements (MW)**

Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ERCOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRCC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MRO US (MAPP)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NPCC ISO New England	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NPCC New York ISO	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SERC Entergy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SERC Southern	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SERC TVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SERC VACAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WECC AZNMNV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WECC CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WECC RMPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WECC NWPP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WECC Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Hydro Retirements (MW)**

Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020

Utilization Summary / Percent Marginal Unit Summary / Retirement Summary

Ready NUM

## Example Final Reports that comes out Automatically from Process

### Delivered Fuel Prices Report

Microsoft Excel - NAPS\_Delivered\_Fuel\_Prices\_7\_31\_2007.xls

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Wood Mackenzie North American Power Service

**Wood Mackenzie Base Case Forecast July 2007**  
July 31, 2007

**Weighted Average Coal Prices (Nominal \$/mmbtu)**

	Arizona	California	Colorado	ECAR	Entergy	ERCOT
2007	1.51	1.64	1.60	1.93	1.98	1.74
2008	1.57	1.68	1.41	1.94	1.97	1.67
2009	1.63	1.72	1.41	2.02	2.01	1.74
2010	1.78	1.76	1.44	2.06	2.04	1.75
2011	1.63	1.83	1.48	2.10	2.07	1.77
2012	1.65	1.84	1.51	2.14	2.12	1.79
2013	1.57	1.88	1.55	2.22	2.17	1.82
2014	1.61	1.93	1.59	2.28	2.25	1.86
2015	1.64	1.97	1.67	2.34	2.36	1.95
2016	1.67	2.02	1.72	2.40	2.43	2.14
2017	1.71	2.06	1.80	2.49	2.52	2.19
2018	1.96	2.11	1.79	2.55	2.55	2.27
2019	2.01	2.16	1.89	2.59	2.62	2.30
2020	2.46	2.21	2.16	2.74	2.97	2.41
2021	2.47	2.26	2.11	3.04	3.02	2.61
2022	2.55	2.31	2.26	3.04	3.14	2.59
2023	2.64	2.37	2.39	3.09	3.24	2.69
2024	2.71	2.42	2.51	3.16	3.35	2.76
2025	2.70	2.48	2.38	3.21	3.35	2.80
2026	2.72	2.54	2.44	3.21	3.39	2.63
2027	2.77	2.60	2.50	3.28	3.46	2.63

New Mexico Nevada New York PJM Southern SPP

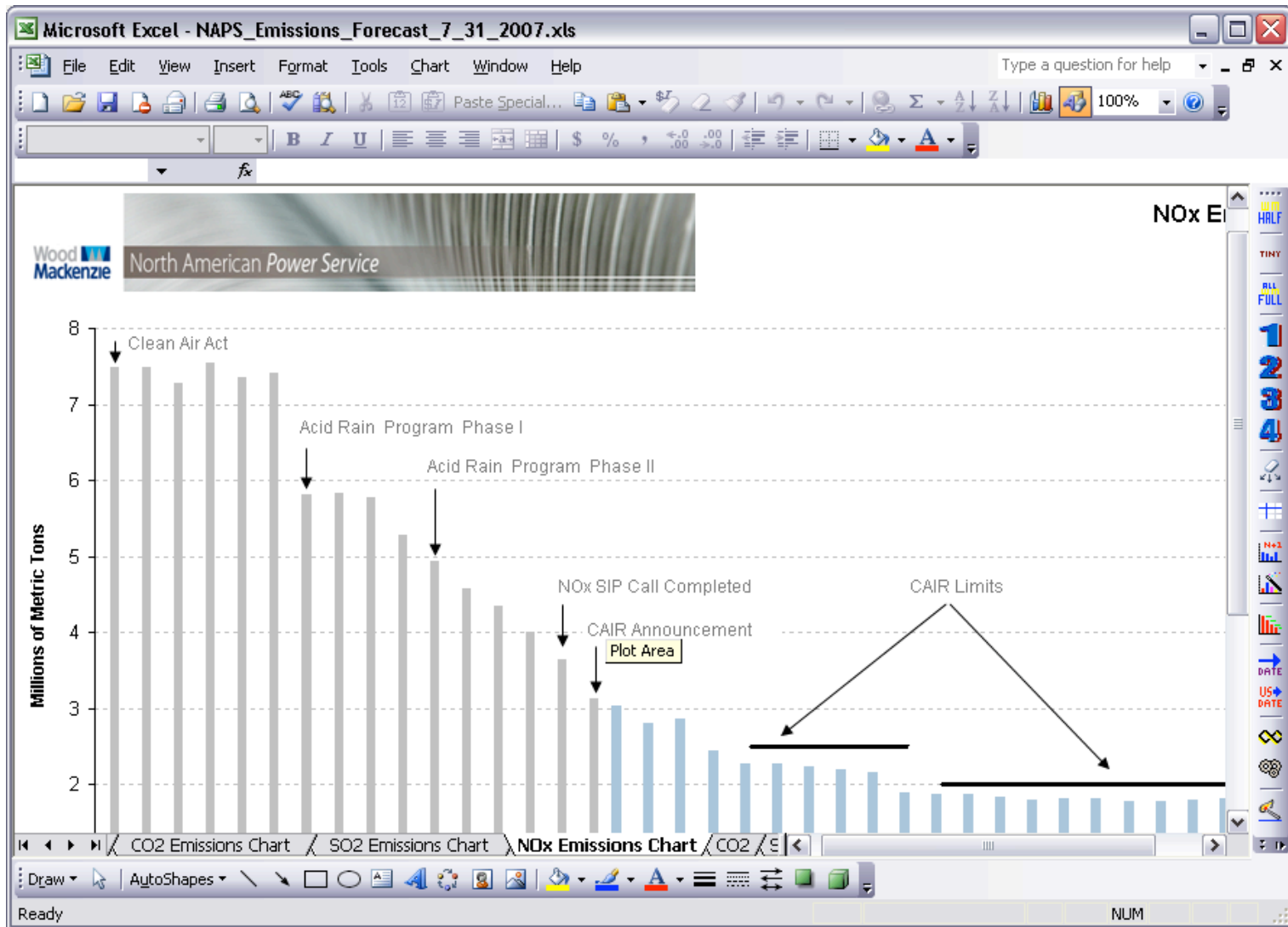
Gas Prices Oil Prices Coal Prices Allowance Prices

Draw AutoShapes

Ready NUM

## Example Final Reports that comes out Automatically from Process

Emissions Forecast Report



# Example Final Reports that comes out Automatically from Process

Transmission Forecast Report

Microsoft Excel - NAPS\_Transmission\_Month\_7\_31\_2007.xls

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Wood Mackenzie North American Power Service

**Wood Mackenzie Base Case Forecast July 2007**

July 31, 2007

**Monthly On-Peak Transmission Link Flow Data from Aurora (MW)**

Zone Out	Zone In	Max Flow	Rating	Max Flow % Rating	Net Load
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	4
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	41
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	12
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	5
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	15
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	156	207	75%	1
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	62	207	30%	1
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	195	207	94%	3
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	21
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	13
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	207	207	100%	22
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	134	207	65%	3
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	6
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	47
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	41
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	4
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	13
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	187	208	90%	2
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	2
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	4
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	21
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	170	208	82%	8
ECAR_PJMrito_DaytonP&L	ECAR_PJMrito-AEP	208	208	100%	46

On-Peak Link Data / Off-Peak Link Data

Ready NUM

# Example Final Reports that comes out Automatically from Process

Prices, Sparks, IHR, Darks Report

Microsoft Excel - NAPS\_Prices\_Sparks\_IHR\_Darks\_7\_31\_2007.xls

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Include Capacity Price

Wood Mackenzie North American Power Service

**Wood Mackenzie Base Case Forecast July 2007**  
July 31, 2007

**On-Peak Energy Price (Nominal \$/MWh)**

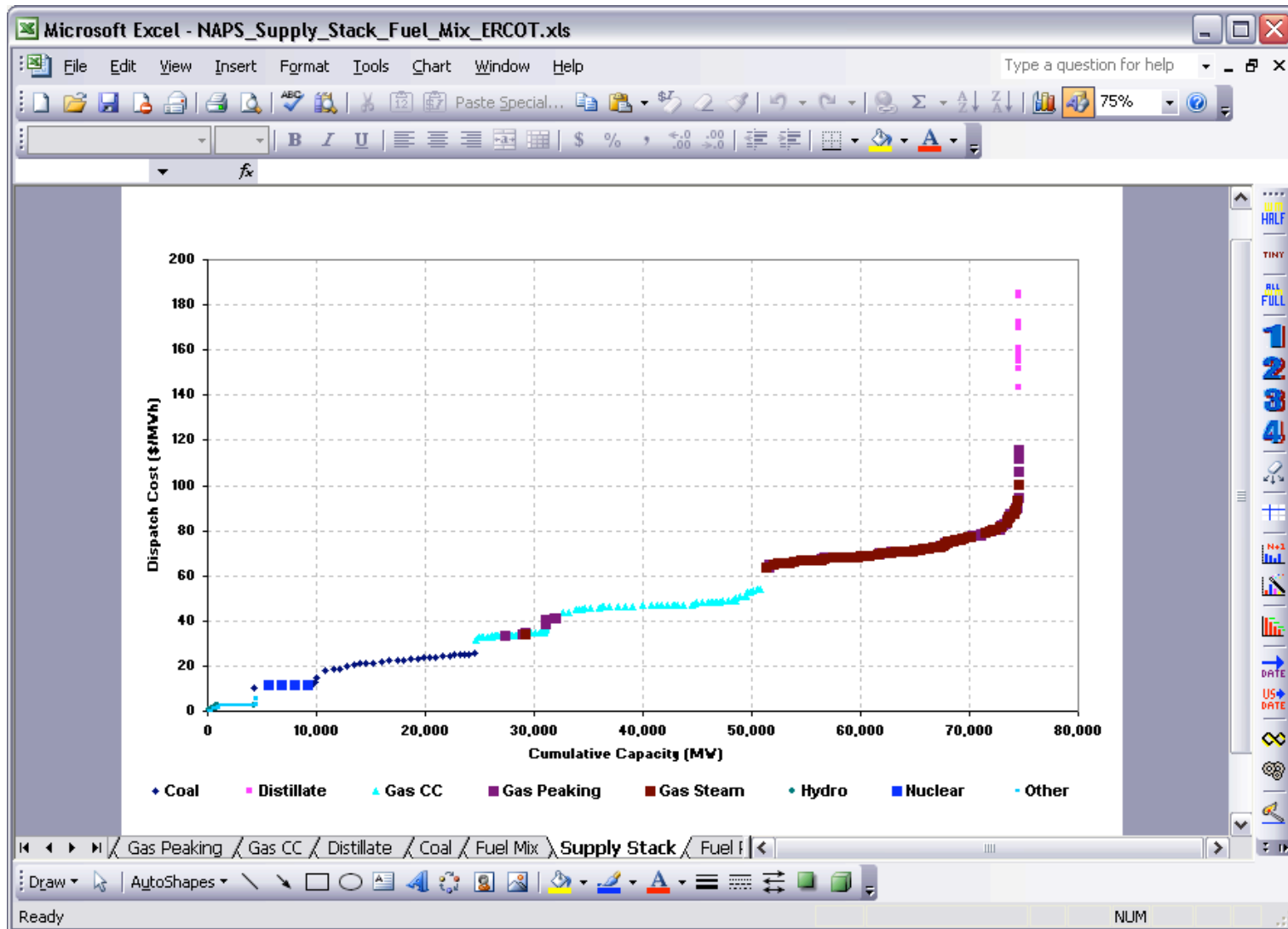
	ERCOT North	ERCOT Houston	ERCOT South	ERCOT West	Cinergy	ComEd
2007	56.36	57.35	54.64	54.37	56.29	55.53
2008	63.55	64.10	60.34	60.23	63.39	63.08
2009	59.72	60.34	57.31	56.57	59.41	58.31
2010	55.28	55.75	52.48	51.94	54.59	53.34
2011	55.54	55.65	52.60	52.47	56.17	55.03
2012	55.70	55.88	53.37	53.34	60.17	57.75
2013	55.38	55.93	53.49	53.63	62.31	59.48
2014	55.92	56.41	53.88	54.31	64.18	61.36
2015	58.07	58.55	56.14	56.87	68.03	65.32
2016	61.29	61.75	59.43	60.41	72.05	70.24
2017	63.69	64.26	62.05	63.07	75.06	73.80
2018	64.19	64.34	62.63	63.32	76.75	75.07
2019	62.20	62.90	60.54	62.03	73.39	72.22
2020	64.15	64.70	62.53	64.03	74.98	73.75
2021	66.79	67.09	64.85	66.67	77.13	75.72
2022	70.96	71.32	68.39	70.22	81.52	80.54
2023	76.83	77.34	74.39	74.82	88.01	87.73
2024	81.41	81.90	79.67	79.92	94.22	93.08
2025	86.81	86.98	85.04	84.17	99.68	98.66
2026	86.64	86.37	84.93	84.16	98.37	98.28
2027	88.52	87.69	86.56	86.13	100.13	99.54

On-Peak Power Prices / Off-Peak Power Prices / On-Peak Spark Spreads / On-Peak Implied HR / Off-Peak I

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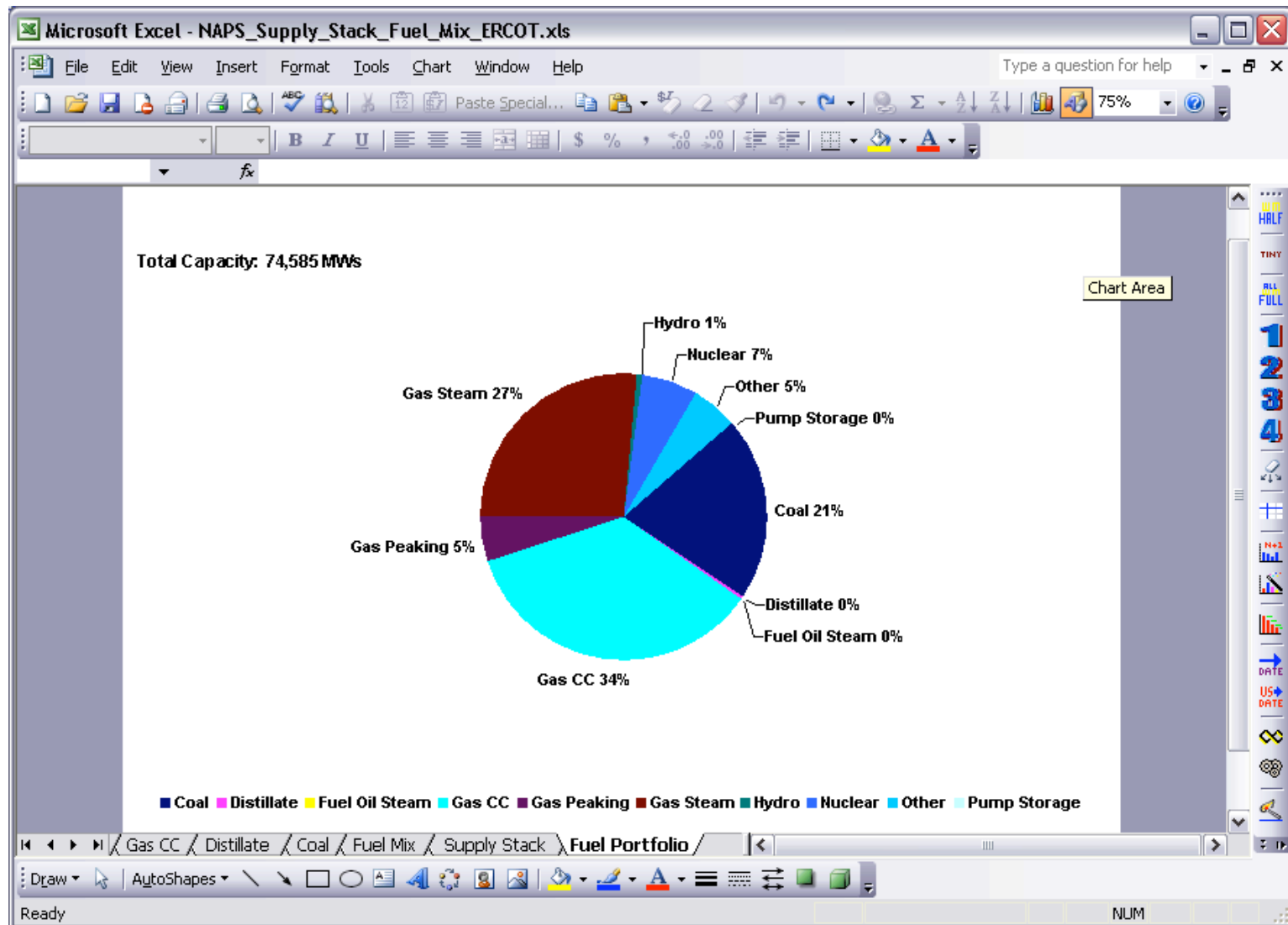
## Example Final Reports that comes out Automatically from Process

### Supply Stack/Fuel Mix



## Example Final Reports that comes out Automatically from Process

### Supply Stack/Fuel Mix



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