Electricity Market Module
Electricity Fuel Dispatch Submodule
Updates for *AEO 1996*

June 1996

Energy Information Administration
Office of Integrated Analysis and Forecasting
U.S. Department of Energy
Washington, DC 20585

MASTER

Electricity Market Module
Electricity Fuel Dispatch Submodule
Updates for *AEO 1996*

June 1996

Energy Information Administration
Office of Integrated Analysis and Forecasting
U.S. Department of Energy
Washington, DC 20585

This report was prepared by the Energy Information Administration, the independent statistical and analytical agency within the Department of Energy. The information contained herein should not be construed as advocating or necessarily reflecting any policy position of the Department of Energy or any other organization.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Introduction

In previous *Annual Energy Outlooks (AEO)*, international electricity trade was represented in the National Energy Modeling System (NEMS) Electricity Market Module (EMM) modeling framework as an exogenous input. The exception to this exogenous treatment was for firm power projections, i.e., new Canadian hydroelectric model builds. The AEO95 implementation of EMM allowed Canadian hydroelectric projects to be selected in the Electricity Capacity Planning (ECP) submodule on an annual basis and otherwise addressed as any other purchased power commitments. This technical memorandum addresses modifications to the Electricity Fuel Dispatch Submodule implemented in AEO96 to enhance the treatment of international electricity trade through the representation of economy imports from Canada.

Background

Electricity trade in the EMM is composed of firm and economy trade between U.S. NEMS regions (interregional) and between the U.S. and Canada and Mexico (international). While the motivation behind the enhancements to the AEO96 EMM international electricity trade focused on trade between Canada and the United States, the analytic framework implemented is equally well suited to address trade with Mexico, once additional information and insights into Mexican border trade are available. The types of international trade addressed in the EMM include firm purchased power contracts, unplanned capacity purchases based on plants built in Canada to serve the U.S. (referred to as the unplanned Canadian builds and represented in the ECP), and economy (energy only) trades. The methodology for representing international economy imports changed for the AEO96 and is documented in the following.

Methodology for Representing International Economy Trade in the Electricity Fuel Dispatch Submodule

International economy trade estimates in previous years were exogenously supplied to the EMM by region and year. These projects were based on historic average trade estimates and relative electricity growth rates in Canada and the United States. For AEO 1996, a full resource base and dispatch of the Canadian system was conducted for those Canadian provinces with which the U.S. has historically traded (Manitoba, British Columbia, Ontario, Quebec, and New Brunswick) to determine excess supply available from Canada by season and time slice from each Canadian province. This import opportunity set was brought into the EMM, and those U.S. NEMS regions with a transmission path to one of these Canadian provinces competed for this supply.

The source of the Canadian data was primarily the North American Electric Reliability Council's (NERC) *Electricity Supply and Demand* generating plant database with forecasts based on Canadian National Energy Board's (NEB) *Canadian Energy Supply and Demand 1993-2010* (Tables A5-1 and A5-2). This was the only source of Canadian data that provided both demand

and supply data, as well as capacity and generation information. The data from the two sources was aligned and reconciled as follows:

- The NERC Canadian plant data (which was at the unit level) was modified to match the capacity amounts by year, province, and prime mover (or come within 100 megawatts of the amount) published in the NEB Table A5-1's. In some cases, units were aggregated to the plant level, and/or aggregated further to achieve the reconciliation.
- The capacity factors associated with this adjusted plant capacity was modified to try to achieve the generation published in the NEB Table A5-2's.

A Canadian EMM was developed and run using this data which achieved the NEB forecast. Note that the results were not a *perfect* match to the NEB, but are very close.¹ In achieving the dispatch result, the corresponding excess Canadian supply available included roughly 0.1 - 3.0 gigawatts of power for various provinces, seasons, and years. Instructions for running the Canadian version of the EMM dispatch and the documentation of its implementation on the RISC machine is attached in Appendix A. Based on this supply opportunity set, a summary of the AEO96 EMM results of the international economy imports compared to AEO96 are contained in Appendix B.

Nonutility Supply

Introduction

In previous *Annual Energy Outlooks*, nonutility power producers (independent power producers, small power producers and exempt wholesale generators) were dispatched along with utility-owned plants using the merit-order dispatch algorithm. This methodology resulted in a decline in generation from nonutilities compared with their historic generation because many of the existing oil- and gas-fired units were not dispatched. However, because most of these facilities have contracts with utilities to purchase power, they are generally utilized consistently over time. As such, the algorithm was changed to allocate nonutility existing and planned capacity prior to dispatching the utility plants. Unplanned nonutility generators are dispatched based on their variable costs and subsequent position in the merit order.

The definition for "nonutilities" also changed in this year's AEO. In previous AEOs, nonutilities were defined based on standard industrial classification (sic), i.e., those which reported that they were an 'electric, gas or sanitary service', sic code of 49, as reported on EIA Form 867, "Annual Nonutility Power Producer Report." Cogenerators and other industrial generators were

1. The methodology for using this data in a Canadian run of the EMM is documented in the "Canadian Economy Trade" Memorandum from OnLocation to Pat Toner, dated May 26, 1995.

represented in the Demand Modules and defined as units with sic codes other than 49. This year, the criteria for representation in the EMM or Demand and Fuel Supply Modules was based on the type of generator. If the generator reported that it is a cogenerator, it was represented in the Demand and Fuel Supply Modules. If the generator reported that it is a small power producer, exempt wholesale generator or 'other', it was represented in the EMM. However, cogenerators, owned by IPPs were handled differently in AEO96.

Nontraditional cogeneration units are cogenerators owned by independent power developers. These units were previously represented in the Industrial Demand Module. However, because they are predominantly grid-serving entities (95 percent of the electricity generated in 1993 was sold to utilities) with their economics based mostly on the price of electricity, they are included in the EMM. They are also considered must run units and represented in the EFD using the same method as the nonutility generators. Because these units are so similar to nonutility units, they are not modeled distinctly in the EMM, i.e., there are no unplanned nontraditional cogeneration builds.

Updates to the Methodology for Dispatching Nonutilities

In order to implement the new methodology, the plant file needed to be modified to denote which plants are 'must run' units. The variable W_MRUN denotes if the unit is must run (i.e., to be dispatched first). If it is set to 1, it will be moved to the beginning of the merit order.

Next, these plants are allocated to their historic generation levels (Form EIA-867 "Nonutility Power Producer Report 1994"). Planned units are utilized based on assumptions of technology utilization from NEAB's Cost and Performance Database.

A comparison of the results of AEO96 compared to AEO95 are contained in Appendix C. Note, the historic nonutility generation numbers are different between the two year's forecasts because of the new definition of nonutilities as described previously.

Appendix A

Documentation of the Implementation of the International Economy Trade Code on the RISC machine and Instructions for running the Canadian EMM

I. Explanation of where files reside and what was implemented

I. Inputs to Canadian EMM Run

Input files (EMMCNTL file, Canadian plant text file, Canadian load shapes, Canadian demands, etc.) were put in the /EMM/CANIN directory.

2. Code changes

Changes were made to the UDAT, UDAF, UEFD, UETT, UTIL, and UNUGs that include code that is switched on or off based on whether it is a "Canadian" run or a regular NEMS run. The switch USW_XP in the EMMCNTL file must be set to 1 to make a "Canadian" run. Other required changes to the EMMCNTL file are highlighted in the attached copy (attachment A-1) of a "Canadian" EMMCNTL file. The EMMCNTL file to be used resides in the /EMM/CANIN directory. Because the code is switchable, the "Canadian" and the normal NEMS runs use the same source code; thus the code does not need to be recompiled for a "Canadian" run.

II. How to run the Canadian EMM

1. Preprocessor runs

Scenario descriptor files have been created for the 4 preprocessors (Plant, Load, Fuel and Contracts/constraints) and are located in the /EMM/CANIN directory. These scenario descriptor files include a switch that signals the preprocessor code to be accessed, and points to the relevant input files to the preprocessor run. Copy these scenario files to your user area and run the script "PREPRO". The PREPRO script will provide a menu of 4 preprocessors runs from which to choose. It will prompt you for the name of a scenario descriptor file that you are running (for example, CANLD for the load preprocessor). The output will go into a directory under your account with the scenario name you provided and the datekey. When the run is complete and you are satisfied with the results, you will need to move the resultant output DAFs to the /EMM/CANIN account. The following provides a description of the scenario descriptor files and the outputs that need to be moved to /EMM/CANIN.

	<u>Scenario Descriptor</u>	<u>Output Filename</u>
Plant	SCEDES.CANPL	PLNTDAF
Load	SCEDES.CANLD	LOADDAF
Fuel	SCEDES.CANFL	FUELDAF
Contracts/ constraints	SCEDES.CANET	ETTDDEM

ETTIN

2. Canadian EMM run

A scenario descriptor file for the Canadian EMM run has been created, called SCEDES.CAN, and it has also been put in the /EMM/CANIN directory. You will need, once again, to copy this file to your account. Run NEMS like normal, i.e., run the script RUNNEMS. Provide the scenario name CAN. The output will go to your area under scenario name CAN and datekey.

3. Postprocessor

Once the results are deemed satisfactory, portions of the Canadian excess supply output (in file @.EFDOUT) from this Canadian run will need to be copied to the input file (CANOUT) that the EMM is expecting. A postprocessor program has been set up for that purpose. It resides in the directory /EMM/CANIN/REWRITE and is run by typing "REWRITE". (Before launching the runs, however, make sure that the FILELIST in the /EMM/CANIN/REWRITE points to the @.EFDOUT in your user area). The output CANOUT file will go into the /EMM/CANIN/REWRITE directory. The last step in this process is to default and "look up" this resultant CANOUT file.