1 of 2

NEMS Integrating Module Documentation Report

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TABLE OF CONTENTS

1. INTRODUCTION	1
Scope of This Document	1
Model Archival Citation	2
Report Organization	2
2. OVERVIEW OF THE STRUCTURE OF NEMS	3
NEMS Objectives	3
Regional Detail	4
Time Horizon	6
Major Assumptions	6
NEMS Modular Structure	6
Modularity	7
Coordination of Modules and Data	8
Data Structure	8
Environment	8
Alternative Approaches	10
Approaches to an Integrating Methodology	11
Conclusions	16
3. Summary of NEMS Modules	19
System Integration Module	19
Supply Modules	20
Oil and Gas Supply Module	20
Natural Gas Transmission and Distribution Module	21
Coal Market Module	21
Renewable Fuels Module	21
Demand Modules	22
Residential Sector Demand Module	22
Commercial Sector Demand Module	22
Transportation Sector Demand Module	22
Industrial Sector Demand Module	23
Conversion Modules	23
Electricity Market Module	23
Petroleum Market Module	23
International and Economic Modules	24
International Energy Activity Module	24
Macroeconomic Activity Module	24
4. Global Data Structure	25
Inter-Module Communications	25
Energy Market Data Representation	27
Other Variables in the Global Data Structure	30
Variable Naming Convention	30
RESTART File	31
Report Data	31
Database Loading	32

5. Integrating Module Solution Methodology	33
Relationship of the Integrating Module to Other NEMS Modules	33
Integrating Module Inputs	34
General Modeling Approach	34
Mathematical Specification	35
Solution Algorithm Flow Chart	39
Convergence	41
Acceleration Techniques	44
Initial Solution Selection	44
Expected Value Foresight	45
Appendix A. Variable, Data and Parameter Listing	51
COMMON Block Name	51
Variable Name	51
Variable Dimensions	51
Variable Descriptors	52
Appendix B. Alphabetical List of NEMS Variables	93
Appendix C. Bibliography	101
NEMS System Design Reports	101
Overall Systems Design and Integration	101
Macroeconomic Activity	101
Demand	102
Electricity	102
Coal	103
Renewable Fuels	103
Oil and Gas Supply	103
Model Documentation Reports	104
Macroeconomic Activity	104
Oil and Gas Supply	105
Coal	105
Electricity Market Module	105
Demand Components	106
Overall Systems Design and Integration	106
Other Documents	107
Appendix D. Model Abstract	111
Figure 1. Census Divisions.	4
Figure 2. Basic NEMS Structure.	7
Figure 3. Integrating Module Flow Chart.	40
Table 1. Summary of NEMS Modeling Detail	5
Table 2. NEMS Module Information Flows.	9
Table 2. NEMS Module Information Flows (Continued).	10
Table 3. COMMON Blocks for the NEMS Global Data Structure.	26
Table 4. Energy Market Data Consumption Product Arrays.	28
Table 5. Energy Market Data Price Arrays.	29
Table 6. Dimension Names.	52
Table 7. Data Dictionary Variable Descriptors.	53

1. INTRODUCTION

The National Energy Modeling System (NEMS) is a computer modeling system that produces a general equilibrium solution for energy supply and demand in the U.S. energy markets. The model achieves a supply and demand balance in the end-use demand regions, defined as the nine Census Divisions, by solving for the prices of each energy type such that the quantities producers are willing to supply equal the quantities consumers wish to consume. The system reflects market economics, industry structure, and energy policies and regulations that influence market behavior.

NEMS is structured as a modular system. The modules include the Integrating Module documented herein and a series of relatively independent analytical modules that represent the domestic energy system, the international energy market, and the economy. The domestic energy system is decomposed into fuel supply markets, conversion activities, and end-use consumption sectors.

In order to compute an integrated energy forecast, it is necessary for the modules of NEMS to exchange data, both with the outside world and with each other. This is accomplished in NEMS by a set of global variables arranged into an efficient, manageable data structure, although each module also has its own local variables and local files used only by that particular module. Most of the data reside in main memory, rapidly accessible by any module during execution.

Scope of This Document

The NEMS Integrating Module is the central integrating component of a complex modeling system. As such, a thorough understanding of its role in the modeling process can only be achieved by placing it in the proper context with respect to the other modules. To that end, this document provides an overview of the complete NEMS model, and includes brief descriptions of the modules with which the Integrating Module interacts. The emphasis and focus, however, is on the structure and function of the Integrating Module of NEMS.

This document is intended to be read by analytical personnel having in-depth experience with modeling systems, who desire a comprehensive, detailed explanation of overall NEMS methodologies and approaches. As the NEMS approaches completion, additional chapters will analyze the quality of NEMS solutions.

Publication of this document is supported by Public Law 93-275, Federal Energy Administration Act of 1974, Section 57(B)(1) (as amended by Public Law 94-385, Energy Conservation and Production Act), which states in part

...that adequate documentation for all statistical and forecast reports prepared...is made available to the public at the time of publication of such reports.

Model Archival Citation

The first model archival of NEMS will be done for the version used for the *Annual Energy Outlook 1994*. This will be available in early 1994.

Report Organization

Later chapters of this document explain NEMS purpose and scope, rationale and structure, focusing on the Integrating Module, but describing important features of the analytical modules as necessary. The properties of the solution process are also covered in detail.

Because the Integrating Module stands at the center of NEMS operations, controlling the solution process, this documentation describes NEMS as a whole, as well as the details of the operation of the solution algorithm. The first chapter is therefore devoted to a description of NEMS.

The **Solution Methodology** chapter discusses the details of the Integrating Module's activities.

Chapters on properties, performance, calibration, and validation are reserved for future editions of this document that will be completed later.

Appendices contain supporting information for the NEMS model: history, bibliography, Model Abstract, and detailed listings of model variables.

2. OVERVIEW OF THE STRUCTURE OF NEMS

The purpose of the National Energy Modeling System (NEMS) is:

To illustrate the energy, economic, environmental, and energy security consequences on the United States of various energy policies and assumptions by providing forecasts of alternative energy futures in the mid-, and long-term periods, using a unified modeling system.

The primary use of NEMS is the development of baseline forecasts, such as those presented in the *Annual Energy Outlook* and special studies requested by clients, including Congress. The Short-Term Integrated Forecasting System (STIFS) is currently used in developing the quarterly *Short-Term Energy Outlook*. NEMS is planned to have both a midterm and a long-term modeling capability. The midterm horizon, to 2015, is the focus of this report and of the initial development effort. Most policy questions or alternative analyses have their greatest impact during the midterm.

In that vein, NEMS represents a rethinking and enhancement of past modeling efforts, with particular sensitivity to current policy-related issues. Some of the areas given enhanced representation by NEMS include:

- **Environmental issues;**
- **Regulatory changes;**
- **New technologies;**
- **Renewable sources of energy;**
- **Alternative fuels and reformulated products;**
- **Extension of the endogenous macroeconomic and microeconomic analysis capability; and**
- **World energy trade endogenous to the system.**

Regional capabilities critical to appropriate representation of issues, such as energy flows, environmental impacts, industry infrastructure, and resource depletion, have also been implemented.

NEMS Objectives

NEMS' design was formulated in response to three objectives:

- **The incorporation of sufficient detail to support a broad range of policy analysis;**
- **The representation of energy markets in a manner that captures the important interrelationships so that actual energy market conditions can be accurately simulated; and**

- The choice of a modeling system design which facilitates maintenance and use.

NEMS is a model of domestic energy markets. As such, the decisions to produce, convert, or consume energy products are presumed to serve the economic self-interest of those making the decisions. Many NEMS modules explicitly reproduce the economic decisionmaking involved in the portion of the energy system being modeled. In order to represent these decisions, NEMS is constructed in a reasonably fine detail of energy product categories and the regional locations of the sites of energy production and use. This detail is necessary since the economics of allocating energy products is strongly influenced by the product category at issue and regional differences in costs and other factors. Table 1 provides a summary of NEMS product and regional detail.

Regional Detail

The Integrating Module of NEMS processes energy information at the level of Census Divisions, which subdivide the nation as shown in Figure 1. NEMS imposes no requirements upon the component analytical modules as to the regional breakout they are to use, beyond the requirement that all data obtained from, or contributed to, the Integrating Module must be by Census Division. In fact, many of the modules use other regional structures as appropriate for their market segments. These modules convert their solutions to the Census Division structure for processing by the Integrating Module and by the reporting programs. Details of the conversion processes embedded in the modules are given in the individual *Model Documentation Reports*. These are listed below, in the bibliography given in Appendix C, pages 104 through 106.

Figure 1. Census Divisions.

Table 1. Summary of NEMS Modeling Detail

Energy System Activity	Categories	Regions
Primary Supply		
Oil	conventional enhanced heavy oil shale oil	six lower 48 onshore three lower 48 offshore three Alaska
Gas	conventional nonassociated conventional associated coalbed methane deep tight sands Devonian shale	six lower 48 onshore three lower 48 offshore three Alaska
Natural Gas Transmission and Distribution	residential, commercial, industrial, utility firm vs. interruptible peak vs. offpeak	twelve transshipment regions
Coal	four sulfur categories four thermal categories deep and surface mining types	sixteen supply regions
Renewables	hydropower, wind, geothermal, solar thermal, photovoltaic, municipal solid waste, biomass	NERC regions for variables to conversion modules; Census divisions for variables to demand modules
Conversion		
Electricity (including uranium for Nuclear)	utilities, independent power cogeneration	thirteen supply regions nine census demand regions
Refining	five crude categories seven product categories	five PADDs
Energy Demand		
Residential	eight end-use services three housing types	nine census divisions
Commercial	eight end-use services eleven building types	nine census divisions
Transportation	six vehicle size categories ten vehicle age categories	nine census divisions
Industrial	thirty-five industries nine primary industries	four census regions shared to nine census divisions

Time Horizon

The horizon for the midterm model is 2015, covering that time period in which the structure of the economy, the nature of energy markets, and regional demographics are sufficiently well understood in structural and regional detail. The majority of policies proposed today can be expected to have their greatest impacts during the midterm years.

Rather than trying to attain some planned state of energy markets, NEMS attempts to simulate where the present state of energy markets and planned policies would take us. Therefore it solves forward in time year-by-year.

Major Assumptions

Each module within NEMS embodies the many assumptions necessary to characterize the future production, conversion, and consumption of energy products in the U.S. There are no specific data-oriented assumptions, in the Integrating Module, such as there are for the other modules. NEMS' Integrating Module assumes that the individual modules can be integrated to provide a convergent process for the system as a whole. It makes use of the Gauss-Seidel algorithm for blocked non-linear simultaneous equations, interpreted for the characteristics of the national energy marketplace simulated here. Chapter 4 describes this approach in detail.

The NEMS algorithm and modeling approach worked successfully in the predecessor IFFS/GAMS modeling system. Although the models differ, NEMS has not added obstacles to finding solutions and has retained the older model's overall structure. Experience has shown that this approach occasionally has difficulty converging on a final solution, due to two broad classes of discontinuities in the component modules: the linear programming solution methods used by some modules jump from one vertex to another of their polygonal solution space; and other modules use tabulated functions evaluated either as step functions or by linear interpolation. These issues are handled in NEMS by ensuring that the spacings between the modules' steps are reasonably small. Convergence issues are discussed in more detail in Chapter 5.

NEMS Modular Structure

As shown in Figure 2, NEMS consists of four supply modules (oil and gas, natural gas transmission and distribution, coal, and renewable fuels), two conversion modules (electricity and petroleum refineries), four demand modules (residential, commercial, transportation and industrial sectors), one module to simulate energy/economy interactions (macroeconomic activity), one to simulate world energy/domestic energy interactions (international energy activity), and one module to provide the mechanism that achieves a general market equilibrium among all the modules (the Integrating Module). The last of these is the focus of this document. Figure 2 depicts the high level of modularity of NEMS.

Figure 2. Basic NEMS Structure.

Modularity

Model modularity implies a system of self-contained units, each performing a specific, well-defined function. This concept is generally consistent with the economic structure of energy markets, which can be represented by various supply, conversion, and demand components that are largely separable. Due to the heterogeneous nature of energy markets, a single methodology cannot adequately represent all fuel supply, energy conversion, and end-use demand sectors. Modularity allows the flexibility to use the methodology and coverage that is most appropriate for each module. Furthermore, modularity provides the capability to execute the modules individually or to easily substitute alternative modules to represent a specific function, so long as the required interfaces are satisfied. The interactions among these modules are controlled by the integrating mechanism.

Coordination of Modules and Data

Required linkages among modules are passed through common interfaces via the Integrating Module. The primary data flows among the major modules are the delivered prices of energy and the quantities consumed by product, region, and sector. As shown in Table 2, the information flows are not limited to prices and quantities, but include other information such as economic activity, capital expenditures, and load curves. The delivered prices for a fuel include the costs of all the activities necessary to produce, import, and transport the fuel to the end user.

The NEMS user can modify input values and key assumptions for the modules through the user interface, thus facilitating analyses using individual modules. For example, the Electricity Market Module normally receives delivered prices of fuels from the fuel supply modules; however the user can specify those prices externally to allow greater flexibility in using individual modules of the system.

Data Structure

The concept of the NEMS Global Data Structure is central to the modular structure. The NEMS Global Data Structure is defined as the set of data communicated among any of the thirteen NEMS modules. The Global Data Structure includes the energy market prices and consumption, macroeconomic variables, energy production, transportation, and conversion information, as well as centralized model control variables, parameters, and assumptions. The Global Data Structure excludes variables that are defined locally within modules and not communicated to other modules.

An important subset of the Global Data Structure is the Energy Market Data, the energy market end-use-sector prices and quantities of fuels used for equilibration and the NEMS energy balance. The Energy Market Data are the principal variables used directly by the Integrating Module in its convergence algorithm. Additional macroeconomic and international trade variables are tested for convergence as well in the solution algorithm.

Environment

Recognizing the importance of environmental issues associated with the use of energy, NEMS includes an environmental impact capability. Six emissions are accounted for in NEMS: carbon, CO, CO₂, SO_x, NO_x, and volatile organic compounds. These emissions are computed only for fuel combustion. In addition, NEMS represents all current environmental regulations, such as the Clean Air Act Amendments of 1990.

Table 2. NEMS Module Information Flows.

Module	Inputs from Other NEMS Modules	Inputs from Exogenous Sources	Important Outputs
Oil and Gas Supply	Oil and Gas Production by Fuel Type Interest Rates/Price Deflators Oil, Gas, Electricity Prices	Resource Levels Finding Rate Parameters Costs Production Profiles Tax Rates	Supply Curve Parameters Oil and Gas Financial Data Pipeline Gas and LNG Imports (Exports) Reserves and Reserve Additions
Natural Gas Transmission and Distribution	End-Use Gas Demands Natural Gas Supply Parameters Interest Rates Labor Costs Productivity	Existing Pipeline and Storage Facilities Historical Consumption Patterns Historical Flow Patterns	End-Use Natural Gas Prices Natural Gas Wellhead Prices Investment for Facilities Pipeline Emissions Storage and Pipeline Capacity Expansion
Coal Market	Coal Demand Natural Gas Prices Refined Product Prices Interest Rates Price Deflators	Base Year Production Contract Quantities Labor Productivity, Costs Transportation Costs Excess Capacity	Coal Production and Distribution Minemouth and End-Use Coal Prices Coal Feedstock Demand and Prices Coal Liquids Production and Prices Synfuel Plant Investment
Renewable Fuels	Installed Capacities Interest Rates, GDP	Technological Parameters Applicable Agricultural Factors Dispersed Geothermal Data	Available Production Capacities Capital Costs Operating Costs Thermal Contents and Heat Rates Biomass (Wood) Prices Supply Curves for Ethanol Load Duration Curves for Solar and Wind Emissions rates for Wood, MSW, Geothermal
Residential	Energy Product Prices Housing Starts	Current Housing Stocks Retirement Rates Current Appliance Stocks & Life Expectancy New Appliance Types, Efficiencies, Costs Housing Shell Retrofit Indices Unit Energy Consumptions	Energy Product Demand Emissions Changes in Housing and Appliance Stocks
Commercial	Energy Product Prices Rates of Interest, GDP	Existing Commercial Floorspace Floorspace Survival Rates Appliance Stocks Appliance Survival Rates New Appliance Types, Efficiencies, Costs Service Demand Intensities	Energy Product Demand Emissions Changes in Floorspace Changes in Appliance Stocks
Transportation	Energy Product Prices GDP Disposable Personal Income Industrial Output New Car and Light Truck Sales	Current and Projected Demographics Existing Vehicle Stocks Vehicle Survival Rates New Vehicle Technologies, Efficiencies, Costs Vehicle Safety and Emissions Regulations Vehicle Miles-per-Gallon Degradation Rates	Energy Product Demand Emissions Stocks and Characteristics of Vehicle Types
Industrial	Energy Product Prices Sectoral Trends of Economic Activity	Production Stages in Energy-Intensive Industries Technology Possibility Curves	Energy Product Demand Sectoral Detail of Future Energy Use

Table 2. NEMS Module Information Flows (Continued).

Module	Inputs from Other NEMS Modules	Inputs from Exogenous Sources	Important Outputs
Petroleum Market	Current World Oil Price Supply Curves for Imported Crudes and Products Petroleum Product Demands Electricity and Natural Gas Prices	Costs of Refining and Capacity Expansion Processing Unit Parameters Existing Refining and Distribution Facilities	Petroleum Product Prices Capital Expenditure for Refineries Crude and Product Imports (Exports) Refinery Fuel Use
International Energy Activity	U.S. Oil Supply/Demand U.S. Net Product Imports	OPEC Production Capacity Path Reference Non-U.S. Oil Supply and Demand	World Oil Price Crude Oil Imports Product Import Prices MTBE and Methanol Prices
Macroeconomic Activity	Wholesale Electricity Prices Retail Electricity Prices For Oil, Gas and Coal: Wholesale Prices Retail Prices Production Rates Rate of Refinery Activity Incremental Energy Investment	Labor Force Productivity	GDP and Other Economic Activity Measures Price Indices and Deflators U.S. Imports/Exports Production Rates by Industry

Alternative Approaches

This section on alternative approaches to the integrating methodology for NEMS provides background on the research that preceded the overall system design.¹ The discussion of methodologies is limited to those with which EIA has some familiarity and is intended to focus on the fundamental principles of the design rather than on the specifics of individual fuel or sector methodologies. This topic was also considered by the National Research Council Committee on NEMS.

Two primary requirements form the basis for discussion of the integrating framework of NEMS. First, NEMS is a tool for performing market-based integrated energy market analysis, but on a sector- and fuel-specific basis. Second, the NEMS design allows a high degree of modularity. The first goal implies that NEMS should be able to balance the supply of and demand for energy, taking into account the economic competition among energy sources. Economic principles for energy supply, consumption, and competition are the foundation of most EIA analysis. Although valuable insights can be derived from the analysis of a narrow sector-specific option, very often the policy discussions center on broad energy market impacts, such as energy security or economic impacts. This is not to imply that all analyses need be done in an integrated framework, but rather that the capability should be in place.

A fixed-shares approach to fuel competition or a system in which the energy sectors do not balance would add little information to the policy debates. A market-based approach, in which supplies and demands for energy respond to the costs and prices of energy, predominates as the underlying principle of the required energy policy analysis. Thus, NEMS must provide a

¹A full discussion of the issues relating to the integrating methodology can be found in the NEMS Issue Paper, *Integrating Methodology of the National Energy Modeling System*, June 28, 1991.

framework in which the market-clearing prices and quantities of energy supply and demand can be derived, subject to other factors, such as regulatory and legislative conditions.

The second goal for NEMS development that directly affects the design of the integrating methodology is the requirement for modularity. Model modularity implies that the modules of NEMS that represent the various supply, conversion, and consumption components are separable in both their methodology and their implementation. Functionally, modularity allows the component modules to be tested and developed without running the entire system, which is necessarily faster, and allows problems to be isolated to particular sectors. In addition, individual fuel or sector studies can be conducted with all other components held constant. Finally, modularity readily allows for the inclusion of alternative modules that meet minimum interface requirements. This desired modularity or segmentation of the modeling system leads to the necessity for a methodology by which the various modules can interact—the integrating methodology. A discussion of various approaches used in earlier models follows.

Approaches to an Integrating Methodology

Project Independence Evaluation System

The Project Independence Evaluation System (PIES), later named the Midterm Energy Forecasting System (MEFS), is one example of a large-scale integrated energy modeling system. It was developed in 1974 by the Federal Energy Administration, a predecessor organization to the EIA. The core model of PIES/MEFS was a single linear program of fuel supply, transportation, conversion, and fixed demand activities, which optimized by solving for the least-cost combination of supply and transportation of fuel to meet end-use demand.

PIES/MEFS solved for a supply/demand equilibrium in one future period by iterating between the linear program and a reduced-form representation of demand models. After the linear program optimized the supply/conversion problem, the marginal, or shadow, prices for each fuel delivered to the end-users were taken from the linear program. The reduced-form demand models were evaluated at these marginal prices, giving revised demands for fuels that were entered into the linear program, which was then re-solved. This process of iterating between the linear program and demand models continued until the marginal prices and end-use demands between subsequent iterations were close within a convergence tolerance. Over the years, many special features were added to PIES/MEFS to reflect regulatory policies or to ensure that certain end-use prices from the linear program were average or regulated prices, rather than strict marginal prices. These features were incorporated in either the linear program or in the program that controlled the equilibration and determined convergence.

As a modeling system, PIES/MEFS encompassed a host of satellite models—coal, oil, natural gas, synthetic fuels, refinery, electric utility, end-use demand, and macroeconomic. Each of these satellite models produced the necessary coefficients and objective function costs for the linear program and incorporated sector-specific features as required. This limited modular structure served to organize the data and allocate responsibilities for the modeling activities; however, there were several significant problems with PIES/MEFS as an integrating methodology.

First, the structure of the system required the entire linear program to be executed together without any means of decomposing the model. This was a serious problem in a testing and debugging mode since PIES/MEFS required several hours to execute, and the simplest changes could only be tested through an entire run of the model. The satellite models and preprocessor programs produced data for the linear program, but did not produce results that could be readily used for analysis or testing of the individual sector. Yet another difficulty with PIES/MEFS was the overarching optimization methodology, which was not suitable for all portions of all the supply sectors. Several special features were incorporated into the system to appropriately represent some regulatory or institutional features of various sectors; however, this became increasingly burdensome.

Intermediate Future Forecasting System

The immediate predecessor to NEMS was the Intermediate Future Forecasting System (IFFS), an annual model that forecasted to a specified time horizon, the maximum finally set at 2010. IFFS partitioned the energy system into fuel supply, conversion, and end-use demand sectors, then solved for a supply/demand equilibrium by successively and repeatedly invoking these modules. This equilibration was performed one forecast year at a time, stepping forward to the next forecast year when the equilibrium for one year was complete.

The fuel supply modules in IFFS encompassed all the activities necessary to produce, import, and transport the fuel to the end user, thus computing the domestic production and the regional end-use prices necessary to meet end-use demand. Each of the end-use demand modules computed fuel requirements for the sector by region, based upon the regional end-use prices of all competing fuels, and other factors. The electricity module, as a conversion module, consumed fuel based on relative prices and then generated and priced electricity. The refinery module was also viewed as a conversion module, except that it used only a single primary input, crude oil, whose price was invariant, and its fuel use was represented in the industrial demand module with no direct linkage to refinery activity.

Within the IFFS framework, the primary interfaces among the modules were the regional end-use prices and demands for each fuel, although other information was passed among modules. Each fuel supply or end-use sector demand module was called in sequence, and each module solved assuming all other variables in the energy markets were held constant. That is, the coal module solved for the production and end-use prices of coal, assuming a slate of demands for coal and assuming that all other sectors were fixed. Any module that used the coal prices would then use these new prices to compute demand the next time the module was executed. This process was equivalent to a Gauss-Seidel algorithm for solving a set of simultaneous equations.

The equilibration module of IFFS called the various modules in sequence and checked for convergence of the system by computing percentage differences between iterations for all end-use prices and demands in each region. When differences were within the user-specified tolerance, convergence was declared and the equilibrating module began solving the next forecast year. Some attempt was made in IFFS to speed convergence by using characteristics of particular modules. For example, the sensitivity of the natural gas price to the level of demand, and the

concomitant sensitivity of gas demand in certain sectors to the price, was well recognized. To handle this, the electricity module computed a derived demand curve for natural gas, explicitly representing the demand for gas at a variety of prices, for both the electricity and gas modules to deal more effectively with convergence. This demand curve was part of the information passed from the electricity module to the gas module.

Due to the partitioning of the energy markets and the specific implementation of the modules and integrating methodology in IFFS, any subset of the modules could be executed, or any module that met a minimum interface requirement could be substituted. A key feature that was necessary to achieve the modularization was the means by which the modules passed information to each other. Within IFFS, none of the modules passed information directly to another module, but rather through a central data storage file. If a particular module was not included in a particular run of the system, the information it normally provided was located in the central data file. Thus, any other module could read that information and was oblivious to whether the module was included.

The modular nature of IFFS allowed for single-fuel studies, if desired. Such studies were conducted on the electricity and natural gas sectors. However, it was not easy to execute, for example, the electricity model with a specified demand or with fuel prices that were different from another instance of the model execution. These functions required explicit programming by someone familiar with IFFS, or adjusted assumptions in other modules to produce the desired input.

In addition, the modular nature of IFFS readily allowed each sector of the energy market to be represented with the methodology deemed most suitable to that sector, allowing for a more natural representation of each market. IFFS contained a mix of simulation, process, econometric, and optimization methods within the various sectors. It also allowed each module to vary the depth and breadth of its coverage of the sector. For example, the coal supply module of IFFS represented 32 coal production regions and a detailed transportation network delivering the coal to the end-use demand regions. By contrast, the petroleum product module computed the refinery gate prices of products at the national level and used regional, sectoral markups to derive end-use prices without an explicit transportation component.

The flexibility of IFFS came at some cost, however. A linear program, for example, is a highly structured approach to modeling. There is an ever-increasing set of software available to generate, debug, analyze, and report linear programs. In a less structured system with more diverse methodologies, many of these features are not available or must be programmed into individual modules.

The basic IFFS methodology was also employed in the PC-AEO, a simplified spreadsheet representation of the modeling system used by EIA for three years. PC-AEO decomposed the energy system into the same supply, conversion, and demand modules, representing each module in a separate spreadsheet. The interface variables among the modules upon which the system iterated were also the end-use prices and quantities by fuel. For easier file handling, each module of PC-AEO solved all years in the forecast horizon each time it was invoked. Thus, the order of looping over modules and forecast years was reversed from IFFS.

Long-term Energy Analysis Package

For three years, EIA used the Long-term Energy Analysis Package (LEAP) for long-range forecasting. LEAP was EIA's configuration of the Generalized Equilibrium Modeling System (GEMS), originally developed by the Stanford Research Institute and now with Decision Focus, Inc. Many organizations use GEMS, configured to suit their particular purposes.

LEAP segments the energy system by separating all supply, transportation, conversion, and end-use processes. Each of these activities is defined as a node, and a network describing the flows of all information between nodes must be explicitly drawn. Each regional activity, such as coal supply by region, would also be a separate node. At all decision points in the system, there are allocation nodes. Several examples of such allocations are:

- The coal transportation network might contain a centroid in the upper Great Plains that can be served by several production regions. An allocation node at that centroid determines how much production comes from each region.
- The decisions on how much natural gas goes to each of the gas technologies in the electricity generation sector or in any end-use sector would be allocation nodes.
- The amount of each competing technology used to satisfy residential heating needs would be an allocation node.
- The entrance of Alaskan North Slope gas into the supply system would be an allocation node.

Each allocation node is a market share algorithm that uses market share coefficients, price premium, behavioral lag coefficients, and initial year market shares. These data, though fundamental to the solution, are very difficult to derive empirically for each node in the system.

LEAP solved for a supply/demand equilibrium in a way fundamentally similar to IFFS, with prices and quantities of the various types of energy being computed by modules that represented production, raw material transportation, conversion, final product transportation, and end-use energy consumption. As a representation of the overall system, the order of solution was directional, prices flowing from supply to end-use demand and quantities flowing in reverse. Thus, it solved for an equilibrium by iteratively computing the network flows.

Like PC-AEO and unlike IFFS, each module of LEAP/GEMS solved for all forecast years at a time, coming to an equilibrium for all years simultaneously.

One feature of the GEMS system is a library of generic models, from which one can choose in building a representation of the energy system. These generic models include a simple and a complex conversion process, an allocation process, a primary resource process, an end-use demand process, and a transportation process. In building a model using GEMS, a user draws the network by selecting a generic model for each node, defining all the input and output links

to other nodes, and specifying all necessary data. It is the data specification and the flows that distinguish, for example, a node representing the industrial sector demand for electricity for machine drive from a node for residential natural gas space heating demand. The value of the generic models depends on the view of the model builder. If the model builders think, for example, that the coal transportation system and the natural gas transportation system differ in their physical or economic characteristics, then a generic model cannot be used for both and separate models must be developed. One model builder might require only a simple energy market representation and therefore be comfortable with the generic models. Someone interested in more sophisticated representations of the different energy sectors for specific issues might be less comfortable with the generic model concept. As the model builder moves away from the generic model concept, the value of the GEMS system and its data structure diminishes.

A potential difficulty in using the GEMS-type approach is the application of methodologies that encompass several nodes. A model builder using GEMS would represent oil and gas production by a separate node for each region and each technology type, differentiated by oil and gas. This was done in LEAP, which made the model large and cumbersome. However, if EIA wished to incorporate a methodology such as an oil and gas industry-wide cash flow or other activity, this would become difficult. EIA has tended to take a wider market view of the various sectors, for example, representing coal supply and transportation in a unified way or natural gas production and transportation. GEMS could incorporate these market views if the model builder programmed larger, more specialized nodes, encompassing a larger number of individual activities, but diminishing the value of the generic module library.

Optimization Methodologies

Optimization models are often appropriate for simulating the behavior of a homogeneous industry or sector of the economy that typically has a single objective function. For example, the electric industry's plant dispatching decisions or the movements in the coal transportation sector can be represented appropriately as an optimization model. In such models, the objective is typically a cost minimization.

Optimization approaches can also be used to solve a market equilibrium problem for a competitive market. The mathematical equivalence between the competitive solution and the cost minimizing solution allows the use of optimization techniques to solve for the market equilibrium. For a competitive model, an equivalent supply side optimization problem is to provide customers with prespecified quantities of end-use fuels at minimum cost. Such a model ignores the fact that real-world markets are always suboptimal, as they are constantly in the process of optimizing to constantly changing conditions. The integrating framework of the PIES model mentioned earlier was structured as an optimization problem.

While optimization methods could be used to determine a generalized market clearing solution, such an approach might prove too difficult or inflexible to apply to the complex U.S. energy economy. As discussed above, the experience with the PIES model cautions against using an overarching optimization approach as an integrating framework for NEMS. Model implementation and management are relatively difficult, as is the simulation of a diverse group

of industries with a single modeling approach. A preferred approach combines a flexible integrating framework with a solution algorithm that yields equilibrium energy market forecasts.

Other Methodologies

All the above methodologies inherently assume a complex representation of the feedbacks and interrelationships of the energy system, as well as an ability to represent a system that evolves over time. Other methodologies that do not incorporate such features are possible.

EIA's *Short-Term Energy Outlook* is a 2-year, quarterly forecast of national energy supply and demand, produced using the Short-Term Integrated Forecasting System (STIFS). Given assumed crude oil and natural gas wellhead prices, STIFS computes delivered energy prices and the consumption of energy based upon relative prices and recent trends. Domestic crude oil and coal production are both projected based on the fuel prices. It achieves an energy balance using a simultaneous non-linear equations approach that adjusts production and import trends and stock levels, with limited feedback of energy prices and consumption on production. Being a short-term system, STIFS does not account for capital stock changes and investment decisions.

STIFS performs credibly for its intended purpose of providing short-term, non-equilibrium forecasts, although its limited structural representation and the lack of certain feedback effects restrict the types of scenarios it can address. In general, the STIFS integrating methodology, which does not allow for equilibration or market transition, would not be appropriate for a longer-term modeling system.

Conclusions

Because of these considerations, NEMS adopted a system design and solution algorithm similar to that of the Intermediate Future Forecasting System (IFFS). The key features of this design are:

- The energy system is decomposed into fuel supply markets, conversion activities, and end-use consumption sectors, with explicitly defined flows among the components. The primary information flows among these major components are the delivered prices of energy and the quantities consumed by product, region, and sector. Other information such as economic activity, capital expenditures, and load curves is passed among the modules as well.
- To allow operational independence, the components do not pass information to each other directly but communicate through a database while executing.
- Solution is achieved by equilibrating on the delivered prices of energy and quantities demanded, which assures an economic equilibrium of supply and demand in each of the consuming sectors.
- Equilibration is achieved annually at least through the midterm. Eventually, longer-term components of NEMS may function with longer time intervals.

Enhancements or improvements to the IFFS approaches implemented in NEMS are as follows:

- **The convergence algorithm allows the use of relaxation techniques to ensure that the system achieves convergence as rapidly as possible.**
- **The integrating framework accounts for global system values, such as emissions and other toxics, capital requirements, and foreign trade, to allow for the representation of feedback effects of such values on the energy system.**
- **The structure of the integrating framework and data storage incorporate alternative assumptions about decision makers' foresight in the system. The integrating algorithm allows the system to cycle through the years to reach convergence, rather than stepping forward progressively through the years.**

3. Summary of NEMS Modules

This chapter gives capsule summaries of the major software components introduced in the previous chapter. For more detailed descriptions of the NEMS modules, the reader is referred to the *NEMS Methodology Summary*, forthcoming in January 1994, and to the documentation packages for the individual modules, which are listed in Appendix C. Inputs for and outputs from the modules are summarized in Table 2.

System Integration Module

Figure 2 depicts the relationship of the Integrating Module of NEMS with each of the component modules. The Integrating Module interacts with all of the NEMS submodels, generally referred to as *modules*. The term module is used because each NEMS submodel is designed to be invoked selectively by the NEMS Integrating Module so that all or some of the NEMS model can be executed in a truly modular way.

The integrating mechanism of NEMS balances the supply of and demand for energy, taking into account the economic competition among energy sources. This competition is the foundation for most of the analysis performed by EIA. Although valuable insights can be derived from a single-sector analysis, very often policy discussions revolve around overall energy market impacts that cannot be understood from the narrow perspective of a single market segment. This does not imply that all analyses must be done in an integrated framework, but rather that the capability be in place. The individual modules of NEMS are designed to account for sector-specific or fuel-specific market characteristics and regulations, while the Integrating Module ensures that the interaction among consuming sectors, energy sources, and the economy is reflected.

The NEMS Integrating Module possesses the following features:

- Solutions are achieved by equilibrating on the delivered prices of energy and the quantities demanded, thus assuring an economic (market-clearing) equilibrium of supply and demand at agreed prices in the consuming and producing sectors. Each fuel supply, conversion, or end-use demand module is called in sequence and solves assuming all other variables in the energy markets are fixed. The modules are called iteratively until the end-use prices and quantities remain constant within a specified tolerance, a state defined as convergence. In NEMS, quantities supplied are not accounted for separately from quantities demanded; a single set of quantities both supplied and demanded ensures that they are in balance with one another.
- Equilibration is achieved annually through the midterm period to 2015.

- The integrating framework incorporates interfaces to macroeconomic and international modules that exchange information with the domestic energy modules. The solution algorithm incorporates iterative calls for the NEMS macroeconomic and international modules and performs convergence tests on a set of key macroeconomic and international trade variables.
- The integrating framework accounts for global system values, such as emissions and capital requirements.

The Integrating Module controls execution of the component modules in an iterative, convergence algorithm. The objective is to equilibrate on the delivered prices of energy and quantities demanded, to ensure an economic equilibrium of supply and demand in the domestic energy markets, with feedbacks from the international market and the economy as whole.

The concept of modularity requires that output variables from each NEMS module be available, even if the module is switched off for a particular run. In support of this requirement, the Integrating Module is capable of replacing a module's output data when that module is omitted from a run. The Integrating Module manages and has access to all data communicated among modules. The Integrating Module also loads initial energy market solutions, assesses market equilibrium, and stores the final solutions for future restart purposes and centralized reporting. In addition, the Integrating Module has access to user-defined model control variables, parameters and centrally defined assumptions.

Supply Modules

Supply sectors are generally characterized by their function of converting raw energy resources into forms that can be consumed by the consumption sectors. In NEMS, supply modules have the responsibility for accepting quantities of energy products demanded by the demand modules, and returning the prices that would be required to produce supplies in matching amounts. In addition, they provide descriptions of the technical characteristics of energy products.

Oil and Gas Supply Module

The Oil and Gas Supply Module represents domestic crude oil, natural gas liquids, and natural gas production within an integrated framework that captures the interrelationships among the various sources of supply: onshore, offshore, Alaska, conventional, and unconventional production. This framework analyzes cash flow and profitability to compute investment in each of the supply sources. Oil and gas market equilibration for production is computed at a regional level. The crude oil and natural gas liquids produced are input to the Petroleum Market Module, a separate conversion module in NEMS, for conversion and blending into refined petroleum products.

The OGSM is solved as a classical process model.

Natural Gas Transmission and Distribution Module

This module represents the transmission, distribution, and pricing of natural gas, subject to end-use demand for natural gas, the production of domestic natural gas, and the availability and price of natural gas traded on the international market. The module tracks the flows of natural gas in an aggregate, domestic pipeline network. This capability allows the analysis of impacts of regional capacity constraints in the interstate natural gas pipeline network and the identification of pipeline capacity expansion requirements. There is an explicit representation of firm and interruptible markets for natural gas transmission services, and the key components of pipeline and distributor tariffs for transmission services are included for the pricing algorithms.

The NGTDM is formulated as a linear program.

Coal Market Module

The Coal Market Module represents the mining, transportation, and pricing of coal, subject to the end-use demand for coal differentiated by physical characteristics, such as the heat and sulfur content. The coal supply curves include a response to capacity utilization and fuel costs. Transportation by various modes, such as trucks or rail, and the effects of coal contracts are represented.

The Coal Market Module incorporates an international submodule that calculates U.S. coal exports as part of the worldwide market for coal. The Coal Synthetics Submodule projects the production of synthetic fuels from coal, to be used as substitutes for conventional petroleum liquids and pipeline-quality natural gas.

The module combines linear programming optimizations with deterministic calculations.

Renewable Fuels Module

The Renewable Fuels Module includes several submodules that represent the supply of wood, municipal solid waste, wind, solar, hydropower, and geothermal technologies. The market penetration of renewable technologies used for centralized electricity generation is represented in the Electricity Market Module. The market penetration of dispersed renewables such as rooftop solar collectors and geothermal heat pumps is incorporated within the end-use demand modules. Renewable supply curves from the renewable supply module provide costs and performance criteria to these other modules. The Renewable Fuels Module also interacts with the refining module to represent the production and pricing of alcohol fuels.

Each of the submodules in the Renewable Fuels Module uses its own techniques for arriving at a solution. All, except for Geothermal, are relatively deterministic formulations. The Geothermal Submodule uses a process modeling technique that accounts for all known potential geothermal sites.

Demand Modules

Demand sectors in the energy marketplace are the end users of energy products, converting them into usable work. In NEMS, the demand modules examine prices for energy products to determine the amounts of the products that would be purchased at those prices. They are responsible also for calculating purchases of additional energy consuming equipment, on the basis of expectations about future energy requirements and prices.

The demand modules are deterministic models, characterized as structural, economic/engineering representations, as opposed to econometric modules.

Residential Sector Demand Module

The Residential Sector Demand Module forecasts the consumption of residential sector fuels and electricity by housing type and end use, subject to delivered energy prices, the availability of renewable sources of energy, and macroeconomic variables representing disposable personal income, interest rates, and housing starts.

The module distinguishes consumption by type of housing unit (single-family, multi-family, mobile home) and end use (heating, air conditioning, water heating, types of appliances, etc.). Because certain end uses and conservation measures interact (e.g., a conversion from incandescent to fluorescent lighting changes demand for other fuels, by increases in heating equipment loads and decreases in cooling loads) the model keeps track of overall, as well as individual, impacts of conservation measures and new technologies.

Commercial Sector Demand Module

The Commercial Sector Demand Module forecasts the consumption of commercial sector fuels and electricity by building type and non-building uses of energy and by category of end use, subject to delivered prices of energy, the availability of renewable sources of energy, and macroeconomic variables representing gross domestic product, employment, interest rates, and floor space construction.

Transportation Sector Demand Module

The Transportation Sector Demand Module forecasts the consumption of transportation sector fuels and electricity by transportation mode, including the use of renewables and synthetic fuels, subject to delivered prices of energy fuels and macroeconomic variables representing disposable personal income, gross domestic product, population, interest rates, and the value of output for industries in the freight sector. Analysis is disaggregated by vehicle age and size class.

Industrial Sector Demand Module

The Industrial Sector Demand Module forecasts the consumption of fuels and electricity for heat and power and for feedstocks and raw materials at a process or end-use level for the energy-intensive industries, including the direct use of renewable energy and the use of synthetic fuels, subject to delivered prices of energy and macroeconomic variables representing gross domestic product, interest rates and cost of capital, employment and labor cost, and the value of output for each industry. It includes simplified process models for 35 industries, with uses broken out to boilers/steam generation, buildings, and process/assembly. This module includes the nonutility generation of electricity that is either used in the sector or sold to electric utilities.

Conversion Modules

Conversion sectors in the energy marketplace convert energy products that could be consumed directly into other forms that can be consumed more easily by the demand sectors. In NEMS, the conversion modules act both like demand modules, in that they demand energy products, and like supply modules, in that they produce energy products for the demand sectors. They also act in a dual capacity in that they calculate the quantities of primary fuels they would consume at specified prices, and calculate the prices necessary to supply quantities of output fuels demanded by the demand modules.

Electricity Market Module

The Electricity Market Module represents the generation, transmission, and pricing of electricity, subject to the delivered prices for coal, petroleum products, natural gas, and synthetic fuels, the costs of generation by centralized renewables, macroeconomic variables for costs of capital and domestic investment, and electricity load shapes and demand. The submodules include capacity planning, fuel dispatch, nonutility generation, finance and electricity pricing, transmission and trade, and demand side management (DSM) in conjunction with the demand models.

DSM programs and all Clean Air Act compliance options are explicitly represented in the capacity expansion and dispatch decisions. Both new generating technologies and some renewable technologies compete directly in these decisions. Several options for wholesale pricing and the competition between utility and nonutility generation are included in the module.

The capacity planning portion of EMM employs a linear programming formulation; the other parts are process models.

Petroleum Market Module

The Petroleum Market Module includes the pricing of petroleum products, crude oil and product import activity in conjunction with the International Energy Activity Module, and domestic refinery operations, subject to the demand for petroleum products, the availability and price of

imported petroleum, and the domestic production of crude oil, natural gas liquids, and alcohol fuels. The module represents the same five crude oil types in the refining activities as does the International Energy Activity Module. It explicitly models the requirements of the Clean Air Act Amendments of 1990 and the costs of new automotive fuels, such as oxygenated and reformulated gasoline, and includes oxygenated production and blending for reformulated gasoline. Costs include required capacity expansion for refinery processing units.

The Petroleum Market Module consists of a set of regional linear programs.

International and Economic Modules

International Energy Activity Module

The International Energy Activity Module represents the world oil markets and projects world oil prices within NEMS. International petroleum product supply curves, including curves for oxygenates, are incorporated, and an international refinery model is being added. This module defines crude oil categories that are consistent with those in the domestic refinery model.

The module is purely deterministic.

Macroeconomic Activity Module

The Macroeconomic Activity Module provides a set of essential macroeconomic drivers to the energy modules, provides a macroeconomic feedback mechanism within NEMS, and evaluates detailed macroeconomic and interindustry impacts associated with energy events. Industrial drivers are calculated for 35 industrial sectors. A capability to analyze the impacts of energy investment is included, as well as regional macroeconomic projections. This module is a response surface representation of the Data Resources, Inc., (DRI) Quarterly Model of the U.S. Economy.

4. Global Data Structure

As a distinct component of NEMS, the Integrating Module operates on a subset of the Global Data Structure that consists primarily of the model control information and the end-use sector prices and quantities of fuels. Some model control information is input to the Integrating Module from the NEMS user interface. Other control information, such as the current model year, is updated during model execution. All of this control information is accessible to NEMS modules, and can be viewed as an output of the Integrating Module.

The end-use prices and quantities are both inputs and outputs for the Integrating Module. The Integrating Module stores these values from one iteration to the next to check on NEMS convergence. At user request, the Integrating Module can change the prices and quantities from the component modules, to speed convergence (see *Acceleration Techniques*, on page 44). Thus, the updated values are considered an output.

Because of the flexible year-looping algorithm in the Integrating Module, all variables in the Global Data Structure are explicitly dimensioned with a NEMS year subscript. As a result, the memory requirements for the NEMS Global Data Structure are significant.

Inter-Module Communications

Four categories of variables provide input and output for each module. Some variables fall into more than one category:

- Variables needed by the module, which pertain to and are specific only to that module, including initial values, parameters, coefficients, and assumptions for that individual module, ordinarily read in from the module's private input files;
- Variables that are outputs of the individual module, derived only from that module, including specialized and/or debug reports, that ordinarily are output to the module's private output files;
- Variables that are critical to the proper functioning of the integrating system, providing the information links that allow the modules to communicate with each other and/or the system to solve for an equilibrium solution, including prices, consumption, and macroeconomic information that are input to and output from the various modules; and
- Variables that are of sufficiently general interest to most of the model users that they are printed in the modeling system reports, cover a wide range of variables, and are a substantial superset of the variables that are necessary for integration.

Only the last two categories in this list are included in the NEMS Global Data Structure.

All data in the NEMS Global Data Structure is defined in FORTRAN COMMON blocks that designate groups of global variables. Only some of the COMMON blocks used by NEMS modules are considered part of the Global Data Structure. During NEMS execution, each module accesses its input and output variables through these NEMS COMMON blocks. The NEMS COMMON block structure designed to store the Global Data Structure is displayed in Table 3. The specific elements of the COMMON block structure can be found in Appendix A. Generally, three COMMON blocks can be found in the Global Data Structure for each NEMS module, to hold three categories of information:

- The module's outputs (moduleOUT) used by other NEMS modules, (exclusive of end-use consumption and prices);
- The module's outputs (moduleREP) used only for reports (for some modules only); and
- The module's input variables (modulePARAM) for its key parameters and assumptions.

Table 3. COMMON Blocks for the NEMS Global Data Structure.

Module Creator	COMMON block Names	Description
Integrating/all	QBLK	End-Use Sector Quantities (See Table 3)
Integrating/all	MPBLK	End-Use Sector Prices (See Table 4)
Integrating/all	MXQBLK	Expected Quantities for foresight
Integrating/all	MXPBLK	Expected Prices for foresight
Integrating/all	QSBLK	SEDS Historical data corresponding to QBLK
Integrating/all	NCNTRL	Control Variables
All	EMISSION	Emissions data
All	CAPEXP	Capital Expenditures for Energy Equipment
All	COGEN	Cogeneration
All	DSM	Demand-Side Management
Exogenous	CONVFACT	Global conversion factors
Refinery	PMMOUT	Module outputs to other modules
Oil & Gas Supply	OGSMOUT	"
Natural Gas T & D	NGTDMOUT	"
		"
Electricity	ENMOUT	"
Coal	COALOUT	"
Renewable/all	WRENEW	"
Commercial	COMOUT	"
Industrial	INDOUT	"
Macroeconomic	MACOUT	"
International	INTOUT	"
Uranium	UMMOUT	
		Key input parameters and assumptions
Refinery	PMPARAM	"
Commercial	COMPARAM	"
Macroeconomic	MACPARMS	
		Module outputs to report writer only
Nat. Gas T&D	NGTDMREP	"
Industrial	INDREP	"
Macroeconomic	MACREP	"
Commercial	COMREP	"
Refinery	PMMRPT	"
Transportation	TRANREP	"
Residential	RESDREP	

In addition, a group of general-purpose COMMON blocks, called the Energy Market Data, hold data that are created by various modules. These are:

QBLK	Sectoral End-Use quantities
MPBLK	Sectoral End-Use prices
MXQBLK	Expectations for End-Use quantities
MXPBLK	Expectations for End-Use prices
CAPEXP	Capital Expenditures on Energy Equipment

Energy Market Data Representation

The Energy Market Data define the energy consumption product and price details that are used for market definition in NEMS. These variables are the principal values necessary for convergence testing in the integrating algorithm. The Energy Market Data are just part of the NEMS Global Data Structure. The quantity and price structure does not attempt to represent all energy flows, but instead focuses on the primary variables necessary for the design of the NEMS equilibrating methodology. In addition, the Energy Market Data structure defines the end-use energy classification for the NEMS energy balance.

Table 4 presents a list of the consumption products in a grid depicting the sectoral detail. Each item in the grid represents the named variable in NEMS. The sectoral definitions include the four end-use sectors and three conversion sectors. The reader may note the inclusion of Synthetics as a conversion sector. This sector is implemented in NEMS as a submodule of the Coal Market Module. The sectoral and fuel consumption detail is defined to meet several objectives, including energy accounting coverage and consistency, the structure of component modules, and the requirements for inter-module communications. Elements of this design requiring clarification are as follows:

- The electricity sector includes fuel used by electric utilities and independent power producers to generate electricity supplied to the grid. The industrial and commercial sectors include fuel used for on-site electricity generation, primarily in cogeneration applications. This breakout is consistent with the coverage of the Electricity Market Module and the demand modules.
- Fuel consumption in the refinery sector is broken out from the industrial sector for inter-module communication requirements. The Petroleum Market Module determines fuel use by the refinery sector. This information is passed to Industrial Demand Module, where fuel consumption for refining is added to other industrial fuel use. Thus, the industrial energy consumption product demands as defined in Table 4 *include* refinery consumption.
- The synthetic sector includes fuel consumed for conversion and omits energy products used solely as feedstocks in the synthesis itself.

Table 4. Energy Market Data Consumption Product Arrays.

Description	Prod Code	End-Uses				Conversions			
		Resid RS	Comm CM	Trans TR	Indus IN	Refin RF	Elect EL	Synth SN	All AS
Purchased Electricity, Peak	EP	QEPRS	QEPCM	QEPTR	QEPIN	QEPRF			QEPAS
Purchased Electricity, Off-Peak	EN	QENRS	QENCM	QENTR	QENIN	QENRF			QENAS
Purchased Electricity (total) *	EL	QELRS	QELCM	QELTR	QELIN	QELRF			QELAS
Natural Gas, Core (Firm)	GF	QGFRS	QGFCM	QGFTR	QGFIN	QGFRF	QGFEL		QGFAS
Natural Gas, Noncore (Interrupt.)	GI	QGIRS	QGICM	QGITR	QGIIN	QGIRF	QGIEL		QGIAS
Natural Gas (total) *	NG	QNGRS	QNGCM	QNGTR	QNGIN	QNGRF	QNGEL		QNGAS
Natural Gas, Pipeline Fuel	GP			QGPTA					
Lease and Plant Fuel	LP				QLPIN				
Steam Coal	CL	QCLRS	QCLCM		QCLIN	QCLRF	QCLEL	QCLSN	QCLAS
Metallurgical Coal	MC				QMCIN				
Motor Gasoline	MG		QMGCM	QMGTB	QMGIN				QMGAS
Jet Fuel	JF			QJFTR					
Distillate	DS	QDSRS	QDSCM	QDSTR	QDSIN	QDSRF	QDSEL		QDSAS
Kerosene	KS	QKRS	QKSCM		QKSIN				QKSAS
Liquid Petroleum Gas	LG	QLGRS	QLGCM	QLGTR	QLGIN	QLGRF			QLGAS
Residual Fuel, Low Sulfur	RL		QRLCM	QRLTR	QRLIN	QRLRF	QRLLEL		QRLAS
Residual Fuel, High Sulfur	RH			QRHTR			QRHEL		QRHAS
Residual Fuel (total) *	RS		QRSCM	QRSTR	QRSIN	QRSRF	QRSEL		QRSAS
Petrochemical Feedstocks	PF				QPFIN				
Still Gas	SG				QSGIN	QSGRF			
Petroleum Coke	PC				QPCIN	QPCRF	QPCLEL		QPCAS
Asphalt and Road Oil	AS				QASIN				
Other Petroleum	OT			QOTTR	QOTIN	QOTRF			QOTAS
Total Petroleum *	TP	QTPRS	QTPCM	QTPTR	QTPIN	QTPRF	QTPLEL		QTPAS
Methanol	ME			QMETR					
Ethanol	ET			QETTR					
Liquid Hydrogen	HY			QHYTR					
Uranium	UR						QUREL		
Hydroelectric	HO				QHOIN		QHOEL		QHOAS
Geothermal	GE				QGEIN		QGEEL		QGEAS
Biomass	BM	QBMRB	QBMCB		QBMIN	QBMBF	QBMBEL	QBMSN	QBMBAS
Municipal Solid Waste	MS				QMSIN		QMSLEL		QMSAS
Solar Thermal	ST	QSTRB	QSTCM		QSTIN		QSTEL		QSTAS
Photovoltaic	PV	QPVRS	QPVCM		QPVIN		QPVLEL		QPVAS
Wind	WI				QWIIN		QWIEL		QWIAS
Total Renewable *	TR	QTRRS	QTRCM	QTRTR	QTRIN		QTRELEL	QTRSN	QTRAS
Net Electricity Imports	EI						QEIEL		
Net Coal Coke Imports	CI				QCIIN				
Total Sectoral Consumption *	TS	QTSRS	QTSCM	QTSTR	QTSIN	QTSRF	QTSELEL	QTSSN	QTSAS

* aggregation of other variables

Table 5 presents the prices in the Energy Market Data structure. In general, the energy prices match the corresponding consumption quantities. The exceptions are as follows:

- Detailed refinery sector prices are omitted even though refinery fuel consumption products are defined. This is because there is no corresponding need to break out refinery sector prices from the rest of the industrial sector. The industrial fuel prices are the delivered prices to industrial fuel consumers, including refineries. As a result, the industrial sector prices match the coverage of the corresponding industrial consumption products.
- Prices for some industrial petroleum categories are combined in the industrial other petroleum category to eliminate unnecessary detail. That is, the industrial other petroleum

price is defined as the average price of three consumption categories: still gas, petroleum coke, and other petroleum. The other petroleum price is not needed by any NEMS module but is required for reporting purposes to determine the average price of all petroleum products.

- Delivered prices for renewable energy categories are left undefined because there are no meaningful market prices for them. For example, there are no delivered prices associated with hydroelectric, geothermal, wind, solar thermal, and photovoltaic energy sources. In the case of biomass, the diverse nature of the product and the lack of organized market structures preclude the definition of a delivered price. Thus, there is no need to define end-use prices for renewables.

Table 4 and Table 5 define the variable names for the NEMS consumption products and end-use prices along with the two-character product code mnemonic for each product. Each array is a two-dimensional, floating point array. The first dimension represents the nine Census Divisions, with a 10th position reserved for possible breakout of California and the 11th position reserved for the National total. The second dimension represents 26 years from 1990 to 2015, plus 3 additional positions reserved for future storage of 2020, 2025, and 2030 results. The space for the latter 3 years is reserved as a possible way of supporting the NEMS long-term modeling capability. Quantities are stored in trillions of Btu. Prices are stored in 1987 dollars per million Btu, as deflated by the implicit GDP price deflator.

Table 5. Energy Market Data Price Arrays.

Description	Prod Code	End Uses				Conversions			
		Resid RS	Comm CM	Trans TR	Indus IN	Refin RF	Elect EL	Synth SN	All AS
Purchased Electricity, Peak	EP	PEPRS	PEPCM	PEPTR	PEPIN				PEPAS
Purchased Electricity, Off-Peak	EN	PENRS	PENCM	PENTR	PENIN				PENAS
Purchased Electricity (average)*	EL	PELRS	PELCM	PELTR	PELIN				PELAS
Natural Gas, Core (Firm)	GF	PGFRS	PGFCM	PGFTR	PGFIN		PGFEL		PGFAS
Natural Gas, Noncore (Interrupt.)	GI	PGIRS	PGICM	PGITR	PGIIN		PGIEL		PGIAS
Natural Gas (average)*	NG	PNGRS	PNGCM	PNGTR	PNGIN		PNGEL		PNGAS
Natural Gas, Pipeline Fuel	GP			PGPTR					
Lease and Plant Fuel	LP				PLPIN				
Steam Coal	CL	PCLRS	PCLCM		PCLIN		PCLLEL	PCLSN	PCLAS
Metallurgical Coal	MC				PMCIN				
Motor Gasoline	MG		PMGCM	PMGTR	PMGIN				PMGAS
Jet Fuel	JF			PJFTR					
Distillate	DS	PDSRS	PDSCM	PDSTR	PDSIN		PDSEL		PDSAS
Kerosene	KS	PKSRS	PKSCM		PKSIN				PKSAS
Liquid Petroleum Gas	LG	PLGRS	PLGCM	PLGTR	PLGIN				PLGAS
Residual Fuel, Low Sulfur	RL		PRLCM	PRLTR	PRLIN		PRLEL		PRLAS
Residual Fuel, High Sulfur	RH			PRHTR			PRHEL		PRHAS
Residual Fuel (average)*	RS		PRSCM	PRSTR	PRSIN		PRSEL		PRSAS
Petrochemical Feedstocks	PF				PFFIN				
Asphalt and Road Oil	AS				PASIN				
Other Petroleum	OT			POTTR	POTIN				POTAS
Petroleum (average)*	TP	PTPRS	PTPCM	PTPTR	PTPIN	PTPRF	PTPEL		PTPAS
Methanol	ME			PMETR					
Ethanol	ET			PETTR					
Liquid Hydrogen	HY			PHYTR					
Uranium	UR						PUREL		

* averaged from other variables

A related part of the Energy Market Data structure comprises the variables to hold energy market expectations. The Integrating Module maintains a separate set of arrays to store consumption and price expectations. The expectations arrays are updated according to the foresight options under consideration. The expectations arrays are defined like the standard energy market arrays, each with an additional leading character, X. Not all energy product detail is duplicated.

Other Variables in the Global Data Structure

In addition to Energy Market Data, the Global Data Structure includes the following information:

Model Control Variables

Key parameters and Assumptions for each of the NEMS modules

Macroeconomic variables, including energy demand drivers such as population

Energy demand characteristics, including demand side management savings

Energy production, conversion, and transportation activities

International energy flows

Emissions

Renewable energy information

Other data for inclusion in central report writing programs

These categories of data are those items necessary for inter-module communications and centralized report writing. COMMON blocks intended for communicating data among the subroutines of a module, but not among modules, are stored in a series of FORTRAN COMMON blocks that are not included in the NEMS data structure.

The details of the contents of the Global Data Structure can be found in Appendix A, where the variables in each COMMON block are described. Appendix A is a partial listing of the contents of the NEMS Data Dictionary, a current version of which can be found in a dataset named CN6005.PRJ.NEMS.DICT.AEO.datekey. Appendix B contains a listing of the same variables in alphabetical order, with references to the COMMON block names shown in Appendix A.

Variable Naming Convention

The naming convention used for the variables in the NEMS Global Data Structure involves up to four components, with 1- to 3-character mnemonics: a sector, an action or classification, a fuel, and miscellaneous, as follows:

[Action] [Fuel] [Sector] [Miscellaneous]

Action	Fuel	Sector	Miscellaneous
Price	CRude	ReFinery	North Slope Alaska
Quantity	Dry NG	Oil & Gas	South Alaska
Cost	Synthetic NG	NGTDM	INdustrial Noncore
Discount(max)	NG Pipeline	ELectricity	Ton Miles
IMport	NG Wellhead	COal	Non Utility
PRoduction	CoaL LiQuid	ReSidential	DSM
Transportation	CoaL Gases	CoMmercial	AVoided
Capacity Additions		INdustrial	ReNewables
GeNeration		TRansportation	
Sales to Grid		InTernational	

For instance, the NEMS variable IMCRRF represents crude oil net imports as defined by the refinery sector. This naming convention is neither exhaustive nor required.

RESTART File

At the beginning of a run, the Integrating Module reads initial values for all data in the Global Data Structure from a user-specifiable version of a special file, called the RESTART file. The RESTART file contains a starting point for the scenario currently under consideration, that consists of results from a prior simulation. During the run, much of this data is updated and changed. For example, alternative values for key module parameters and input assumptions, read separately from the user interface file or other sources, override the values stored in the RESTART file. At the end of the run, a new RESTART file is created with all the data from the run. The file is available for future runs, as well as to link with reporting and database management routines.

This feature promotes modularity by supplying values for all shared variables, regardless of whether the module that creates them is active in the run. Prices, quantities demanded or supplied, and other variables normally generated by a module that is switched off for the current run, are provided instead by the RESTART file.

Report Data

NEMS contains several varieties of reporting functionality. While each module generates detailed, module-specific reports, there is also a central reporting feature that prepares reports that combine output from all of the modules and inputs to the models. A simple post-processing user interface is available to prepare standard reports and compose special reports.

A user interface also allows extraction of data and conversion to input for other types of analytic software, and facilitates transfer of output data between platforms. For example, selected output

from several NEMS runs may be extracted from the total results on the mainframe, reformatted into Lotus 1-2-3 format, and transferred to the PC for subsequent spreadsheet analysis.

Database Loading

The primary NEMS data management objectives are met with a FORTRAN-callable procedure, **FILER**, that standardizes and automates storage and retrieval of the NEMS Global Data Structure. In addition, the routine provides a file-based data interchange capability to allow communication among NEMS modules, where necessary, and supports standalone module development and testing.

FILER provides a simple, reliable, and fast mechanism for moving data between **COMMON** blocks of the Global Data Structure and files. The **COMMON** blocks used to store the NEMS Global Data Structure and are accessed by most modules. The basic capabilities of **FILER** are:

- To load data from a file into a standard NEMS **COMMON** block; and
- To write data from a standard NEMS **COMMON** block to a file.

This capability is constructed such that files created by **FILER** can also be read by **FILER**. Beyond these basic capabilities, **FILER** simplifies operation of modules in standalone mode by allowing users to create simple, sequential files containing the subset of the data they need, and the software necessary to read these data. This allows a user to use **FILER** to prepare sequential files containing all the data needed by a program in a simple format that can be transferred to a PC or another platform for independent operation and development, without need for access to the **FILER** routines. User access to the **FILER** program is available outside NEMS through the NEMS macro command, **TFILER**.

5. Integrating Module Solution Methodology

This chapter discusses the Integrating Module within the context of the entire NEMS model. Acting as the overall coordinator of the activities of NEMS, the Integrating Module is responsible for controlling the overall flow of the solution algorithm, and for implementing user choices as to which portions of the entire system are to be executed, and in which order. In addition, it tests for convergence of the system during each year, as it controls the iteration process.

Among the major modules that comprise the NEMS, only the Integrating Module is required, as all other modules can be switched off at will by means of simple user interfaces.

Using the Energy Market Data portions of the NEMS Global Data Structure as inputs, the Integrating Module measures whether convergence has occurred, and occasionally, upon user request, adjusts the Energy Market Data values in order to accelerate the convergence process. By means of calls to the FILER and the File Manager, the Integrating Module controls the flow of overall system data; however, beyond reading the user's parameter requests, it has no important input nor output functions of its own.

Relationship of the Integrating Module to Other NEMS Modules

The modular structure of NEMS implies that the Integrating Module documented here does little modeling of its own. The component modules have the responsibility for the energy analysis of NEMS; the Integrating Module oversees the interactions among the various energy sectors, calling upon the component modules as needed. In a very real sense, the structure of the Integrating Module is therefore synonymous with the structure of NEMS, insofar as the Integrating Module imposes a structure within which the analytical modules function.

The Integrating Module controls execution of the other component modules in an iterative convergence algorithm. The objective is to equilibrate iteratively on the delivered prices of energy and quantities demanded, thus assuring an economic equilibrium of supply and demand in the domestic energy markets, with feedbacks from the international markets and the U.S. economy as whole.

The Integrating Module also coordinates communication among the other modules. The primary information flows among these major modules are the delivered prices of energy and the quantities consumed by product, region, and sector. However, the data flows are not limited to prices and quantities and include other information such as economic activity, capital expenditures, and impacts of demand side management programs.

Integrating Module Inputs

Given its mediating role in the NEMS system, the Integrating Module has little input data of its own; the major model inputs are processed by each of the component modules. The Integrating Module reads user run description parameters and invokes a database portion that reads the NEMS Global Data Structure.

As a body, all data used, either read or written, by more than one of the NEMS component modules are referred to as the *NEMS Global Data Structure*. For convenient sharing among the modules, all such variables are stored internally in FORTRAN's COMMON block structure. At the end of each NEMS iteration, the Integrating Module invokes a process, called *FILER*, which stores the contents of the COMMON blocks that constitute the NEMS Global Data Structure into a single large file, called the *RESTART file*. At the start of each NEMS run, the Integrating Module makes use of *FILER* to read an entire RESTART file to initialize the COMMON blocks. Thus, the NEMS Global Data Structure includes both the external file and its internal representation in COMMON.

Because all NEMS shared data are initialized from the RESTART file at the start of each run, it is not strictly necessary for the Integrating Module to invoke all of the component modules; if any module is omitted, its normal output variables can be found by the other modules in exactly the same places they would otherwise occupy, filled with values from the end of an earlier NEMS run. An important function of the Integrating Module is to ascertain which of the component modules are to be used in the current run, and to skip the others at times when they would otherwise be called.

General Modeling Approach

Optimization models are often appropriate to simulate the behavior of a homogeneous industry or sector of the economy that typically has a single objective function. For example, the electric industry's plant dispatch decisions or the movements in the coal transportation sector can be appropriately represented as an optimization model. Optimization models are often inappropriate if more complex decision making criteria are necessary to represent an industry or sector of the U.S. energy markets. EIA has taken the approach of developing models that characterize the natural decision making of each sector of the energy market, linking or integrating the models together in a simulation framework to represent the aggregate U.S. energy market response to basic assumptions and alternative policies.

The fundamental integrating methodology used by NEMS involves a control program, the Integrating Module, that commences the modeling process with an initial set of estimates of energy prices and quantities for the forecast. It calls each of the modules in turn to generate new end-use demands for energy in the demand modules, and new end-use prices at which the demands can be satisfied in the supply and conversion sources. This new set of prices and quantities is then used for another round of calling the modules and so on, until the model has computed price estimates at which supply and demand are in balance.

NEMS design criteria do not specify the modeling approaches to be taken by the individual analytical modules. A variety of approaches can be found among the existing modules, ranging in complexity from simple accounting models through detailed mathematical optimization algorithms. Some sectors have implemented multiple approaches that the user can select by choosing alternative complete modules.

Figure 2 depicts the relationship of the Integrating Module of NEMS with each of the component modules. Generally, the component modules of NEMS do not interact with one another directly, but instead communicate through the Integrating Module. The organization has a number of benefits. It allows each module to be executed or omitted independently. More importantly, it provides centralized control over such Integrating Module functions as execution sequence, convergence checks, equilibration procedures, and data access. Finally, the organization promotes a division of labor for the development and maintenance of NEMS, as each module is the responsibility of a single team.

The approach followed by NEMS is comparable to that followed by the predecessor Intermediate Future Forecasting System. The model is entirely new, with additional features such as the implementation of foresight throughout the model and the concept of the Global Data Structure. Improvements in the NEMS approach can be found more in the analytical modules than in the Integrating Module.

The following section provides a more explicit, detailed formulation of the Integrating Module solution algorithm. It includes a complete mathematical specification as well as a detailed flow chart of the algorithm.

Mathematical Specification

The NEMS integrating algorithm, which is similar to the approach used for the predecessor Intermediate Future Forecasting System (IFFS), is an application of the Gauss-Seidel algorithm designed to solve a set of simultaneous nonlinear equations.² The approach partitions the equations and variables into subsets. For NEMS, the subsets consist of predefined fuel supply, energy conversion, and sectoral demand modules. Each subset of equations is solved keeping the other variables constant at their trial values and ignoring the effects of current variables on equations in other subsets. The process is repeated for each subset, updating the trial values for each variable from the prior solution.

More formally, for a stylized NEMS, the nonlinear system of equations could be represented by

$$x_i = g_i(x) \quad \text{for } i = 1, \dots, n \quad (1)$$

having the market clearing or equilibrium solution vector

²Murphy, F., J. Conti, S. Shaw, and R. Sanders, "Modeling and Forecasting Energy Markets with the Intermediate Future Forecasting System," *Operations Research*, Vol. 36, No. 3, May-June 1988.

$$x = (x_1, \dots, x_n).$$

Here, each x_i is a single variable. A trial solution for iteration k for a certain year is denoted by x^k , where

$$x^k = (x_1^k, \dots, x_n^k).$$

Here, each $g_i(x)$ uses one or more of the elements of the trial solution vector x^k , excluding its own solution, x_i^k . Further, we define a series of non linear equations $f_i(x^k)$ that represent the amount by which any trial solution $g_i(x^k)$ deviates from an equilibrium solution:

$$f_i(x) = x - g_i(x).$$

To reiterate, the solution vector x represents the set of solutions to the model: prices of energy products, quantities of energy products demanded, and certain key economic quantities. The functions $g_i(x)$ represent the formulas by which the x are calculated, and $f_i(x)$ represent the discrepancies between the calculated values for the solution vector and the solution vector itself.

At the end of iteration k for a certain year, the discrepancy $f_i(x^k)$ from the equilibrium solution can be estimated as follows:

$$f_i(x^k) = x^{k+1} - g_i(x^{k+1}), \quad (2)$$

$$f_i(x^k) = x^{k+1} - x^k. \quad (3)$$

where x^{k+1} is the trial solution vector from the previous iteration for the same year.

In the block Gauss-Seidel scheme, unknowns are grouped together in such a way that a subsystem (e.g. a NEMS module) must be solved before any of the unknowns can be determined. The NEMS equations are divided into groups (modules) and the subsystem of equations belonging to a given group is solved for the corresponding unknowns using approximate values for the other unknowns. For example, suppose the unknowns are divided into n groups so that $X_1, X_2, \dots, X_{m_1}$ belong to group x_1 ; $X_{m_1+1}, X_{m_1+2}, \dots, X_{m_2}$ belong to group x_2 ; $X_{m_{(k-1)+1}}, X_{m_{(k-1)+2}}, \dots, X_{m_k}$ belong to group x_k etc. In our case, n corresponds to the number of separate modules in NEMS (residential demand, commercial, industrial, transportation, petroleum markets, electric generation, oil and gas supply, etc.) In the NEMS context each x_i represents the set of *outputs* from the module ($g_i(x)$), given approximate values for the other unknowns in the remaining NEMS modules. Consequently, there are n blocks of variables to be solved for as groups using each of the n model blocks, $g_i(x)$. At iteration $k+1$, the solution can be represented by

$$x_1^{k+1}, x_2^{k+1}, \dots, x_{i-1}^{k+1}, x_i^k, \dots, x_n^k$$

In the above representation of the solution, the first $i-1$ groups of unknowns (x 's) have been solved for in iteration $k+1$ and the other groups remain to be solved for. The i -th group will be solved for next in the scheme. To solve for the next estimate of x_i , we solve for x_i in the functional relationship

$$g_i(x_1^{k+1}, x_2^{k+1}, \dots, x_{i-1}^{k+1}, x_i^k, x_{i+1}^k, \dots, x_n^k) = (x_1^{k+1}, x_2^{k+1}, \dots, x_{i-1}^{k+1}, x_i^{k+1}, x_{i+1}^k, \dots, x_n^k)$$

Notice that x_i^k is usually not used to solve module i but is included here for completeness. Starting at the beginning of iteration $(k+1)$, the algorithm proceeds as follows:

Step 0: Start with $x = (x_1^k, x_2^k, \dots, x_n^k)$.

Step 1: Solve first module in iteration $(k+1)$

Solve for x_1^{k+1} by solving for x_1 in the nonlinear system

$$g_1(x_1, x_2^k, \dots, x_n^k) = (x_1^{k+1}, x_2^k, \dots, x_n^k).$$

The solution yields a new estimate of the unknowns $x = (x_1^{k+1}, x_2^k, \dots, x_n^k)$.

Step 2: Solve second module in iteration $(k+1)$.

Solve for x_2^{k+1} by solving for x_2 in the nonlinear system

$$g_2(x_1^{k+1}, x_2, x_3^k, \dots, x_n^k) = (x_1^{k+1}, x_2^{k+1}, x_3^k, \dots, x_n^k).$$

The solution yields a new estimate of the unknowns $x = (x_1^{k+1}, x_2^{k+1}, x_3^k, \dots, x_n^k)$.

In general, when solving for the i -th group of variables,

Step i : Solve the i -th module in iteration $(k+1)$.

Solve for x_i^{k+1} by solving for x_i in the nonlinear system

$$g_i(x_1^{k+1}, x_2^{k+1}, x_{i-1}^{k+1}, x_i, x_{i+1}^k, \dots, x_n^k) = (x_1^{k+1}, x_2^{k+1}, x_{i-1}^{k+1}, x_i^{k+1}, x_{i+1}^k, \dots, x_n^k).$$

The solution for x_i above in g_i updates the solution estimate to

$$x = (x_1^{k+1}, x_2^{k+1}, x_{i-1}^{k+1}, x_i^{k+1}, x_{i+1}^k, \dots, x_n^k).$$

The process continues until a $k+1$ iteration estimate is derived for all groups of x_j .

At the end of the $k+1$ iteration, we compare, pointwise, every component of every group of variables in the $k+1$ iteration versus the k -th iteration values. A final solution, x^k , has been achieved if, after all modules have been executed, the absolute values of the proportional changes in the x_i remain smaller than a specified tolerance, ϵ :

$$\left| \frac{x_i^{k+1} - x_i^k}{x_i^{k+1}} \right| < \epsilon$$

for $i = 1, \dots, n$. Values of ϵ can be chosen on a variable-specific basis. Defaults are in the range of 5 percent for the Census Division variables, less for the national macroeconomic variables.

After the convergence criterion has been met, another iteration is performed to test whether a stable equilibrium has been reached, and to allow the modules to perform final processing for the year; so that the final converged solution vector for the year is x^{k+1} .

To handle cases where the procedure does not converge on a solution or does not achieve the specified tolerance, a limit on the number of iterations terminates the algorithm for the current year. In such cases, the model performs the additional iteration mentioned in the previous paragraph, reports the convergence status with a list of the variables failing to converge, and then proceeds to the next projection year. The final solution for the year is therefore the result of one iteration beyond the non-converged trial solution.

The equations are partitioned in the fuel supply and sectoral demand modules, with the x_i consisting primarily of quantities and prices of fuels by region and consuming sector. These variables are defined as

$P_{f,s,r,y}^k$ = Energy product price (current iteration)

$P_{f,s,r,y}^{k-1}$ = Energy product price (previous iteration)

$Q_{f,s,r,y}^k$ = Energy product quantity consumed (current iteration)

$Q_{f,s,r,y}^{k-1}$ = Energy product quantity consumed (previous iteration)

indices:

f fuel/energy product (natural gas, coal, petroleum products, electricity, etc)

s consuming sector (residential, commercial, industrial, transportation, electric utility, refinery, synthetic)

r region (census divisions)

y year

While each module solves one year at a time, their simulations of planning activities involve an extrapolation of energy market conditions. Those modules making new capacity construction decisions apply an assumption about foresight in their expectations of future energy prices and quantities. In NEMS, a set of price and quantity variables is defined to store expectations:

$XP_{f,s,r,y}$ = Expected prices of energy products beyond the current forecast year (for $y > y$)

$XQ_{f,t,y}$ = Expected consumption of energy products beyond the current forecast year

The foresight mode determines how the expectation variables are to be calculated: under perfect foresight, the various NEMS modules are invoked for years beyond the current iteration year; otherwise, the Integrating Module calculates simple-minded extrapolations of present-year conditions. Foresight is therefore always calculated by looking forward to the consequences of conditions in the present iteration year, not by attempting to reach some end state determined *a priori*. The treatment of expectations is discussed in greater detail under Expected Value Foresight, on page 45.

Additional variables, representing such values as macroeconomic activity, world oil prices and trade, and emissions, may be added to the convergence algorithm, but are omitted here for clarity. In terms of the energy market interactions, the sectoral demand models estimate current-year energy demands $Q_{f,t,y}$ and energy-related capital stock additions as functions of current and expected energy prices. The supply models estimate end-use prices $P_{f,t,y}$ and capacity additions as functions of current and expected energy demands. The conversion modules (electricity, refinery, and synthetics) are viewed primarily as supply components, but they are both consumers of primary energy and suppliers of energy products.

Solution Algorithm Flow Chart

Figure 3 presents a detailed flow of the Integrating Module solution algorithm. The objective of the algorithm is to execute the system of component modules repeatedly until convergence is reached. The solution procedure for one iterative cycle involves execution of the component modules, as well as updating expectation variables. The component modules include the International Energy Activity Module, the Macroeconomic Activity Module, the sectoral demand models, the conversion models, and the supply models.

Through program control options, the looping over years takes place either within an iterative cycle (Inner Year Loop) or outside the iterative cycle (Outer Year Loop). That is, component modules may either be called repeatedly to execute for all years in a given iteration, or may be executed one year at a time. The flexible year looping is designed to support different approaches for foresight, as discussed in detail under Expected Value Foresight, on page 45, below. Generally, looping for all years at a time is used only for the perfect foresight approach. The solution of each module one year at a time has been found to be more efficient than solving all years each time.

In Figure 3, the *Outer Year Loop* is executed once for each year in the forecast horizon when all modules are being executed for one year during each iteration. In that case, the *Inner Year Loop* executes for a single year as well. When modules execute for all years during each iteration, the *Inner Year Loop* controls the year indexing, and the *Outer Year Loop* is entered only once.

Figure 3. Integrating Module Flow Chart.

To accommodate flexible year looping, the solution procedure for a given iteration begins with the establishment of starting and ending year index ranges for the inner year loop. The next step is to update the expectation variables over the specified inner year range (either a single year or all years):

$$\begin{aligned} XP_{f,r,y}^k &= f(P_{f,r,y}^{k-1}) && \text{(update price expectations from previous iteration prices)} \\ XQ_{f,r,y}^k &= f(Q_{f,r,y}^{k-1}) && \text{(update quantity expectations from previous iteration quantities)} \end{aligned}$$

Next, each of the modules is executed in turn. Normally, for each year in the inner year range, the International Energy Module and the Macroeconomic Module are called first, followed by the sectoral demand models.

$$Q_{f,r,y}^k = f(P_{f,r,y}^{k-1}, XP_{f,r,y}^k, \text{macroeconomic, other variables})$$

The conversion and supply models are then called, using updated demand quantities, to return prices:

$$P_{f,r,y}^k = f(Q_{f,r,y}^k, XQ_{f,r,y}^k, \text{macroeconomic, other variables})$$

After all modules have been executed for an inner year, the next inner year is begun. The order of calling the modules is flexible.

Convergence

After a module has been called, a check for convergence for that specific module is made, and the storage of previous iteration values is performed. Modules that had converged on an earlier iteration in the current year are bypassed. These intervening convergence checks isolate the specific modules that are not converging. An additional global convergence check requires all submodels to have converged. A separate convergence check is made for prices and quantities, consisting of a comparison of the absolute value of the percent changes to an assumed tolerance, ϵ , as follows:

$$\left| \frac{Q_{f,r,y}^k - Q_{f,r,y}^{k-1}}{(Q_{f,r,y}^k + Q_{f,r,y}^{k-1}) / 2} \right| < \epsilon$$

$$\left| \frac{P_{f,r,y}^k - P_{f,r,y}^{k-1}}{(P_{f,r,y}^k + P_{f,r,y}^{k-1}) / 2} \right| < \epsilon$$

Here, the denominators use an average to avoid convergence difficulties if either the starting value or a trial solution value is equal to zero. To avoid unnecessary iterations for changes in insignificant values, the quantity convergence check is omitted for changes less than a user-specified minimum level.

The last step is to store the current quantities and prices for the next iteration's convergence check:

$$\begin{aligned} Q_{f,s,y}^{k+1} &= Q_{f,s,y}^k \\ P_{f,s,y}^{k+1} &= P_{f,s,y}^k \end{aligned}$$

The cycle is repeated until convergence is achieved for all submodules over the specified inner year range or until the maximum number of iterations is reached. When one of these two conditions occurs, an additional iteration, referred to as the "Final Convergence and Reporting Loop" is executed. This has several purposes. First, it is used to test whether a solution meeting the convergence criteria is maintained on two successive iterations. If so, there is a greater likelihood that the solution is an equilibrium solution. Second, it provides a signal for each module to write any reporting data out to disk, thus saving resources on intermediate iterations. Third, it provides a signal to the Integrating Module that all modules are to be executed, even if they had already converged on prior iterations. If the modules fail to converge on the Final Convergence and Reporting Loop, the convergence algorithm is repeated. In such cases, the model may converge on a subsequent iteration, thus triggering the Final Convergence and Reporting Loop a second time.

Once the model completes the Final Convergence and Reporting Loop, or when the maximum number of iterations is reached, the cycle for the current inner year range is completed. If the specified inner year range is only one year, the outer year index is incremented and the algorithm is repeated for the next year.

Whenever iteration for a year fails to converge within the user-specified number of iterations, the model completes the Final Convergence and Reporting Loop, accepts the resulting solution as the final solution, and proceeds to the next model year. The unconverged final solution should be examined in detail by the user, to verify its validity. Furthermore, later years' solutions in modules that refer to earlier years' solutions in their formulations can be affected adversely by the data in the unconverged final solution.

A model "execution log" is generated to record the progress of the model as it proceeds from one iteration to the next. The convergence status after execution of each module is reported in the log. Also reported are the names of any variables failing to converge, along with their values on the current and previous iterations, and their fractional changes. If the values of any tested variables fail to converge within the specified number of iterations, a message is written to the execution log, and execution continues with the next year. During or after a model run, the user may review the execution log to examine the convergence status.

When a nonconvergent situation arises, the results of the run must be viewed with caution. An assessment should be made as to the type of convergence problem and its effect on the results. A failure to converge may be an indication of a programming error, or it may be an accurate reflection of an unstable modeling configuration. Theoretical studies involving application of the Gauss-Seidel iteration procedure to linear problems have demonstrated that convergence can sometimes be achieved simply by reordering the system of equations. This would correspond to

specifying a different execution order for the NEMS modules. Generally, convergence problems must be evaluated on a case-by-case basis.

Other than specifying the run options through the run submission user interface, and substituting modified files containing data upon which the NEMS modules depend, there is no intervention required of the user to ensure a successful model run. The user should examine the primary run log and other output reports to ensure that convergence has been achieved, and that the results are credible. In the case of a problem with convergence, the order of module execution may be modified, appropriate modules may be "switched off", the allowable number of iterations may be increased, or other such parameters may be adjusted through the user interface, and the simulation resubmitted.

Summary of Convergence Problems and Resolution

Integrated developmental testing of NEMS revealed a number of convergence problems. Factors leading to convergence problems were assessed and changes were made as needed to the individual NEMS modules. In a few cases, provisions to pass additional information between modules were required to develop stable convergence properties. Many of the convergence problems involved interactions between the Electricity Market Module (EMM) and the three supply modules providing it with fuel prices: the Natural Gas Transmission and Distribution Module (NGTDM), the Petroleum Market Module (PMM), and the Coal Market Module (CMM). The primary convergence problems and their resolutions are summarized below. (For more information, the reader should refer to the individual model documentation reports listed in Appendix C.)

- Some petroleum product price oscillations were traced to supply step curves for petroleum product imports. In other cases, the large step sizes on the curves led to an insensitivity of residual fuel prices to changes in demand. To resolve these problems, the PMM was modified to generate petroleum product supply curves with finer step sizes.
- The EMM and CMM classify coal quantities and prices to distinguish between the rank of the coal, the sulfur content, and the coal supply region. The pricing and demand switching among coal classes resulted in a number of convergence problems. To track these problems more closely, the more detailed coal quantity and price variables were added to the list of variables examined for convergence in the Integrating Module. Convergence problems included oscillations between the pricing and the use of high and low sulfur coal types. Problem resolution occurred in several stages as refinements progressed. The primary changes were to:
 - 1) incorporate a coal price relaxation algorithm in the EMM;
 - 2) disaggregate coal plant groupings in EMM to promote finer demand steps;
 - 3) introduce restrictions on relative prices of high and low sulfur coals in the CMM; and

- 4) adjust for the tendency of the EMM sulfur allowance cost to equalize the cost of using fuels of different sulfur content when meeting the overall sulfur emissions restriction.
- The EMM and NGTDM classify natural gas quantities and prices to distinguish between firm, interruptible, and competitively-priced gas by supply/demand region. These more detailed natural gas quantity and price variables were added to the list of convergence variables in the Integrating Module. Convergence problems resulted from the simulation of fuel switching between residual fuel oil and competitive natural gas in dual-fired steam plants in EMM. A classification of the gas and oil used in these plants was defined as "GOIL." A GOIL sharing algorithm in the EMM was developed to generate a gradual shift between minimum and maximum levels of oil and gas in response to variations in the oil-gas price ratio. The NGTDM was modified to use the GOIL sharing algorithm to generate a natural gas demand step function.

Acceleration Techniques

The NEMS Integrating Module incorporates a number of features that provide the user some amount of control over the speed with which the equilibration process converges on a final solution. Foremost among such features in terms of accelerating convergence while at the same time increasing the overall robustness of the solution process, is a user-controllable feature known as *relaxation*.

As the Integrating Module iteratively directs the energy supply, demand, and other modules to recalculate the energy market data, the calculated prices and quantities can be expected to oscillate about the equilibrium solution as they converge on the supply and demand equilibrium for the current year. If the relaxation option is selected for the run by the user, then these swings from iteration to iteration are damped by a user-specified factor, which may accelerate convergence and lead to a more stable and robust solution process. Using the notation developed above,

$$x^k = x^k + r (x^{k-1} - x^k)$$

where r = relaxation factor.

The wide range of run options available through the user interface of the Run Submission system provides the user with a large amount of flexibility in controlling the evolution of a particular simulation. The user can choose specific combinations of run options that can alter convergence compared to the default selections. For example, if an alternative scenario to a prior run is to be simulated, and the difference between the two runs could not possibly affect certain supply or demand sectors, then modules representing those sectors can be "switched off" so that data for those sectors obtained from the prior run's RESTART file. This eliminates the execution time otherwise required for the general equilibrium solution involving these modules.

Initial Solution Selection

At the start of a NEMS run, initial values for all years for all variables in the Global Data Structure, including the energy market data, are read from a user-specified version of the RESTART file. In turn, the final solution for all years at the end of the NEMS run is stored and becomes available for use as the initial solution for subsequent runs.

Expected Value Foresight

Approaches to foresight ($XP_{f,s,r,y}$ and $XQ_{f,s,r,y}$) are important for theoretical and practical reasons. Mid- and long-term energy forecasting involves assessing changes in energy-using capital stocks and choices among energy supply alternatives. This analysis requires simulation of such decisions as the selection of durable appliances, planning electricity-generating capacity additions, and building gas pipelines. The economic evaluation of these decisions requires energy demand and price expectations for life-cycle cost and capacity additions calculations. An objective in this aspect of the modeling is to simulate such decision making in the aggregate for predictive and analytical purposes, representing how players in the energy marketplace make long term planning decisions, rather than by deriving the theoretically optimal long-term expansion path. As a result, the formulation of foresight assumptions is a subjective exercise open to alternative approaches based on observed industry practices.

NEMS could, in principle, approach the issue of foresight by prescribing a desirable end state for the energy marketplace, and calculating backwards in time to prescribe how best to arrive there. However, as a simulation, NEMS calculates foresight as an extrapolation of the present state of energy markets, subject to planned policies. Rather than determining how to arrive at the planned future, NEMS can evaluate whether present plans could result in the desired end state.

In reality, different methodologies for treating foresight are used in different sectors and supply areas, and alternate approaches to representing expectations may yield significantly different planning decisions. Consequently, treatment of foresight becomes an important modeling decision.

There is no one best approach to treating foresight. The National Research Council Committee on NEMS recommended that several options for modeling foresight be developed.³ As a result, an objective in NEMS was to build the flexibility to support different approaches to foresight to allow for experimentation and future modeling changes. In addition, it is desirable to have the option to treat foresight consistently throughout the modeling system.

The purpose of dealing with foresight and expectations in the Integrating Module is to be able to represent different types of foresight consistently. At the same time the Integrating Module allows individual modules to handle foresight independently, should industry practice require

³National Research Council, *The National Energy Modeling System*, National Academy Press, Washington, D.C. 1992.

different approaches. To achieve this flexibility, each NEMS module is intended to be constructed so that an on-off switch is examined to determine whether the module uses the system-generated expectations or not. If this central-control switch is turned on, the module uses system expectations; otherwise, the module uses expectations it generates for itself.

The system-generated expectations include several types:

- The "myopic expectations" option is one in which expected prices for any forecast period are assumed to be constant in real dollar terms relative to the current period in which decisions are being made. Generally, this case applies only to expected prices because an assumption of constant energy demands would rarely be assumed.
- "Adaptive expectations," also known as "extrapolative expectations," is an approach that assumes planners extrapolate recent trends when making long-term decisions. For the system-generated expectations, this assumption about foresight is implemented by extrapolating the current projection year prices and quantities using the average annual growth over the previous few projection years. For example, the expectations generated in model year 2000 for use in 2001 would be determined from the growth over the last few model years (e.g., 1998 to 2000), with the number of years being a model option. For expectations generated within individual modules, more elaborate behavioral models, or adaptive expectations, are used.
- The "perfect foresight" approach is based on rational expectations theory. The approach generates an internally-consistent scenario for which the formation of expectations is consistent with the projections realized in the model. In practice, perfect foresight describes the configuration and solution algorithm that achieves the convergence of expected values and realized values. A variation in the integrating algorithm is required to implement perfect foresight. Instead of solving for an equilibrium for each year, the Integrating Module calls each model for all years of the forecast horizon during each iteration. The objective is to converge across all years simultaneously rather than solving one year at a time. Expectations of variables beyond the standard forecast horizon, required for long-term decisions made late in the forecast period, are, however, still extrapolated under the perfect foresight approach.

While these approaches are implemented in full in the Integrating Module, they cannot as yet be used in NEMS runs. Some of the analytical modules have not yet been programmed for the approaches other than myopic foresight, and others have not been tested. The foresight options have therefore not been tested in the full NEMS system, and will not be available until later editions of the system.

Among those modules using alternative expectations was the Electricity Market Module (EMM). The EMM requires fuel price expectations for natural gas, oil, and coal for use in its capacity planning submodule. For the 1994 AEO, separate approaches for generating oil, gas and coal prices for this module were developed and are summarized below:

- Coal price expectation equations were developed using a regression approach on a NERC region basis. This methodology is implemented directly in the EMM.
- Oil product price expectations are generated in the Integrating Module. The prices are calculated from an external forecast of world oil prices, assuming a constant markup between the regional product price and the world oil price. In each forecast year, the assumed markup is derived from the prior forecast year:

$$P_{e+k} = (P_e - W_e) + W_{e+k} \quad \text{for } k=1, \dots, 40$$

where P_e and W_e are the product price and the exogenous world oil price from the previous forecast year, and P_{e+k} and W_{e+k} are the prices in the expectation years.

- Delivered natural gas prices are derived from expected well-head prices, assuming a constant markup between the delivered prices and the wellhead price. The well-head price expectations are based on a simple, nonlinear function which relates the expected well-head gas price to cumulative domestic gas production. The equation is of the following form:

$$P_k = A * Q_k^{1.5} + B$$

where P is the well-head price, Q is the cumulative production from 1991 to year k , and A and B are determined each year, as explained below.

The approach was developed to have the following properties:

- 1) Prices should be upward sloping as a function of cumulative gas production.
- 2) The rate of change in wellhead prices should increase as fewer economical reserves remain to be discovered and produced.

The approach assumes that at some point in the future a given target price, PF , results when cumulative gas production reaches a given level, QF . Thus, the target values PF and QF are assumed inputs to the approach. For simplicity, the annual production is assumed to be constant at the prior year's level. The parameters of the price equation, A and B , are determined each projection year such that the price equation will intersect the future target point. That is:

let D = Last year's gas production
 let PS = Last year's well-head gas price
 let QS = Last year's cumulative gas production since 1991

$$A = (PF - PS) / (QF^{1.5} - QS^{1.5})$$

$$B = PF - A * QF^{1.5}$$

Extrapolate cumulative production for future years $k = 1, \dots, 40$:

$$Q_t = Q_{t-1} + D$$

Generate expected well-head prices:

$$P_t = A * Q_t^{1.5} + B$$

Appendix A. Variable, Data and Parameter Listing

Appendix A. Variable, Data and Parameter Listing

This appendix gives the details of the NEMS Global Data Structure. The bulk of the appendix is a modified listing of the NEMS Data Dictionary, where the modifications are intended to make the somewhat terse content of the Data Dictionary more intelligible to the less-technical reader. Full details of the content of the Global Data Structure are contained herein.

The version of the NEMS Data Dictionary printed here was that created on February 18, 1993. For the most current data, the reader should refer to a dataset on the EIA Service Facility mainframe computer named CN6005.PRJ.NEMS.DICT.AEO.datekey, where *datekey* is the most recent date found. The dataset listed herein was CN6005.PRJ.NEMS.DICT.AEO.D0218931.

In the ordinary format of the Data Dictionary, a series of header records give detailed information about some of the fields in the body of the Data Dictionary. This information is given instead in the tables that follow.

On most of the pages of this appendix, there is a header that describes the content of the columns below. The headings in this row are described in the sections that follow.

COMMON Block Name

Appears at the beginning of the COMMON block, preceded by some delimiters and a verbal description of the purpose for the COMMON. Followed by a row for each variable in the COMMON block; the descriptions that follow describe the content of the rows for variables.

Variable Name

Variable names that appear in this column are the actual FORTRAN names by which the variables are used in the program.

Variable Dimensions

In the Variable Dimensions column are up to five dimensions for each variable. NEMS conventions limit Global Data Structure variables to five dimensions. There is no convention that limits variables that are not part of the Global Data Structure from assuming the full seven dimensions allowed by the FORTRAN syntax.

Names are used as variable dimensions, so as to distinguish the meanings of the values of the sizes of the variables. The following table defines the meanings of the names:

Table 6. Dimension Names.

Dimension Name	Value	Description
NOGCAT	12	Oil Categories (Regions)
NOGCRO	5	Gas Categories (Regions)
NOGROH	10	OGSM Reporting Regions
NOGDTF	4	OGSM Drilling Regions
NFNGSS	4	OGSM Import/export Regions
GRADCR	5	Grades of Crude Oil
MMPLL	8	No. Air Emissions+Particulates
MMETON	5	No. of Ethanol Vol steps
MMICROP	2	No. of Crops(Corn,Biomass)
MMTECH	10	Renewables
MMUNCL	3	Renewables
MMUNSO	9	Renewables
MMUNVI	20	Renewables
MMUNPR	6	PADD Regions
DSMPCN	10	No. of DSM Progs. Commer.
DSMPRS	10	No. of DSM Progs. Residen.
MMUNCR	11	Census Regions
MMUNOR	11	Coal Export Regions
MODELS	12	Number of Modules
MSICM	12	Non-Mfg: No. of SIC's
MMUNOR	13	Oil & Gas Regions
MMUNEX	18	NG Border Crossings
MMUNGR	15	NGTDM Regions
CLTYPE	16	Coal Type
MMUNWR	16	'NERC' Electric Supply Regions
MMUNLR	17	Coal Supply Regions
MDREGN	23	Coal Demand Regions
MFTYPE	29	No. of Mfg Types
MMUNYR	29	Years=1990-2015, '20, '25, '30
MECPYR	39	MMUNYR + 10 yrs (horizon)
MSEDYR	2	# Historical SEDS years
MSISCH	40	Mfg: Number of SIC's
MMXYRS	66	No. of Expectation Years
FLTYPE	6	Fuel Type-Oil,NG,MCL,SCL,Ren,Al

Variable Descriptors

In the Data Dictionary, the Variable Descriptors are columns provided to allow one-word categorization of each variable in a COMMON block. Within each COMMON block, the variety of categorization can be customized to the purpose of the COMMON block, as shown by the titles at the top of each of the four columns. In fact, the Data Dictionary allows five columns of descriptors, although no COMMON block uses more than four.

The tables on the next page give the names of the legal values for each of the categorizations, and, where the programmers have provided them, the meanings of the categories.

Brief variable descriptions are provided in the dictionary.

Table 7. Data Dictionary Variable Descriptors.

TYPE		FUEL	
CHTROL	SED/Other Historical Data	AS	Asphalt and Road Oil
HISTOR	Parameter	BN	Biomass
PARAM	Price	CI	Net Coal Coke Imports
PRICE	Quantity	CL	Coal
QUNTY	Expected Price \$/BTU	DS	Distillate
XPRICE	Expected Quantity tBTU	EI	Net Electricity Imports
XQUNTY		EL	Purchased Electricity
RATE		EN	Purchased Electricity, Non-Peak
LEVEL		EP	Purchased Electricity, Peak
INDEX		ET	Ethanol
CONFAC	Generation Capacity	GE	Geothermal
GENCAP	Capacity Factor	GF	Natural Gas, Core
CAPFAC	Capital Cost	GI	Natural Gas, Non-Core
CAPCOS	Operating Cost	GP	Natural Gas, Pipeline
OPCOST	Plant Lifetime	HO	HydroPower
LIFE	% Rate	HY	Liquid Hydrogen
HEATRT	Fuel Cost	MO	World Oil Price
FUECOS		JF	Jet Fuel
		KS	Kerosene
		LG	Liquid Petroleum Gases
		LP	Lease and Plant Fuel
		MC	Metallurgical Coal
		ME	Methanol
		MG	Motor Gasoline
		MS	Municipal Solid Waste
		NG	Natural Gas
		OT	Other Petroleum
		PC	Petroleum Coke
		PF	Petrochemical Feedstock
		PV	Photovoltaic
		RH	Residual Fuel, High Sulfur
		RL	Residual Fuel, Low Sulfur
		RS	Residual Fuel
		SG	Still Gas
		ST	Solar Thermal
		TP	Total Petroleum
		TR	Total Renewables
		TS	Total Sectorial Energy Consumption
		UR	Uranium
		WI	Wind
		COALGS	
		COALIG	
		COALST	
		ETBE	
		FUEL4	
		GASOLN	
		LNG	
		OTHER	
		WOOD	
		ALL	All Fuels
UNITS		SECTOR	
\$/BTU	\$/B per million BTU	RESID	Residential
\$/BSL	\$/B per Barrel	COMMER	Commercial
\$/MCF	\$/B per million cu ft	TRANSP	Transportation
BARREL		INDUST	Industrial
MBSL		REFINE	Refinery
BSL/DA		ALLSEC	All Sectors
tBSL/D	thousand Barrels per day	ELECTR	Electricity
MPS		SYNTH	Synthetics
mBTU/B	Million BTU / Barrel	PIPELN	
tBTU/C	Thousand btu / Cubic Ft	INTERN	International
MMBT	Megawatts	PLANT	
MMBT	Thousand Megawatts		
GMAT	Gigawatts		
GMHRS	Gigawatt hours		
SCALAR			
BLANK			
DEC 4			
INT 2			
INT 3			
INT 4			
NCF			
MMWH			
ON OFF			
RADS			
tBTU	Trillion BTU		
THREE			
TONS			
tTONS	thousand Metric Tons		
mTONS	Million Metric Tons		
sTONS	Million Short Tons		
bBS	Billion Pounds		
S/TON			
TON ML	Ton Miles		
TWO			
UNIT1			
UNIT2			
UNIT3			
UNIT4			
UNIT5			
UNIT6			
BCF	Billion Cu Ft		
b\$7s	Billion \$7s		
m\$7s	Million \$7s		
m\$2s	Million \$2s		
PERCNT	Percent		
MILL	Million (units)		
1000s	Thousand (units)		
89=1.0	1989=1.0		
87=1.0	1987=1.0		
82=1.0	1982=1.0		
b\$0FT	Billion Sq Ft		
\$/HR	\$ per Hour		
\$/GAL	\$ per Gallon		
FLUR/\$	Foreign Currency/\$		
\$7\$W	\$7s per Megawatt		
\$7\$KW	\$7s per Kilowatt-hour		
\$7\$KW	\$7s per Kilowatt-hour		
BTU\$W	Trillion Btu per Kilowatt-hour		
YR	Years		
FRACT	Fraction		
BTUCOR	Btu per Cord		
BTUGAL	Btu per Gallon		
BTUNSF	Btu per Thousand Square Feet		
		MODELS	
		INTERN	
		MACRO	
		ELECTR	
		RESID	
		COMMER	
		INDUST	
		TRANS	
		UTIL	
		COAL	
		OIL&GS	
		NATGAS	
		PETROL	
		RENEW	
		ALL	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors				Variable Description		

* Quantities Common Block									

GBLK			TYPE	UNITS	FUEL	SECTOR	QUANTITIES		
GEPRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	RESIDN	Purchased Electricity,	Peak.	Residential
GEPCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	COMMER	Purchased Electricity,	Peak.	Commercial
GEPTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	TRANSP	Purchased Electricity,	Peak.	Transportation
GEPIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	INDUST	Purchased Electricity,	Peak.	Industrial
GEPRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	REFINE	Purchased Electricity,	Peak.	Refinery
GEPAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EP	ALLSEC	Purchased Electricity,	Peak.	All Sectors
GENRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	RESIDN	Purchased Electricity,	Nonpeak.	Residential
GENCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	COMMER	Purchased Electricity,	Nonpeak.	Commercial
GENTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	TRANSP	Purchased Electricity,	Nonpeak.	Transportation
GENIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	INDUST	Purchased Electricity,	Nonpeak.	Industrial
GENRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	REFINE	Purchased Electricity,	Nonpeak.	Refinery
GENAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EN	ALLSEC	Purchased Electricity,	Nonpeak.	All Sectors
GELRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	RESIDN	Purchased Electricity,		Residential
GELCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	COMMER	Purchased Electricity,		Commercial
GELTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	TRANSP	Purchased Electricity,		Transportation
GELIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	INDUST	Purchased Electricity,		Industrial
GELRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	REFINE	Purchased Electricity,		Refinery
GELAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	EL	ALLSEC	Purchased Electricity,		All Sectors
OGFRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	RESIDN	Natural Gas, Core.		Residential
OGFCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	COMMER	Natural Gas, Core.		Commercial
OGFTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	TRANSP	Natural Gas, Core.		Transportation
OGFIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	INDUST	Natural Gas, Core.		Industrial
OGFRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	REFINE	Natural Gas, Core.		Refinery
OGFEL	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	ELECTR	Natural Gas, Core.		Electricity
OGFAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	GF	ALLSEC	Natural Gas, Core.		All Sectors
OGIRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	RESIDN	Natural Gas, Noncore.		Residential
OGICN	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	COMMER	Natural Gas, Noncore.		Commercial
OGITR	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	TRANSP	Natural Gas, Noncore.		Transportation
OGIIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	INDUST	Natural Gas, Noncore.		Industrial
OGIRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	REFINE	Natural Gas, Noncore.		Refinery
OGIEL	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	ELECTR	Natural Gas, Noncore.		Electricity
OGIAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	GI	ALLSEC	Natural Gas, Noncore.		All Sectors
ONGRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	RESIDN	Natural Gas,		Residential
ONGCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	COMMER	Natural Gas,		Commercial
ONGTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	TRANSP	Natural Gas,		Transportation
ONGIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	INDUST	Natural Gas,		Industrial
ONGRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	REFINE	Natural Gas,		Refinery
ONGEL	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	ELECTR	Natural Gas,		Electricity
ONGAS	(MMUMCR,MMUMYR)		QUNTY	tBTU	NG	ALLSEC	Natural Gas,		All Sectors
OGPTR	(MMUMCR,MMUMYR)		QUNTY	tBTU	GP	TRANSP	Natural Gas,		Pipeline
GLPIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	LP	INDUST	Lease and Plant Fuel		
QCLRS	(MMUMCR,MMUMYR)		QUNTY	tBTU	CL	RESIDN	Coal,		Residential
QCLCN	(MMUMCR,MMUMYR)		QUNTY	tBTU	CL	COMMER	Coal,		Commercial
QCLIN	(MMUMCR,MMUMYR)		QUNTY	tBTU	CL	INDUST	Coal,		Industrial
QCLRF	(MMUMCR,MMUMYR)		QUNTY	tBTU	CL	REFINE	Coal,		Refinery

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description	
QCLEL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	CL	ELECTR Coal. Electricity
QCLSN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	CL	SYNTNE Coal. Synthetics
QCLAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	CL	ALLSEC Coal. All Sectors
QPCIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	NC	INDUST Metallurgical Coal. Industrial
QMGCM	(MNUMCR, MNUMYR)	QUANTITY	TBTU	MG	COMMER Motor Gasoline. Commercial
QMGTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	MG	TRANSP Motor Gasoline. Transportation
QMGIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	MG	INDUST Motor Gasoline. Industrial
QMGAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	MG	ALLSEC Motor Gasoline. All Sectors
QJFTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	JF	TRANSP Jet Fuel. Transportation
QDSRS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	RESIDN Distillate. Residential
QDSCH	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	COMMER Distillate. Commercial
QDSTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	TRANSP Distillate. Transportation
QDSIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	INDUST Distillate. Industrial
QDSRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	REFINE Distillate. Refinery
QDSEL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	ELECTR Distillate. Electricity (incl. petroleum coke)
QDSAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	DS	ALLSEC Distillate. All Sectors
QKRS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	KS	RESIDN Kerosene. Residential
QKSCN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	KS	COMMER Kerosene. Commercial
QKSIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	KS	INDUST Kerosene. Industrial
QKSAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	KS	ALLSEC Kerosene. All Sectors
QLGRS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	RESIDN Liquid Petroleum Gases. Residential
QLGCM	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	COMMER Liquid Petroleum Gases. Commercial
QLGTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	TRANSP Liquid Petroleum Gases. Transportation
QLGIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	INDUST Liquid Petroleum Gases. Industrial
QLGRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	REFINE Liquid Petroleum Gases. Refinery
QLGAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	LG	ALLSEC Liquid Petroleum Gases. All Sectors
QRLCH	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	COMMER Residual Fuel, Low Sulfur. Commercial
QRLTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	TRANSP Residual Fuel, Low Sulfur. Transportation
QRLIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	INDUST Residual Fuel, Low Sulfur. Industrial
QRLRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	REFINE Residual Fuel, Low Sulfur. Refinery
QRLLEL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	ELECTR Residual Fuel, Low Sulfur. Electricity
QRLAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RL	ALLSEC Residual Fuel, Low Sulfur. All Sectors
QRNTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RH	TRANSP Residual Fuel, High Sulfur. Transportation
QRNEL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RH	ELECTR Residual Fuel, High Sulfur. Electricity
QRNAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RH	ALLSEC Residual Fuel, High Sulfur. All Sectors
QRSCN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	COMMER Residual Fuel. Commercial
QRSTR	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	TRANSP Residual Fuel. Transportation
QRSIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	INDUST Residual Fuel. Industrial
QRSRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	REFINE Residual Fuel. Refinery
QRSEL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	ELECTR Residual Fuel. Electricity
QRSAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	RS	ALLSEC Residual Fuel. All Sectors
QPFIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	PF	INDUST Petrochemical Feedstocks. Industrial
QSGIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	SG	INDUST Still Gas. Industrial
QSGRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	SG	REFINE Still Gas. Refinery
QPCIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	PC	INDUST Petroleum Coke. Industrial
QPCRF	(MNUMCR, MNUMYR)	QUANTITY	TBTU	PC	REFINE Petroleum Coke. Refinery
QPCCL	(MNUMCR, MNUMYR)	QUANTITY	TBTU	PC	ELECTR Petroleum Coke. Electricity
QPCAS	(MNUMCR, MNUMYR)	QUANTITY	TBTU	PC	ALLSEC Petroleum Coke. All Sectors
QASIN	(MNUMCR, MNUMYR)	QUANTITY	TBTU	AS	INDUST Asphalt and Road Oil. Industrial

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
GOTTR	(NHLNCR,NHLNTR)	QUNTY tSTU OT	TRANSP Other Petroleum.	Trans (lubes, aviation gas)
GOTIN	(NHLNCR,NHLNTR)	QUNTY tSTU OT	INDUST Other Petroleum.	Industrial
GOTRF	(NHLNCR,NHLNTR)	QUNTY tSTU OT	REFINE Other Petroleum.	Refinery
GOTAS	(NHLNCR,NHLNTR)	QUNTY tSTU OT	ALLSEC Other Petroleum.	All Sectors
GTPRS	(NHLNCR,NHLNTR)	QUNTY tSTU TP	RESIDN Total Petroleum.	Residential
GTPCH	(NHLNCR,NHLNTR)	QUNTY tSTU TP	COMMER Total Petroleum.	Commercial
GTPTR	(NHLNCR,NHLNTR)	QUNTY tSTU TP	TRANSP Total Petroleum.	Transportation
GTPIN	(NHLNCR,NHLNTR)	QUNTY tSTU TP	INDUST Total Petroleum.	Industrial
GTPRF	(NHLNCR,NHLNTR)	QUNTY tSTU TP	REFINE Total Petroleum.	Refinery
GTPEL	(NHLNCR,NHLNTR)	QUNTY tSTU TP	ELECTR Total Petroleum.	Electricity
GTPAS	(NHLNCR,NHLNTR)	QUNTY tSTU TP	ALLSEC Total Petroleum.	All Sectors
GMETR	(NHLNCR,NHLNTR)	QUNTY tSTU ME	TRANSP Methanol.	Transportation
GETTR	(NHLNCR,NHLNTR)	QUNTY tSTU ET	TRANSP Ethanol.	Transportation
GNYTR	(NHLNCR,NHLNTR)	QUNTY tSTU HY	TRANSP Liquid Hydrogen.	Transportation
GLREL	(NHLNCR,NHLNTR)	QUNTY tSTU UR	ELECTR Uranium.	Electricity
GNOIN	(NHLNCR,NHLNTR)	QUNTY tSTU NO	INDUST Hydropower.	Industrial
GNOEL	(NHLNCR,NHLNTR)	QUNTY tSTU NO	ELECTR Hydropower.	Electricity
GNOAS	(NHLNCR,NHLNTR)	QUNTY tSTU NO	ALLSEC Hydropower.	All Sectors
GGEIN	(NHLNCR,NHLNTR)	QUNTY tSTU GE	INDUST Geothermal.	Industrial
GGEEL	(NHLNCR,NHLNTR)	QUNTY tSTU GE	ELECTR Geothermal.	Electricity
GGEAS	(NHLNCR,NHLNTR)	QUNTY tSTU GE	ALLSEC Geothermal.	All Sectors
GBMRS	(NHLNCR,NHLNTR)	QUNTY tSTU BM	RESIDN Biomass.	Residential
GBMCH	(NHLNCR,NHLNTR)	QUNTY tSTU BM	COMMER Biomass.	Commercial
GBMIN	(NHLNCR,NHLNTR)	QUNTY tSTU BM	INDUST Biomass.	Industrial
GBMRF	(NHLNCR,NHLNTR)	QUNTY tSTU BM	REFINE Biomass.	Refinery
GBMEL	(NHLNCR,NHLNTR)	QUNTY tSTU BM	ELECTR Biomass.	Electricity
GBMSH	(NHLNCR,NHLNTR)	QUNTY tSTU BM	SYNTHE Biomass.	Synthetics
GBMAS	(NHLNCR,NHLNTR)	QUNTY tSTU BM	ALLSEC Biomass.	All Sectors
GMSIN	(NHLNCR,NHLNTR)	QUNTY tSTU MS	INDUST Municipal Solid Waste.	Industrial
GMSSEL	(NHLNCR,NHLNTR)	QUNTY tSTU MS	ELECTR Municipal Solid Waste.	Electricity
GMSAS	(NHLNCR,NHLNTR)	QUNTY tSTU MS	ALLSEC Municipal Solid Waste.	All Sectors
GSTRS	(NHLNCR,NHLNTR)	QUNTY tSTU ST	RESIDN Solar Thermal.	Residential
GSTCH	(NHLNCR,NHLNTR)	QUNTY tSTU ST	COMMER Solar Thermal.	Commercial
GSTIN	(NHLNCR,NHLNTR)	QUNTY tSTU ST	INDUST Solar Thermal.	Industrial
GSTEL	(NHLNCR,NHLNTR)	QUNTY tSTU ST	ELECTR Solar Thermal.	Electricity
GSTAS	(NHLNCR,NHLNTR)	QUNTY tSTU ST	ALLSEC Solar Thermal.	All Sectors
GPVRS	(NHLNCR,NHLNTR)	QUNTY tSTU PV	RESIDN Photovoltaic.	Residential
GPVCH	(NHLNCR,NHLNTR)	QUNTY tSTU PV	COMMER Photovoltaic.	Commercial
GPVIN	(NHLNCR,NHLNTR)	QUNTY tSTU PV	INDUST Photovoltaic.	Industrial
GPVEL	(NHLNCR,NHLNTR)	QUNTY tSTU PV	ELECTR Photovoltaic.	Electricity
GPVAS	(NHLNCR,NHLNTR)	QUNTY tSTU PV	ALLSEC Photovoltaic.	All Sectors
GWIN	(NHLNCR,NHLNTR)	QUNTY tSTU WI	INDUST Wind.	Industrial
GWIEL	(NHLNCR,NHLNTR)	QUNTY tSTU WI	ELECTR Wind.	Electricity
GWIAS	(NHLNCR,NHLNTR)	QUNTY tSTU WI	ALLSEC Wind.	All Sectors
GTRRS	(NHLNCR,NHLNTR)	QUNTY tSTU TR	RESIDN Total Renewables.	Residential
GTRCH	(NHLNCR,NHLNTR)	QUNTY tSTU TR	COMMER Total Renewables.	Commercial
GTRTR	(NHLNCR,NHLNTR)	QUNTY tSTU TR	TRANSP Total Renewables.	Transportation
GTRIN	(NHLNCR,NHLNTR)	QUNTY tSTU TR	INDUST Total Renewables.	Industrial
GTRREL	(NHLNCR,NHLNTR)	QUNTY tSTU TR	ELECTR Total Renewables.	Electricity

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors			Variable Description
	QTRSN	(MMUNCR,MMUNYR)	QUNTY	tBTU	TR	SYNTHE Total Renewables. Synthetics
	QTRAS	(MMUNCR,MMUNYR)	QUNTY	tBTU	TR	ALLSEC Total Renewables. All Sectors
	QEIEL	(MMUNCR,MMUNYR)	QUNTY	tBTU	EI	ELECTR Net Electricity Imports. Electricity
	QCIIN	(MMUNCR,MMUNYR)	QUNTY	tBTU	CI	INDUST Net Coal Coke Imports. Industrial
	QTSRS	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	RESIDN Total Sectoral Energy Consumption. Residential
	QTSCH	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	COMMER Total Sectoral Energy Consumption. Commercial
	QTSTR	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	TRANSP Total Sectoral Energy Consumption. Transportation
	QTSIN	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	INDUST Total Sectoral Energy Consumption. Industrial
	QTSRF	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	REFINE Total Sectoral Energy Consumption. Refinery
	QTSEL	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	ELECTR Total Sectoral Energy Consumption. Electricity
	QTSSN	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	SYNTHE Total Sectoral Energy Consumption. Synthetics
	QTSAS	(MMUNCR,MMUNYR)	QUNTY	tBTU	TS	ALLSEC Total Sectoral Energy Consumption. All Sectors

* PRICES Common Block						

NPBLK			TYPE	UNITS	FUEL	SECTOR
	PEPRS	(MMUNCR,MMUNYR)	PRICE	8738TU	EP	RESIDN Purchased Electricity, Peak. Residential
	PEPCM	(MMUNCR,MMUNYR)	PRICE	8738TU	EP	COMMER Purchased Electricity, Peak. Commercial
	PEPTR	(MMUNCR,MMUNYR)	PRICE	8738TU	EP	TRANSP Purchased Electricity, Peak. Transportation
	PEPIN	(MMUNCR,MMUNYR)	PRICE	8738TU	EP	INDUST Purchased Electricity, Peak. Industrial
	PEPAS	(MMUNCR,MMUNYR)	PRICE	8738TU	EP	ALLSEC Purchased Electricity, Peak. Refinery
	PENRS	(MMUNCR,MMUNYR)	PRICE	8738TU	EN	RESIDN Purchased Electricity, Nonpeak. Residential
	PENCH	(MMUNCR,MMUNYR)	PRICE	8738TU	EN	COMMER Purchased Electricity, Nonpeak. Commercial
	PENTR	(MMUNCR,MMUNYR)	PRICE	8738TU	EN	TRANSP Purchased Electricity, Nonpeak. Transportation
	PENIN	(MMUNCR,MMUNYR)	PRICE	8738TU	EN	INDUST Purchased Electricity, Nonpeak. Industrial
	PENAS	(MMUNCR,MMUNYR)	PRICE	8738TU	EN	ALLSEC Purchased Electricity, Nonpeak. All Sectors
	PELRS	(MMUNCR,MMUNYR)	PRICE	8738TU	EL	RESIDN Purchased Electricity. Residential
	PELCH	(MMUNCR,MMUNYR)	PRICE	8738TU	EL	COMMER Purchased Electricity. Commercial
	PELTR	(MMUNCR,MMUNYR)	PRICE	8738TU	EL	TRANSP Purchased Electricity. Transportation
	PELIN	(MMUNCR,MMUNYR)	PRICE	8738TU	EL	INDUST Purchased Electricity. Industrial
	PELAS	(MMUNCR,MMUNYR)	PRICE	8738TU	EL	ALLSEC Purchased Electricity. All Sectors
	PGFRS	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	RESIDN Natural Gas, Core. Residential
	PGFCM	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	COMMER Natural Gas, Core. Commercial
	PGFTR	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	TRANSP Natural Gas, Core. Transportation
	PGFIN	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	INDUST Natural Gas, Core. Industrial
	PGFEL	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	ELECTR Natural Gas, Core. Electricity
	PGFAS	(MMUNCR,MMUNYR)	PRICE	8738TU	GF	ALLSEC Natural Gas, Core. All Sectors
	PGIRS	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	RESIDN Natural Gas, Noncore. Residential
	PGICM	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	COMMER Natural Gas, Noncore. Commercial
	PGITR	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	TRANSP Natural Gas, Noncore. Transportation
	PGIIN	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	INDUST Natural Gas, Noncore. Industrial
	PGIEL	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	ELECTR Natural Gas, Noncore. Electricity
	PGIAS	(MMUNCR,MMUNYR)	PRICE	8738TU	GI	ALLSEC Natural Gas, Noncore. All Sectors
	PNGRS	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	RESIDN Natural Gas. Residential
	PNGCM	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	COMMER Natural Gas. Commercial
	PNGTR	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	TRANSP Natural Gas. Transportation
	PNGIN	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	INDUST Natural Gas. Industrial
	PNGEL	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	ELECTR Natural Gas. Electricity
	PNGAS	(MMUNCR,MMUNYR)	PRICE	8738TU	NG	ALLSEC Natural Gas. All Sectors

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
PGPTR	(MNUJCR, MNUJYR)	PRICE	8738TU GP	TRANSP Natural Gas. Pipeline
PLPIN	(MNUJCR, MNUJYR)	PRICE	8738TU LP	INDUST Lease and Plant Fuel
PCLRS	(MNUJCR, MNUJYR)	PRICE	8738TU CL	RESIDN Coal. Residential
PCLCH	(MNUJCR, MNUJYR)	PRICE	8738TU CL	COMMER Coal. Commercial
PCLIN	(MNUJCR, MNUJYR)	PRICE	8738TU CL	INDUST Coal. Industrial
PCLLE	(MNUJCR, MNUJYR)	PRICE	8738TU CL	ELECTR Coal. Electricity
PCLSN	(MNUJCR, MNUJYR)	PRICE	8738TU CL	SYNTNE Coal. Synthetics
PCLAS	(MNUJCR, MNUJYR)	PRICE	8738TU CL	ALLSEC Coal. All Sectors
PGCIN	(MNUJCR, MNUJYR)	PRICE	8738TU MC	INDUST Metallurgical Coal. Industrial
PGGCH	(MNUJCR, MNUJYR)	PRICE	8738TU MG	COMMER Motor Gasoline. Commercial
PGGTR	(MNUJCR, MNUJYR)	PRICE	8738TU MG	TRANSP Motor Gasoline. Transportation
PGGIN	(MNUJCR, MNUJYR)	PRICE	8738TU MG	INDUST Motor Gasoline. Industrial
PGGAS	(MNUJCR, MNUJYR)	PRICE	8738TU MG	ALLSEC Motor Gasoline. All Sectors
PJFTR	(MNUJCR, MNUJYR)	PRICE	8738TU JF	TRANSP Jet Fuel. Transportation
PDSRS	(MNUJCR, MNUJYR)	PRICE	8738TU DS	RESIDN Distillate. Residential
PDSCH	(MNUJCR, MNUJYR)	PRICE	8738TU DS	COMMER Distillate. Commercial
PDSTR	(MNUJCR, MNUJYR)	PRICE	8738TU DS	TRANSP Distillate. Transportation
PDSIN	(MNUJCR, MNUJYR)	PRICE	8738TU DS	INDUST Distillate. Industrial
PDSLE	(MNUJCR, MNUJYR)	PRICE	8738TU DS	ELECTR Distillate. Electricity (incl. petroleum coke)
PDSAS	(MNUJCR, MNUJYR)	PRICE	8738TU DS	ALLSEC Distillate. All Sectors
PKSRS	(MNUJCR, MNUJYR)	PRICE	8738TU KS	RESIDN Kerosene. Residential
PKSCH	(MNUJCR, MNUJYR)	PRICE	8738TU KS	COMMER Kerosene. Commercial
PKSIN	(MNUJCR, MNUJYR)	PRICE	8738TU KS	INDUST Kerosene. Industrial
PKSAS	(MNUJCR, MNUJYR)	PRICE	8738TU KS	ALLSEC Kerosene. All Sectors
PLGRS	(MNUJCR, MNUJYR)	PRICE	8738TU LG	RESIDN Liquid Petroleum Gases. Residential
PLGCH	(MNUJCR, MNUJYR)	PRICE	8738TU LG	COMMER Liquid Petroleum Gases. Commercial
PLGTR	(MNUJCR, MNUJYR)	PRICE	8738TU LG	TRANSP Liquid Petroleum Gases. Transportation
PLGIN	(MNUJCR, MNUJYR)	PRICE	8738TU LG	INDUST Liquid Petroleum Gases. Industrial
PLGAS	(MNUJCR, MNUJYR)	PRICE	8738TU LG	ALLSEC Liquid Petroleum Gases. All Sectors
PRLCH	(MNUJCR, MNUJYR)	PRICE	8738TU RL	COMMER Residual Fuel, Low Sulfur. Commercial
PRLTR	(MNUJCR, MNUJYR)	PRICE	8738TU RL	TRANSP Residual Fuel, Low Sulfur. Transportation
PRLIN	(MNUJCR, MNUJYR)	PRICE	8738TU RL	INDUST Residual Fuel, Low Sulfur. Industrial
PRLEL	(MNUJCR, MNUJYR)	PRICE	8738TU RL	ELECTR Residual Fuel, Low Sulfur. Electricity
PRLAS	(MNUJCR, MNUJYR)	PRICE	8738TU RL	ALLSEC Residual Fuel, Low Sulfur. All Sectors
PRNTR	(MNUJCR, MNUJYR)	PRICE	8738TU RH	TRANSP Residual Fuel, High Sulfur. Transportation
PRNEL	(MNUJCR, MNUJYR)	PRICE	8738TU RH	ELECTR Residual Fuel, High Sulfur. Electricity
PRNAS	(MNUJCR, MNUJYR)	PRICE	8738TU RS	ALLSEC Residual Fuel, High Sulfur. All Sectors
PRSCH	(MNUJCR, MNUJYR)	PRICE	8738TU RS	COMMER Residual Fuel. Commercial
PRSTR	(MNUJCR, MNUJYR)	PRICE	8738TU RS	TRANSP Residual Fuel. Transportation
PRSIN	(MNUJCR, MNUJYR)	PRICE	8738TU RS	INDUST Residual Fuel. Industrial
PRSEL	(MNUJCR, MNUJYR)	PRICE	8738TU RS	ELECTR Residual Fuel. Electricity
PRSAS	(MNUJCR, MNUJYR)	PRICE	8738TU RS	ALLSEC Residual Fuel. All Sectors
PPFIN	(MNUJCR, MNUJYR)	PRICE	8738TU PF	INDUST Petrochemical Feedstocks. Industrial
PASIN	(MNUJCR, MNUJYR)	PRICE	8738TU AS	INDUST Asphalt, Road Oil. Industrial
POTTR	(MNUJCR, MNUJYR)	PRICE	8738TU OT	TRANSP Other. Transportation
POTIN	(MNUJCR, MNUJYR)	PRICE	8738TU OT	INDUST Other. Industrial
POTAS	(MNUJCR, MNUJYR)	PRICE	8738TU OT	ALLSEC Other. All Sectors
PTPRS	(MNUJCR, MNUJYR)	PRICE	8738TU TP	RESIDN Total Petroleum. Residential
PTPCN	(MNUJCR, MNUJYR)	PRICE	8738TU TP	COMMER Total Petroleum. Commercial

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
XONGRF	(NMUMCR,MIXYRS)	XQUANTITY	NG	REFINE Natural Gas. Refinery
XONGEL	(NMUMCR,MIXYRS)	XQUANTITY	NG	ELECTR Natural Gas. Electricity
XONGAS	(NMUMCR,MIXYRS)	XQUANTITY	NG	ALLSEC Natural Gas. All Sectors
XOGPTR	(NMUMCR,MIXYRS)	XQUANTITY	GP	TRANSP Natural Gas. Pipeline
XOLPIN	(NMUMCR,MIXYRS)	XQUANTITY	LP	INDUST Lease and Plant Fuel
XOCLRS	(NMUMCR,MIXYRS)	XQUANTITY	CL	RESIDN Coal. Residential
XOCLCH	(NMUMCR,MIXYRS)	XQUANTITY	CL	COMMER Coal. Commercial
XOCLIN	(NMUMCR,MIXYRS)	XQUANTITY	CL	INDUST Coal. Industrial
XOCLRF	(NMUMCR,MIXYRS)	XQUANTITY	CL	REFINE Coal. Refinery
XOCLLE	(NMUMCR,MIXYRS)	XQUANTITY	CL	ELECTR Coal. Electricity
XOCLSN	(NMUMCR,MIXYRS)	XQUANTITY	CL	SYNTHE Coal. Synthetics
XOCLAS	(NMUMCR,MIXYRS)	XQUANTITY	CL	ALLSEC Coal. All Sectors
XOCLIN	(NMUMCR,MIXYRS)	XQUANTITY	MC	INDUST Metallurgical Coal. Industrial
XONGCH	(NMUMCR,MIXYRS)	XQUANTITY	NG	COMMER Motor Gasoline. Commercial
XONGTR	(NMUMCR,MIXYRS)	XQUANTITY	NG	TRANSP Motor Gasoline. Transportation
XONGIN	(NMUMCR,MIXYRS)	XQUANTITY	NG	INDUST Motor Gasoline. Industrial
XONGAS	(NMUMCR,MIXYRS)	XQUANTITY	NG	ALLSEC Motor Gasoline. All Sectors
XOJFTR	(NMUMCR,MIXYRS)	XQUANTITY	JF	TRANSP Jet Fuel. Transportation
XODSRS	(NMUMCR,MIXYRS)	XQUANTITY	DS	RESIDN Distillate. Residential
XODSCH	(NMUMCR,MIXYRS)	XQUANTITY	DS	COMMER Distillate. Commercial
XODSTR	(NMUMCR,MIXYRS)	XQUANTITY	DS	TRANSP Distillate. Transportation
XODSIN	(NMUMCR,MIXYRS)	XQUANTITY	DS	INDUST Distillate. Industrial
XODSRF	(NMUMCR,MIXYRS)	XQUANTITY	DS	REFINE Distillate. Refinery
XODSEL	(NMUMCR,MIXYRS)	XQUANTITY	DS	ELECTR Distillate. Electricity (incl. petroleum coke)
XODSAS	(NMUMCR,MIXYRS)	XQUANTITY	DS	ALLSEC Distillate. All Sectors
XOKSRS	(NMUMCR,MIXYRS)	XQUANTITY	KS	RESIDN Kerosene. Residential
XOKSCH	(NMUMCR,MIXYRS)	XQUANTITY	KS	COMMER Kerosene. Commercial
XOKSIN	(NMUMCR,MIXYRS)	XQUANTITY	KS	INDUST Kerosene. Industrial
XOKSAS	(NMUMCR,MIXYRS)	XQUANTITY	KS	ALLSEC Kerosene. All Sectors
XOLGRS	(NMUMCR,MIXYRS)	XQUANTITY	LG	RESIDN Liquid Petroleum Gases. Residential
XOLGCH	(NMUMCR,MIXYRS)	XQUANTITY	LG	COMMER Liquid Petroleum Gases. Commercial
XOLGTR	(NMUMCR,MIXYRS)	XQUANTITY	LG	TRANSP Liquid Petroleum Gases. Transportation
XOLGIN	(NMUMCR,MIXYRS)	XQUANTITY	LG	INDUST Liquid Petroleum Gases. Industrial
XOLGRF	(NMUMCR,MIXYRS)	XQUANTITY	LG	REFINE Liquid Petroleum Gases. Refinery
XOLGAS	(NMUMCR,MIXYRS)	XQUANTITY	LG	ALLSEC Liquid Petroleum Gases. All Sectors
XORLCH	(NMUMCR,MIXYRS)	XQUANTITY	RL	COMMER Residual Fuel, Low Sulfur. Commercial
XORLTR	(NMUMCR,MIXYRS)	XQUANTITY	RL	TRANSP Residual Fuel, Low Sulfur. Transportation
XORLIN	(NMUMCR,MIXYRS)	XQUANTITY	RL	INDUST Residual Fuel, Low Sulfur. Industrial
XORLRF	(NMUMCR,MIXYRS)	XQUANTITY	RL	REFINE Residual Fuel, Low Sulfur. Refinery
XORLEL	(NMUMCR,MIXYRS)	XQUANTITY	RL	ELECTR Residual Fuel, Low Sulfur. Electricity
XORLAS	(NMUMCR,MIXYRS)	XQUANTITY	RL	ALLSEC Residual Fuel, Low Sulfur. All Sectors
XORHTR	(NMUMCR,MIXYRS)	XQUANTITY	RH	TRANSP Residual Fuel, High Sulfur. Transportation
XORHEL	(NMUMCR,MIXYRS)	XQUANTITY	RH	ELECTR Residual Fuel, High Sulfur. Electricity
XORHAS	(NMUMCR,MIXYRS)	XQUANTITY	RH	ALLSEC Residual Fuel, High Sulfur. All Sectors
XORSCH	(NMUMCR,MIXYRS)	XQUANTITY	RS	COMMER Residual Fuel. Commercial
XORSTR	(NMUMCR,MIXYRS)	XQUANTITY	RS	TRANSP Residual Fuel. Transportation
XORSIN	(NMUMCR,MIXYRS)	XQUANTITY	RS	INDUST Residual Fuel. Industrial
XORSRF	(NMUMCR,MIXYRS)	XQUANTITY	RS	REFINE Residual Fuel. Refinery
XORSEL	(NMUMCR,MIXYRS)	XQUANTITY	RS	ELECTR Residual Fuel. Electricity

Common Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
XORSAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	RS	ALLSEC Residual Fuel. All Sectors
XOPFIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	PF	INDUST Petrochemical Feedstocks. Industrial
XOSGIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	SG	INDUST Still Gas. Industrial
XOSGRF	(NMUNCR,MNXYRS)	XQUNTY tSTU	SG	REFINE Still Gas. Refinery
XOPCIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	PC	INDUST Petroleum Coke. Industrial
XOPCRF	(NMUNCR,MNXYRS)	XQUNTY tSTU	PC	REFINE Petroleum Coke. Refinery
XOPCEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	PC	ELECTR Petroleum Coke. Electricity
XOPCAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	PC	ALLSEC Petroleum Coke. All Sectors
XOASIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	AS	INDUST Asphalt and Road Oil. Industrial
XOOTTR	(NMUNCR,MNXYRS)	XQUNTY tSTU	OT	TRANSP Other Petroleum. Trans (lubes, aviation gas)
XOOTIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	OT	INDUST Other Petroleum. Industrial
XOOTRF	(NMUNCR,MNXYRS)	XQUNTY tSTU	OT	REFINE Other Petroleum. Refinery
XOOTAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	OT	ALLSEC Other Petroleum. All Sectors
XOTPRS	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	RESIDN Total Petroleum. Residential
XOTPCM	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	COMMER Total Petroleum. Commercial
XOTPTR	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	TRANSP Total Petroleum. Transportation
XOTPIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	INDUST Total Petroleum. Industrial
XOTPRF	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	REFINE Total Petroleum. Refinery
XOTPEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	ELECTR Total Petroleum. Electricity
XOTPAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	TP	ALLSEC Total Petroleum. All Sectors
XOMETR	(NMUNCR,MNXYRS)	XQUNTY tSTU	ME	TRANSP Methanol. Transportation
XOETTR	(NMUNCR,MNXYRS)	XQUNTY tSTU	EY	TRANSP Ethanol. Transportation
XOHYTR	(NMUNCR,MNXYRS)	XQUNTY tSTU	HY	TRANSP Liquid Hydrogen. Transportation
XOUREL	(NMUNCR,MNXYRS)	XQUNTY tSTU	UR	ELECTR Uranium. Electricity
XONOIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	NO	INDUST Hydropower. Industrial
XONOEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	NO	ELECTR Hydropower. Electricity
XONOAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	NO	ALLSEC Hydropower. All Sectors
XOGEIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	GE	INDUST Geothermal. Industrial
XOGEEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	GE	ELECTR Geothermal. Electricity
XOGEAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	GE	ALLSEC Geothermal. All Sectors
XOBHRS	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	RESIDN Biomass. Residential
XOBHCH	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	COMMER Biomass. Commercial
XOBHIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	INDUST Biomass. Industrial
XOBHRF	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	REFINE Biomass. Refinery
XOBHML	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	ELECTR Biomass. Electricity
XOBHSH	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	SYNTNE Biomass. Synthetics
XOBHAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	BM	ALLSEC Biomass. All Sectors
XOHSIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	MS	INDUST Municipal Solid Waste. Industrial
XOHSML	(NMUNCR,MNXYRS)	XQUNTY tSTU	MS	ELECTR Municipal Solid Waste. Electricity
XOHSAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	MS	ALLSEC Municipal Solid Waste. All Sectors
XOSTRS	(NMUNCR,MNXYRS)	XQUNTY tSTU	ST	RESIDN Solar Thermal. Residential
XOSTCH	(NMUNCR,MNXYRS)	XQUNTY tSTU	ST	COMMER Solar Thermal. Commercial
XOSTIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	ST	INDUST Solar Thermal. Industrial
XOSTEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	ST	ELECTR Solar Thermal. Electricity
XOSTAS	(NMUNCR,MNXYRS)	XQUNTY tSTU	ST	ALLSEC Solar Thermal. All Sectors
XOPVRS	(NMUNCR,MNXYRS)	XQUNTY tSTU	PV	RESIDN Photovoltaic. Residential
XOPVCH	(NMUNCR,MNXYRS)	XQUNTY tSTU	PV	COMMER Photovoltaic. Commercial
XOPVIN	(NMUNCR,MNXYRS)	XQUNTY tSTU	PV	INDUST Photovoltaic. Industrial
XOPVEL	(NMUNCR,MNXYRS)	XQUNTY tSTU	PV	ELECTR Photovoltaic. Electricity

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	XGPVAS	(MMUNCR,MMKYRS)	XQUNTY tBTU PV	ALLSEC Photovoltaic. All Sectors
	XGM11N	(MMUNCR,MMKYRS)	XQUNTY tBTU W1	INDUST Wind. Industrial
	XGM1EL	(MMUNCR,MMKYRS)	XQUNTY tBTU W1	ELECTR Wind. Electricity
	XGM1AS	(MMUNCR,MMKYRS)	XQUNTY tBTU W1	ALLSEC Wind. All Sectors
	XGTRRS	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	RESIDN Total Renewables. Residential
	XGTRCH	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	COMMER Total Renewables. Commercial
	XGTRTR	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	TRANSP Total Renewables. Transportation
	XGTRIN	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	INDUST Total Renewables. Industrial
	XGTRRL	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	ELECTR Total Renewables. Electricity
	XGTRSN	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	SYNTHE Total Renewables. Synthetics
	XGTRAS	(MMUNCR,MMKYRS)	XQUNTY tBTU TR	ALLSEC Total Renewables. All Sectors
	XGE1EL	(MMUNCR,MMKYRS)	XQUNTY tBTU EI	ELECTR Net Electricity Imports. Electricity
	XGC11N	(MMUNCR,MMKYRS)	XQUNTY tBTU CI	INDUST Net Coal Coke Imports. Industrial
	XGTSRS	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	RESIDN Total Sectoral Energy Consumption. Residential
	XGTSCH	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	COMMER Total Sectoral Energy Consumption. Commercial
	XGTSR	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	TRANSP Total Sectoral Energy Consumption. Transportation
	XGTSIN	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	INDUST Total Sectoral Energy Consumption. Industrial
	XGTSRF	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	REFINE Total Sectoral Energy Consumption. Refinery
	XGTSEL	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	ELECTR Total Sectoral Energy Consumption. Electricity
	XGTSSN	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	SYNTHE Total Sectoral Energy Consumption. Synthetics
	XGTSAS	(MMUNCR,MMKYRS)	XQUNTY tBTU TS	ALLSEC Total Sectoral Energy Consumption. All Sectors
	XONGELFN	(21,MMKYRS)	XQUNTY tBTU NG	ELECTR Natural Gas - Firm Consumption. Electricity
	XONGELIN	(21,MMKYRS)	XQUNTY tBTU NG	ELECTR Natural Gas - Interruptible Consum. Electricity
	XONGELCH	(21,MMKYRS)	XQUNTY tBTU NG	ELECTR Natural Gas - Competitive Consum. Electricity

* Expected Value (PRICES) Common Block

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
XGPBLK	XPEPRS	(MMUNCR,MMKYRS)	XPRICE 8738TU EP	RESIDN Purchased Electricity, Peak. Residential
	XPEPCN	(MMUNCR,MMKYRS)	XPRICE 8738TU EP	COMMER Purchased Electricity, Peak. Commercial
	XPEPTR	(MMUNCR,MMKYRS)	XPRICE 8738TU EP	TRANSP Purchased Electricity, Peak. Transportation
	XPEPIN	(MMUNCR,MMKYRS)	XPRICE 8738TU EP	INDUST Purchased Electricity, Peak. Industrial
	XPEPAS	(MMUNCR,MMKYRS)	XPRICE 8738TU EP	ALLSEC Purchased Electricity, Peak. Refinery
	XPEMRS	(MMUNCR,MMKYRS)	XPRICE 8738TU EN	RESIDN Purchased Electricity, Nonpeak. Residential
	XPEMCH	(MMUNCR,MMKYRS)	XPRICE 8738TU EN	COMMER Purchased Electricity, Nonpeak. Commercial
	XPEMTR	(MMUNCR,MMKYRS)	XPRICE 8738TU EN	TRANSP Purchased Electricity, Nonpeak. Transportation
	XPEMIN	(MMUNCR,MMKYRS)	XPRICE 8738TU EN	INDUST Purchased Electricity, Nonpeak. Industrial
	XPEMAS	(MMUNCR,MMKYRS)	XPRICE 8738TU EN	ALLSEC Purchased Electricity, Nonpeak. All Sectors
	XPELRS	(MMUNCR,MMKYRS)	XPRICE 8738TU EL	RESIDN Purchased Electricity. Residential
	XPELCH	(MMUNCR,MMKYRS)	XPRICE 8738TU EL	COMMER Purchased Electricity. Commercial
	XPELTR	(MMUNCR,MMKYRS)	XPRICE 8738TU EL	TRANSP Purchased Electricity. Transportation
	XPELIN	(MMUNCR,MMKYRS)	XPRICE 8738TU EL	INDUST Purchased Electricity. Industrial
	XPELAS	(MMUNCR,MMKYRS)	XPRICE 8738TU EL	ALLSEC Purchased Electricity. All Sectors
	XPGFRS	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	RESIDN Natural Gas, Core. Residential
	XPGFCN	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	COMMER Natural Gas, Core. Commercial
	XPGFTR	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	TRANSP Natural Gas, Core. Transportation
	XPGFIN	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	INDUST Natural Gas, Core. Industrial
	XPGFEL	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	ELECTR Natural Gas, Core. Electricity
	XPGFAS	(MMUNCR,MMKYRS)	XPRICE 8738TU GF	ALLSEC Natural Gas, Core. All Sectors

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
XPGRS	(NHLNCR,NHXYRS)	XPRICE 8738TU GI	RESIDN Natural Gas, Noncore.	Residential
XPGRN	(NHLNCR,NHXYRS)	XPRICE 8738TU GI	COMMER Natural Gas, Noncore.	Commercial
XPGRTR	(NHLNCR,NHXYRS)	XPRICE 8738TU GI	TRANSP Natural Gas, Noncore.	Transportation
XPGRIN	(NHLNCR,NHXYRS)	XPRICE 8738TU GI	INDUST Natural Gas, Noncore.	Industrial
XPGRIL	(NHLNCR,NHXYRS)	XPRICE 8738TU GI	ELECTR Natural Gas, Noncore.	Electricity
XPGRAS	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	ALLSEC Natural Gas, Noncore.	All Sectors
XPGRS	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	RESIDN Natural Gas.	Residential
XPGRCH	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	COMMER Natural Gas.	Commercial
XPGRTR	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	TRANSP Natural Gas.	Transportation
XPGRIN	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	INDUST Natural Gas.	Industrial
XPGRIL	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	ELECTR Natural Gas.	Electricity
XPGRAS	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	ALLSEC Natural Gas.	All Sectors
XPGRTR	(NHLNCR,NHXYRS)	XPRICE 8738TU SP	TRANSP Natural Gas.	Pipeline
XPLPIN	(NHLNCR,NHXYRS)	XPRICE 8738TU LP	INDUST Lease and Plant Fuel	
XPCLRS	(NHLNCR,NHXYRS)	XPRICE 8738TU CL	RESIDN Coal.	Residential
XPCLCH	(NHLNCR,NHXYRS)	XPRICE 8738TU CL	COMMER Coal.	Commercial
XPCLIN	(NHLNCR,NHXYRS)	XPRICE 8738TU CL	INDUST Coal.	Industrial
XPCLIL	(NHLNCR,NHXYRS)	XPRICE 8738TU CL	ELECTR Coal.	Electricity
XPCLSN	(NHLNCR,NHXYRS)	XPRICE 8738TU CL	SYNTHE Coal.	Synthetics
XPCLAS	(NHLNCR,NHXYRS)	XPRICE 8738TU MC	ALLSEC Coal.	All Sectors
XPCLIN	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	INDUST Metallurgical Coal.	Industrial
XPGRCH	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	COMMER Motor Gasoline.	Commercial
XPGRTR	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	TRANSP Motor Gasoline.	Transportation
XPGRIN	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	INDUST Motor Gasoline.	Industrial
XPGRAS	(NHLNCR,NHXYRS)	XPRICE 8738TU NG	ALLSEC Motor Gasoline.	All Sectors
XPJFTR	(NHLNCR,NHXYRS)	XPRICE 8738TU JF	TRANSP Jet Fuel.	Transportation
XPDSRS	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	RESIDN Distillate.	Residential
XPDSCH	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	COMMER Distillate.	Commercial
XPDSRTR	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	TRANSP Distillate.	Transportation
XPDSIN	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	INDUST Distillate.	Industrial
XPDSIL	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	ELECTR Distillate.	Electricity (incl. petroleum coke)
XPDSAS	(NHLNCR,NHXYRS)	XPRICE 8738TU DS	ALLSEC Distillate.	All Sectors
XPDSRS	(NHLNCR,NHXYRS)	XPRICE 8738TU KS	RESIDN Kerosene.	Residential
XPDSCH	(NHLNCR,NHXYRS)	XPRICE 8738TU KS	COMMER Kerosene.	Commercial
XPDSIN	(NHLNCR,NHXYRS)	XPRICE 8738TU KS	INDUST Kerosene.	Industrial
XPDSIL	(NHLNCR,NHXYRS)	XPRICE 8738TU KS	ALLSEC Kerosene.	All Sectors
XPDSAS	(NHLNCR,NHXYRS)	XPRICE 8738TU LG	RESIDN Liquid Petroleum Gases.	Residential
XPDSRS	(NHLNCR,NHXYRS)	XPRICE 8738TU LG	COMMER Liquid Petroleum Gases.	Commercial
XPDSCH	(NHLNCR,NHXYRS)	XPRICE 8738TU LG	TRANSP Liquid Petroleum Gases.	Transportation
XPDSIN	(NHLNCR,NHXYRS)	XPRICE 8738TU LG	INDUST Liquid Petroleum Gases.	Industrial
XPDSIL	(NHLNCR,NHXYRS)	XPRICE 8738TU LG	ALLSEC Liquid Petroleum Gases.	All Sectors
XPDSAS	(NHLNCR,NHXYRS)	XPRICE 8738TU RL	COMMER Residual Fuel, Low Sulfur.	Commercial
XPRLCH	(NHLNCR,NHXYRS)	XPRICE 8738TU RL	TRANSP Residual Fuel, Low Sulfur.	Transportation
XPRLTR	(NHLNCR,NHXYRS)	XPRICE 8738TU RL	INDUST Residual Fuel, Low Sulfur.	Industrial
XPRLIN	(NHLNCR,NHXYRS)	XPRICE 8738TU RL	ELECTR Residual Fuel, Low Sulfur.	Electricity
XPRLIL	(NHLNCR,NHXYRS)	XPRICE 8738TU RL	ALLSEC Residual Fuel, Low Sulfur.	All Sectors
XPRLAS	(NHLNCR,NHXYRS)	XPRICE 8738TU RH	TRANSP Residual Fuel, High Sulfur.	Transportation
XPRLTR	(NHLNCR,NHXYRS)	XPRICE 8738TU RH	ELECTR Residual Fuel, High Sulfur.	Electricity
XPRLIN	(NHLNCR,NHXYRS)	XPRICE 8738TU RH	ALLSEC Residual Fuel, High Sulfur.	All Sectors
XPRLIL	(NHLNCR,NHXYRS)			
XPRLAS	(NHLNCR,NHXYRS)			
XPRLTR	(NHLNCR,NHXYRS)			
XPRLIN	(NHLNCR,NHXYRS)			
XPRLIL	(NHLNCR,NHXYRS)			
XPRLAS	(NHLNCR,NHXYRS)			
XPRLTR	(NHLNCR,NHXYRS)			
XPRLIN	(NHLNCR,NHXYRS)			
XPRLIL	(NHLNCR,NHXYRS)			
XPRLAS	(NHLNCR,NHXYRS)			
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XPRLTR	(NHLNCR,NHXYRS)			
XPRLIN	(NHLNCR,NHXYRS)			
XPRLIL	(NHLNCR,NHXYRS)			
XPRLAS	(NHLNCR,NHXYRS)			
XPRLTR	(NHLNCR,NHXYRS)			
XPRLIN	(NHLNCR,NHXYRS)			

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	XPROCH	(NMUNCR, NDKYRS)	XPRICE 8738TU RS	CONNER Residual Fuel. Commercial
	XPRSTR	(NMUNCR, NDKYRS)	XPRICE 8738TU RS	TRANSP Residual Fuel. Transportation
	XPRSHN	(NMUNCR, NDKYRS)	XPRICE 8738TU RS	INDUST Residual Fuel. Industrial
	XPRSEL	(NMUNCR, NDKYRS)	XPRICE 8738TU RS	ELECTR Residual Fuel. Electricity
	XPRSAS	(NMUNCR, NDKYRS)	XPRICE 8738TU RS	ALLSEC Residual Fuel. All Sectors
	XPPFIN	(NMUNCR, NDKYRS)	PRICE 8738TU PF	INDUST Petrochemical Feedstocks. Industrial
	XPASIN	(NMUNCR, NDKYRS)	PRICE 8738TU AS	INDUST Asphalt, Road Oil. Industrial
	XPTTR	(NMUNCR, NDKYRS)	XPRICE 8738TU OT	TRANSP Other. Transportation
	XPOTIN	(NMUNCR, NDKYRS)	XPRICE 8738TU OT	INDUST Other. Industrial
	XPOTAS	(NMUNCR, NDKYRS)	XPRICE 8738TU OT	ALLSEC Other. All Sectors
	XTPRS	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	RESIDN Total Petroleum. Residential
	XTPCH	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	CONNER Total Petroleum. Commercial
	XTPTR	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	TRANSP Total Petroleum. Transportation
	XTPIN	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	INDUST Total Petroleum. Industrial
	XTPRF	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	REFINE Total Petroleum. Refinery
	XTPEL	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	ELECTR Total Petroleum. Electricity
	XTPAS	(NMUNCR, NDKYRS)	XPRICE 8738TU TP	ALLSEC Total Petroleum. All Sectors
	XPNETR	(NMUNCR, NDKYRS)	XPRICE 8738TU NE	TRANSP Methanol. Transportation
	XPETTR	(NMUNCR, NDKYRS)	XPRICE 8738TU ET	TRANSP Ethanol. Transportation
	XPWYTR	(NMUNCR, NDKYRS)	XPRICE 8738TU NY	TRANSP Liquid Hydrogen. Transportation
	XPUREL	(NMUNCR, NDKYRS)	XPRICE 8738TU UR	ELECTR Uranium. Electricity
	XIT WOP	(NDKYRS, 2)	XPRICE 8738TU WO	INTERN WORLD OIL PRICE (2--UNITS)
	XOGLPRNG	(NMUNCR, NDKYRS)	XPRICE 8738TU NG	PIPELN NG WELLHEAD PRICE (387/MCF)

* History Data From SEDS/Other Sources				

GSBLK			TYPE UNITS FUEL	SECTOR
GSEPRS	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	RESIDN Purchased Electricity, Peak. Residential
GSEPCN	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	CONNER Purchased Electricity, Peak. Commercial
GSEPTR	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	TRANSP Purchased Electricity, Peak. Transportation
GSEPIN	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	INDUST Purchased Electricity, Peak. Industrial
GSEPRF	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	REFINE Purchased Electricity, Peak. Refinery
GSEPAS	(NMUNCR, NSEDYR)	HISTOR	1BTU EP	ALLSEC Purchased Electricity, Peak. All Sectors
GSENRS	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	RESIDN Purchased Electricity, Nonpeak. Residential
GSENCN	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	CONNER Purchased Electricity, Nonpeak. Commercial
GSENTR	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	TRANSP Purchased Electricity, Nonpeak. Transportation
GSEINH	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	INDUST Purchased Electricity, Nonpeak. Industrial
GSENRF	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	REFINE Purchased Electricity, Nonpeak. Refinery
GSENAS	(NMUNCR, NSEDYR)	HISTOR	1BTU EN	ALLSEC Purchased Electricity, Nonpeak. All Sectors
GSELRS	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	RESIDN Purchased Electricity. Residential
GSELCH	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	CONNER Purchased Electricity. Commercial
GSELTR	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	TRANSP Purchased Electricity. Transportation
GSELIN	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	INDUST Purchased Electricity. Industrial
GSELRF	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	REFINE Purchased Electricity. Refinery
GSELAS	(NMUNCR, NSEDYR)	HISTOR	1BTU EL	ALLSEC Purchased Electricity. All Sectors
GSGFRS	(NMUNCR, NSEDYR)	HISTOR	1BTU GF	RESIDN Natural Gas, Core. Residential
GSGFCH	(NMUNCR, NSEDYR)	HISTOR	1BTU GF	CONNER Natural Gas, Core. Commercial
GSGFTR	(NMUNCR, NSEDYR)	HISTOR	1BTU GF	TRANSP Natural Gas, Core. Transportation
GSGFIN	(NMUNCR, NSEDYR)	HISTOR	1BTU GF	INDUST Natural Gas, Core. Industrial

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
QSGFRF	(NNUNCR, HSEDYR)	HISTOR	TBTU GF	REFINE Natural Gas, Core. Refinery
QSGFEL	(NNUNCR, HSEDYR)	HISTOR	TBTU GF	ELECTR Natural Gas, Core. Electricity
QSGFAS	(NNUNCR, HSEDYR)	HISTOR	TBTU GF	ALLSEC Natural Gas, Core. All Sectors
QSGIRS	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	RESIDN Natural Gas, Noncore. Residential
QSGICH	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	COMMER Natural Gas, Noncore. Commercial
QSGITR	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	TRANSP Natural Gas, Noncore. Transportation
QSGIIN	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	INDUST Natural Gas, Noncore. Industrial
QSGIRF	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	REFINE Natural Gas, Noncore. Refinery
QSGIEL	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	ELECTR Natural Gas, Noncore. Electricity
QSGIAS	(NNUNCR, HSEDYR)	HISTOR	TBTU GI	ALLSEC Natural Gas, Noncore. All Sectors
QSNGRS	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	RESIDN Natural Gas. Residential
QSNICH	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	COMMER Natural Gas. Commercial
QSNIGR	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	TRANSP Natural Gas. Transportation
QSNGIN	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	INDUST Natural Gas. Industrial
QSNGRF	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	REFINE Natural Gas. Refinery
QSNIEL	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	ELECTR Natural Gas. Electricity
QSNIGAS	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	ALLSEC Natural Gas. All Sectors
QSGPTR	(NNUNCR, HSEDYR)	HISTOR	TBTU GP	TRANSP Natural Gas. Pipeline
QSLPIN	(NNUNCR, HSEDYR)	HISTOR	TBTU LP	INDUST Lease and Plant Fuel
QSLIRS	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	RESIDN Coal. Residential
QSLICH	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	COMMER Coal. Commercial
QSLICH	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	INDUST Coal. Industrial
QSLICH	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	REFINE Coal. Refinery
QSLIRF	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	ELECTR Coal. Electricity
QSLIEL	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	SYNTHE Coal. Synthetics
QSLICH	(NNUNCR, HSEDYR)	HISTOR	TBTU CL	ALLSEC Coal. All Sectors
QSLIAS	(NNUNCR, HSEDYR)	HISTOR	TBTU NC	INDUST Metallurgical Coal. Industrial
QSMICH	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	COMMER Motor Gasoline. Commercial
QSMICH	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	TRANSP Motor Gasoline. Transportation
QSMIGR	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	INDUST Motor Gasoline. Industrial
QSMGIN	(NNUNCR, HSEDYR)	HISTOR	TBTU NG	ALLSEC Motor Gasoline. All Sectors
QSMIGAS	(NNUNCR, HSEDYR)	HISTOR	TBTU JF	TRANSP Jet Fuel. Transportation
QSJFTR	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	RESIDN Distillate. Residential
QSDIRS	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	COMMER Distillate. Commercial
QSDICH	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	TRANSP Distillate. Transportation
QSDSTR	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	INDUST Distillate. Industrial
QSDGIN	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	REFINE Distillate. Refinery
QSDSRF	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	ELECTR Distillate. Electricity (incl. petroleum coke)
QSDSEL	(NNUNCR, HSEDYR)	HISTOR	TBTU DS	ALLSEC Distillate. All Sectors
QSDSAS	(NNUNCR, HSEDYR)	HISTOR	TBTU KS	RESIDN Kerosene. Residential
QSKSRS	(NNUNCR, HSEDYR)	HISTOR	TBTU KS	COMMER Kerosene. Commercial
QSKSCH	(NNUNCR, HSEDYR)	HISTOR	TBTU KS	INDUST Kerosene. Industrial
QSKICH	(NNUNCR, HSEDYR)	HISTOR	TBTU KS	ALLSEC Kerosene. All Sectors
QSKIAS	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	RESIDN Liquid Petroleum Gases. Residential
QSLGRS	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	COMMER Liquid Petroleum Gases. Commercial
QSLICH	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	TRANSP Liquid Petroleum Gases. Industrial
QSLGTR	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	INDUST Liquid Petroleum Gases. Industrial
QSLGIN	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	REFINE Liquid Petroleum Gases. Refinery
QSLGRF	(NNUNCR, HSEDYR)	HISTOR	TBTU LG	ALLSEC Liquid Petroleum Gases. All Sectors
QSLGAS	(NNUNCR, HSEDYR)			

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
QSRICH	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	COMMER Residual Fuel, Low Sulfur. Commercial
QSRLTR	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	TRANSP Residual Fuel, Low Sulfur. Transportation
QSRLIN	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	INDUST Residual Fuel, Low Sulfur. Industrial
QSRRLF	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	REFINE Residual Fuel, Low Sulfur. Refinery
QSRLEL	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	ELECTR Residual Fuel, Low Sulfur. Electricity
QSRLAS	(NMUNCR, NSEDYR)	HISTOR tBTU	RL	ALLSEC Residual Fuel, Low Sulfur. All Sectors
QSRNTR	(NMUNCR, NSEDYR)	HISTOR tBTU	RH	TRANSP Residual Fuel, High Sulfur. Transportation
QSRNEL	(NMUNCR, NSEDYR)	HISTOR tBTU	RH	ELECTR Residual Fuel, High Sulfur. Electricity
QSRNAS	(NMUNCR, NSEDYR)	HISTOR tBTU	RH	ALLSEC Residual Fuel, High Sulfur. All Sectors
QSRSCH	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	COMMER Residual Fuel. Commercial
QSRSTR	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	TRANSP Residual Fuel. Transportation
QSR SIN	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	INDUST Residual Fuel. Industrial
QSRSRF	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	REFINE Residual Fuel. Refinery
QSRSEL	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	ELECTR Residual Fuel. Electricity
QSR SAS	(NMUNCR, NSEDYR)	HISTOR tBTU	RS	ALLSEC Residual Fuel. All Sectors
QSPFIN	(NMUNCR, NSEDYR)	HISTOR tBTU	PF	INDUST Petrochemical Feedstocks. Industrial
QSSGIN	(NMUNCR, NSEDYR)	HISTOR tBTU	SG	INDUST Still Gas. Industrial
QSSGRF	(NMUNCR, NSEDYR)	HISTOR tBTU	SG	REFINE Still Gas. Refinery
QSPCIN	(NMUNCR, NSEDYR)	HISTOR tBTU	PC	INDUST Petroleum Coke. Industrial
QSPCRF	(NMUNCR, NSEDYR)	HISTOR tBTU	PC	REFINE Petroleum Coke. Refinery
QSPCEL	(NMUNCR, NSEDYR)	HISTOR tBTU	PC	ELECTR Petroleum Coke. Refinery
QSPCAS	(NMUNCR, NSEDYR)	HISTOR tBTU	PC	ALLSEC Petroleum Coke. All Sectors
QSASIN	(NMUNCR, NSEDYR)	HISTOR tBTU	AS	INDUST Asphalt and Road Oil. Industrial
QSOTTR	(NMUNCR, NSEDYR)	HISTOR tBTU	OT	TRANSP Other Petroleum. Trans (lubes, aviation gas)
QSOTIN	(NMUNCR, NSEDYR)	HISTOR tBTU	OT	INDUST Other Petroleum. Industrial
QSOTRF	(NMUNCR, NSEDYR)	HISTOR tBTU	OT	REFINE Other Petroleum. Refinery
QSOTAS	(NMUNCR, NSEDYR)	HISTOR tBTU	OT	ALLSEC Other Petroleum. All Sectors
QSTPRS	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	RESIDN Total Petroleum. Residential
QSTPCN	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	COMMER Total Petroleum. Commercial
QSTPTR	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	TRANSP Total Petroleum. Transportation
QSTPIN	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	INDUST Total Petroleum. Industrial
QSTPRF	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	REFINE Total Petroleum. Refinery
QSTPEL	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	ELECTR Total Petroleum. Electricity
QSTPAS	(NMUNCR, NSEDYR)	HISTOR tBTU	TP	ALLSEC Total Petroleum. All Sectors
QSMETR	(NMUNCR, NSEDYR)	HISTOR tBTU	ME	TRANSP Methanol. Transportation
QSETTR	(NMUNCR, NSEDYR)	HISTOR tBTU	ET	TRANSP Methanol. Transportation
QSHYTR	(NMUNCR, NSEDYR)	HISTOR tBTU	HY	TRANSP Methanol. Transportation
QSHREL	(NMUNCR, NSEDYR)	HISTOR tBTU	UR	ELECTR Uranium. Electricity
QSHOIN	(NMUNCR, NSEDYR)	HISTOR tBTU	NO	INDUST Hydropower. Industrial
QSHOEL	(NMUNCR, NSEDYR)	HISTOR tBTU	NO	ELECTR Hydropower. Electricity
QSHOAS	(NMUNCR, NSEDYR)	HISTOR tBTU	NO	ALLSEC Hydropower. All Sectors
QSGEIN	(NMUNCR, NSEDYR)	HISTOR tBTU	GE	INDUST Geothermal. Industrial
QSGEEL	(NMUNCR, NSEDYR)	HISTOR tBTU	GE	ELECTR Geothermal. Electricity
QSGEAS	(NMUNCR, NSEDYR)	HISTOR tBTU	GE	ALLSEC Geothermal. All Sectors
QSBHRS	(NMUNCR, NSEDYR)	HISTOR tBTU	BH	RESIDN Biomass. Residential
QSBMCH	(NMUNCR, NSEDYR)	HISTOR tBTU	BH	COMMER Biomass. Commercial
QSBMIN	(NMUNCR, NSEDYR)	HISTOR tBTU	BH	INDUST Biomass. Industrial
QSBPRF	(NMUNCR, NSEDYR)	HISTOR tBTU	BH	REFINE Biomass. Industrial
QSBREL	(NMUNCR, NSEDYR)	HISTOR tBTU	BH	ELECTR Biomass. Electricity

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	QSDMSH	(NNUMCR,MSEDYR)	HISTOR tBTU BM	SYNTHE Biomass. Synthetics
	QSDMAS	(NNUMCR,MSEDYR)	HISTOR tBTU BM	ALLSEC Biomass. All Sectors
	QSMNIN	(NNUMCR,MSEDYR)	HISTOR tBTU MS	INDUST Municipal Solid Waste. Industrial
	QSMSEL	(NNUMCR,MSEDYR)	HISTOR tBTU MS	ELECTR Municipal Solid Waste. Electricity
	QSMRAS	(NNUMCR,MSEDYR)	HISTOR tBTU MS	ALLSEC Municipal Solid Waste. All Sectors
	QSTRS	(NNUMCR,MSEDYR)	HISTOR tBTU ST	RESIDN Solar Thermal. Residential
	QSTCH	(NNUMCR,MSEDYR)	HISTOR tBTU ST	COMMER Solar Thermal. Commercial
	QSTIN	(NNUMCR,MSEDYR)	HISTOR tBTU ST	INDUST Solar Thermal. Industrial
	QSTEL	(NNUMCR,MSEDYR)	HISTOR tBTU ST	ELECTR Solar Thermal. Electricity
	QSTAS	(NNUMCR,MSEDYR)	HISTOR tBTU ST	ALLSEC Solar Thermal. All Sectors
	QSPVRS	(NNUMCR,MSEDYR)	HISTOR tBTU PV	RESIDN Photovoltaic. Residential
	QSPVCH	(NNUMCR,MSEDYR)	HISTOR tBTU PV	COMMER Photovoltaic. Commercial
	QSPVIN	(NNUMCR,MSEDYR)	HISTOR tBTU PV	INDUST Photovoltaic. Industrial
	QSPVEL	(NNUMCR,MSEDYR)	HISTOR tBTU PV	ELECTR Photovoltaic. Electricity
	QSPVAS	(NNUMCR,MSEDYR)	HISTOR tBTU PV	ALLSEC Photovoltaic. All Sectors
	QSWIIN	(NNUMCR,MSEDYR)	HISTOR tBTU WI	INDUST Wind. Industrial
	QSWIEL	(NNUMCR,MSEDYR)	HISTOR tBTU WI	ELECTR Wind. Electricity
	QSWIAS	(NNUMCR,MSEDYR)	HISTOR tBTU WI	ALLSEC Wind. All Sectors
	QSTRRS	(NNUMCR,MSEDYR)	HISTOR tBTU TR	RESIDN Total Renewables. Residential
	QSTRCH	(NNUMCR,MSEDYR)	HISTOR tBTU TR	COMMER Total Renewables. Commercial
	QSTRTR	(NNUMCR,MSEDYR)	HISTOR tBTU TR	TRANSP Total Renewables. Transportation
	QSTRIN	(NNUMCR,MSEDYR)	HISTOR tBTU TR	INDUST Total Renewables. Industrial
	QSTREL	(NNUMCR,MSEDYR)	HISTOR tBTU TR	ELECTR Total Renewables. Electricity
	QSTRSN	(NNUMCR,MSEDYR)	HISTOR tBTU TR	SYNTHE Total Renewables. Synthetics
	QSTRAS	(NNUMCR,MSEDYR)	HISTOR tBTU TR	ALLSEC Total Renewables. All Sectors
	QSEIEL	(NNUMCR,MSEDYR)	HISTOR tBTU EI	ELECTR Net Electricity Imports. Electricity
	QSCIIN	(NNUMCR,MSEDYR)	HISTOR tBTU CI	INDUST Net Coal Coke Imports. Industrial
	QSTSR	(NNUMCR,MSEDYR)	HISTOR tBTU TS	RESIDN Total Sectoral Energy Consumption. Residential
	QSTSCH	(NNUMCR,MSEDYR)	HISTOR tBTU TS	COMMER Total Sectoral Energy Consumption. Commercial
	QSTSTR	(NNUMCR,MSEDYR)	HISTOR tBTU TS	TRANSP Total Sectoral Energy Consumption. Transportation
	QSTSIN	(NNUMCR,MSEDYR)	HISTOR tBTU TS	INDUST Total Sectoral Energy Consumption. Industrial
	QSTSRF	(NNUMCR,MSEDYR)	HISTOR tBTU TS	REFINE Total Sectoral Energy Consumption. Refinery
	QSTSEL	(NNUMCR,MSEDYR)	HISTOR tBTU TS	ELECTR Total Sectoral Energy Consumption. Electricity
	QSTSSN	(NNUMCR,MSEDYR)	HISTOR tBTU TS	SYNTHE Total Sectoral Energy Consumption. Synthetics
	QSTAS	(NNUMCR,MSEDYR)	HISTOR tBTU TS	ALLSEC Total Sectoral Energy Consumption. All Sectors

* Control Modules Common Block				

MCNTRL			TYPE UNITS	EXECUTE WORLD (INTERNATIONAL)
EXM	(1)		CNTRL ON_OFF	EXECUTE MAC (MACROECONOMIC)
EXN	(1)		CNTRL ON_OFF	EXECUTE RESD (RESIDENTIAL)
EXR	(1)		CNTRL ON_OFF	EXECUTE COMH (COMMERCIAL)
EXK	(1)		CNTRL ON_OFF	EXECUTE IND (INDUSTRIAL)
EXI	(1)		CNTRL ON_OFF	EXECUTE TRAN (TRANSPORTATION)
EXT	(1)		CNTRL ON_OFF	EXECUTE UTIL (UTILITY)
EXE	(1)		CNTRL ON_OFF	EXECUTE COAL (COAL SUPPLY)
EXC	(1)		CNTRL ON_OFF	EXECUTE WELL (OIL AND GAS SUPPLY)
EXL	(1)		CNTRL ON_OFF	EXECUTE PIPE (GAS TRANS.& DISTR.)
EXG	(1)		CNTRL ON_OFF	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	EXO	(1)	CNTROL ON_OFF	EXECUTE REFINE (PETROLEUM REFINERY)
	EXN	(1)	CNTROL ON_OFF	EXECUTE RENEW (RENEWABLES)
	RUNMOD	(12)	CNTROL BLANK	FLAGS FOR WHETHER EACH MODEL IS BEING RUN
	FIRSTYR	(1)	CNTROL BLANK	FIRST FORECAST YEAR INDEX (EG. 2)
	LASTYR	(1)	CNTROL BLANK	LAST FORECAST YEAR INDEX (EG. 29)
	MAXITR	(1)	CNTROL BLANK	MAXIMUM ITERATIONS
	FRCTOL	(1)	CNTROL BLANK	MINIMUM FRACTIONAL CONVERGENCE TOLERANCE
	ABSTOL	(1)	CNTROL BLANK	MINIMUM ABSOLUTE CONVERGENCE TOLERANCE
	RLXPC	(1)	CNTROL BLANK	RELAXATION FRACTION
	MYRS	(1)	CNTROL BLANK	NUMBER OF GROWTH YEARS FOR EXPECTATIONS
	I4SITE	(1)	CNTROL BLANK	FORESIGHT OPT (1:MYOPIC, 2: ADAPTIVE, 3: PERFECT)
	I4SCT	(1)	CNTROL BLANK	FORESIGHT CONTROL: (1: MAIN, 2: SUBMODULE)
	IRELAX	(1)	CNTROL BLANK	OPTION TO RUN HEURISTIC ROUTINE TO SPEED
	WJOP	(1)	CNTROL BLANK	WORLD OIL PRICE CASE
	MMAC	(1)	CNTROL BLANK	MACRO CASE
	HISTORY	(1)	CNTROL BLANK	OPTION TO OVERWRITE 1990 DATA W/SEDS DATA (1=TRUE)
	CURITR	(1)	CNTROL BLANK	CURRENT ITERATIONS
	CURITR	(1)	CNTROL BLANK	CURRENT IYEAR INDEX
	BASEYR	(1)	CNTROL BLANK	YEAR CORRESPONDING TO FIRSTYR=1
	ENDYR	(1)	CNTROL BLANK	YEAR CORRESPONDING TO LASTYR=29
	LOOPOP	(1)	CNTROL BLANK	NEWS YEAR LOOPING (1: A YEAR AT A TIME, 2: ALL YR)
	CTEST	(1)	CNTROL BLANK	OVERALL CONVERGENCE TEST (0: NOT, 1:CONVERGED)
	FCRL	(1)	CNTROL BLANK	FINAL CONVERGENCE AND REPORTING LOOP SWITCH (1=ON)
	NCRL	(1)	CNTROL BLANK	REPORTING LOOP SWITCH FOR EACH MODEL (1=ON)
	MACFDBK	(1)	CNTROL ON_OFF	MACROECONOMIC FEEDBACK SWITCH
	ELASSW	(1)	CNTROL ON_OFF	ELASTICITY SWITCH (0->OFF, 1->ON)
	DSMSWTC	(1)	CNTROL ON_OFF	DEM SIDE MGMT SWITCH(0->OFF,1->ON)
	DBDUMP	(1)	CNTROL ON_OFF	DATABASE DUMP/YR SW (0->OFF,1->ON) (DEF=0)
	MODELON	(1)	CNTROL ON_OFF	MODELS NEVER OFF SWITCH(0->OFF,1->ON)(DEF=0)
	ECPSTART	(1)	CNTROL ON_OFF	START YEAR FOR ECP MODULE (DEF=1)
	CMTST	(12,MMUNYR)	CNTROL BLANK	CONVERGENCE TEST FLAGS FOR EACH MODEL
	ITIMNG	(1)	CNTROL BLANK	TIMING SWITCH (ITIMNG=1 MEANS TIMING ON)
	YEARPR	(1)	CNTROL BLANK	FOR REPORTING, YEAR DOLLARS
	SCALPR	(1)	CNTROL BLANK	FOR REPORTING, DEFLATOR FOR YEARPR
	MORDER	(12)	CNTROL BLANK	MODULE EXECUTION ORDER
	PRTDBGW	(1)	CNTROL BLANK	PRINT DEBUG IN WORLD (INTERNATIONAL)
	PRTDBGN	(1)	CNTROL BLANK	PRINT DEBUG IN MAC (MACROECONOMIC)
	PRTDBGR	(1)	CNTROL BLANK	PRINT DEBUG IN RESD (RESIDENTIAL)
	PRTDBGK	(1)	CNTROL BLANK	PRINT DEBUG IN COMM (COMMERCIAL)
	PRTDBGI	(1)	CNTROL BLANK	PRINT DEBUG IN IND (INDUSTRIAL)
	PRTDBGT	(1)	CNTROL BLANK	PRINT DEBUG IN TRAN (TRANSPORTATION)
	PRTDBGE	(1)	CNTROL BLANK	PRINT DEBUG IN UTIL (UTILITY)
	PRTDBGC	(1)	CNTROL BLANK	PRINT DEBUG IN COAL (COAL SUPPLY)
	PRTDBGL	(1)	CNTROL BLANK	PRINT DEBUG IN MELL (OIL AND GAS SUPPLY)
	PRTDBGG	(1)	CNTROL BLANK	PRINT DEBUG IN PIPE (GAS TRANS.& DISTR.)
	PRTDBGO	(1)	CNTROL BLANK	PRINT DEBUG IN REFIN (PETROLEUM REFINERY)
	PRTDBGH	(1)	CNTROL BLANK	PRINT DEBUG IN RENEW (RENEWABLES)

* Refinery Module Output

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description

P99OUT			TYPE UNITS	7 Refinery revenues
	RFREV	(MMUNYR)	QUNTY tBTU	TOTAL PRODUCT SUPPLIED
	RFQPRDT	(MMUNCR,MMUNYR)	QUNTY tBTU	DOMESTIC TOTAL CRUDE MMBSL/YR/OGSN
	RFQDCRD	(15,MMUNYR)	QUNTY MMBSL	RF SPR FILL RATE
	RFSPRFR	(MMUNYR)	QUNTY tBTU	SPR IMPORTS
	RFSPRIM	(MMUNYR)	QUNTY tBTU	RF CAPITAL EXPENDITURES
	RFCAPEXP	(MMUNYR)	PRICE \$73\$BTU	SULFUR ALLOWANCES TONS/YR U.S. 35,000
	RF\$AL	(MMUNYR)	QUNTY tBTU	PRICE/QUANTITY OF MGL BY PADD FOR 6 MGL'S
	RF\$ONGL	(MMUNPR,MMUNYR, 6, 2)	QUNTY tBTU	QUANT. DOMESTIC OTHER INPUTS TO REFINERS MMBSL
	RF\$DINPOT	(MMUNPR,MMUNYR)	QUNTY tBTU	QUANT. OF PROCESSING GAINS MMBSL
	RF\$PRCG	(MMUNPR,MMUNYR)	QUNTY tBTU	GAS PLANT FUEL CONSUMED/TOTAL NG PRODUCTION
	PCTPLT PADD	(MMUNPR,MMUNYR)	QUNTY tBTU	DOMESTIC CRUDE WELHEAD PRICE
	DCRDWMP	(MMUNCR,MMUNYR)	PRICE \$73\$BL	EXPECTED DOMESTIC CRUDE WELHEAD PRICE
	XDCRDWMP	(MMUNCR,MMUNYR)	PRICE \$73\$BL	EXPECTED DOMESTIC CRUDE PRODUCTION
	XRFQDCRD	(MMUNCR,MMUNYR)	PRICE \$73\$BL	DOMESTIC TOTAL CRUDE (INCL EOR) MMBSL/YR/OGSN
	RFQDCRD	(15,MMUNYR)	QUNTY MMBSL	

* Refinery Module Parameters				

P99PARAM			TYPE UNITS	Gasoline share-Reformulated
	RF\$HRRF	(MMUNCR,MMUNYR)	PARAM BLANK	Gasoline share-Oxygenated
	RF\$HROK	(MMUNCR,MMUNYR)	PARAM BLANK	Gasoline share-oxygenated/reform
	RF\$HROK	(MMUNCR,MMUNYR)	PARAM BLANK	Gasoline share-?
	RF\$HRT	(MMUNCR,MMUNYR)	PARAM BLANK	Federal Diesel Tax Rate
	RF\$STAX	(MMUNYR)	PARAM BLANK	Switch reduction for dist fuel
	RF\$SDH	(1)	PARAM BLANK	

* Refinery Module Report Writer Variables				

P99RPT			TYPE UNITS	ELECTRICITY PURCHASED BY P
	RFELPURPD	(MMUNPR,MMUNYR)	QUNTY MKWH	COGEN CAP KWH/YR->CGRECAP
	RF\$GAPCD	(MMUNCR,MMUNYR)	QUNTY MKWH	COGEN CAPACITY KWH/YR BY P
	RF\$GAPPD	(MMUNPR,MMUNYR)	QUNTY MKWH	COGEN CAP KWH/YR BY PADD A
	RF\$GAPADDPD	(MMUNPR,MMUNYR)	QUNTY tBTU	REFINERY DISTILLATION CAPACITY
	RF\$DSTCAP	(MMUNPR,MMUNYR)	QUNTY tBTU	CAPACITY UTILIZATION RATE
	RF\$DSTUTL	(MMUNPR,MMUNYR)	QUNTY tBTU	IMPORT CRUDE-LO SULFUR LT(P,Q)
	RF\$POCLL	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORT CRUDE-MD SULFUR HWY
	RF\$POCHN	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORT CRUDE-HI SULFUR LT
	RF\$POCNL	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORT CRUDE-HI SULFUR HWY
	RF\$POCHN	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORT CRUDE-HI SULFUR V HWY
	RF\$POCHV	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS MOTOR GASOLINE(P,Q)
	RF\$PONG	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS DISTILLATE (P,Q)
	RF\$PODS	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS LO SULFUR RESID (P,Q)
	RF\$PORL	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS HI SULFUR RESID (P,Q)
	RF\$PORH	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS JET FUEL (P,Q)
	RF\$POJF	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS LPG (P,Q)
	RF\$POLG	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	IMPORTS METHANOL (P,Q)
	RF\$PQNE	(MMUNPR,MMUNYR, 2)	QUNTY BBL/DA	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	RFIPONT	(MMUNPR,MMUNYR, 2)	QUNTY DBL/DA	IMPORTS NTBE(P,0)
	RFINCR	(MMUNPR,MMUNYR)	QUNTY tSTU	1 Crude net imports
	RFINTP	(MMUNPR,MMUNYR)	QUNTY tSTU	2 Total prod net imports
	RFGNG	(MMUNCR,MMUNYR)	QUNTY tSTU	REFORMULATED /
	RFGDS	(MMUNCR,MMUNYR)	QUNTY tSTU	DISTILLATE FUEL OIL --> GDSAS (MMUNCR, MMUNYR)
	RFQJF	(MMUNCR,MMUNYR)	QUNTY tSTU	JET FUEL --> GJFTR (MMUNCR, MMUNYR)
	RFQRL	(MMUNCR,MMUNYR)	QUNTY tSTU	RESIDUAL FUEL OIL LOW SULFUR --> GRLAS (CR,YR)
	RFORM	(MMUNCR,MMUNYR)	QUNTY tSTU	RESIDUAL FUEL OIL HIGH SULFUR --> GRHAS (CR,YR)
	RFQLG	(MMUNCR,MMUNYR)	QUNTY tSTU	LPG --> GLGAS (MMUNCR, MMUNYR)
	RFQPF	(MMUNCR,MMUNYR)	QUNTY tSTU	PETROCHEMICAL FEED STOCKS --> GPFIN (CR,YR)
	RFQKS	(MMUNCR,MMUNYR)	QUNTY tSTU	KEROSENE --> GKSAS (MMUNCR, MMUNYR)
	RFQOTH	(MMUNCR,MMUNYR)	QUNTY tSTU	OTHER --> GOTAS (MMUNCR, MMUNYR)
	RFQARO	(MMUNCR,MMUNYR)	QUNTY tSTU	QUANTITY OF ASPHALT AND ROAD OIL
	RFQSTG	(MMUNCR,MMUNYR)	QUNTY tSTU	QUANTITY OF STILL GAS
	RFQPCCK	(MMUNCR,MMUNYR)	QUNTY tSTU	QUANTITY OF PETROLEUM COKE
	RFQIPRODT	(MMUNPR,MMUNYR, 2)	QUNTY tSTU	TOTAL PRODUCT IMPORTED
	RFQEXPRODT	(MMUNPR,MMUNYR)	QUNTY tSTU	CRUDE EXPORTED
	RFQEXCRD	(MMUNPR,MMUNYR)	QUNTY tSTU	CRUDE EXPORTED
	RFQICRD	(MMUNPR,MMUNYR, 2)	QUNTY DBL/DA	IMPORTED TOTAL CRUDE MMBBL/PADD
	RFQOUFC	(MMUNPR,MMUNYR, 2)	QUNTY tSTU	TOTAL IMPORTS OF UNFINISHED REF MOD OUTPUT COMM
	RFQIN	(MMUNYR)	QUNTY tSTU	INDUSTRIAL PRDS
	RFQTR	(MMUNYR)	QUNTY tSTU	TRANSP. PRDS
	RFQRC	(MMUNYR)	QUNTY tSTU	RESID/COMM.PRDS
	RFQEL	(MMUNYR)	QUNTY tSTU	UTILITY PRDS
	RFQSECT	(MMUNYR)	QUNTY tSTU	TOTAL SECT.PRDS
	RFQPRDLPG	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; LPG
	RFQPRDTRG	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; MOTOR GASOLINE
	RFQPRDRFG	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; REFORMULATED MOGAS
	RFQPRDTRH	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; HIGH OXYGENATED MOGAS
	RFQPRDRFH	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; REFORM HI OXYG MOGAS
	RFQPRDJTA	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; JET FUEL
	RFQPRDKER	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; KEROSENE
	RFQPRDNZN	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; NO. 2 DISTILLATE
	RFQPRDN6I	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; LO SULFUR RESID OIL
	RFQPRDN6S	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; HI SULFUR RESID OIL
	RFQPRDOTH	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; OTHER PETROLEUM
	RFQPRDPCF	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; PETROCHEM FEEDSTOCKS
	RFQPRDAST	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; ASPHALT & ROAD OIL
	RFQPRDOSL	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; LOW SULFUR DIESEL
	RFQPRDSTG	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; STILL GAS
	RFQPRDCOK	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF PRD; PETROLEUM COKE
	RFQSCUM	(MMUNPR,MMUNYR)	QUNTY tDBL/D	REF CLM CAP EXPANSION
	RFQDSTCAP	(MMUNPR,MMUNYR)	QUNTY DBL/DA	REF BASE DISTILLATION CAPACITY

* Oil & Gas Module Output				

OG3NOUT			TYPE UNITS	NA dry gas reserves onshore
OGRESNGON	(17,MMUNYR)		QUNTY BCF	NA dry gas p/r ratio onshore
OGPRRNGON	(17,MMUNYR)		PARAM SCALAR	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	OGELSNQON	(17,MMUNYR)	PARAM SCALAR	NA dry gas prod fcn param onshr
	OGRESNGOF	(3,MMUNYR)	QUNTY BCF	NA dry gas reserves offshore
	OGPRRNGOF	(3,MMUNYR)	PARAM SCALAR	NA dry gas p/r ratio onshore
	OGELSNQOF	(3,MMUNYR)	PARAM SCALAR	NA dry gas prod fcn param offshr
	OGSPEND	(MMUNYR)	QUNTY BLANK	TOTAL NATIONAL EXPENDITURES
	OGELSCO	(MMUNOR,MMUNYR)	QUNTY BLANK	OIL ELASTICITY
	OGPRRCO	(MMUNOR,MMUNYR)	QUNTY SCALAR	OIL P/R RATIO
	OGRESCO	(MMUNOR,MMUNYR)	QUNTY MMDBL	OIL RESERVES (BILL. BARRELS)
	OGONGEXP	(MMUNEX,MMUNYR)	QUNTY BCF	NG EXPORTS (BILL. CU FT)
	OGONGIMP	(MMUNEX,MMUNYR)	QUNTY BCF	NG IMPORTS (BILL. CU FT)
	OGNGEXP	(MMUNEX,MMUNYR)	PRICE 87\$MCF	NG PRICE EXPORTS (\$ / MMCF)
	OGNGIMP	(MMUNEX,MMUNYR)	PRICE 87\$MCF	NG PRICE IMPORTS (\$ / MMCF)
	OGPCRVMP	(MMUNYR)	QUNTY 87\$DBL	CRUDE AVG WELHEAD PRICE
	OGGCRREP	(NOGCRO,MMUNYR)	QUNTY MMDBL	CRUDE PRODUCTION BY OIL CAT
	OGGCRRSV	(MMUNYR)	QUNTY MMDBL	CRUDE RESERVES
	OGNGMMP	(MMUNYR)	QUNTY 87\$MCF	NG AVG WELHEAD PRICE
	OGNGREP	(NOGCAT,MMUNYR)	QUNTY BCF	NG PRODUCTION BY GAS CAT
	OGNGRSV	(MMUNYR)	QUNTY BCF	NG RESERVES
	OGNOMELL	(MMUNYR)	QUNTY SCALAR	MELLS COMPLETED
	OGTECHON	(3, 6,MMUNYR)	QUNTY SCALAR	TECH FACTORS BY COSTCAT/FUEL/YEAR
	OGELSCAN	(2,MMUNYR)	QUNTY SCALAR	(BETA) PRICE ELASTICITY (1=OIL,2=NG).
	OGPRRCAN	(2,MMUNYR)	QUNTY SCALAR	(OMEGA) GAS EXTRACTION RATE; P/R RATIOS.
	OGRESCAN	(2,MMUNYR)	QUNTY SCALAR	(R) END-OF-YEAR RESERVES.
	OGCNPPO	(2,MMUNYR)	QUNTY SCALAR	CANADIAN PRODUCTION OF OIL & GAS
	OGCNPPO	(2,MMUNYR)	QUNTY SCALAR	CANADIAN PRICE OF OIL & GAS
	OGCNPARN1	(1)	QUNTY SCALAR	(ALPHA) ACTUAL GAS ALLOCATION FACTOR.
	OGCNPARN2	(1)	QUNTY SCALAR	(Y) RESPONSIVENESS OF FLOW TO DIFF IN BRDR PRC
	OGADFACT	(1)	QUNTY SCALAR	AD GAS FACTOR (BCF/MMB)
	OGDIFWOP	(1)	QUNTY SCALAR	CANADA WORLD OIL->WELHND PRC DIFFERENTIAL
	OGCNDEN	(3)	QUNTY SCALAR	CANADIAN DEMAND CALCULATION PARAMETERS
	OGCNCAP	(6,MMUNYR)	QUNTY SCALAR	CANADIAN CAPACITIES AT BORDER CROSSING
	OGCNFLW	(6)	QUNTY SCALAR	INITIAL FLOW RATES AT BORDER CROSSING
	OGCNBLOSS	(6)	QUNTY SCALAR	GAS LOST IN TRANSIT TO BORDER
	OGCNEXLOSS	(1)	QUNTY SCALAR	GAS LOST FROM US EXPORT TO CANADA DEMAND
	OGCNDWLOSS	(1)	QUNTY SCALAR	GAS LOST FROM WELL HEAD TO CANADA DEMAND
	OGCNPMAKUP	(6)	QUNTY SCALAR	TRANSPORTATION MARK-UP AT BORDER
	OGONGSAIOK	(MMUNYR)	QUNTY SCALAR	MAXIMUM PRODUCTION LIMIT OF SOUTH ALASKA
	OGGEORCON	(6,MMUNYR)	QUNTY SCALAR	CRUDE OIL CONSUMPTION FOR EOR BY REGION
	OGGEORPR	(6,MMUNYR)	QUNTY SCALAR	CRUDE OIL SUPPLY FROM EOR BY REGION
	OGGEORNGC	(6, 2,MMUNYR)	QUNTY SCALAR	NG CONSUMPTION FOR EOR PROD BY REGION/USE
	OGGEORNGP	(6,MMUNYR)	QUNTY SCALAR	NG (COPRODUCT) PRODUCTION FROM EOR
	OGGEORCOG	(6, 2,MMUNYR)	QUNTY SCALAR	COGEN ELEC CAPACITY FROM EOR BY REGION/USE
	OGGEORCOG	(6, 2,MMUNYR)	QUNTY SCALAR	COGEN ELEC GENERATION FROM EOR BY REGION/USE
	OGGANGTS	(MMUNYR)	QUNTY BCF	GAS FLOW AT U.S. BORDER FROM ANGTS
	OGANGTSRK	(MMUNYR)	QUNTY BCF	MAX KNOWN FLOW IN CURRENT YR (BCF)
	OGCHCON	(2,MMUNYR)	QUNTY BCF	CANADIAN GAS CONSUMPTION
	OGGLNGMAX	(4,MMUNYR)	QUNTY BCF	MAX FORESEEABLE LNG REGAS FLOWS
	OGCORSV	(NOGCRO,MMUNYR)	QUNTY MMDBL	CRUDE RESERVES BY OIL CATEGORY
	OGNGRSV	(NOGCAT,MMUNYR)	QUNTY BCF	NG RESERVES BY GAS CATEGORY

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	OGCOPRO	(NOGRGN,MNUNYR)	QUNTY MMBL	CRUDE PRODUCTION BY OIL CATEGORY
	OGNGPRO	(NOGRGN,MNUNYR)	QUNTY BCF	NG PRODUCTION BY GAS CATEGORY
	OGCOMP	(NOGRGN,MNUNYR)	PRICE \$73MBL	CRUDE WELLHEAD PRICE BY OIL CATEGORY
	OGNGMP	(NOGRGN,MNUNYR)	PRICE \$73MCF	NG WELLHEAD PRICE BY GAS CATEGORY
	EXSPEND	(NOGDTF,MNUNYR)	PRICE \$875	EXPLORATORY EXPENDITURES
	DVSPEND	(NOGDTF,MNUNYR)	PRICE \$875	DEVELOPMENT EXPENDITURES
	EXOILFT	(NOGDTF,MNUNYR)	QUNTY MILL	OIL FOOTAGE (EXPL.)
	DVOILFT	(NOGDTF,MNUNYR)	QUNTY MILL	OIL FOOTAGE (DEV.)
	EXGASFT	(NOGDTF,MNUNYR)	QUNTY MILL	GAS FOOTAGE (EXPL.)
	DVGASFT	(NOGDTF,MNUNYR)	QUNTY MILL	GAS FOOTAGE (DEV.)
	EXDRYFT	(NOGDTF,MNUNYR)	QUNTY MILL	DRY FOOTAGE (EXPL.)
	DVDRYFT	(NOGDTF,MNUNYR)	QUNTY MILL	DRY FOOTAGE (DEV.)
	EXFTAGE	(NOGDTF,MNUNYR)	QUNTY MILL	TOTAL FOOTAGE (EXPL.)
	DVFTAGE	(NOGDTF,MNUNYR)	QUNTY MILL	TOTAL FOOTAGE (DEV.)
	FNGINPORT	(NFMGSS,MNUNYR)	QUNTY BCF	NG IMPORTS
	FNSEXPORT	(NFMGSS,MNUNYR)	QUNTY BCF	NG EXPORTS
	FNGINPI C	(NFMGSS,MNUNYR)	QUNTY \$73MCF	IMPORT PRICES

* Natural Gas Transmission & Distribution Module Output				

NGTDHOUT			TYPE UNITS	
OGPRDNGON	(17,MNUNYR)		QUNTY BCF	NA DRY GAS PROD ONSHORE (BCF)
OGPRDNGOF	(3,MNUNYR)		QUNTY BCF	NA DRY GAS PROD OFFSHORE (BCF)
PRNG PADO	(MNUNYR,MNUNYR)		QUNTY BCF	TOT DRY GAS PRODUCTION (BCF) W/L&P
PGFELGR	(21,MNUNYR)		PRICE \$738TU	E UTIL FIRM NG PRICE (T BTU)
PGIELGR	(21,MNUNYR)		PRICE \$738TU	E UTIL INTERRUPTIBLE NG PRICE (T BTU)
POCELGR	(21,MNUNYR)		PRICE \$738TU	E UTIL COMPETITIVE NG PRICE (T BTU)
CLSYNGMP	(17,MNUNYR)		PRICE \$738TU	SYNTHETIC NG PRICE FROM COAL

* Natural Gas Transmission & Distribution report Writer outputs				

NGTDHREP			TYPE UNITS	
OGMPRNG	(MNUNYR,MNUNYR)		PRICE \$73MCF	NG WELLHEAD PRICE (\$73/MCF)
OGIMNGP	(MNUNYR)		QUNTY BCF	NET IMPORTS - PIPELINE NG
OGIMLNG	(MNUNYR)		QUNTY BCF	NET IMPORTS OF LNG
OGPRSUP	(MNUNYR)		QUNTY BCF	TOTAL SUPPLEMENTAL GAS (STN+OTH)
OGPRDNG	(MNUNYR,MNUNYR)		QUNTY BCF	DOMESTIC DRY NG PRODUCTION
OGIMEX	(MNUNYR)		QUNTY BCF	NET IMPORTS OF MEX NG
OGIMCAN	(MNUNYR)		QUNTY BCF	NET IMPORTS OF CAN NG
NGSTRCAP	(24,MNUNYR)		QUNTY MCF	NG UNDERGROUND STORAGE CAPACITY
NGPIPCAP	(2,MNUNYR)		QUNTY BCF	NG PIPELINE CAPACITY - NATIONAL
OGMSUP3	(3,MNUNYR)		QUNTY BCF	SUPPLEMENTAL NG SUBCATEGORIES

* Utility EFP Module Output				

UEFPOUT			TYPE UNITS	
PELAY	(MNUNYR,MNUNYR)		PRICE \$73KWH	Utility avoided costs
PELCP	(MNUNYR,MNUNYR)		PRICE \$73KWH	Capital component of price
PELFL	(MNUNYR,MNUNYR)		PRICE \$73KWH	Fuel component of price

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	PELON	(MOLMCR,MOLMYR)	PRICE 87\$KWH	OGM component of price
	PELW	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Wholesale Electricity Price
	PELTL	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Total price
* Utility	EFM Module Output			
* Utility	EFOUT		TYPE UNITS	
	PEPRSNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Peak. Res. by MERC
	PEPCNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Peak. Com. by MERC
	PEPTRNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Peak. Trans. by MERC
	PEPINNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Peak. Ind. by MERC
	PEPASNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Peak. All by MERC
	PENRSNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Nonpk. Res. by MERC
	PENCRNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Nonpk. Com. by MERC
	PENTRNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Nonpk. Trans. by MERC
	PENINNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Nonpk. Ind. by MERC
	PENASNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec, Nonpk. All by MERC
	PELRSNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec. Res. by MERC
	PELCNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec. Com. by MERC
	PELTRNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec. Trans. by MERC
	PELINNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec. Ind. by MERC
	PELASNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Pur. Elec. All Sectors by MERC
	PELCPNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Capital Component by MERC
	PELFLNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Fuel Component by MERC
	PELOPNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	OGM Component by MERC
	PELWNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	WHOLESALE Component by MERC
	PELTLNR	(MOLMCR,MOLMYR)	PRICE 87\$KWH	Avg--All Components by MERC
* Utility	EFD Module Output			
* Utility	UEFDOUT		TYPE UNITS	
	UGNCLNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Coal Gen by Ownership Type/MERC
	UGNGFNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Gas (Firm) Gen by Ownership Type/MERC
	UGNGINR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Gas (Int.) Gen by Ownership Type/MERC
	UGNGCNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Gas (Comp.) Gen by Ownership Type/MERC
	UGNDSNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	DS Gen by Ownership type/MERC
	UGNRLNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	RL Gen by Ownership type/MERC
	UGNRNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	RN Gen by Ownership type/MERC
	UGNURNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Nuc Gen by Ownership type/MERC
	UGNPSNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	PS Gen by Ownership type/MERC
	UGNHYNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Hyd (Not PS) Gen by Ownership type/MERC
	UGNGENR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Geothermal Gen by Ownership type/MERC
	UGNPSNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	MSW Gen by Ownership type/MERC
	UGNDONR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Wind Gen by Ownership type/MERC
	UGNSONR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Solar Gen by Ownership type/MERC
	UGNPVNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Photovoltaic Gen by Ownership type/MERC
	UGNWRNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Wind Gen by Ownership type/MERC
	UGNHONR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Hyd/Oth Gen by Ownership type/MERC
	UGNTLNR	(2,MOLMCR,MOLMYR)	QUNTY MCKW	Tot. Gen by Ownership Type/MERC

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	UPRCLNR	(MILPWR, MILMYR)	PRICE 873KWH	Coal Price by Ownership Type/MERC
	UPRGFNR	(MILPWR, MILMYR)	PRICE 873KWH	Gas (Firm) Price by Ownership Type/MERC
	UPRGINR	(MILPWR, MILMYR)	PRICE 873KWH	Gas (Int.) Price by Ownership Type/MERC
	UPRGCHNR	(MILPWR, MILMYR)	PRICE 873KWH	Gas (Comp) Price by Ownership Type/MERC
	UPROSNR	(MILPWR, MILMYR)	PRICE 873KWH	DS Price by Ownership Type/MERC
	UPRRLNR	(MILPWR, MILMYR)	PRICE 873KWH	RL Price by Ownership Type/MERC
	UPRRHNR	(MILPWR, MILMYR)	PRICE 873KWH	RH Price by Ownership Type/MERC
	UPRURNR	(MILPWR, MILMYR)	PRICE 873KWH	Muc Price by Ownership Type/MERC
	UPRCHNR	(MILPWR, MILMYR)	PRICE 873KWH	Ren. Price by Ownership Type/MERC
	UTSO2	(MILPWR, MILMYR)	QUNTY MCKWH	Total SO2 Emissions by MERC
	UTNOK	(MILPWR, MILMYR)	QUNTY MCKWH	Total NOK Emissions by MERC
	UTC02	(MILPWR, MILMYR)	QUNTY MCKWH	Total CO2 Emissions by MERC
	URETTLU	(MILPWR, MILMYR)	QUNTY MCKWH	Util Total Retirements by Merc
	UGNUSCR	(MILPWR, MILMYR)	QUNTY MCKWH	Util BUR Nuclear gener. by CENSUS
	UGNUPCR	(MILPWR, MILMYR)	QUNTY MCKWH	Util PUR Nuclear gener. by CENSUS
	GBCELNR	(NDREGN, MILMYR)	QUNTY MCKWH	VLS Bit Coal consumption by Coal Reg
	GBDELNR	(NDREGN, MILMYR)	QUNTY MCKWH	LS Bit Coal consumption by Coal Reg
	GBNELNR	(NDREGN, MILMYR)	QUNTY MCKWH	MS Bit Coal consumption by Coal Reg
	GBHCLNR	(NDREGN, MILMYR)	QUNTY MCKWH	NS Bit Coal consumption by Coal Reg
	GBCELNR	(NDREGN, MILMYR)	QUNTY MCKWH	VLS Sub Coal consumption by Coal Reg
	GBDELNR	(NDREGN, MILMYR)	QUNTY MCKWH	LS Sub Coal consumption by Coal Reg
	GBNELNR	(NDREGN, MILMYR)	QUNTY MCKWH	MS Sub Coal consumption by Coal Reg
	GBHCLNR	(NDREGN, MILMYR)	QUNTY MCKWH	NS Sub Coal consumption by Coal Reg
	GLCELNR	(NDREGN, MILMYR)	QUNTY MCKWH	VLS Lig Coal consumption by Coal Reg
	GLDELNR	(NDREGN, MILMYR)	QUNTY MCKWH	LS Lig Coal consumption by Coal Reg
	GLNELNR	(NDREGN, MILMYR)	QUNTY MCKWH	MS Lig Coal consumption by Coal Reg
	GLHCLNR	(NDREGN, MILMYR)	QUNTY MCKWH	NS Lig Coal consumption by Coal Reg
	OSTELNR	(NDREGN, MILMYR)	QUNTY MCKWH	1-4 Bit Coal consumption by Coal Reg
	OSTELNR	(NDREGN, MILMYR)	QUNTY MCKWH	5-7 Sub Coal consumption by Coal Reg
	OLTELNR	(NDREGN, MILMYR)	QUNTY MCKWH	9-12 Lig Coal consumption by Coal Reg
	OGFELGR	(21, MILMYR)	QUNTY MCKWH	NG "firm" consumption by NGTDM
	OGIELGR	(21, MILMYR)	QUNTY MCKWH	NG "inter" consumption by NGTDM
	OGCELGR	(21, MILMYR)	QUNTY MCKWH	NG "compet" consumption by NGTDM
* Utility DAT Module Output				
UDATOUT			TYPE UNITS	
UCAPCSU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Coal Steam Capacity by MERC
UCAPOSU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Other Steam Capacity by MERC
UCAPCCU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Combined Cycle Capacity by MERC
UCAPCTU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Combustion Turb. Capacity by MERC
UCAPNUU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Nuclear Capacity by MERC
UCAPPSU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Pump Storage Capacity by MERC
UCAPHYU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Convention Hydro Cap by MERC
UCAPGEU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Geothermal Capacity by MERC
UCAPRSU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util MSW Capacity by MERC
UCAPUDU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Biomass/Wood Capacity by MERC
UCAPSTU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Solar Thermal Capacity by MERC
UCAPPVU	(MILPWR, MILMYR)	QUNTY	CHMATT	Util Photovoltaic Capacity by MERC

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	UCAPWU	(MNUHR,MNUYR)	QUNTY TMAATT	Util Wind Capacity by MERC
	UCAPRU	(MNUHR,MNUYR)	QUNTY TMAATT	Util Renewable (exclud PS) Cap by MERC
	UCAPTLU	(MNUHR,MNUYR)	QUNTY TMAATT	Util Total Capacity by MERC
	UCAPCSN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Coal Steam Capacity by MERC
	UCAPOSH	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Other Steam Capacity by MERC
	UCAPCCN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Combined Cycle Cap by MERC
	UCAPCTN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Comb Turb. Capacity by MERC
	UCAPNUJ	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Nuclear Capacity by MERC
	UCAPPSN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Pump Storage Capacity by MERC
	UCAPHYN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Convention Hydro Cap by MERC
	UCAPGEN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Geothermal Capacity by MERC
	UCAPHSN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil MSW Capacity by MERC
	UCAPMDN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Biomass/Wood Capacity by MERC
	UCAPSTN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Solar Thermal Capacity by MERC
	UCAPPVN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Photovoltaic Capacity by MERC
	UCAPWUN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Wind Capacity by MERC
	UCAPRUW	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Renewable (ex PS) Cap by MERC
	UCAPTLN	(MNUHR,MNUYR)	QUNTY TMAATT	NonUtil Total Capacity by MERC

* Utility ECP Module Output				

UECPOUT			TYPE UNITS	
UADDCSU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util coal steam additions by Merc
UADDOSU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util other steam additions by Merc
UADDCCU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util combined cycle additions by Merc
UADDOCTU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util comb. turb. additions by Merc
UADONJU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util nuclear additions by Merc
UADDRNU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util hydro additions by Merc
UADDPNU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util pump storage additions by Merc
UADDTLU	(2,MNUHR,MNUYR)	QUNTY TMAATT		Util total additions by Merc
UADDCSN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS coal additions by Merc
UADDOCN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS gas additions by Merc
UADDOCN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS oil additions by Merc
UADDOCN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS hydro additions by Merc
UADDOCTN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS other additions by Merc
UADONUN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS total additions by Merc
UADDRNN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS total additions by Merc
UADOPSN	(2,MNUHR,MNUYR)	QUNTY TMAATT		MUGS total additions by Merc
UADDTLN	(2,MNUHR,MNUYR)	QUNTY TMAATT		Exp. Avoided EL cost by Merc
XPELAVN	(MNUHR,MECPYR)	QUNTY TMAATT		Total hydro additions by Merc
UADHYT	(MNUHR,MECPYR)	QUNTY TMAATT		Tot Geoth. Additions by Merc
UADGET	(MNUHR,MECPYR)	QUNTY TMAATT		Tot MSW additions by Merc
UADHST	(MNUHR,MECPYR)	QUNTY TMAATT		Tot wood additions by Merc
UADHDT	(MNUHR,MECPYR)	QUNTY TMAATT		Tot solar th. additions by Merc
UADSTT	(MNUHR,MECPYR)	QUNTY TMAATT		Tot PV additions by Merc
UADPYT	(MNUHR,MECPYR)	QUNTY TMAATT		Tot wind additions by Merc
UADUNT	(MNUHR,MECPYR)	QUNTY TMAATT		Tot pump stor. additions by Merc
UADOPST	(MNUHR,MECPYR)	QUNTY TMAATT		

* LDSN Module Output				

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description

ULDSHOUT			TYPE UNITS	DSM Energy Savings--Merc (Mkwh)
	ULDSHRC	(MNUIMR, MNUIMYR)	QUANTITY MKWH	DSM Capacity Savings--Merc (Mkwh)
	ULDSHAP	(MNUIMR, MNUIMYR)	QUANTITY MKWH	DSM Expenditures--Merc (M\$)
	ULDSHXP	(MNUIMR, MNUIMYR)	QUANTITY MKWH	

* Utility	ETT Module Output			

UETTOUT			TYPE UNITS	Domestic Firm Power Sales--Merc (Mkwh)
	UTDMHF	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Domestic Economy Sales--Merc (Mkwh)
	UTDMHE	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Domestic Firm Power Sales--Merc (M\$)
	UTDMDF	(MNUIMR, MNUIMYR)	QUANTITY M\$7S	Domestic Economy Sales--Merc (M\$)
	UTDMDE	(MNUIMR, MNUIMYR)	QUANTITY M\$7S	Firm Power Imports--Merc (Mkwh)
	UTIMPF	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Economy Power Imports--Merc (Mkwh)
	UTIMPE	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Firm Power Exports--Merc (Mkwh)
	UTEXPF	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Economy Power Exports--Merc (Mkwh)
	UTEXPE	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Gross Dom. Firm Power --Merc (Mkwh)
	UTEXHF	(MNUIMR, MNUIMYR)	QUANTITY MKWH	Gross Dom. Economy Sales--Merc (Mkwh)
	UTEXHE	(MNUIMR, MNUIMYR)	QUANTITY M\$7S	Gross Dom. Firm Power --Merc (M\$)
	UTEXDF	(MNUIMR, MNUIMYR)	QUANTITY M\$7S	Gross Dom. Economy Sales--Merc (M\$)
	UTEXDE	(MNUIMR, MNUIMYR)	QUANTITY M\$7S	

* UGOIL Electricity Market	Module Output			

UGOILOUT			TYPE UNITS	LS RESID PRC FOR D-F PLANTS
	PRLELCR	(MNUIMR, MNUIMYR)	PRICE \$7SKWH	NS RESID PRC FOR D-F PLANTS
	PRNELCR	(MNUIMR, MNUIMYR)	PRICE \$7SKWH	LS RESID USE IN D-F PLANTS
	ORLELCR	(21, MNUIMYR)	QUANTITY MKWH	NS RESID USE IN D-F PLANTS
	ORNELCR	(21, MNUIMYR)	QUANTITY MKWH	MIN GAS USE IN D-F PLANTS
	GSHRMIN	(21, MNUIMYR)	QUANTITY MKWH	G/O PRC RATIO AT MIN USE
	GRATHIN	(21, MNUIMYR)	QUANTITY MKWH	MAX GAS USE IN D-F PLANTS
	GSHRMAX	(21, MNUIMYR)	QUANTITY MKWH	G/O PRC RATIO AT MAX USE
	GRATHMAX	(21, MNUIMYR)	QUANTITY MKWH	PAR GAS USE IN D-F PLANTS
	GSHRPAR	(21, MNUIMYR)	QUANTITY MKWH	G/O PRC RATIO AT PAR USE
	GRATPAR	(21, MNUIMYR)	QUANTITY MKWH	

* Coal Module Output				

COALOUT			TYPE UNITS	Coal transportation ton-miles
	COIN TH	(MNUIMR, MNUIMYR)	QUANTITY TON ML	Supply of coal liquids
	COPRCLQ	(MNUIMR, MNUIMYR)	QUANTITY tBTU	Supply of coal gases
	COPRCLG	(MNUIMR, MNUIMYR)	QUANTITY tBTU	Coal exports
	COIN	(MNUIMR, CLTYPE, MNUIMYR)	QUANTITY tBTU	Coal export prices
	COIMP	(MNUIMR, CLTYPE, MNUIMYR)	PRICE \$7SBTU	Delivered costs of coal liquids
	COCCLO	(MNUIMR, MNUIMYR)	PRICE \$7SBTU	Delivered costs of coal gases
	COCCLG	(MNUIMR, MNUIMYR)	PRICE \$7SBTU	Coal supply curves
	COBUPC	(MNUIMR, CLTYPE, MNUIMYR)	QUANTITY tBTU	Utility Coal price
	COELPRC	(CLTYPE, MNUIMYR)	PRICE \$7SBTU	Synthetic NG Price from Coal
	CLSTNGPR	(17, MNUIMYR)	PRICE \$7SBTU	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
CLSTNGGN	(17,MNUNYR)	QUANTITY	18TU	Synthetic NS quantity
COS88	(3,MNUNYR)	QUANTITY	18TU	Coal Prod (East,West Mias)
COS8T	(3,MNUNYR)	PARAM	SCALAR	Coal Conv Factor for Prod
CPS8	(3,MNUNYR)	PRICE	8798TU	Coal Minemouth Price
COS8FT	(MNUNCR, 6,MNUNYR)	PARAM	SCALAR	Coal Conv Factor for Cons
COS8FB	(MNUNCR, 6,MNUNYR)	QUANTITY	18TU	Imports, Exports, Stock Changes
PBCELNR	(NDREGN,MNUNYR)	PRICE	8798TU	VLS BIT COAL PRICE BY MERC
PBDELNR	(NDREGN,MNUNYR)	PRICE	8798TU	LS BIT COAL PRICE BY MERC
PBNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS BIT COAL PRICE BY MERC
PBNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS BIT COAL PRICE BY MERC
PSCELNR	(NDREGN,MNUNYR)	PRICE	8798TU	VLS SUB COAL PRICE BY MERC
PSDELNR	(NDREGN,MNUNYR)	PRICE	8798TU	LS SUB COAL PRICE BY MERC
PSNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS SUB COAL PRICE BY MERC
PSNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS SUB COAL PRICE BY MERC
PLCELNR	(NDREGN,MNUNYR)	PRICE	8798TU	VLS LIG COAL PRICE BY MERC
PLDELNR	(NDREGN,MNUNYR)	PRICE	8798TU	LS LIG COAL PRICE BY MERC
PLNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS LIG COAL PRICE BY MERC
PLNELNR	(NDREGN,MNUNYR)	PRICE	8798TU	NS LIG COAL PRICE BY MERC
BSCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS BIT COAL BTU FACT. BY MERC
BSDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS BIT COAL BTU FACT. BY MERC
BSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS BIT COAL BTU FACT. BY MERC
BSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS BIT COAL BTU FACT. BY MERC
BSCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS SUB COAL BTU FACT. BY MERC
BSDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS SUB COAL BTU FACT. BY MERC
BSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS SUB COAL BTU FACT. BY MERC
BSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS SUB COAL BTU FACT. BY MERC
BLCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS LIG COAL BTU FACT. BY MERC
BLDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS LIG COAL BTU FACT. BY MERC
BLNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS LIG COAL BTU FACT. BY MERC
BLNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS LIG COAL BTU FACT. BY MERC
SSCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS BIT COAL SULF. FACT. BY MERC
SSDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS BIT COAL SULF. FACT. BY MERC
SSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS BIT COAL SULF. FACT. BY MERC
SSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS BIT COAL SULF. FACT. BY MERC
SSCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS SUB COAL SULF. FACT. BY MERC
SSDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS SUB COAL SULF. FACT. BY MERC
SSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS SUB COAL SULF. FACT. BY MERC
SSNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS SUB COAL SULF. FACT. BY MERC
SLCELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	VLS LIG COAL SULF. FACT. BY MERC
SLDELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	LS LIG COAL SULF. FACT. BY MERC
SLNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS LIG COAL SULF. FACT. BY MERC
SLNELNR	(NDREGN,MNUNYR)	LEVEL	SCALAR	NS LIG COAL SULF. FACT. BY MERC

* Coal Module Report				

COALREP			TYPE UNITS	COAL DISTRIBUTION
COALPROD	(MNUNCR,MNUNLR,MNUNYR)	QUANTITY	8ETONS	COAL DISTRIBUTION INCLUDING EXPORTS
COALPROD2	(MNUNCR,MNUNLR,MNUNYR)	QUANTITY	8ETONS	COAL IMPORTS
COALIMP	(MNUNCR,MNUNYR)	QUANTITY	8ETONS	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	COALPRICE	(MMBBLR,MMUNYR)	PRICE \$/TON	COAL PRICE
	ABSULF	(4,MMUNYR)	QUNTY MTONS	Appalachia Bituminous Coal
	ALSULF	(4,MMUNYR)	QUNTY MTONS	Appalachia Lignite Coal
	IBSULF	(4,MMUNYR)	QUNTY MTONS	Interior Bituminous Coal
	ILSULF	(4,MMUNYR)	QUNTY MTONS	Interior Lignite Coal
	WBSULF	(4,MMUNYR)	QUNTY MTONS	West Bituminous Coal
	WSSULF	(4,MMUNYR)	QUNTY MTONS	West Sub-Bituminous Coal
	WLSULF	(4,MMUNYR)	QUNTY MTONS	West Lignite Coal
	WSCF	(4, 10, 6)	QUNTY MTONS	Steam Coal World Flow
	WSCF	(4, 10, 6)	QUNTY MTONS	Metallurgical Coal World Flow
	WTCF	(4, 10, 6)	QUNTY MTONS	Total Coal World Flow

* Industrial Module Output				

INDOUT			TYPE UNITS	
	INGNELMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility generation of electricity
	INGELMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility electricity sales to the grid
	INCAELMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility capacity
	INGNGMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility consumption: NG
	INGCLMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility consumption: Steam Coal
	INGREMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility consumption: Residual oil
	INGOMMU	(MMUNCR,MMUNYR)	QUNTY tBTU	Nonutility consumption: Biomass
	INGOMRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Biomass
	INGMYRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Hydro
	INGOSRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Solar
	INGOWRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Wind
	INGOGRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Geothermal
	INGOTRN	(MMUNCR,MMUNYR)	QUNTY tBTU	Consumption of renewables: Other

* Industrial Module Report				

INDREP			TYPE UNITS	
	MANHP	(12,MMUNYR)	QUNTY tBTU	MFG, HEAT & POWER
	NONHP	(8,MMUNYR)	QUNTY tBTU	NON-MFG, HEAT & POWER
	MISCFD	(6,MMUNYR)	QUNTY tBTU	PAPER INDUSTRY CONSUMPTION
	FOODCON	(8,MMUNYR)	QUNTY tBTU	FOOD INDUSTRY CONSUMPTION
	PAPERCON	(8,MMUNYR)	QUNTY tBTU	PAPER INDUSTRY CONSUMPTION
	CHEMCON	(8,MMUNYR)	QUNTY tBTU	CHEMICAL INDUSTRY CONSUMPTION
	GLASSCON	(8,MMUNYR)	QUNTY tBTU	GLASS INDUSTRY CONSUMPTION
	CEMENTCON	(8,MMUNYR)	QUNTY tBTU	CEMENT INDUSTRY CONSUMPTION
	STEELCON	(10,MMUNYR)	QUNTY tBTU	STEEL INDUSTRY CONSUMPTION
	ALUMCON	(8,MMUNYR)	QUNTY tBTU	ALUMINUM INDUSTRY CONSUMPTION
	REFCON	(9,MMUNYR)	QUNTY tBTU	REFINERY INDUSTRY CONSUMPTION

* Residential Module Output				

HTCN			TYPE UNITS	
	HTRCON	(26, 7, 9)	QUNTY tBTU	Space Heating Consumption

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
CLCN	COOLCN	(26, 3, 9)	TYPE UNITS QUNTY tBTU	Space Cooling Consumption
*-----				
HWCN	H2OCON	(26, 4, 9)	TYPE UNITS QUNTY tBTU	Hot Water Heat Consumption
*-----				
CKCN	CKCON	(26, 3, 9)	TYPE UNITS QUNTY tBTU	Cooking Consumption
*-----				
DRYCN	DRYCON	(26, 2, 9)	TYPE UNITS QUNTY tBTU	Dryer Consumption
*-----				
RFCN	REFCON	(26, 9)	TYPE UNITS QUNTY tBTU	Refrigeration Consumption
*-----				
FZCN	FRZCON	(26, 9)	TYPE UNITS QUNTY tBTU	Freezer Consumption
*-----				
LTC	LTCN	(26, 9)	TYPE UNITS QUNTY tBTU	Lighting Consumption
*-----				
APC	APCON	(26, 9)	TYPE UNITS QUNTY tBTU	Appliance Consumption
*-----				
SNC	SHTCON	(26, 7, 9)	TYPE UNITS QUNTY tBTU	Secondary Heat Consumption
*-----				
* Residential Module Report Variables				
*-----				
RESREP			TYPE UNITS	Existing Housing
	RSEN	(MMUMYR, 3)	LEVEL MILL	New Housing
	RSNH	(MMUMYR, 3)	LEVEL MILL	Housing Starts
	RSNSEADD	(MMUMYR, 3)	LEVEL MILL	Space Heating Consumption
	RSNTRCON	(MMUMYR, 8)	QUNTY tBTU	Space Cooling Consumption
	RSCOOLCN	(MMUMYR, 3)	QUNTY tBTU	Hot Water Heat Consumption
	RSN2OCON	(MMUMYR, 5)	QUNTY tBTU	Cooking Consumption
	RSCCKCON	(MMUMYR, 3)	QUNTY tBTU	Dryer Consumption
	RSDRYCON	(MMUMYR, 2)	QUNTY tBTU	Refrigeration Consumption
	RSREFCON	(MMUMYR)	QUNTY tBTU	Freezer Consumption
	RSFRZCON	(MMUMYR)	QUNTY tBTU	Lighting Consumption
	RSLTCON	(MMUMYR)	QUNTY tBTU	Appliance Consumption
	RSAPCON	(MMUMYR, 4)	QUNTY MILL	Heating Equipment
	RSNTRS	(MMUMYR, 9)	QUNTY MILL	Cooling Equipment
	RSCOOLERS	(MMUMYR, 5)	QUNTY MILL	Water Equipment
	RSWATER	(MMUMYR, 5)	QUNTY MILL	Cooking Equipment
	RSCOOK	(MMUMYR, 3)	QUNTY MILL	Drying Equipment
	RSDRY	(MMUMYR, 2)	QUNTY MILL	Refrigerator Equipment
	RSREF	(MMUMYR)	QUNTY MILL	Freezer Equipment
	RSFRZ	(MMUMYR)	QUNTY MILL	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	RSEEFNT	(MMUNYR, 5)	HEATRT FRACT	Heating Efficiency
	RSEEFCL	(MMUNYR, 5)	HEATRT FRACT	Cooling Efficiency
	RSEEFNW	(MMUNYR, 4)	HEATRT FRACT	Hot Water Efficiency
	RSEEFRF	(MMUNYR)	HEATRT FRACT	Refrigerator efficiency
	RSEEFFZ	(MMUNYR)	HEATRT FRACT	Freezer Efficiency
	RSNEFNT	(MMUNYR, 5)	HEATRT FRACT	Heating Efficiency
	RSNEFCL	(MMUNYR, 5)	HEATRT FRACT	Cooling Efficiency
	RSNEFNW	(MMUNYR, 4)	HEATRT FRACT	Hot Water Efficiency
	RSNEFRF	(MMUNYR)	HEATRT FRACT	Refrigerator Efficiency
	RSNEFFZ	(MMUNYR)	HEATRT FRACT	Freezer Efficiency
	GGERS	(MMUNCR, MMUNYR)	QUNTY tBTU	Geothermal Consumption

* Commercial Module Output				

CONOUT			TYPE UNITS	
	CHruGen	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility generation of electricity
	CHruGrid	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility electricity sales to the grid
	CHruCap	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility capacity
	CHruConIG	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility consumption: IG
	CHruConSC	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility consumption: Steam Coal
	CHruConRS	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility consumption: Residual oil
	CHruConBio	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility consumption: Biomass
	CHruConBio	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Biomass
	CHruConHyd	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Hydro
	CHruConSol	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Solar
	CHruConWind	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Wind
	CHruConGeo	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Geothermal
	CHruConOth	(MMUNCR, MMUNYR)	QUNTY tBTU	Consumption of renewables: Other
	CHruConDS	(MMUNCR, MMUNYR)	QUNTY tBTU	Nonutility Consumption of Dist

* Commercial Module Parameters				

CONPARAM			TYPE UNITS	
	CHRisk_Prem	(9)	PARAM SCALAR	(premium over zero risk rate)
	CHLog_Perm_A	(11)	PARAM SCALAR	(logistic survival function parm A)
	CHLog_Perm_B	(11)	PARAM SCALAR	(logistic survival function parm B)
	CHDSN_Capital	(45, MMUNCR)	PARAM SCALAR	(dollar value of capital incentives)
	CHDSN_Rate	(45, MMUNCR)	PARAM SCALAR	(DSN rate incentives)
	CHBehav_Rule	(3)	PARAM SCALAR	(technology choice behavioral rules)
	CHMinFuelGrowth	(5, MMUNCR)	PARAM SCALAR	(minor fuels growth rate)
	CHNonBldgGrowth	(8, MMUNCR)	PARAM SCALAR	(non-bldg growth rate)
	CHTechPerRate	(45, 9, MMUNCR)	PARAM SCALAR	(technology penetration rate)
	CHmode	(1)	PARAM SCALAR	(0= PC Standalone; 1= NEMS Integrated)
	CHSTElas	(1)	PARAM SCALAR	ST Elasticity (0= Off; 1= On)
	CHTechShareOpt	(45)	PARAM SCALAR	(compete technology (1) or use user
	EndUseConsump	(8, 9, 11, MMUNCR)	QUNTY tBTU	End Use Consumption

* Commercial Module Report Variables				

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
COMREP	CHUSSurvFloorTot	(MMUMYR)	TYPE LEVEL	Surviving Floorspace
	CHUSNewFloorTot	(MMUMYR)	LEVEL MILL	Floorspace - New Additions
	CHUSConsumption	(7, 3,MMUMYR)	QUANTITY tBTU	Consumption-by End-Use, Fuel
	CHSurvFloorTot	(11,MMUMYR)	QUANTITY tBTU	Survival Firepc-Bldg Type
	CHNewFireSpace	(11,MMUMYR)	QUANTITY tBTU	New Floorspace by Bld Type
	CHFinalEndUseCon	(11,MMUMYR)	QUANTITY tBTU	Consumption by Bldg Type
	CHSAvgEff	(6, 3,MMUMYR)	QUANTITY tBTU	Avg Tech Eff by End Use, Fuel

* Transportation Module Report Variables				

TRANREP	TRONMY	(6,MMUMYR)	QUANTITY tBTU	Highway Energy Use
	TRONHMY	(4,MMUMYR)	QUANTITY tBTU	Non-highway Energy Use
	TROEUSE	(12,MMUMYR)	QUANTITY tBTU	Energy Use by Fuel Type
	TROLD	(8,MMUMYR)	QUANTITY tBTU	Light-Duty Energy Use
	TROFTRK	(5,MMUMYR)	QUANTITY tBTU	Freight Truck Energy Use
	TRORRF	(3,MMUMYR)	QUANTITY tBTU	Railroad Freight Energy Use
	TRODONS	(3,MMUMYR)	QUANTITY tBTU	Domestic Shipping Energy Use
	TROINTS	(2,MMUMYR)	QUANTITY tBTU	International Shipping Energy Use
	TROAIRT	(2,MMUMYR)	QUANTITY tBTU	Air Transportation Energy Use
	TROHIL	(4,MMUMYR)	QUANTITY tBTU	Military Energy Use
	TROBUS	(5,MMUMYR)	QUANTITY tBTU	Bus Transportation Energy Use
	TRORRP	(5,MMUMYR)	QUANTITY tBTU	Passenger Rail Energy Use
	TROBOAT	(MMUMYR)	QUANTITY tBTU	Recreational Boats Energy Use
	TROLUB	(MMUMYR)	QUANTITY tBTU	Lubricants Energy Use
	TREFFCAR	(8,MMUMYR)	QUANTITY tBTU	New Car Fuel Eff by Size Class
	TREFFTRK	(8,MMUMYR)	QUANTITY tBTU	New Truck Fuel Eff by Size Class
	TREFFALTC	(4,MMUMYR)	QUANTITY tBTU	Alt Fuel Cars Eff by Size Class
	TREFFALTT	(4,MMUMYR)	QUANTITY tBTU	Alt Fuel Trucks Eff by Size Class
	TRLSHRC	(7,MMUMYR)	LEVEL FRACT	New Car Sales Share
	TRLSHRT	(7,MMUMYR)	LEVEL FRACT	New Truck Sales Share
	TRNPCAR	(7,MMUMYR)	QUANTITY 1000s	New Car Average Horsepower
	TRNPTRK	(7,MMUMYR)	QUANTITY 1000s	New Truck Average Horsepower
	TRLDQTEK	(17,MMUMYR)	QUANTITY tBTU	Lt Duty Vehicle Energy Consumptn
	TRLDSALC	(17,MMUMYR)	QUANTITY 1000s	Lt Duty New Car Sales
	TRLDSALT	(17,MMUMYR)	QUANTITY 1000s	Lt Duty New Truck Sales
	TRLDSTKC	(17,MMUMYR)	QUANTITY 1000s	Lt Duty New Car Stock
	TRLDSTKT	(17,MMUMYR)	QUANTITY 1000s	Lt Duty New Truck Stock
	TRLDMPGC	(17,MMUMYR)	QUANTITY MPG	Lt Duty New Car Efficiency
	TRLDMPGT	(17,MMUMYR)	QUANTITY MPG	Lt Duty New Trk Efficiency
	TRLDMPGF	(3,MMUMYR)	QUANTITY MPG	Lt Duty Fleet Efficiency
	TRLDVHT	(17,MMUMYR)	QUANTITY SCALAR	Lt Duty Vehicle Miles Travelled
	TRLDVHTE	(12,MMUMYR)	LEVEL SCALAR	Lt Duty VHT Effects
	TRTRAVLD	(11,MMUMYR)	QUANTITY SCALAR	
	TRAIRSL	(2,MMUMYR)	QUANTITY 1000s	
	TRAIRSTK	(2,MMUMYR)	QUANTITY 1000s	
	TRAIREFFH	(3,MMUMYR)	QUANTITY MPG	ciency
	TRAIREFFS	(3,MMUMYR)	QUANTITY MPG	ficiency

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	TRSTNDEN	(2,MMUNYR)	LEVEL 1000s	Seat Miles Demanded
	TREFFTRKF	(3, 5,MMUNYR)	QUNTY MPG	Fuel Eff by Trk Type by Fuel
	TRVNTTRK	(3, 5,MMUNYR)	QUNTY 1000s	WMT by Truck Type by Fuel
	TRTHRR	(2,MMUNYR)	QUNTY TON_ML	Billion Ton Miles by Railroad
	TRTNSHIP	(2,MMUNYR)	QUNTY TON_ML	Billion Ton Miles by Dom Ship
	TRMNSHIP	(MMUNYR)	QUNTY tBTU	International Shipping - Imports
	TRKLDVMT	(MMUNYR)	INDEX SCALAR	Light Duty Vehicle Index
	TRXFRVMT	(MMUNYR)	INDEX SCALAR	Freight Truck Index
	TRXAIR	(MMUNYR)	INDEX SCALAR	Air Travel Index
	TRXRAIL	(MMUNYR)	INDEX SCALAR	Rail Travel Index
	TRXSHIP	(MMUNYR)	INDEX SCALAR	Ship Travel Index
	TRXAIREF	(MMUNYR)	INDEX SCALAR	Aircraft Efficiency Index
	TRXFREF	(MMUNYR)	INDEX SCALAR	Freight Truck Efficiency Index
	TRXRAILEFF	(MMUNYR)	INDEX SCALAR	Rail Efficiency Index
	TRXSHIPEFF	(MMUNYR)	INDEX SCALAR	Domestic Shipping Eff Index
	TRGLDV	(9,MMUNCR,MMUNYR)	QUNTY tBTU	Lt Duty Vehicle Energy Use
	TRORAILR	(3,MMUNCR,MMUNYR)	QUNTY tBTU	RR Passenger Energy Use
	FLTECHRP	(2, 6,MMUNYR)	QUNTY 1000s	Fleet Car/Truck Sales
	FLTECHSTKRPT	(2, 6,MMUNYR)	QUNTY 1000s	Fleet Car/Truck Stock
	FLTFCLOVBSTU	(2, 6,MMUNYR)	QUNTY tBTU	Fleet Car/Truck Consumption
	FLTECHVTRPT	(2, 6,MMUNYR)	QUNTY 1000s	Fleet Car/Truck WMT
	REGSALERPT	(9, 5,MMUNYR)	QUNTY MILL	Regional Car Sales
	DEGRPT	(2,MMUNYR)	RATE PERCENT	Degradation Factor
	TREFFFLT	(4,MMUNYR)	QUNTY MPG	Fleet Vehicle Efficiency (EPA Rating)
	EMLDTGAS	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt Gas
	EMLDDES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt DES
	EMLDTHET	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt MET
	EMLDTCNG	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt CNG
	EMLDTHYD	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt HYD
	EMLDTEH	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt ETH
	EMLDLPG	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Lt Dt LPG
	EMFRTGAS	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Frght Gas
	EMFRIDES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Frght DES
	EMFRTCNG	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Frght CNG
	EMRLTDES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Rail DES
	EMRLTRES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Rail RES
	EMDSTDES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Dom DES
	EMDSTRES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Dom RES
	EMDSTGAS	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Dom GAS
	EMISTDES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Int DES
	EMISTRES	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Int RES
	EMAITJET	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Air Jet
	EMAITAVG	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Air Avg
	EMHILT	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Mil
	EMBUST	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Bus
	EMRAILT	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Rail
	EMRECT	(MMNPOLL,MMUNCR,MMUNYR)	QUNTY MTONS	Emissions Rec Boat

* Macroeconomic Module Output

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
***** MACROUT	MC_GDP	(NNUNYR)	TYPE LEVEL	Real gross domestic product
	MC_GNP	(NNUNYR)	LEVEL	Real gross national product
	MC_PGDP	(NNUNYR)	INDEX	Implicit GDP price deflator
	MC_RNPLAANS	(NNUNYR)	RATE	Yield on AA utility bonds
	MC_REALRNGBLUS	(NNUNYR)	RATE	Yield on U.S. govt 10-yr bonds
	MC_RNGBS3NS	(NNUNYR)	RATE	Avg market rate of US Govt 3 mo bills
	MC_IFIXMR	(NNUNYR)	LEVEL	Real gross pvt nonres investment
	MC_ECIVSPNS	(NNUNYR)	INDEX	Employment cos: index-pvt wages & salaries
	MC_RNMBCHENWS	(NNUNYR)	RATE	Avg Yield-New issue-NI grade Corp Bond
	MC_RNMTGCCNS	(NNUNYR)	RATE	Conventional commitment mortgage rate
	MC_SQDTRUCKSL	(NNUNYR)	LEVEL	Truck deliveries-Light duty
	MC_RUC	(NNUNYR)	RATE	Unemployment rate
	MC_EXCH	(NNUNYR)	RATE	U.S. trade-weighted exchange rate
	MC_EXB2	(NNUNYR)	LEVEL	Real exports
	MC_IMB2	(NNUNYR)	LEVEL	Real imports
	MC_SQTRCARS	(NNUNYR)	LEVEL	Unit sales of automobiles
	MC_CP1	(NNUNCR, NNUNYR)	INDEX	Consumer price index
	MC_YD	(NNUNCR, NNUNYR)	LEVEL	Real disposable personal income
	MC_YP	(NNUNCR, NNUNYR)	LEVEL	Real personal income
	MC_VSD	(NNUNCR, NNUNYR)	LEVEL	Wage & Salary disbursements
	MC_MFG1	(NNUNCR, NNUNYR)	INDEX	Index of mfg gross output
	MC_MFGMGT	(NNUNCR, NNUNYR)	LEVEL	Manufacturing wage rate
	MC_MFMGT	(NNUNCR, NNUNYR)	LEVEL	Non-manufacturing wage rate
	MC_POPAFO	(NNUNCR, NNUNYR)	LEVEL	Pop-incl armed forces overseas
	MC_POP16	(NNUNCR, NNUNYR)	LEVEL	Pop-aged 16 and over
	MC_COMMFLSP	(NNUNCR, 14, NNUNYR)	LEVEL	Commercial floorspace
	MC_EMPNA	(NNUNCR, MFTYPE, NNUNYR)	LEVEL	Employment-non-agriculture
	MC_MFGO	(NNUNCR, NSICNM, NNUNYR)	LEVEL	Real gross output:non-mfg
	MC_MFGO	(NNUNCR, NSICNM, NNUNYR)	LEVEL	Real gross output:mfg
	MC_EXDNB7	(NNUNYR)	LEVEL	Exports of merchandise
	MC_SHUMBL	(NNUNCR, NNUNYR)	LEVEL	Shipments of mobile homes
	MC_HUSTS1	(NNUNCR, NNUNYR)	LEVEL	Housing starts-Single family
	MC_HUSTS2	(NNUNCR, NNUNYR)	LEVEL	Housing starts-Multi family
	MC_KOMH	(NNUNCR, NNUNYR)	LEVEL	Housing stock-Mobile homes
	MC_KOHUSTS1	(NNUNCR, NNUNYR)	LEVEL	Housing stock-Single family
	MC_KOHUSTS2	(NNUNCR, NNUNYR)	LEVEL	Housing stock-Multi family
	MC_GFM187	(NNUNYR)	LEVEL	Fed Govt Purchases-Defense
	MC_SQTRCARSIMP	(NNUNYR)	LEVEL	Unit sales of autos-Foreign
	MC_SQTRCARSDOM	(NNUNYR)	LEVEL	Unit sales of autos-Domestic
	MC_CONS	(NNUNYR)	LEVEL	Real Consumption
	MC_INVEST	(NNUNYR)	LEVEL	Real Investment
	MC_GOVT	(NNUNYR)	LEVEL	Real Govt Spending
	MC_JULCHF	(NNUNYR)	INDEX	Unit Labor Cost Index
	MC_WPI	(NNUNYR)	INDEX	Producer Price Index
	MC_WPI14	(NNUNYR)	INDEX	PPI - Transportation

* MACRO Module Parameters

Common Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
MACPABNS	MACPABNS			NUMBER OF MACRO VARIABLES, NOT REGIONALIZED
	MACPABNS			NUMBER OF YEARS OF WPI LAGS FOR FORECAST
	MACPABNS			NUMBER OF YEARS OF ENDG. LAGS FOR FORECAST
	MACPABNS			# OF FORECASTED INDUSTRY SECTORS IN BASELINE
	MACPABNS			LAST HISTORICAL YEAR
	MACPABNS			BASE YEAR MANUFACTURING OUTPUT, 1967
	MACPABNS			NUMBER OF MACRO VARIABLES, REGIONALIZED
	MACPABNS			NUMBER OF FINAL DEMAND VARIABLES
	MACPABNS			# OF MANUFACTURING VARIABLES IN BASELINE
	MACPABNS			NUMBER OF REGIONS
	MACPABNS			# OF NO N-MANUF VARIABLES IN BASELINE
	MACPABNS			ERROR RETURN CODE
	MACPABNS			TOTAL # OF IND SECTORS FORECAST LESS TOTALS
	MACPABNS			Investment Multiplication Factor
	MACPABNS			Labor Force Multiplication Factor
	MACPABNS			Productivity Multiplication Factor
	MACPABNS			Investment Ramping Factor
	MACPABNS			Labor Force Ramping Factor
	MACPABNS			Productivity Ramping Factor
	MACPABNS			Number of Macro Driver Variables
	MACPABNS			Number of Macro baseline Driver Variables
	MACPABNS			Adjustment Factors
	MACPABNS			Number of Floorspace types
	MACPABNS			
	MACPABNS			
	MACPABNS			
	MACPABNS			
	MACPABNS			
MACREP	MACREP			AGGREGATE ENERGY PRICE INDEX
	MACREP			
INTOUT	INTOUT			
	INTOUT			
INTERNAT/ONAL MODULE OUTPUT	IT WOP	(MNUYR, 2)	PRICE	WORLD OIL PRICE
	Q ITIMCRSC	(MNUYR, 5)	QUANTITY	CRUDE IMPORTS SUPPLY CURVE QUANTS
	P ITIMCRSC	(MNUYR, 5)	PRICE	CRUDE IMPORTS SUPPLY CURVE PRICES
	ITIMCRSC	(MNUYR, 5)	QUANTITY	REF GASOLINE IMPORT SUPPLY CURVE
	ITIMCRSC	(MNUYR, 5)	QUANTITY	GASOLINE
	ITIMCRSC	(MNUYR, 5)	QUANTITY	DISTILLATE
	ITIMCRSC	(MNUYR, 5)	QUANTITY	LO SUL DIS
	ITIMCRSC	(MNUYR, 5)	QUANTITY	LO SUL RES
	ITIMCRSC	(MNUYR, 5)	QUANTITY	HI SUL RES
	ITIMCRSC	(MNUYR, 5)	QUANTITY	JET FUEL
	ITIMCRSC	(MNUYR, 5)	QUANTITY	LPG
	ITIMCRSC	(MNUYR, 5)	QUANTITY	PETCHEN FEED
	ITIMCRSC	(MNUYR, 5)	QUANTITY	OTHER
	ITIMCRSC	(MNUYR, 5)	QUANTITY	METHANOL
	ITIMCRSC	(MNUYR, 5)	QUANTITY	MTBE7
	ITIMCRSC	(MNUYR, 5)	QUANTITY	
	ITIMCRSC	(MNUYR, 5)	QUANTITY	
MACREP	MACREP			
	MACREP			

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors		Variable Description
	REPORT	(MMUNYR, 29)	QUNTY	tBTU	REPORT WRITER VARIABLES
* Uranium Module Output	UNPOUT		TYPE	UNITS	
	UNPUN	(MMUNYR)	PRICE	8738TU	Levelized nuclear prices
	UNPUNH	(MMUNYR,MMUNYR)	QUNTY	tBTU	Natural uranium reactor demand
	UNGEUM	(MMUNYR,MMUNYR)	QUNTY	tBTU	Enriched uranium reactor demand
* Capital Expenditures	CAPEXP		TYPE	UNITS	
	CAPEXF	(MMUNYR)	PRICE	b\$7s	Capital expenditures for refineries
	CAPEOG	(MMUNYR)	PRICE	b\$7s	Capital expenditures at the wellhead
	CAPEUT	(MMUNYR)	PRICE	b\$7s	Capital expenditures for NGTDM
	CAPEEL	(MMUNYR)	PRICE	b\$7s	Capital expenditures for ERM
	CAPECL	(MMUNYR)	PRICE	b\$7s	Capital expenditures for Coal Module
* Demand Side Management	DSM		TYPE	UNITS	
	DSMGEIRS	(MMUNCR,DSMPRS,MMUNYR)	QUNTY	tBTU	DSM program savings from residential
	DSMGEIRN	(MMUNCR,DSMPCN,MMUNYR)	QUNTY	tBTU	DSM program savings from commercial
* Emission Output	EMISSION		TYPE	UNITS	
	EMRFS	(MMUNYR)	QUNTY	TONS	Sulfur allowances
	EMELPSO2	(MMUNYR)	QUNTY	\$/TON	Sulfur dioxide emission allowance price
	EMUMH	(MMUNYR)	QUNTY	tMTONS	Spent nuclear fuel discharges
	EMRS	(4,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Read Emissions of Air Pollutants
	EMRSC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Read Emissions by Region
	EMCH	(5,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Comm Emissions by Air Pollutants
	EMCHC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Comm Emissions by Region
	EMINC	(4,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Ind Emis by Fuel-Combustion
	EMINCC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Ind Emis by Region-Comb
	EMINCH	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Ind Emis by Reg-Noncomb
	ENTR	(5,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Transportation Emissions by Fuel
	ENTRC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Trans Emissions by Region
	ENTRS	(5,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Trans Emissions by Trans Modes
	EMNT	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	NGTDM Emissions by Region
	ENOGC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Oil&Gas Emissions by Region
	ENOGCS	(2,MMNPOLL,MMUNYR)	QUNTY	mMTONS	O&G Emis by Activity (Onshore/Offshore)
	ENOGF	(2,MMNPOLL,MMUNYR)	QUNTY	mMTONS	O&G Emis by Fuel (Oil, NG)
	ENEL	(4,MMNPOLL,MMUNYR)	QUNTY	mMTONS	ERM Emissions by Fuel Type
	EMELC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	ERM Emissions by Region
	ENPMC	(4,MMNPOLL,MMUNYR)	QUNTY	mMTONS	Petroleum Emis by Fuel-Combustion
	ENPMCC	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	PMH Emis by Regn-Comb
	ENPMCH	(MMUNCR,MMNPOLL,MMUNYR)	QUNTY	mMTONS	PMH Emis by Reg-Noncomb

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	ENCP	(MMUMCR,MMIPOLL,MMUMYR)	QUNTY MTONS	Coal Supply Emissions by Region
	ENCP5	(3,MMIPOLL,MMUMYR)	QUNTY MTONS	Coal Supply Emissions by Activity
	EMCS	(MMUMCR,MMIPOLL,MMUMYR)	QUNTY MTONS	Coal Synthetics Emissions by Reg
	EMRN	(3,MMIPOLL,MMUMYR)	QUNTY MTONS	Renewable Emissions by Fuel
	EMRNC	(MMUMCR,MMIPOLL,MMUMYR)	QUNTY MTONS	Renewable Emissions by Region
	EMCARBON	(FLTYPE,MMUMYR)	QUNTY MTONS	National Carbon emissions by fuel
	EMRNET	(MMETON,MMIPOLL,MMUMYR)	QUNTY MTONS	Ethanol Emissions by Vol
	EMRNEC	(MMETON,MMIPOLL,MMUMYR)	QUNTY MTONS	Ethanol Emissions by Reg
	EMBTAX	(15,MMUMYR)	QUNTY 8758TU	Btu Tax by Fuel
	EMETAX	(15,MMUMYR)	QUNTY 8758TU	Excise (Consumption) Tax by Fuel
	EMENTAX	(MMIPOLL,MMUMYR)	QUNTY \$/TON	Emissions Tax by Air Pollutant
	EMLIN	(3,MMUMYR)	QUNTY \$/TON	Emission Constraints by (CO2,SOx,NOx)

* Cogeneration				

COGEN			TYPE UNITS	OTHER COGEN CAPACITY (MEGAWATTS)
CGOTCAP	(MMUMCR,MMUMYR, 4)		QUNTY MWATT	OTHER COGEN GENERATION (GIGAWATT HOURS)
CGOTGEN	(MMUMCR,MMUMYR, 4)		QUNTY GWTHRS	HEAT RATES BY FUEL FOR OTHER FACILITIES
CGOTHR	(4)		HEATRT BTUKWH	REFINERY FUEL CONSUMPT (TRILLION BTU)
CGREQ	(MMUMCR,MMUMYR, 4, 2)		QUNTY tBTU	REFINERY COGEN CAPACITY
CGRECAP	(MMUMCR,MMUMYR, 4, 2)		2)QUNTY MWATT	GENERATION
CGREGEN	(MMUMCR,MMUMYR, 4, 2)		QUNTY GWTHRS	EOB HEAT RATES BY FUEL (TRILLION BTU / KWH)
CGOGO	(MMUMCR,MMUMYR, 4, 2)		HEATRT BTUKWH	OIL & GAS COGEN CAPACITY
CGOGCAP	(MMUMCR,MMUMYR, 4, 2)		2)QUNTY MWATT	GENERATION
CGOGGEN	(MMUMCR,MMUMYR, 4, 2)		QUNTY GWTHRS	INDUSTRIAL FUEL CONSUMPT
CGINDQ	(MMUMCR,MMUMYR, 4, 2)		QUNTY tBTU	INDUSTRIAL COGEN CAPACITY
CGINDCAP	(MMUMCR,MMUMYR, 4, 2)		2)QUNTY MWATT	GENERATION
CGINDGEN	(MMUMCR,MMUMYR, 4, 2)		QUNTY GWTHRS	NONUTIL GENERATION OF ELEC
CGCOMGEN	(MMUMCR,MMUMYR, 4)		QUNTY GWTHRS	NONUTIL ELEC SALES TO GRID
CGCOMQ	(MMUMCR,MMUMYR, 4)		QUNTY GWTHRS	NONUTIL CAPACITY
CGCOMCAP	(MMUMCR,MMUMYR, 4, 2)		QUNTY MWATT	GRID/OWN USE SHARES
GRIDSNR	(MMUMCR,MMUMYR)		LEVEL SCALAR	TOTAL COGEN CAPACITY
CGTLCAP	(MMUMCR,MMUMYR)		QUNTY MWATT	COGEN GENERATION GRID AND OWN USE
CGTLGEN	(MMUMCR,MMUMYR, 2)		QUNTY GWTHRS	

* Renewable Information				

WRENEW			TYPE UNITS	UTIL HYDRO GENER CAPACITY MW
WCANYEL	(MMUMCR,MMUMYR)		QUNTY UNIT1	UTIL HYDRO CAPACITY FACTOR FRACT
WCFHYEL	(MMUMCR,MMUMYR)		QUNTY UNIT1	UTIL HYDRO CAPITAL COST \$/KW
WCCNYEL	(MMUMCR,MMUMYR)		PRICE UNIT1	UTIL HYDRO FIXED OP COST mills/Kwh
WCCHYEL	(MMUMCR,MMUMYR)		PRICE UNIT1	UTIL HYDRO VAR OP COST mills/Kwh
WVCHYEL	(MMUMCR,MMUMYR)		PRICE UNIT1	UTIL HYDRO HEAT RATE BTU/KWH
WWRHYEL	(MMUMCR,MMUMYR)		QUNTY UNIT1	UTIL HYDRO UNIT LIFE YRS
WLIHYEL	(1)		QUNTY UNIT1	UTIL FLASH GEOTH GENER CAPACITY MW
WCAGFEL	(MMUMCR,MMUMYR)		QUNTY UNIT1	UTIL FLASH GEOTH CAPACITY FACTOR FRACT
WCFGFEL	(MMUMCR,MMUMYR)		QUNTY UNIT1	UTIL FLASH GEOTH CAPITAL COST \$/KW
WCCGFEL	(MMUMCR,MMUMYR)		PRICE UNIT1	UTIL FLASH GEOTH FIXED OP COST mills/Kwh
WCCGFEL	(MMUMCR,MMUMYR)		PRICE UNIT1	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
			PRICE UNIT1	UTIL FLASH GEOTH VAR OP COST mills/Kwh
WVGFEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL FLASH GEOTH HEAT RATE BTU/KWH
WHRGFEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL FLASH GEOTH UNIT LIFE YRS
WLIGFEL	(1)		QUNTY UNIT1	UTIL BINARY GEOTH GENER CAPACITY MW
WCAGBEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL BINARY GEOTH CAPACITY FACTOR FRACT
WCFGBEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL BINARY GEOTH CAPITAL COST \$/KW
WCCGBEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL BINARY GEOTH FIXED OP COST mills/Kw
WOCGBEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL BINARY GEOTH VAR OP COST mills/Kwh
WVCGBEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL BINARY GEOTH HEAT RATE BTU/KWH
WHRGBEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL BINARY GEOTH UNIT LIFE YRS
WLIGBEL	(1)		QUNTY UNIT1	RESIDEN GEOTH CAP MWBTU
WCAGERS	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	RESIDEN GEOTH CAP FACTOR HOURS
WCFGERS	(NNLUNCR,NNLUNYR)		PRICE UNIT1	RESIDEN GEOTH CAP COST \$/MWBTU-YR
WCCGERS	(NNLUNCR,NNLUNYR)		PRICE UNIT1	RESIDEN GEOTH FIXED OP COST mills/Kw
WOCGERS	(NNLUNCR,NNLUNYR)		PRICE UNIT1	RESIDEN GEOTH VAR OP COST mills/Kwh
WVGERS	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	RESIDEN GEOTH HEAT RATE COP
WHRGERS	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	RESIDEN GEOTH LIFE YRS
WLIGERS	(1)		QUNTY UNIT1	COMMERC GEOTH CAP MWBTU
WCAGECH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC GEOTH CAP FACTOR HOURS
WCFGCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC GEOTH CAP COST \$/MWBTU-YR
WCCGCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC GEOTH FIXED OP COST mills/Kw
WOCGCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC GEOTH VAR OP COST mills/Kwh
WVGCH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC GEOTH HEAT RATE COP
WHRGCH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC GEOTH LIFE YRS
WLIGCH	(1)		QUNTY UNIT1	UTIL NSW GENER CAPACITY MW
WCANSEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL NSW CAPACITY FACTOR FRACT
WCFNSEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL NSW CAPITAL COST \$/KW
WCCNSEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL NSW FIXED OP COST mills/Kw
WOCNSEL	(NNLUNR,NNLUNYR)		PRICE UNIT1	UTIL NSW VAR OP COST mills/Kwh
WVNSEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL NSW HEAT RATE BTU/KWH
WHRNSEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL NSW HEAT CONT BTU/LB
WLNSEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL NSW UNIT LIFE YRS
WCANSCH	(1)		QUNTY UNIT1	COMMERC NSW CAP MW
WCFNSCH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC NSW CAP FACTOR FRACT
WCCNSCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC NSW CAP COST \$/KW
WOCNSCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC NSW FIXED OP COST mills/Kw
WVNCHSCH	(NNLUNCR,NNLUNYR)		PRICE UNIT1	COMMERC NSW VAR OP COST mills/Kwh
WHRNSCH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC NSW HEAT RATE BTU/KWH
WLNCHSCH	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	COMMERC NSW HEAT CONT BTU/LB
WLNCHSCH	(1)		QUNTY UNIT1	COMMERC NSW LIFE YRS
WCANSHIN	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	INDUST NSW CAP MW
WCFNSHIN	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	INDUST NSW CAP FACTOR FRACT
WCCSHIN	(NNLUNCR,NNLUNYR)		PRICE UNIT1	INDUST NSW CAP COST \$/KW
WOCSHIN	(NNLUNCR,NNLUNYR)		PRICE UNIT1	INDUST NSW FIXED OP COST mills/Kw
WVNCHSHIN	(NNLUNCR,NNLUNYR)		PRICE UNIT1	INDUST NSW VAR OP COST mills/Kwh
WHRCHSHIN	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	INDUST NSW HEAT RATE BTU/KWH
WLNCHSHIN	(NNLUNCR,NNLUNYR)		QUNTY UNIT1	INDUST NSW HEAT CONT BTU/LB
WLNCHSHIN	(1)		QUNTY UNIT1	INDUST NSW LIFE YRS
WCABNEL	(NNLUNR,NNLUNYR)		QUNTY UNIT1	UTIL WOOD GENER CAPACITY MW

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
UCFBMEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL WOOD CAPACITY FACTOR FRACT	
UCCBMEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL WOOD CAPITAL COST \$/KW	
UVCBMEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL WOOD FIXED OP COST mills/Kw	
UWCBMEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL WOOD VAR OP COST mills/Kwh	
UWRBMEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL WOOD HEAT RATE BTU/KWH	
UWCBMEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL WOOD HEAT CONT MMBTU/TON	
ULIBMEL	(1)	GUNTY UNIT1	UTIL WOOD UNIT LIFE YRS	
UCABMRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN WOOD CAP MMBTU	
UCFBMRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN WOOD CAP FACTOR FRACT	
UCCBMRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN WOOD CAP COST \$/MMBTU-YR	
UVCBMRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN WOOD FIXED OP COST mills/Kw	
UWCBMRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN WOOD VAR OP COST mills/Kwh	
UWRBMRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN WOOD HEAT RATE MMBTU/TON	
ULIBMRS	(1)	GUNTY UNIT1	RESIDEN WOOD LIFE YRS	
UCABMCH	(PMLPCR, PMLMYR)	GUNTY UNIT1	COMMERC WOOD CAP MMBTU	
UCFBMCH	(PMLPCR, PMLMYR)	GUNTY UNIT1	COMMERC WOOD CAP FACTOR FRACT	
UCCBMCH	(PMLPCR, PMLMYR)	PRICE UNIT1	COMMERC WOOD CAP COST \$/MMBTU-YR	
UVCBMCH	(PMLPCR, PMLMYR)	PRICE UNIT1	COMMERC WOOD FIXED OP COST mills/Kw	
UWCBMCH	(PMLPCR, PMLMYR)	PRICE UNIT1	COMMERC WOOD VAR OP COST mills/Kwh	
UWRBMCH	(PMLPCR, PMLMYR)	GUNTY UNIT1	COMMERC WOOD HEAT RATE MMBTU/TON	
ULIBMCH	(1)	GUNTY UNIT1	COMMERC WOOD LIFE YRS	
UCABMIN	(PMLPCR, PMLMYR)	GUNTY UNIT1	INDUST WOOD CAP MMBTU	
UCFBMIN	(PMLPCR, PMLMYR)	GUNTY UNIT1	INDUST WOOD CAP FACTOR FRACT	
UCCBMIN	(PMLPCR, PMLMYR)	PRICE UNIT1	INDUST WOOD CAP COST \$/MMBTU-YR	
UVCBMIN	(PMLPCR, PMLMYR)	PRICE UNIT1	INDUST WOOD FIXED OP COST mills/Kw	
UWCBMIN	(PMLPCR, PMLMYR)	PRICE UNIT1	INDUST WOOD VAR OP COST mills/Kwh	
UWRBMIN	(PMLPCR, PMLMYR)	GUNTY UNIT1	INDUST WOOD HEAT RATE MMBTU/TON	
ULIBMIN	(1)	GUNTY UNIT1	INDUST WOOD LIFE YRS	
UCASTEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL SOLAR TH GENER CAPACITY MW	
UCFSTEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL SOLAR TH CAPACITY FACTOR FRACT	
UCCSTEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL SOLAR TH CAPITAL COST \$/KW	
UVCSTEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL SOLAR TH FIXED OP COST mills/Kw	
UWVSTEL	(PMLPWR, PMLMYR)	PRICE UNIT1	UTIL SOLAR TH VAR OP COST mills/Kwh	
UWRSTEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL SOLAR TH HEAT RATE BTU/KWH	
UWVSTEL	(PMLPWR, PMLMYR)	GUNTY UNIT1	UTIL SOLAR TH HEAT CONT BTU/SFT	
ULISTEL	(1)	GUNTY UNIT1	UTIL SOLAR TH UNIT LIFE YRS	
UCASURS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH CAP MMBTU	
UCFSURS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH CAP FACTOR HOURS	
UCCSURS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH CAP COST \$/MMBTU-YR	
UVCSURS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH FIXED OP COST mills/Kw	
UWVSURS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH VAR OP COST mills/Kwh	
UWRVSURS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH HEAT RATE MMBTU/SFT	
ULISURS	(1)	GUNTY UNIT1	RESIDEN SOL TH LIFE YRS	
UCASSRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH CAP MMBTU	
UCFSSRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH CAP FACTOR HOURS	
UCCSSRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH CAP COST \$/MMBTU-YR	
UVCSSRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH FIXED OP COST mills/Kw	
UWSSRS	(PMLPCR, PMLMYR)	PRICE UNIT1	RESIDEN SOL TH VAR OP COST mills/Kwh	
UWRSSRS	(PMLPCR, PMLMYR)	GUNTY UNIT1	RESIDEN SOL TH HEAT RATE MMBTU/SFT	

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
WLSSRS	(1)		QUNTY UNIT1	RESIDEN SOL TH LIFE YRS
WCASCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH CAP MBTU
WCFSCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH CAP FACTOR HOURS
WCCSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH CAP COST \$/MBTU-YR
WOCSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH FIXED OP COST mills/Kw
WVCSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH VAR OP COST mills/Kwh
WHRSCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH HEAT RATE MBTU/SFT
WLISCH	(1)		QUNTY UNIT1	COMMERC SOL TH LIFE YRS
WCASSCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH CAP MBTU
WCFSSCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH CAP FACTOR HOURS
WCCSSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH CAP COST \$/MBTU-YR
WOCSSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH FIXED OP COST mills/Kw
WVCSSCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL TH VAR OP COST mills/Kwh
WHRSSCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL TH HEAT RATE MBTU/SFT
WLISCH	(1)		QUNTY UNIT1	COMMERC SOL TH LIFE YRS
WCAPVEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL PHOTOV GENER CAPACITY MW
WCFPVEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL PHOTOV CAPACITY FACTOR FRACT
WCCPVEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL PHOTOV CAPITAL COST \$/KW
WOCPVEL	(NNLNCR,NNLNYR)		PRICE UNIT1	UTIL PHOTOV FIXED OP COST mills/Kw
WVCPVEL	(NNLNCR,NNLNYR)		PRICE UNIT1	UTIL PHOTOV VAR OP COST mills/Kwh
WHRPVEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL PHOTOV HEAT RATE BTU/KWH
WHCPVEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL PHOTOV HEAT CONT BTU/SFT
WLIPVEL	(1)		QUNTY UNIT1	UTIL PHOTOV UNIT LIFE YRS
WCAPVRS	(NNLNCR,NNLNYR)		QUNTY UNIT1	RESIDEN SOL PV CAP MBTU
WCFPVR	(NNLNCR,NNLNYR)		QUNTY UNIT1	RESIDEN SOL PV CAP FACTOR HOURS
WCCPVR	(NNLNCR,NNLNYR)		PRICE UNIT1	RESIDEN SOL PV CAP COST \$/MBTU-YR
WOCPVR	(NNLNCR,NNLNYR)		PRICE UNIT1	RESIDEN SOL PV FIXED OP COST mills/Kw
WVCPVR	(NNLNCR,NNLNYR)		PRICE UNIT1	RESIDEN SOL PV VAR OP COST mill-/Kwh
WHRPVR	(NNLNCR,NNLNYR)		QUNTY UNIT1	RESIDEN SOL PV HEAT RATE BTU/KWH
WHCPVR	(NNLNCR,NNLNYR)		QUNTY UNIT1	RESIDEN SOL PV HEAT CONT MBTU/SFT
WLIPVR	(1)		QUNTY UNIT1	RESIDEN SOL PV LIFE YRS
WCAPVCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL PV CAP MBTU
WCFPVCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL PV CAP FACTOR HOURS
WCCPVCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL PV CAP COST \$/MBTU-YR
WOCPVCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL PV FIXED OP COST mills/Kw
WVCPVCH	(NNLNCR,NNLNYR)		PRICE UNIT1	COMMERC SOL PV VAR OP COST mills/Kwh
WHRPVCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL PV HEAT RATE BTU/KWH
WHCPVCH	(NNLNCR,NNLNYR)		QUNTY UNIT1	COMMERC SOL PV HEAT CONT MBTU/SFT
WLIPVCH	(1)		QUNTY UNIT1	COMMERC SOL PV LIFE YRS
WCAMIEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL WIND GENER CAPACITY MW
WCFVIEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL WIND CAPACITY FACTOR FRACT
WCCVIEL	(NNLNCR,NNLNYR)		PRICE UNIT1	UTIL WIND CAPITAL COST \$/KW
WOCVIEL	(NNLNCR,NNLNYR)		PRICE UNIT1	UTIL WIND FIXED OP COST mills/Kw
WVCVIEL	(NNLNCR,NNLNYR)		PRICE UNIT1	UTIL WIND VAR OP COST mills/Kwh
WHRVIEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL WIND HEAT RATE BTU/KWH
WHCMIEL	(NNLNCR,NNLNYR)		QUNTY UNIT1	UTIL WIND HEAT CONT BTU/SQKM
WLIVIEL	(1)		QUNTY UNIT1	UTIL WIND UNIT LIFE YRS
WPETON	(NNCROP,NNLNCR,NNLNYR,NNETON)		QUNTY UNIT1	ETHANOL PRICE/STEP
WGETON	(NNCROP,NNLNCR,NNLNYR,NNETON)		QUNTY UNIT1	ETHANOL QUAN/STEP

COMMON Block Name	Variable Name	Variable Dimensions	Variable Descriptors	Variable Description
	WEMSEL	(MMPLL,MMMYR)	QUNTY UNIT1	UTIL EMISSIONS FROM MSW LBS/MMBTU
	WEMFEL	(MMPLL,MMMYR)	QUNTY UNIT1	UTIL EMISSIONS FROM BICMASS LBS/MMBTU
	WEMGFEL	(MMPLL,MMMYR)	QUNTY UNIT1	UTIL ENISS FROM GEOTH FLASH LBS/MMBTU
	WCAV	(UNTECH)	QUNTY UNIT1	Year Available
	WCSU	(UNTECH,MMMYR)	PRICE UNIT1	Subsidy (mills/Kwh)
	WCSI	(UNTECH,MMMYR)	PRICE UNIT1	Subsidy (\$/S invested)
	WCLT	(UNTECH)	QUNTY UNIT1	Construction Lead Time (yr)
	WCPC	(UNTECH, 8)	QUNTY UNIT1	Percent Constructed (fract)
	WPOVIEL	(MMMYR)	QUNTY UNIT1	Wind Planned Outage (fract of year)
	WCRVIEL	(MMMYR,MMMYR)	QUNTY UNIT1	Wind Capacity Credit (fract)
	WSCHVIEL	(MMMYR,MMMYR,MMMYR)	QUNTY UNIT1	Avail Wind Capacity (MW)
	WSFVIEL	(MMMYR,MMMYR,MMMYR)	QUNTY UNIT1	Wind Cap Factor (DEC)
	WSSSTEL	(MMMYR,MMMYR,MMMYR)	QUNTY UNIT1	Solar Thermal Supply Shape (by time pd)
	WSSPVEL	(MMMYR,MMMYR,MMMYR)	QUNTY UNIT1	Photovoltaics Supply Shape (by time pd)
	WCKSINEL	(4, 4,MMMYR)	QUNTY UNIT1	MSW Electricity for Industries (TStu)
	WCKSINST	(4, 4,MMMYR)	QUNTY UNIT1	MSW Steam for Industries (TStu)

* Conversion Factors				

CONVFACT			TYPE UNITS	
CFASQ	(1)		CONFAC mBTU/B	Asphalt and Road Oil.
CFBUQ	(1)		CONFAC mBTU/B	Butane.
CFDSQ	(1)		CONFAC mBTU/B	Distillate.
CFETQ	(1)		CONFAC mBTU/B	Ethanol.
CFIBQ	(1)		CONFAC mBTU/B	Isobutane.
CFJFK	(1)		CONFAC mBTU/B	Jet Fuel. Kerosene
CFJFN	(1)		CONFAC mBTU/B	Jet Fuel. Naptha
CFKSO	(1)		CONFAC mBTU/B	Kerosene.
CFLGQ	(MMMYR)		CONFAC mBTU/B	Liquid Petroleum Gas.
CFNGQ	(MMMYR)		CONFAC mBTU/B	Motor Gasoline.
CFOTQ	(MMMYR)		CONFAC mBTU/B	Other Petr. (lubas, av gas)
CFPPQ	(1)		CONFAC mBTU/B	Pentanes Plus.
CFPFQ	(MMMYR)		CONFAC mBTU/B	Petrochemical Feedstocks.
CFPCQ	(1)		CONFAC mBTU/B	Petroleum Coke.
CFPRQ	(1)		CONFAC mBTU/B	Propane.
CFRSQ	(1)		CONFAC mBTU/B	Residual Fuel.
CFSGQ	(1)		CONFAC mBTU/B	Still Gas.
CFNGU	(1)		CONFAC tBTU/C	Natural Gas. Util - 1034
CFNGH	(1)		CONFAC tBTU/C	Natural Gas. Nonutil - 1030
CFNGC	(1)		CONFAC tBTU/C	Natural Gas. Consum/Prod-1031
CFNGI	(1)		CONFAC tBTU/C	Natural Gas. Imports - 1004

Appendix B. Alphabetical List of NEMS Variables

Appendix B. Alphabetical List of NEMS Variables

This appendix lists the NEMS Global Data Structure variables in alphabetical order, rather than by COMMON blocks, as shown in Appendix A.

COMMON	Variable	COMMON	Variable	COMMON	Variable	COMMON	Variable
NCNTRL	ABSTOL	COGEN	CGRECAP	COALOUT	COTN_TH	MISSION	ENLIN
COALREP	ABSULF	COGEN	CGREGEN	COALOUT	CPSS	TRANREP	ENMILT
COALREP	ALBULF	COGEN	CGREG	COALOUT	CGDBFB	EMISSION	ENMT
INDREP	ALUMCON	COGEN	CGTLCAP	COALOUT	CGDBFT	EMISSION	ENOGC
APC	APCON	COGEN	CGTLGEN	COALOUT	CGSBB	EMISSION	ENOGCS
NCNTRL	BASEYR	INDREP	CHENCON	COALOUT	CGSBT	EMISSION	ENOGF
COALOUT	BBCELNR	CXCN	CXCON	NCNTRL	CTEST	EMISSION	ENPMC
COALOUT	BBDELNR	COALOUT	CLSYNGPR	NCNTRL	CURITR	EMISSION	ENPWCC
COALOUT	BBHELNR	COALOUT	CLSYNGGN	NCNTRL	CURIYR	EMISSION	ENPWCH
COALOUT	BBHELNR	NGTDNOUT	CLSYNGUP	NCNTRL	DBDUMP	TRANREP	ENRAILT
COALOUT	BLCELNR	COMPARAM	CHmode	PHMOUT	DCRDUMP	TRANREP	ENRECT
COALOUT	BLDELNR	CONOUT	CHnuCap	TRANREP	DECRPT	EMISSION	ENRFA
COALOUT	BLHELNR	CONOUT	CHnuConBio	DRYCH	DRYCON	TRANREP	ENRLTDES
COALOUT	BLHELNR	CONOUT	CHnuConDS	DSH	DSHDELCH	TRANREP	ENRLTRES
COALOUT	BSCELNR	CONOUT	CHnuConG	DSH	DSHDELRS	EMISSION	ENRHN
COALOUT	BSDELNR	CONOUT	CHnuConRS	NCNTRL	DSHSWCH	EMISSION	ENRNC
COALOUT	BSHELNR	CONOUT	CHnuConSC	OGSMOUT	DVDRYFT	EMISSION	ENRNEC
COALOUT	BSHELNR	CONOUT	CHnuGen	OGSMOUT	DVFTAGE	EMISSION	ENRNET
CAPEXP	CAPECL	CONOUT	CHnuGrid	OGSMOUT	DVGASFT	EMISSION	ENRS
CAPEXP	CAPEEL	CONOUT	CHnuConBio	OGSMOUT	DVOILFT	EMISSION	ENRSC
CAPEXP	CAPEP	CONOUT	CHnuConGeo	OGSMOUT	DVSPEND	EMISSION	ENRTR
CAPEXP	CAPEOG	CONOUT	CHnuConHyd	COMPARAM	EndUseCon?ap	EMISSION	ENRTRC
CAPEXP	CAPEPF	CONOUT	CHnuConOth	NCNTRL	ECPSTART	EMISSION	ENRTR
INDREP	CEMENTCON	CONOUT	CHnuConSol	NCNTRL	ELASSW	EMISSION	ENRWN
CONVFACT	CFASQ	CONOUT	CHnuConWind	TRANREP	EMATAVG	NCNTRL	ENDYR
CONVFACT	CFBAG	COMPARAM	CHBehav_Rule	TRANREP	EMATJET	NCNTRL	EXC
CONVFACT	CFDSQ	COMPARAM	CHDSH_Capital	EMISSION	EMBAX	OGSMOUT	EXDRYFT
CONVFACT	CFETQ	COMPARAM	CHDSH_Rate	TRANREP	EMBUST	NCNTRL	EXE
CONVFACT	CFIBQ	CONVREP	CHFinalEndUseCon	EMISSION	ENCARBON	OGSMOUT	EXFTAGE
CONVFACT	CFJFK	COMPARAM	CHLog_Parm_A	EMISSION	ENCH	NCNTRL	EXG
CONVFACT	CFJFN	COMPARAM	CHLog_Parm_B	EMISSION	ENCHC	OGSMOUT	EXGASFT
CONVFACT	CFKQ	COMPARAM	CHMinFuelGrowth	EMISSION	ENCHP	NCNTRL	EXI
CONVFACT	CFLQ	CONVREP	CHNewFireSpace	EMISSION	ENCHPS	NCNTRL	EXK
CONVFACT	CFMQ	COMPARAM	CHNonBldgGrowth	EMISSION	ENCHS	NCNTRL	EXL
CONVFACT	CFNGC	COMPARAM	CHRisk_Prem	TRANREP	ENDSTDES	NCNTRL	EXN
CONVFACT	CFNGI	CONVREP	CHSurvFloorTot	TRANREP	ENDSTGAS	NCNTRL	EXN
CONVFACT	CFNGN	COMPARAM	CHSTELas	TRANREP	ENDSTRES	NCNTRL	EXO
CONVFACT	CFNGU	COMPARAM	CHTechPenRate	EMISSION	ENEL	OGSMOUT	EXOILFT
CONVFACT	CFOTQ	COMPARAM	CHTechShareOpt	EMISSION	ENELC	NCNTRL	EXR
CONVFACT	CFPCQ	CONVREP	CHUSaveEff	EMISSION	ENELPSO2	OGSMOUT	EXSPEND
CONVFACT	CFPFQ	CONVREP	CHUSConsumption	EMISSION	ENEMTAX	NCNTRL	EXT
CONVFACT	CFPPQ	CONVREP	CHUSNewFloorTot	EMISSION	ENETAX	NCNTRL	EXW
CONVFACT	CFPRQ	CONVREP	CHUSSurvFloorTot	TRANREP	ENFRTCNG	NCNTRL	FCRL
CONVFACT	CFRQ	NCNTRL	CHYST	TRANREP	ENFRTDES	NCNTRL	FIRSYR
CONVFACT	CFRQ	COALREP	COALIMP	TRANREP	ENFRTGAS	TRANREP	FLTECHNPT
COGEN	CGCONCAP	COALREP	COALPRICE	EMISSION	ENINC	TRANREP	FLTECHNTPRT
COGEN	CGCONGEN	COALREP	COALPROD	EMISSION	ENINCC	TRANREP	FLTECHNTPRT
COGEN	CGCONQ	COALREP	COALPROD2	EMISSION	ENINCH	TRANREP	FLTCLDVSTU
COGEN	CGINDCAP	COALOUT	COCLG	TRANREP	ENISTDES	OGSMOUT	FNEXPORT
COGEN	CGINDGEN	COALOUT	COCLG	TRANREP	ENISTRES	OGSMOUT	FNIMPORT
COGEN	CGINDQ	COALOUT	COELPRC	TRANREP	ENLDTCNG	OGSMOUT	FNIMPORT
COGEN	CGOGCAP	COALOUT	COIM	TRANREP	ENLDTDES	INDREP	FOODCON
COGEN	CGOGGEN	COALOUT	COIMP	TRANREP	ENLDTETH	NCNTRL	FRTOL
COGEN	CGOGQ	CLCN	COOLCH	TRANREP	ENLDTGAS	FZCN	FRZCON
COGEN	CGOTCAP	COALOUT	COPRCLG	TRANREP	ENLDTHYD	INDREP	GLASSCON
COGEN	CGOTGEN	COALOUT	COPRCLG	TRANREP	ENLDTLPG	UGOILOUT	GRATMAX
COGEN	CGOTH	COALOUT	COSUPC	TRANREP	ENLDTHET	UGOILOUT	GRATMIN

COMMON	Variable	COMMON	Variable	COMMON	Variable	COMMON	Variable
UGOILOUT	GRATPAR	MACOUT	NC_MFGMRT	OGSHOUT	OGELSHGON	EFFPOUT	PELFLNR
COGEN	GRIDSHR	MACOUT	NC_MNFGO	OGSHOUT	OGGEORCOGC	MPBLK	PELIN
UGOILOUT	GSNRMX	MACOUT	NC_MNFGMRT	OGSHOUT	OGGEORCOGG	EFFPOUT	PELINNR
UGOILOUT	GSNRMIN	MACOUT	NC_PGP	NGTDMREP	OGINCAN	UEFPOUT	PELON
UGOILOUT	GSNRPAP	MACOUT	NC_POPAFO	NGTDMREP	OGINLNG	EFFPOUT	PELONNR
NCNTRL	HISTORY	MACOUT	NC_POP16	NGTDMREP	OGIMNEX	MPBLK	PELRS
NYCN	NYRCOIN	MACOUT	NC_REALRMGBLUS	NGTDMREP	OGINNGP	EFFPOUT	PELRSNR
NVCN	NZOCIN	MACOUT	NC_RMGSSMS	OGSHOUT	OGNGPRD	UEFPOUT	PELTL
COALREP	ISBULF	MACOUT	NC_RMBSCHEMS	OGSHOUT	OGNGRSV	EFFPOUT	PELTLNR
COALREP	ILBULF	MACOUT	NC_RNMTGCCNS	OGSHOUT	OGNGMNP	MPBLK	PELTR
INDOUT	INCAELNU	MACOUT	NC_RMPAAMS	OGSHOUT	OGNOMELL	EFFPOUT	PELTRNR
INDOUT	INAGELNU	MACOUT	NC_RUC	OGSHOUT	OGPCRWNP	UEFPOUT	PELWN
INDOUT	INGBMMU	MACOUT	NC_SHUNBL	OGSHOUT	OGPNGEXP	EFFPOUT	PELWNR
INDOUT	INGBMRN	MACOUT	NC_SQDTRUCKSL	OGSHOUT	OGPNGINP	MPBLK	PENAS
INDOUT	INGCLMU	MACOUT	NC_SQTRCARS	OGSHOUT	OGPNGMNP	EFFPOUT	PENASNR
INDOUT	INGGORN	MACOUT	NC_SQTRCARSDOM	NGTDMREP	OGPRONG	MPBLK	PENCH
INDOUT	INGMYRN	MACOUT	NC_SQTRCARSHIP	NGTDMOUT	OGPRONGOF	EFFPOUT	PENCHNR
INDOUT	INGMGU	MACOUT	NC_WP1	NGTDMOUT	OGPRONGON	MPBLK	PENIN
INDOUT	INGOTRN	MACOUT	NC_WP114	OGSHOUT	OGPRCAN	EFFPOUT	PENINNR
INDOUT	INGREMU	MACOUT	NC_WSD	OGSHOUT	OGPRCO	MPBLK	PENRS
INDOUT	INGBORN	MACOUT	NC_YD	OGSHOUT	OGPRNGOF	EFFPOUT	PENRSNR
INDOUT	INGTRN	MACOUT	NC_YP	OGSHOUT	OGPRNGON	MPBLK	PENTR
INDOUT	INGELMU	MACPARMS	MCADJ	NGTDMREP	OGPRSUP	EFFPOUT	PENTNR
NCNTRL	IRELAX	MACPARMS	MCBIMPRD	NGTDMREP	OGPRSUP3	MPBLK	PEPAS
INTOUT	IT_WCP	MACPARMS	MCLN1SYR	OGSHOUT	OGRAAGTS	EFFPOUT	PEPASNR
INTOUT	ITINDSSC	MACPARMS	MCNELAG	OGSHOUT	OGGCRREP	MPBLK	PEPCH
INTOUT	ITINGSSC	MACPARMS	MCNMBDRVRS	OGSHOUT	OGGCRSV	EFFPOUT	PEPCNR
INTOUT	ITIMHSC	MACPARMS	MCNMDRVRS	OGSHOUT	OGGEORCON	MPBLK	PEPIN
INTOUT	ITIMJFSC	MACPARMS	MCNMFDVARS	OGSHOUT	OGGEORNGC	EFFPOUT	PEPINNR
INTOUT	ITINDLSC	MACPARMS	MCNMFITYPE	OGSHOUT	OGGEORNGP	MPBLK	PEPRS
INTOUT	ITIMLPSC	MACPARMS	MCNMIND	OGSHOUT	OGGEORPR	EFFPOUT	PEPRSNR
INTOUT	ITIMLRSC	MACPARMS	MCNMAC	OGSHOUT	OGGLNGMAX	MPBLK	PEPTR
INTOUT	ITIMHSC	MACPARMS	MCNMACREG	OGSHOUT	OGNGEXP	EFFPOUT	PEPTRNR
INTOUT	ITIMHSC	MACPARMS	MCNMMNF	OGSHOUT	OGNGINP	MPBLK	PETTR
NCNTRL	ITIMNS	MACPARMS	MCNMMNOMF	OGSHOUT	OGNGREP	NGTDMOUT	PGCELGR
INTOUT	ITIMCTSC	MACPARMS	MCNMMREGS	OGSHOUT	OGNGRSV	MPBLK	PGFAS
INTOUT	ITIMJFSC	MACPARMS	MCNMLAG	OGSHOUT	OGNGSAJOK	MPBLK	PGFON
INTOUT	ITIMRGSC	MACPARMS	MCNMPINV	OGSHOUT	OGRESAN	MPBLK	PGFEL
NCNTRL	14SCNT	MACPARMS	MCNMPPLC	OGSHOUT	OGRESO	NGTDMOUT	PGFELGR
NCNTRL	14SITE	MACPARMS	MCNMPRAW	OGSHOUT	OGRESNGOF	MPBLK	PGFIN
NCNTRL	LASTYR	MACPARMS	MCNRETCD	OGSHOUT	OGRESNGON	MPBLK	PGFNS
NCNTRL	LOOPOP	MACPARMS	MCNTOIND	OGSHOUT	OGSPEND	MPBLK	PGFTR
LTC	LYCON	INDREP	MISCFO	OGSHOUT	OGTECHON	MPBLK	PGIAS
NCNTRL	MACFDBK	NCNTRL	MMAC	NGTDMREP	OGUPRNG	MPBLK	PGICN
MACPARMS	MACINV	NCNTRL	MODELON	INTOUT	P_ITIMCRSC	MPBLK	PGIEL
MACPARMS	MACLC	NCNTRL	MORDER	INDREP	PAPERCON	NGTDMOUT	PGIELGR
MACPARMS	MACRAW	NCNTRL	MCRL	MPBLK	PASIN	MPBLK	PGIIN
INDREP	MANHP	NGTDMREP	NGP1PCAP	COALOUT	PBCELNR	MPBLK	PGIRS
NCNTRL	MAXITR	NGTDMREP	NGSTRCAP	COALOUT	PBDELNR	MPBLK	PGITR
MACOUT	MC_COMMFLSP	INDREP	NONHP	COALOUT	PBHELNR	MPBLK	PGPTR
MACOUT	MC_CONS	NCNTRL	MYRS	COALOUT	PBMELNR	MPBLK	PHYTR
MACOUT	MC_CPI	OGSHOUT	OGADFACT	MPBLK	PCLAS	MPBLK	PJFTR
MACOUT	MC_ECIVSPNS	OGSHOUT	OGANGTSOX	MPBLK	PCLCN	MPBLK	PKBAS
MACOUT	MC_EMPMA	OGSHOUT	OGCNBLOS	MPBLK	PCLLE	MPBLK	PKSCH
MACOUT	MC_EXCH	OGSHOUT	OGCNCAP	MPBLK	PCLIN	MPBLK	PKSIN
MACOUT	MC_EXDN87	OGSHOUT	OGCNCON	MPBLK	PCLRS	MPBLK	PKSRS
MACOUT	MC_EX82	OGSHOUT	OGCNDEN	MPBLK	PCLSN	COALOUT	PLCELNR
MACOUT	MC_GDP	OGSHOUT	OGCNDLOSS	PMOUT	PCTPLT_PADO	COALOUT	PLDELNR
MACOUT	MC_GFNL87	OGSHOUT	OGCNEXLOSS	MPBLK	POSAS	MPBLK	PLGAS
MACOUT	MC_GNP	OGSHOUT	OGCNFLW	MPBLK	POSCH	MPBLK	PLGCH
MACOUT	MC_GOVT	OGSHOUT	OGCNPARM1	MPBLK	POSEL	MPBLK	PLGIN
MACOUT	MC_MUSTS1	OGSHOUT	OGCNPARM2	MPBLK	POSIN	MPBLK	PLGRS
MACOUT	MC_MUSTS2	OGSHOUT	OGCNPHARKUP	MPBLK	POSRS	MPBLK	PLGTR
MACOUT	MC_IFIXNR	OGSHOUT	OGCNPPRD	MPBLK	POSTR	COALOUT	PLNELNR
MACOUT	MC_IMS2	OGSHOUT	OGCNOPRD	MPBLK	PELAS	COALOUT	PLNELNR
MACOUT	MC_INVEST	OGSHOUT	OGCOPRD	EFFPOUT	PELASNR	MPBLK	PLPIN
MACOUT	MC_JULCNF	OGSHOUT	OGCORSV	UEFPOUT	PELAV	MPBLK	PNCIN
MACOUT	MC_KPMUSTS1	OGSHOUT	OGCOUNP	MPBLK	PELCH	MPBLK	PMETR
MACOUT	MC_KPMUSTS2	OGSHOUT	OGDIWOP	EFFPOUT	PELCHNR	MPBLK	PNGAS
MACOUT	MC_KPMH	OGSHOUT	OGELSCAN	UEFPOUT	PELCP	MPBLK	PNGCH
MACOUT	MC_MFG1	OGSHOUT	OGELSCO	EFFPOUT	PELCPNR	MPBLK	PNGIN
MACOUT	MC_MFGO	OGSHOUT	OGELSGOF	UEFPOUT	PELFL	MPBLK	PNGTR

COMMON	Variable	COMMON	Variable	COMMON	Variable	COMMON	Variable
NPBLK	PNCAS	QBLK	QDSAS	QBLK	QNGAS	QBLK	QSELCH
NPBLK	PNCCM	QBLK	QDSCH	QBLK	QNGCM	QBLK	QSELIN
NPBLK	PNCEL	QBLK	QDSEL	QBLK	QNGIN	QBLK	QSELR
NPBLK	PNGIN	QBLK	QDSIN	QBLK	QNGTR	QBLK	QSELR
NPBLK	PNGRS	QBLK	QDSRF	QBLK	QNGSAS	QBLK	QSELTR
NPBLK	PNGTR	QBLK	QDSRS	QBLK	QNGSEL	QBLK	QSENAS
NPBLK	POTAS	QBLK	QDSTR	QBLK	QNGSIN	QBLK	QSENCM
NPBLK	POTIN	QBLK	QETEL	QBLK	QNGAS	QBLK	QSENTN
NPBLK	POTTR	QBLK	QELAS	QBLK	QNGCM	QBLK	QSENR
NPBLK	PPFIN	QBLK	QELCH	QBLK	QNGEL	QBLK	QSENR
NPBLK	PRNAS	QBLK	QELIN	QBLK	QNGIN	QBLK	QSENR
NPBLK	PRNEL	QBLK	QELRF	QBLK	QNGRF	QBLK	QSEPAS
UGOILOUT	PRNELCR	QBLK	QELRS	QBLK	QNGRS	QBLK	QSEPCN
NPBLK	PRNTR	QBLK	QELTR	QBLK	QNGTR	QBLK	QSEPIN
NPBLK	PRLAS	QBLK	QENAS	QBLK	QOTAS	QBLK	QSEPR
NPBLK	PRLCN	QBLK	QENCM	QBLK	QOTIN	QBLK	QSEPRS
NPBLK	PRLEL	QBLK	QENTN	QBLK	QOTRF	QBLK	QSEPTR
UGOILOUT	PRLELCR	QBLK	QENRF	QBLK	QOTTR	QBLK	QSETTR
NPBLK	PRLIN	QBLK	QENRS	QBLK	QPCAS	QBLK	QSGEAS
NPBLK	PRLTR	QBLK	QENTR	QBLK	QPCEL	QBLK	QSGEEL
NGTDMOUT	PRNG PADO	QBLK	QEPAS	QBLK	QPCIN	QBLK	QSGEIN
NPBLK	PRNAS	QBLK	QEPCH	QBLK	QPCR	QBLK	QSGFAS
NPBLK	PRSCN	QBLK	QEPIN	QBLK	QPFIN	QBLK	QSGFCN
NPBLK	PRSEL	QBLK	QEPRF	QBLK	QPVAS	QBLK	QSGFEL
NPBLK	PRSIN	QBLK	QEPRS	QBLK	QPVCH	QBLK	QSGGIN
NPBLK	PRSTR	QBLK	QEPTR	QBLK	QPVEL	QBLK	QSGGRF
NCNTRL	PRTDGCG	QBLK	QETTR	QBLK	QPVIN	QBLK	QSGFRS
NCNTRL	PRTDGGE	UEFDOUT	QGCCELGR	QBLK	QPVRS	QBLK	QSGFTR
NCNTRL	PRTDGGE	QBLK	QGEAS	QBLK	QRNAS	QBLK	QSGIAS
NCNTRL	PRTDGCI	QBLK	QGEEL	QBLK	QRNEL	QBLK	QSGICH
NCNTRL	PRTDGCK	QBLK	QGEIN	UGOILOUT	QRNELGR	QBLK	QSGIEL
NCNTRL	PRTDGCL	RESOREP	QGERS	QBLK	QRNTR	QBLK	QSGIIN
NCNTRL	PRTDGCM	QBLK	QGFAS	QBLK	QRLAS	QBLK	QSGIN
NCNTRL	PRTDGCM	QBLK	QGFCH	QBLK	QRLCH	QBLK	QSGIRF
NCNTRL	PRTDGCO	QBLK	QGFEL	QBLK	QRLLEL	QBLK	QSGIRS
NCNTRL	PRTDGCR	UEFDOUT	QGFELGR	UGOILOUT	QRLLEGR	QBLK	QSGITR
NCNTRL	PRTDGCT	QBLK	QGFIN	QBLK	QRLIN	QBLK	QSGPTR
NCNTRL	PRTDGCM	QBLK	QGFRF	QBLK	QRLRF	QBLK	QSGRF
COALOUT	PSCELNR	QBLK	QGFRS	QBLK	QRLTR	UEFDOUT	QSHELNR
COALOUT	PSDELNR	QBLK	QGFTR	QBLK	QRSAS	QBLK	QSHOAS
COALOUT	PSHELNR	QBLK	QGTAS	QBLK	QRSCH	QBLK	QSHOEL
COALOUT	PSHELNR	QBLK	QGICH	QBLK	QRSEL	QBLK	QSHOIN
NPBLK	PTPAS	QBLK	QGTEL	QBLK	QRSIN	QBLK	QSHYTR
NPBLK	PTPCN	UEFDOUT	QGTELGR	QBLK	QSRF	QBLK	QSJFTR
NPBLK	PTPEL	QBLK	QGTIN	QBLK	QRSTR	QBLK	QSKSAS
NPBLK	PTPIN	QBLK	QGIRF	QBLK	QSASIN	QBLK	QSKSCH
NPBLK	PTPRF	QBLK	QGIRS	QBLK	QSBMAS	QBLK	QSKSIN
NPBLK	PTPRS	QBLK	QGITR	QBLK	QSBMCM	QBLK	QSKSRS
NPBLK	PTPTR	QBLK	QGPTR	QBLK	QSBMEL	QBLK	QSLGAS
NPBLK	PUREL	QBLK	QHOAS	QBLK	QSBMIN	QBLK	QSLGCM
INTOUT	QJTINCRSC	QBLK	QHOEL	QBLK	QSBMRF	QBLK	QSLGIN
QBLK	QASIN	QBLK	QHON	QBLK	QSBMRS	QBLK	QSLGRF
UEFDOUT	QBCELNR	QBLK	QHYTR	QBLK	QSBMSN	QBLK	QSLGRS
UEFDOUT	QBDENNR	QBLK	QJFTR	UEFDOUT	QSCENNR	QBLK	QSLGTR
UEFDOUT	QBENLNR	QBLK	QKSAS	QBLK	QSCIIN	QBLK	QSLPIN
QBLK	QBNAS	QBLK	QKSCN	QBLK	QSCLAS	QBLK	QSNCH
QBLK	QBMCN	QBLK	QKSTN	QBLK	QSCLCN	UEFDOUT	QSMELNR
QBLK	QBSEL	QBLK	QKSRS	QBLK	QSCLEL	QBLK	QSMETR
UEFDOUT	QBENLNR	UEFDOUT	QLCELNR	QBLK	QSCLIN	QBLK	QSMGAS
QBLK	QBMIN	UEFDOUT	QLDELNR	QBLK	QSCLEL	QBLK	QSMGCM
QBLK	QBMR	QBLK	QLGAS	QBLK	QSCLEL	QBLK	QSMGIN
QBLK	QBMR	QBLK	QLGCM	QBLK	QSCLEL	QBLK	QSMGTR
QBLK	QBMR	QBLK	QLGIN	UEFDOUT	QSDENNR	QBLK	QSMNAS
UEFDOUT	QBENLNR	QBLK	QLGRF	QBLK	QSDSAS	QBLK	QSMSEL
QBLK	QCIIN	QBLK	QLGRS	QBLK	QSDSCH	QBLK	QSMSTN
QBLK	QCLAS	QBLK	QLGTR	QBLK	QSDSEL	QBLK	QSMGAS
QBLK	QCLCH	UEFDOUT	QLHNLNR	QBLK	QSDSIN	QBLK	QSMGCM
QBLK	QCLLEL	UEFDOUT	QLHNLNR	QBLK	QSDSRF	QBLK	QSMGEL
QBLK	QCLIN	QBLK	QLPIN	QBLK	QSDSRS	QBLK	QSMGIN
QBLK	QCLRF	UEFDOUT	QLTELNR	QBLK	QSDSTR	QBLK	QSMGRF
QBLK	QCLRS	QBLK	QMCIN	QBLK	QSETEL	QBLK	QSMGRS
QBLK	QCLSN	QBLK	QMETR	QBLK	QSELAS	QBLK	QSMGTR

2 of 2

COMMON Variable

GBLK GSOTAS
 GBLK GSOTIN
 GBLK GSOTRF
 GBLK GSOTTR
 GBLK GSPCAS
 GBLK GSPCEL
 GBLK GSPCIN
 GBLK GSPCRF
 GBLK GSPFIN
 GBLK GSPVAS
 GBLK GSPVCH
 GBLK GSPVEL
 GBLK GSPVIN
 GBLK GSPVRS
 GBLK GSRHAS
 GBLK GSRMEL
 GBLK GSRNTR
 GBLK GSRLAS
 GBLK GSRLCM
 GBLK GSRLEL
 GBLK GSRLIN
 GBLK GSRLRF
 GBLK GSRLTR
 GBLK GSRSSAS
 GBLK GSRSCM
 GBLK GSRSEL
 GBLK GSRGIN
 GBLK GSRGRF
 GBLK GSRSTR
 GBLK GSSGIN
 GBLK GSSGRF
 GBLK GSSTAS
 GBLK GSSTCM
 GBLK GSSTEL
 GBLK GSSTIN
 GBLK GSSTRS
 GBLK GSTAS
 GBLK GSTCM
 GBLK GSTEL
 UECPOUT GSTELNR
 GBLK GSTIN
 GBLK GSTPAS
 GBLK GSTPCM
 GBLK GSTPEL
 GBLK GSTPIN
 GBLK GSTPRF
 GBLK GSTPRS
 GBLK GSTPTR
 GBLK GSTRAS
 GBLK GSTRCH
 GBLK GSTRCL
 GBLK GSTRIN
 GBLK GSTRRS
 GBLK GSTRS
 GBLK GSTRSN
 GBLK GSTRTR
 GBLK GSTSAS
 GBLK GSTSCM
 GBLK GSTSEL
 GBLK GSTSIN
 GBLK GSTSRF
 GBLK GSTSRS
 GBLK GSTSSN
 GBLK GSTSTR
 GBLK GSUREL
 GBLK GSUIAS
 GBLK GSUIEL
 GBLK GSUIIN
 GBLK QTPAS
 GBLK QTPCH
 GBLK QTPCL
 GBLK QTPIN

COMMON Variable

GBLK QTPRF
 GBLK QTPRS
 GBLK QTPTR
 GBLK QTRAS
 GBLK QTRCH
 GBLK QTRCL
 GBLK QTRIN
 GBLK QTRRS
 GBLK QTRSN
 GBLK QTRTR
 GBLK QTSAS
 GBLK QTSCH
 GBLK QTSEL
 GBLK QTSIN
 GBLK QTSRF
 GBLK QTSRS
 GBLK QTSSN
 GBLK QTSTR
 GBLK QUREL
 GBLK QUIAS
 GBLK QUIEL
 GBLK QUIIN
 RFCM REFCOM
 INDREP REFCOM
 TRANREP REGSALERPT
 INTOUT REPORT
 PNMOUT RFBSTCAP
 PNMOUT RFCAPEXP
 PNMPT RFCGAPADOPD
 PNMPT RFCGAPCD
 PNMPT RFCGAPPD
 PNMPT RFDPRDAST
 PNMPT RFDPRDCOK
 PNMPT RFDPRDOSL
 PNMPT RFDPRDJTA
 PNMPT RFDPRDKER
 PNMPT RFDPRDLPG
 PNMPT RFDPRDN2H
 PNMPT RFDPRDN68
 PNMPT RFDPRDN6I
 PNMPT RFDPRDOTH
 PNMPT RFDPRDPCH
 PNMPT RFDPRDRFG
 PNMPT RFDPRDRFH
 PNMPT RFDPRDSTG
 PNMPT RFDPRDTRG
 PNMPT RFDPRDTRH
 PNMPT RFDSCUM
 PNMPT RFDSTAX
 PNMPT RFDSTCAP
 PNMPT RFDSTUTL
 PNMPT RFELPUPD
 PNMPT RFINTP
 PNMPT RFIPOCHN
 PNMPT RFIPOCHL
 PNMPT RFIPOCHV
 PNMPT RFIPOCLL
 PNMPT RFIPOCHN
 PNMPT RFIPODS
 PNMPT RFIPOJF
 PNMPT RFIPOLG
 PNMPT RFIPOME
 PNMPT RFIPOMG
 PNMPT RFIPOMT
 PNMPT RFIPORN
 PNMPT RFIPORL
 PNMPT RFIQIPRODT
 PNMOUT RFPONGL
 PNMPT RFPQUFC
 PNMPT RFGARO
 PNMOUT RFGOCRO

COMMON Variable

PNMOUT RFGDIMPOT
 PNMPT RFGDS
 PNMPT RFGEL
 PNMPT RFGEXCRD
 PNMPT RFGEXPRDT
 PNMPT RFGICRD
 PNMPT RFGIN
 PNMPT RFGJF
 PNMPT RFGKS
 PNMPT RFGLG
 PNMPT RFGMG
 PNMPT RFGOTH
 PNMPT RFGPCK
 PNMPT RFGPF
 PNMOUT RFGPRCG
 PNMOUT RFGPRDT
 PNMPT RFGRC
 PNMPT RFGRN
 PNMPT RFGRL
 PNMPT RFGSECT
 PNMPT RFGSTG
 PNMOUT RFGTDCRD
 PNMPT RFGTR
 PNMOUT RFREV
 PNMOUT RFSL
 PNMPT RFSHROR
 PNMPT RFSHROX
 PNMPT RFSHRRF
 PNMPT RFSHRT
 PNMOUT RFSRFR
 PNMOUT RFSRPH
 PNMPT RFSWDH
 NCHTRL RLXPC
 RESDREP RSAPCON
 RESDREP RSCKCON
 RESDREP RSCOOK
 RESDREP RSCOOLCH
 RESDREP RSCOOLERS
 RESDREP RSDRY
 RESDREP RSDRYCON
 RESDREP RSEEFCL
 RESDREP RSEEFZ
 RESDREP RSEEFH
 RESDREP RSEEFH
 RESDREP RSEEFH
 RESDREP RSEH
 RESDREP RSFRZ
 RESDREP RSFRZCON
 RESDREP RSHSEADO
 RESDREP RSHTRCON
 RESDREP RSHTRS
 RESDREP RSHZCON
 RESDREP RSLTCON
 RESDREP RSNEFCL
 RESDREP RSNEFFZ
 RESDREP RSNEFHT
 RESDREP RSNEFW
 RESDREP RSNEFRF
 RESDREP RSNH
 RESDREP RSREF
 RESDREP RSREFCON
 RESDREP RSMATER
 NCHTRL RUNMOD
 COALOUT SCELNR
 COALOUT SDELNR
 COALOUT SHELNR
 COALOUT SHELNR
 NCHTRL SCALPR
 SNC SNTCON
 COALOUT SLCELNR
 COALOUT SLDELNR
 COALOUT SLMELNR

COMMON Variable

COALOUT SLMELNR
 COALOUT SCELNR
 COALOUT SDELNR
 COALOUT SHELNR
 COALOUT SHELNR
 INDREP STEELCON
 TRANREP TRAIREFFH
 TRANREP TRAIREFFS
 TRANREP TRAIRSLS
 TRANREP TRAIRSTK
 TRANREP TREFFALT
 TRANREP TREFFALTC
 TRANREP TREFFALTT
 TRANREP TREFFCAR
 TRANREP TREFFFLT
 TRANREP TREFFTRK
 TRANREP TREFFTRKF
 TRANREP TRMPCAR
 TRANREP TRMPTK
 TRANREP TRIMSHIP
 TRANREP TRLDMPGC
 TRANREP TRLDMPGF
 TRANREP TRLDMPGT
 TRANREP TRLDQTEK
 TRANREP TRLDALC
 TRANREP TRLDALT
 TRANREP TRLDSTKC
 TRANREP TRLDSTKT
 TRANREP TRLDVMT
 TRANREP TRLDVMT
 TRANREP TRGAIRT
 TRANREP TRGBOAT
 TRANREP TRGBUS
 TRANREP TRGDONS
 TRANREP TRGENUSE
 TRANREP TRGFTK
 TRANREP TRGWY
 TRANREP TRQINTS
 TRANREP TRQLD
 TRANREP TRQLDV
 TRANREP TRQLUB
 TRANREP TRQHIL
 TRANREP TRQHMY
 TRANREP TRQRAILR
 TRANREP TRORRF
 TRANREP TRORRP
 TRANREP TRSLSHRC
 TRANREP TRSLSHRT
 TRANREP TRSTNDEM
 TRANREP TRTHRR
 TRANREP TRTMSHIP
 TRANREP TRTRAVLD
 TRANREP TRVMTTRK
 TRANREP TRXAIR
 TRANREP TRXAIREF
 TRANREP TRXFREF
 TRANREP TRXFRVMT
 TRANREP TRXLDMVT
 TRANREP TRXRAIL
 TRANREP TRXRAILLEFF
 TRANREP TRXSHIP
 TRANREP TRXSHIPEFF
 UECPOUT UADCCN
 UECPOUT UADCCU
 UECPOUT UADCCSN
 UECPOUT UADCCSU
 UECPOUT UADDOCTN
 UECPOUT UADDOCTU
 UECPOUT UADDOGET
 UECPOUT UADDOHNT
 UECPOUT UADDOHST
 UECPOUT UADDOHUN
 UECPOUT UADDOHJ

COMMON	Variable	COMMON	Variable	COMMON	Variable	COMMON	Variable
MXPBLK	XPOSBL	MXPBLK	XPRSEL	MXQBLK	XQHOAS	MXQBLK	XQTPCM
MXPBLK	XPOSIN	MXPBLK	XPRSIN	MXQBLK	XQHOEL	MXQBLK	XQTPEL
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MXPBLK	XPOSTR	MXPBLK	XPTPAS	MXQBLK	XQHYTR	MXQBLK	XQTPRF
MXPBLK	XPELAS	MXPBLK	XPTPCM	MXQBLK	XQJFTR	MXQBLK	XQTPRS
UECPOUT	XPELAVN	MXPBLK	XPTPEL	MXQBLK	XQKSAS	MXQBLK	XQTPTR
MXPBLK	XPELCN	MXPBLK	XPTPIN	MXQBLK	XQKSCN	MXQBLK	XQTRAS
MXPBLK	XPELIN	MXPBLK	XPTPRF	MXQBLK	XQKSTN	MXQBLK	XQTRCN
MXPBLK	XPELRS	MXPBLK	XPTPRS	MXQBLK	XQKSRB	MXQBLK	XQTRCL
MXPBLK	XPELTR	MXPBLK	XPTPTR	MXQBLK	XQLGAS	MXQBLK	XQTRIN
MXPBLK	XPENAS	MXPBLK	XPUREL	MXQBLK	XQLGCH	MXQBLK	XQTRRS
MXPBLK	XPENCN	MXQBLK	XQASIN	MXQBLK	XQLGIN	MXQBLK	XQTRSN
MXPBLK	XPENIN	MXQBLK	XQBHAS	MXQBLK	XQLGRF	MXQBLK	XQTRTR
MXPBLK	XPENRS	MXQBLK	XQBHCH	MXQBLK	XQLGRB	MXQBLK	XQTSAS
MXPBLK	XPENR	MXQBLK	XQBHEL	MXQBLK	XQLGTR	MXQBLK	XQTSCH
MXPBLK	XPFPAS	MXQBLK	XQBMIN	MXQBLK	XQLPIN	MXQBLK	XQTSCL
MXPBLK	XPFPCH	MXQBLK	XQBHRF	MXQBLK	XQMCIN	MXQBLK	XQTSIN
MXPBLK	XPFPIN	MXQBLK	XQBHRS	MXQBLK	XQMETR	MXQBLK	XQTSRF
MXPBLK	XPFPRS	MXQBLK	XQBMSN	MXQBLK	XQMGAS	MXQBLK	XQTSRS
MXPBLK	XPFPTR	MXQBLK	XQCIIN	MXQBLK	XQMGCH	MXQBLK	XQTSRN
MXPBLK	XPETTR	MXQBLK	XQCLAS	MXQBLK	XQMGIN	MXQBLK	XQTSR
MXPBLK	XPGFAS	MXQBLK	XQCLCH	MXQBLK	XQMGTR	MXQBLK	XQUREL
MXPBLK	XPGFCN	MXQBLK	XQCLEL	MXQBLK	XQMSAS	MXQBLK	XQVIAS
MXPBLK	XPGFEL	MXQBLK	XQCLIN	MXQBLK	XQMSCL	MXQBLK	XQVIEL
MXPBLK	XPGFIN	MXQBLK	XQCLRF	MXQBLK	XQMSIN	MXQBLK	XQVIN
MXPBLK	XPGFRS	MXQBLK	XQCLRS	MXQBLK	XQNGAS	PHMOUT	XRFQDCRD
MXPBLK	XPGFTR	MXQBLK	XQCLSN	MXQBLK	XQNGCH	NCHTRL	YEARPR
MXPBLK	XPGIAS	MXQBLK	XQDSAS	MXQBLK	XQNGEL		
MXPBLK	XPGICH	MXQBLK	XQDSCH	MXQBLK	XQNGELCH		
MXPBLK	XPGIEL	MXQBLK	XQDSEL	MXQBLK	XQNGELFN		
MXPBLK	XPGIIN	MXQBLK	XQDSIN	MXQBLK	XQNGELIN		
MXPBLK	XPGIRS	MXQBLK	XQDSRF	MXQBLK	XQNGIN		
MXPBLK	XPGITR	MXQBLK	XQDSRS	MXQBLK	XQNGRF		
MXPBLK	XPGPTR	MXQBLK	XQDSTR	MXQBLK	XQNGRS		
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MXPBLK	XPJFTR	MXQBLK	XQELAS	MXQBLK	XQOTAS		
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MXPBLK	XPKSIN	MXQBLK	XQELRF	MXQBLK	XQOTTR		
MXPBLK	XPKSAS	MXQBLK	XQELRS	MXQBLK	XQPCAS		
MXPBLK	XPLGAS	MXQBLK	XQELTR	MXQBLK	XQPCCL		
MXPBLK	XPLGCH	MXQBLK	XQENAS	MXQBLK	XQPCIN		
MXPBLK	XPLGIN	MXQBLK	XQENCH	MXQBLK	XQPCRF		
MXPBLK	XPLGRS	MXQBLK	XQENIN	MXQBLK	XQPFIN		
MXPBLK	XPLGTR	MXQBLK	XQENRF	MXQBLK	XQPVAS		
MXPBLK	XPLPIN	MXQBLK	XQENRS	MXQBLK	XQPVCH		
MXPBLK	XPNCIN	MXQBLK	XQENTR	MXQBLK	XQPVCL		
MXPBLK	XPNEYR	MXQBLK	XQEPAS	MXQBLK	XQPVIN		
MXPBLK	XPNGAS	MXQBLK	XQEPCH	MXQBLK	XQPVRS		
MXPBLK	XPNGCH	MXQBLK	XQEPIN	MXQBLK	XQRHAS		
MXPBLK	XPNGIN	MXQBLK	XQEPRF	MXQBLK	XQRHEL		
MXPBLK	XPNGTR	MXQBLK	XQEPRS	MXQBLK	XQRHTR		
MXPBLK	XPNGAS	MXQBLK	XQEPTTR	MXQBLK	XQRLAS		
MXPBLK	XPNGCH	MXQBLK	XQETTR	MXQBLK	XQRLCH		
MXPBLK	XPNGEL	MXQBLK	XQGEAS	MXQBLK	XQRLCL		
MXPBLK	XPNGIN	MXQBLK	XQGEEL	MXQBLK	XQRLIN		
MXPBLK	XPNGRS	MXQBLK	XQGEIN	MXQBLK	XQRLRF		
MXPBLK	XPNGTR	MXQBLK	XQGFAS	MXQBLK	XQRLTR		
MXPBLK	XPOTAS	MXQBLK	XQGFCH	MXQBLK	XQRSAS		
MXPBLK	XPOTIN	MXQBLK	XQGFEL	MXQBLK	XQRSCH		
MXPBLK	XPOTTR	MXQBLK	XQGFIN	MXQBLK	XQRSEL		
MXPBLK	XPPFIN	MXQBLK	XQGFRF	MXQBLK	XQRSIN		
MXPBLK	XPRHAS	MXQBLK	XQGFRS	MXQBLK	XQRSRF		
MXPBLK	XPRHEL	MXQBLK	XQGFTR	MXQBLK	XQRSTR		
MXPBLK	XPRHTR	MXQBLK	XQGIAS	MXQBLK	XQSGIN		
MXPBLK	XPRLAS	MXQBLK	XQGITCH	MXQBLK	XQSGRF		
MXPBLK	XPRLCN	MXQBLK	XQGIEL	MXQBLK	XQSTAS		
MXPBLK	XPRLEL	MXQBLK	XQGIN	MXQBLK	XQSTCH		
MXPBLK	XPRLIN	MXQBLK	XQGIRF	MXQBLK	XQSTCL		
MXPBLK	XPRLTR	MXQBLK	XQGIRS	MXQBLK	XQSTIN		
MXPBLK	XPRSAS	MXQBLK	XQGITR	MXQBLK	XQSTRS		
MXPBLK	XPRSCH	MXQBLK	XQGPTR	MXQBLK	XQTPAS		

Appendix C. Bibliography

Appendix C. Bibliography

This appendix gives a detailed list of documents that describe the National Energy Modeling System. All reports listed in this appendix, unless cited otherwise, were produced by the Energy Information Administration.

NEMS System Design Reports

The NEMS System Design Reports were written by the Energy Information Administration as the primary design documents, prior to initial coding of the NEMS modules. The documents in this section were the primary source for most of the information published in the body of this document.

Overall Systems Design and Integration

"Development Plan for the National Energy Modeling System," Office of Integrated Analysis and Forecasting, draft July 21, 1992.

"Integrating Module Component Design Report," National Energy Modeling System Branch, Office of Integrated Analysis and Forecasting, December 21, 1992.

"International Energy Module, World Oil Market, Petroleum Product Supply and Oxygenates Supply Components," Energy Demand and Integration Division, International, Economic and Integrated Forecasting Branch, Office of Integrated Analysis and Forecasting, July 31, 1992.

"Requirements for a National Energy Modeling System," Office of Integrated Analysis and Forecasting, May 18, 1992.

"System Design for the National Energy Modeling System," Office of Integrated Analysis and Forecasting, January 16, 1992.

Macroeconomic Activity

"Interindustry Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Integration Division, Office of Integrated Analysis and Forecasting, August 28, 1992.

"National Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Integration Division, Office of Integrated Analysis and Forecasting, May 1992.

"Regional Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Integration Division, Office of Integrated Analysis and Forecasting, September 18, 1992.

Demand

"Commercial Sector Component Design Report," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, January 21, 1993.

"Industrial Sector Component Design Report," Energy Demand Analysis Branch, Energy Demand and Integration Division, Office of Integrated Analysis and Forecasting, July 7, 1992.

"Residential Sector Component Design Report," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, January 19, 1993.

"Transportation Sector Component Design Report," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, January 21, 1993.

Electricity

"Overview of the Electricity Market Module of the National Energy Modeling System," Energy Supply and Conversion Division, Nuclear and Electricity Analysis Branch, Office of Integrated Analysis and Forecasting.

"Capacity Planning," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, August 1992.

"Finance and Pricing Submodule," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, December 7, 1992.

"Fuel Dispatch," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, May 28, 1992.

"Transmission and Trade," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, January 13, 1993.

"Load and Demand-Side Management Submodule," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, October 1992.

"Nonutility Generation Supply," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, May 11, 1992.

Coal

"Overview of the Coal Market Module of the National Energy Modeling System," Energy Supply and Conversion Division, Coal, Uranium and Renewable Fuels Analysis Branch, Office of Integrated Analysis and Forecasting, April 1992.

"Coal Distribution," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, April 1992.

"Coal Production Submodule," Coal, Uranium, and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, May 1992.

"Coal Synthetics Submodule," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, October 1992.

Renewable Fuels

"Overview of the Renewable Fuels Module of the National Energy Modeling System," Energy Supply and Conversion Division, Coal, Uranium and Renewable Fuels Analysis Branch, Office of Integrated Analysis and Forecasting, July 2, 1992.

"Biofuels (Ethanol) Supply Submodule," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, July 2, 1992.

"Biomass Supply Submodule of the Renewable Fuels Module," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, January 14, 1993.

"Geothermal Electricity Submodule," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, December 15, 1992.

"Hydropower Submodule," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, June 25, 1992.

Oil and Gas Supply

"Alaska Oil and Gas Supply," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, May 7, 1992.

"Basic Framework and Onshore Lower 48 Conventional Oil and Gas Supply," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, January 21, 1993.

"Capacity Expansion Module for the Natural Gas Transmission and Distribution Model of the National Energy Modeling System," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, December 29, 1992.

"Detailed NEMS Refinery Model Design Report," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, May 1992.

"Foreign Natural Gas Supply," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, January 27, 1993.

"Natural Gas Annual Flow Module," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, June 24, 1992.

"Offshore Lower 48 Conventional Oil and Gas Supply," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, July 1992.

"Petroleum Market Module," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, December 16, 1992.

"Pipeline Tariff Module for the Natural Gas Transmission and Distribution Model of the National Energy Modeling System," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, December 29, 1992.

"Unconventional Gas Recovery," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, July 1992.

Model Documentation Reports

This section lists the documentation reports for NEMS, planned as of the writing of this edition of this *Integrating Module Documentation Report*. All eventually will be authored by the Energy Information Administration.

Macroeconomic Activity

"Interindustry Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Intergration Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"National Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Intergration Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Regional Submodule," International, Economic and Integrated Forecasting Branch, Energy Demand and Integration Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Oil and Gas Supply

"Annual Flow Component," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Capacity Expansion Component," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Distribution Tariffs Component," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Petroleum Market Module," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Pipeline Tariffs Component," Oil and Gas Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Coal

"Coal Distribution Component," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Coal Export Component," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Coal Production Component," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Coal Synthetics Component," Coal, Uranium and Renewable Fuels Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Electricity Market Module

"Capacity Planning," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Financial and Pricing Component," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Fuel Dispatch Component," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Load and Demand-side Management Component," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Nonutility Generation Supply Component," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Transmission and Trade Component," Nuclear and Electricity Analysis Branch, Energy Supply and Conversion Division, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Demand Components

"Commercial Demand Module," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Industrial Demand Module," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Residential Demand Module," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

"Transportation Demand Module," Energy Demand Analysis Branch, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Overall Systems Design and Integration

"NEMS Methodology Summary," National Energy Modeling System Branch, Office of Integrated Analysis and Forecasting, forthcoming in January 1994.

"International Energy Module," Energy Demand and Integration Division, International, Economic and Integrated Forecasting Branch, Office of Integrated Analysis and Forecasting, forthcoming December 1993.

Other Documents

Reports listed in this section describe earlier models. They are listed here because they contain information summarized in this report.

"Documentation of the Integrating Module of the Intermediate Future Forecasting System," Energy Information Administration, Reserves and Natural Gas Division, Office of Oil and Gas, U.S. Department of Energy, May 1991.

"The Integrating Model of the Project Independence Evaluation System, Volume 3: User's Guide," U.S. Department of Energy, Energy Information Administration, Assistant Administrator for Applied Analysis, March 1979.

"The Integrating Model of the Project Independence Evaluation System, Volume 5: Code Documentation," U.S. Department of Energy, Energy Information Administration, Assistant Administrator for Applied Analysis, July 1978.

"The Integrating Model of the Project Independence Evaluation System, Volume 6: Data Documentation, Part 1," U.S. Department of Energy, Energy Information Administration, Assistant Administrator for Applied Analysis, February 1979.

"Model Documentation of the Gas Analysis Modeling System," Energy Information Administration, U.S. Department of Energy, Office of Oil and Gas, May 1991.

"Project Independence Report," Federal Energy Administration, November 1974.

"Research into the Methodology of the LEAP Model," U.S. Department of Energy, Energy Information Administration, Assistant Administrator for Applied Analysis, December 1979.

Appendix D. Model Abstract

Appendix D. Model Abstract

Model Name: National Energy Modeling System

Acronym: NEMS

Description: NEMS represents a general equilibrium solution of the interactions between the U.S. energy markets and the economy. The model achieves a supply and demand balance in the end-use demand regions, defined as the nine Census Divisions, by solving for the prices of each energy type such that the quantities producers are willing to supply equal the quantities consumers wish to consume. The system reflects market economics, industry structure, and energy policies and regulations that influence market behavior.

Purpose: The objective of NEMS is to account for the many interactions of the different segments of the energy industries and to provide an internally consistent forecast of prices and quantities for which supply equals demand. This equilibrium solution accounts for the main economic factors that affect supply and demand, allows price competition of fuels, and accounts for policies and regulations that cause deviations from purely economic behavior.

Last Model Update: October 1993.

Part of Another Model? No.

Model Interfaces: NEMS integrates the efforts of the following submodels:

- Oil and Gas Market Module
- Natural Gas Transmission and Distribution Module
- Coal Market Module
- Renewable Fuels Module
- Electricity Market Module
- Petroleum Market Module
- Residential Sector Demand Module
- Commercial Sector Demand Module
- Transportation Sector Demand Module
- Industrial Sector Demand Module
- Macroeconomic Activity Module
- International Energy Activity Module

Sponsor: Office of Integrated Analysis and Forecasting, Energy Information Administration;
U.S. Department of Energy.

Model Contacts:

Ms. Susan H. Shaw (202) 586-4838

Documentation: "NEMS Methodology Summary," National Energy Modeling System Branch, Office of Integrated Analysis and Forecasting, forthcoming in January 1994.

Archive Media and Installation Manual(s): Forthcoming.

Energy System Described by Model: NEMS is a general equilibrium model of domestic energy supply and demand. It represents the domestic production of oil natural gas, refined petroleum products, coal and electricity. It also represents the two major energy conversion activities, the refining of crude oil into petroleum products and the conversion of fossil fuels, nuclear power, hydropower, and other renewable sources into electricity. Consumption of energy is represented by four end-use sectors: residential, commercial, industrial, and transportation.

Coverage:

- **Geographic:** Nine Bureau of Census Divisions. Some component analytical modules represent energy production or conversion at different levels of regional detail. All equilibration takes place at the Census Division level.
- **Time Unit/Frequency:** Annual through 2015
- **Product(s):** Natural gas, electricity, coal, steam coal, metallurgical coal, distillate fuel oil, residual fuel oil, motor gasoline, jet fuel, liquefied petroleum gases, petrochemical feedstocks, kerosene, other petroleum products, hydropower, and other renewable sources.
- **Economic Sector(s):** Residential, commercial, industrial, and transportation end-use consumption; coal supply; oil and gas production and natural gas markets; utility and nonutility capacity, and generation of electricity; oil product pricing.

Modeling Features:

- **Model Structure:** NEMS provides an equilibrium framework in which the economic forces of supply and demand can be simulated. Its modular structure allows each individual module to be represented in a different fashion if desired.
- **Modeling Technique:** NEMS is a simulation of the impacts of present and planned energy market conditions upon the supplies of and demands for energy products. Different techniques are applied in different sectors, as appropriate.
- **Special Features:** The primary design feature of NEMS is its modularity. That is, the model is organized by fuel production—oil, natural gas, coal, and electricity—and by end-use consumption sector. Any of these modules can be replaced by a simple representation when detailed results are not required. The modularity also allows any single module or group of modules to be run independently as a debugging aid or for stand-alone analysis. Furthermore, modularity also allows the flexibility for each sector to be represented in the most appropriate way, highlighting the particular issues important for the sector, including the most appropriate regional structure.

Non-DOE Input Sources: All data sources are listed under the appropriate modules of NEMS, which are listed in the Model Interfaces section.

DOE Data Input Sources: All data sources are listed under the appropriate modules of NEMS, which are listed in the Model Interfaces section.

Inventory of Parameter Estimates: None.

General Description of Output Data: The following are generally used in published reports:

- Total Energy Supply and Disposition
- Domestic Production by Fuel Type
- Imports and Exports by Fuel Type
- Electric Utility and Nonutility Fuel Consumption, Generation and Capacity
- Electricity Disposition and End-Use Sectoral and Regional Prices
- Petroleum Supply, Disposition and End-Use Sectoral and Regional Prices
- Natural Gas Supply, Disposition and End-Use Sectoral and Regional Prices
- Coal Supply, Disposition and End-Use Sectoral and Regional Prices
- Consumption of Energy by Fuel, Sector and Region

Computing Environment:

Hardware Used: IBM 3090QX.

Language Used: FORTRAN 77.

Core Requirement: Over 16,000K, when all modules are being executed.

Estimated Run Time: 24 hours.

Special Features: NEMS is designed to operate in a mainframe computing environment that allows in excess of 16 megabytes of main memory.

Independent Expert Reviews Conducted: None.

Status of Evaluation Efforts by Sponsor: Currently undergoing evaluation.

References: "NEMS Methodology Summary," National Energy Modeling System Branch, Office of Integrated Analysis and Forecasting, forthcoming in January 1994.

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