



Project Summary

Economic Growth Analysis System: Version 2.0

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The two-volume report describes the development of, and provides information needed to operate, the **Economic Growth Analysis System (E-GAS)** model. The model will be used to project emissions inventories of volatile organic compounds (VOCs), oxides of nitrogen (NO_x), and carbon monoxide (CO) for ozone nonattainment areas and **Regional Oxidation Model (ROM)** modeling regions.

The report details the design and development of E-GAS and includes detailed descriptions of the workings of the E-GAS computer modeling software components and external software.

The system is an economic and activity forecast model that translates the user's assumptions regarding regional economic policies and resource prices into **Source Classification Code (SCC)** level growth factors. The report provides E-GAS users with sufficient background information to define and calibrate the E-GAS model, as well as the procedures and syntax necessary to operate the system. The organization of the user's manual is determined by the process used in operating the system, providing images of sample screens as well as text.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in two volumes (see Project Report ordering information at back).

Introduction

On November 15, 1990, the Clean Air Act Amendments (CAAA) of 1990 were signed into law. The CAAA require that extreme, severe, serious, and multi-state moderate ozone non-attainment areas use photochemical grid modeling to demonstrate future attainment with the ozone national ambient air quality standard (NAAQS) [Section 182(e)(2)(A)]. In addition to photochemical grid modeling, the CAAA require that moderate, serious, severe, and extreme ozone non-attainment areas submit rate-of-progress (ROP) inventories demonstrating a 15% reduction in emissions from 1990 to 1996 [Section 182(b)(1)(A)]. Further, ROP inventories for serious, severe, and extreme areas must include demonstration of a 3% reduction (averaged over 3 years) from 1996 until attainment is achieved [Section 182(c)(2)(B)].

Section 182(b)(1)(A) of the CAAA specifies that the 15% reduction from baseline emissions accounts for any growth in emissions after 1990. A key component of the ROP inventories and photochemical grid modeling demonstrations will be the development of credible growth factors for the existing inventories.

Since growth in source emissions largely depends on the amount of economic activity growth in an area, a consistent set of growth factors requires forecasts using consistent Gross National Product (GNP) forecasts and a consistent methodology for estimating economic activity in Urban Airshed Model (UAM) and Regional Oxi-

dant Model (ROM) modeling regions. The need for consistent economic growth factors, however, must be satisfied in a way that allows states to use their own estimates of national and regional economic activity. The Economic Growth Analysis System (E-GAS) is an economic and activity forecast model which satisfies both of these standards.

The existing inventories for ROP demonstration and photochemical modeling will be housed in the Aerometric Information Retrieval System (AIRS). E-GAS can be applied to AIRS inventories for the development of emission projections to 2010, when extreme areas must reach attainment. State users can create custom GNP forecasts and may modify input assumptions for the regional models in the E-GAS system. The system also allows EPA users to develop volatile organic compound (VOC), nitrogen oxide (NO_x), and carbon monoxide (CO) growth factors using a single GNP forecast, providing baseline emission growth estimates for comparison with growth factors submitted by the states.

The nonattainment areas modeled were chosen on the basis of their nonattainment designation. All serious, severe, and extreme areas were modeled, as were multi-state moderate areas. These areas, their designations and area definitions, were announced in the November 6, 1991, *Federal Register*.

To minimize both the number and run time of the models in E-GAS, eight models were developed. Separate models were developed for EPA Regions 1, 4, 5, 6, 7, and 9. In addition, models were developed that combine the areas in EPA Regions 2 and 3 and EPA Regions 8 and 10. Each model includes all extreme, severe, serious, and multi-state moderate areas, as well as each state and partial state in the region.

E-GAS is a menu-driven system that guides the user through a series of screens which collect information for adapting the model to the user's needs. User input is limited to selecting menu items and setting parameters by entering data in text boxes.

The E-GAS modeling system contains three tiers. Tier 1 includes available national economic forecasts which are used to drive the regional economic models; Tier 2 includes regional economic models for the UAM modeling areas, as well as the states in the ROM modeling regions; and Tier 3 estimates fuel consumption, physical output, and Vehicle Miles Traveled (VMT) based on Tier 2's regional economic forecasts. The tiers must be sequentially executed, since data are created by and passed from early tiers for

transfer to later tiers. The three-tiered structure of E-GAS allows users flexibility in modeling. While tiers must be run before proceeding to later tiers, the system allows the models to be rerun at the user's discretion. For example, users may run a variety of national models before performing regional modeling on the last national model run.

The National REMI Model allows the user to create a national-level growth projection. It is Tier 1 of the three-part process of creating estimated growth factors; it generates data to drive the Regional REMI Model (Tier 2). This tier may be rerun any number of times before proceeding to Tier 2. Five national forecasts are available: Bureau of Labor Statistics (BLS), Data Resources, Inc. (DRI), Research Seminar in Quantitative Economics (RSQE), Wharton Econometric Forecasting Associates (WEFA), and user-entered Gross National Product (GNP) Data.

The Regional REMI Model allows the user to develop a regional growth simulation. This is Tier 2 of the three-part process of creating estimated growth factors; it generates data to drive the Growth Factor Module (Tier 3). In the E-GAS model, more than 100 regular economic policy variables, translator variables, and population variables can be adjusted. Changing these variables allows the user to simulate the economic impact of anticipated government policy changes, market changes, or other exogenous changes to the regional economy. These variables are accessed from the REMI EDFs-14 model and offer scenarios for changes in tax rates (corporate profit tax, equipment tax, investment tax, personal income tax, and property tax), costs (including relative production cost, import cost, and export cost), wage rate, employment transfer payments, purchasing power, and final demand. This tier may be rerun any number of times before proceeding to Tier 3.

The Growth Factor Module is the third tier where growth factors are generated and written to files in the \EGAS subdirectory. This module translates changes in the economic activity levels of the most recent regional forecast to growth factors for physical output, fuel consumption, and VMT. These growth factors will be developed for two-, three-, and four-digit Standard Industrial Classification (SIC) levels, depending on available data for developing and disaggregating the factors. These

SIC-level growth factors will be matched with SCC codes. The user is given a choice of file formats as either the Emission Preprocessor System (EPS) format

or an ASCII text file. The file is output by year, county level, and SCC code.

E-Gas Reference Manual

The Reference Manual provides background information on the design, development, and implementation of the E-GAS system, as well as information concerning the execution of the system itself. Chapter 1 provides an overview of the system as well as discussions of basic system design and development considerations. Chapter 2 discusses the CAAA requirements related to the use of photochemical grid modeling in demonstrating future NAAQS attainment and the submission of rate of progress plans that will demonstrate how an area will achieve the 15% reduction in VOC emissions by 1996 vis-a-vis the use of E-GAS. Chapter 3 discusses the current EPA emissions projection guidance and its relationship to E-GAS. Chapter 4 explains the role and use of national and regional economic forecasts in E-GAS. Chapter 5 discusses how fuel choice is forecast within E-GAS. Chapter 6 discusses how electric utility generation is estimated within E-GAS. Chapter 7 discusses how physical output is estimated within E-GAS. Chapter 8 explains the methodology used within E-GAS to forecast vehicle miles traveled. Chapter 9 explains, CROSSWALK, the final component of E-GAS. CROSSWALK assigns growth factors from the other E-GAS modules to point, area, and mobile SCC's. Appendix A lists the data used to develop electric utility generation estimates. Appendix B lists the parameter values by state used in the electric utility module within E-GAS. Appendix C lists the Bureau of Labor Statistics codes and SCC matches within CROSSWALK. Appendix D provides an example of the CROSSWALK output files.

E-Gas User's Guide

The User's Guide can be used to pilot the user through the E-GAS system. Chapter 1 introduces the terminology used with the system as well as the syntax and format of the program and user guide. Chapter 2 discusses the use of E-GAS by explaining the logical progression of the program, presenting sample screens, providing explanations of input formats, and describing the E-GAS utilities found throughout the system. Chapter 3 describes the role of national economic models in E-GAS and the five options available to the user. Chapter 4 explains the general function of E-GAS's policy variables; it then describes the specific variables while explaining their input. Chapter 5 describes the role of model suppress-

sions in E-GAS and describes all suppressions available to the user. Chapter 6 describes the operation of and data required for the E-GAS National Model (Tier 1). Chapter 7 provides similar descriptions of the Regional Model (Tier 2), and Chapter 8 describes Tier 3, the Growth Factor Module. Chapter 9 identifies contacts for further information regarding the operation of E-GAS and the logic of the system.

Basic Hardware Requirements

The program has been designed for an IBM-compatible personal computer environment. The system requires the following *minimum* hardware configurations:

- IBM 80386 or 100% compatible personal computer
- Math coprocessor
- 580 Kilobytes of Conventional Memory
- 100 Megabytes of available fixed disk storage
- VGA graphics capabilities
- DOS 5.0 or higher
- 5.25 or 3.5 in. floppy disk drive

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*The two-volume report, entitled "Economic Growth Analysis System: Reference
Manual, Version 2.0; and User's Guide, Version 2.0," includes paper copy and
eight sets of floppy disks (Order No. PB95-501961/AS; Cost: \$360.00; subject to
change).*

The set will be available only from:

*National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650*

The EPA Project Officer can be contacted at:

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