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Comparison of economic impacts of outages : REMI versus IMPLAN / : prepared for Los Alamos National Laboratory by Center for Economic Development Research, College of Business Administration, University of South Florida

University of South Florida. Center for Economic Development Research

Comparison of Economic Impacts of Outages

REMI versus IMPLAN

Prepared for
Los Alamos National Laboratory

by

CENTER FOR ECONOMIC DEVELOPMENT RESEARCH
College of Business Administration

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Preface

Los Alamos National Laboratory (LANL) has been conducting a comprehensive evaluation of the Nation's critical infrastructures for more than a decade. Although this evaluation has focused primarily on national security concerns, these critical infrastructures are an integral component of the Nation's economic activity and whose vulnerabilities have economic impacts that are important to understand. As an outgrowth of their research, LANL has developed a model of the natural gas pipeline system and electric power grid for the Tampa Bay region that is resolved to a very detailed level of description. Using this model to simulate outages of electric power and natural gas, LANL commissioned the Center for Economic Development Research (CEDR) to estimate the economic impacts of specified outage areas in the seven-county Tampa Bay region. To estimate the economic impacts CEDR used the REMI^{TM} Policy Insight model. CEDR provided its findings of economic impact to LANL in the report titled "Electric Power and Natural Gas Outage Study," dated March 2003.

Subsequently, LANL commissioned CEDR to compare the economic impacts of the previously specified outages as estimated using the REMI model with the impacts estimated from using the IMPLAN^{TM} Professional model. The document is a report of the comparison of estimates of the two models.

The Center for Economic Development Research initiates and conducts innovative research on economic development. The Center's education programs are designed to cultivate excellence in regional development. Our information system serves to enhance development efforts at the University of South Florida, its College of Business, and throughout the Tampa Bay region.

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Executive Summary

This study compares the estimated economic impacts of power outages using the REMI™ Policy Insight and the IMPLAN™ Professional models. Los Alamos National Laboratory (LANL) provided the geographical definitions of the nine outage areas. The same definition of each outage area is used to estimate the economic impacts using both models. The measure of economic impact we use is value-added.

For the purpose of comparison, impact results at the division level are presented in this report. Division level results using the REMI model are taken from a previous research project performed for LANL and are repeated in this report. Results using the IMPLAN model were aggregated at the 1-digit SIC, or division, level.

Total impacts are generally higher using the REMI model, and average about 7% higher than total impacts generated using the IMPLAN model. Most of the differences in total impact can be traced to differences in impacts generated by each model in the Manufacturing division. Generally, REMI reports impacts in the Manufacturing division that are about twice as much as impacts reported using the IMPLAN model.

Introduction

The purpose of this study is to compare the estimated economic impacts of power outages using the REMI™ Policy Insight and the IMPLAN™ Professional models. In an earlier research project[1], we estimated the economic impacts of outages, defined by geographic area and duration, using the REMI model. In this study, we use the same outage definition and estimate the economic impacts using the IMPLAN model. We then compare the two estimates of economic impact.

Our methodology, whether using REMI or IMPLAN, is unique in that we seek to directly estimate the economic impact of an interruption of electrical power or natural gas within specific outage areas. Using geographic information system (GIS) software, we merge detailed establishment databases with outage areas generated by a Los Alamos National Laboratory (LANL) simulation model to identify with great precision exactly which establishments are affected by a given outage. Incorporating establishment data with a nationally recognized economic impact model, we are then able to estimate a measure of impact that considers the specific industry mix and density within the outage area. This approach provides a greater understanding of how hypothetical outages may impact specific areas than previous studies, which rely upon simple linear trends of aggregate or survey data.

Method

The method employed to determine the economic impact of a business interruption due to an outage of electricity or natural gas is a multi-step procedure requiring the integration of several distinct processes. First, simulated outages are generated using a variant of LANL's Energy Interdependence Simulation (EISIMS) model (Unal *et al.* 2002) developed for the Tampa Bay region. Geographical Information System (GIS) shape files are then created to delineate the areas affected by the outage. The shape files and duration for each outage are then sent to the Center for Economic Development Research (CEDR) to estimate the economic impact. The method used to estimate the economic impact is outlined in **Figure 1**.

[1] "Electric Power and Natural Gas Outage Study," March 2003, prepared for Los Alamos National Laboratory, by the Center of Economic Development Research, College of Business Administration, University of South Florida.

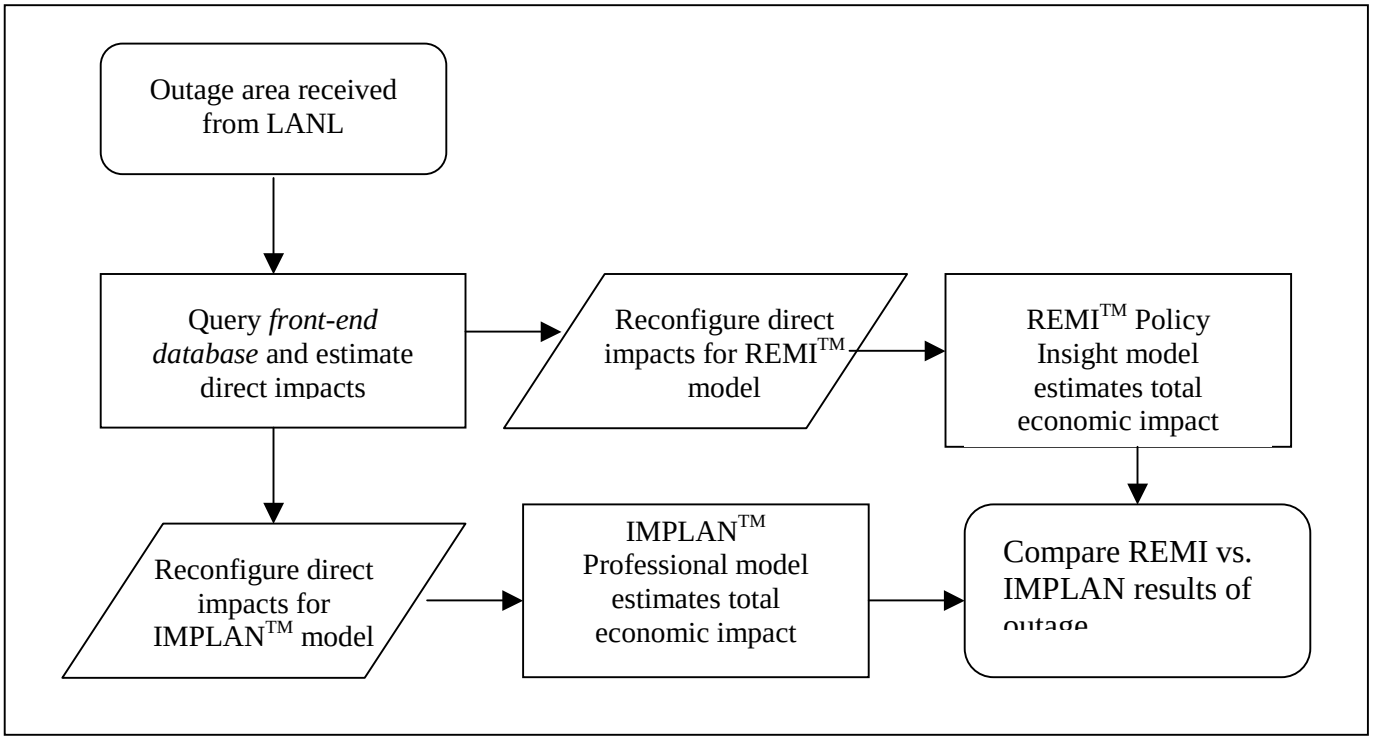


Figure 1. CEDR Business Interruption Economic Impact Procedure

As shown above, once CEDR has received simulated outage area shape files from LANL, the shape fields are integrated into the *front-end database* and direct economic impacts are determined. We then formatted the results from this process for input into the REMI model, which estimates the total economic impacts. Total impacts are the primary effects, i.e. direct impacts plus the secondary effects as the primary effects ripple through the economy. Similarly, for this study we format the direct economic impacts for input into the IMPLAN model. Thus, for a given set of direct economic impacts, we compare each model's estimate of the total impacts.

Tampa Bay GIS Overlays (*Front-end Database*)

The foundation of our analysis is the creation of the *front-end database*, a geographical model of the seven county Tampa Bay region comprised of several linked geographical overlays and databases. Using the Environmental Systems Research Institute's (ESRI) ArcView 3.2 GIS software, linked geographic overlays were created for the census tracts, counties, and zip codes in the Tampa Bay study area. These overlays were integrated with comprehensive street maps of the region.

Linking the Tampa Bay spatial overlays with comprehensive street maps allow for the geo-coding of individual establishments by street address to the combined GIS project area. The geo-coding process is the identification and addition of point locations to an existing geographical overlay. Typically, as in this case, the point locations are linked to databases that contain additional characteristic data that are associated with the point locations.

Databases including street address, employment, and industry group as defined by the 3-digit Standard Industry Classification (SIC) code of all business and educational establishments in the Tampa Bay region were geo-coded to the project area to complete the *front-end database*. A detailed description of the data sets used to create the *front-end database* and results of the geo-coding process is included in the Data portion of CEDR's March 2003 report (reference footnote 1).

Measures of Economic Impact

We examine the economic impact of an outage of electricity or natural gas through primary effects, i.e. direct impacts, and secondary effects. We first measure the direct impacts as the number of establishments and employees of those establishments immediately affected by the outage. Then, using the REMI or IMPLAN model, we estimate the total impacts. Total impacts are the sum of the primary and secondary effects. We measure total impacts by the value of lost production caused by the outage. This lost production includes both the production of industries directly affected by the business interruption and the production lost through the "ripple effect" as the flow of goods and services is momentarily slowed down or halted through the economy.

Lost production is the sum of annual value-added for each industry group uniformly scaled to the duration of the outage. We use the counter-factual approach with the REMI or IMPLAN models. With this approach, we use a model to simulate the removal of the output by workers directly affected by the power outage.

A key assumption inherent within our measure of lost production is that all production lost due to a business interruption cannot be made up later during the business year. While this assumption may be untenable for very short interruptions in the production process, the value of any recovered lost production still represents the opportunity cost of using additional resources to compensate for the interruption and thus a tangible economic loss. Additionally, because we measure lost production as a proportion of annual value-added, we do not capture inventories lost during the outage, such as products requiring refrigeration or further production lost after the interruption that may occur while manufacturers set-up to restart production. This imparts a downward bias in our estimate of total economic impacts.

The value-added is measured using a counterfactual approach in application of the REMI model. REMI is a dynamic model that predicts how changes in an economy will occur on a year-by-year basis. The model is sensitive to a wide range of policy and project alternatives as well as interactions between regional economies and the national

economy. Given the relatively static nature of a *short-duration* business interruption analysis, the model has been specified according to the assumptions of a traditional Input-Output model. CEDR's March 2003 report contains a discussion of alternative REMI specifications (reference footnote 1). The REMI specification we use for this report approximates Type II Multipliers.

IMPLAN is a proprietary economic impact assessment software system which, according to its developers, the Minnesota IMPLAN Group, Inc. (MIG, Inc.) is a traditional Input-Output model. IMPLAN is static in nature in that can analyze changes in an economy at a particular point in time. A region is defined in IMPLAN as a collection of counties. For example, the Tampa Bay region is defined by constructing a representative model containing the seven component counties: Hernando, Hillsborough, Manatee, Pasco, Pinellas, Polk, and Sarasota. Input into the IMPLAN model is specified as an impact to the region, as compared to the REMI model where input is specified as an impact to an individual county within the region.

The methodology used to construct an IMPLAN model of the Tampa Bay region includes use of Type II Multipliers with 100% Local Purchasing Coefficients. Use of Type II Multipliers indicates that both indirect and induced effects of an impact are included in the total impact. IMPLAN defines indirect effects as the second round of spending by industries which provide inputs to the directly affected industry. Induced effects include all subsequent rounds of spending, including household spending of income. Use of 100% Local Purchasing Coefficients is necessary to foment the entire direct effect to the region. This means, for instance, that in order to counterfactually remove 50 jobs from the region, 100% of the output associated with these 50 jobs must be extracted from the region's economy.

The primary distinction between the REMI and IMPLAN models is the difference between a dynamic general equilibrium model and a static Input-Output model, respectively. The prior has the ability to forecast into the future while the latter is attuned to analysis of a specific point in time. Significant differences also exist in industry aggregation between the REMI and IMPLAN models. The REMI model contains 53 sectors, most of which relate to one or more 2-digit SIC codes. The IMPLAN model contains 528 sectors, many of which contain only one 4-digit SIC code. In addition, several 4-digit SIC-codes have parts included in more than one IMPLAN sector. These facts complicate bridging between REMI and IMPLAN. For this project, input into REMI was compiled from source files of 3-digit SIC employment data for each outage area extracted from the front-end database. Each 3-digit SIC was assigned to an appropriate REMI sector and the employment data totaled by county for each of the 53 sectors for input into the model. For IMPLAN input, the same source files of 3-digit SIC employment data were used. Each 3-digit SIC was either reassigned or apportioned to the proper IMPLAN sector or sectors, then employment data was totaled for each of the 528 sectors for the Tampa Bay region. The total number of employees counterfactually removed is the same in both models.

Results of Test Outage OA1

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa1.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 191,366.7 Area (Km^2): 774.436

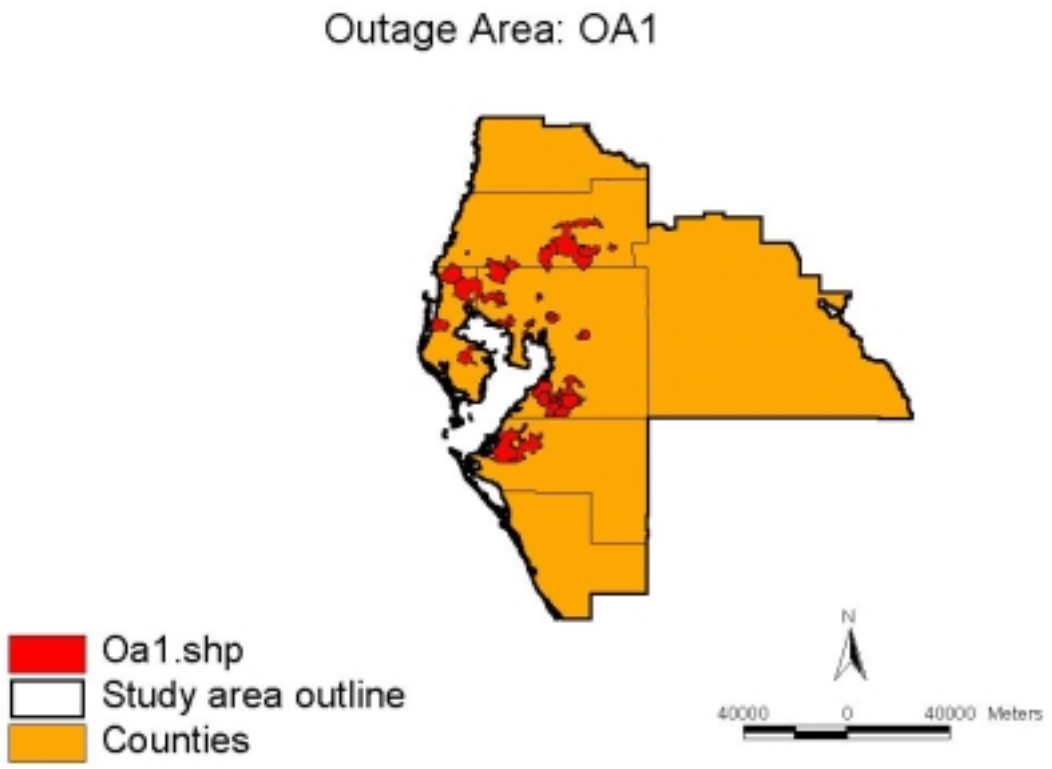
The outage area contains 37 non-contiguous areas and encompasses all or part of the following:

Counties: Hillsborough, Manatee, Pasco, and Pinellas

Major Cities: Clearwater, Oldsmar, Palmetto, Tampa, Wesley Chapel, and Zephyrhills

Zip Codes: 33510 33511 33525 33540 33541 33543 33544 33547 33549 33556
33569 33570 33572 33573 33576 33592 33594 33598 33602 33603
33606 33607 33609 33610 33612 33613 33614 33615 33617 33619
33624 33625 33626 33629 33634 33635 33647 33702 33716 33755
33756 33760 33762 33764 33765 33767 33781 33782 34202 34205
34208 34209 34219 34221 34222 34639 34653 34655 34677 34683
34684 34685 34689 34690 34691

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 6,986 establishments where 165,471 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 23.892 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 1** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 23.789 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 2** describes the loss by divisions of the economy, as determined using IMPLAN.

Although the size of the overall effect is reasonably comparable between the two models, several differences are noticeable at the division level. For instance, the REMI combined durables and non-durables Manufacturing divisions total an impact of about $4.78 million while the IMPLAN model reports a total effect of just over $2.16 million in Manufacturing. A portion of the difference between models in the Manufacturing division is offset by opposing differences in the FIRE division. For the FIRE division, REMI reports an impact of about $4.40 million, while IMPLAN reports an impact of almost $6.16 million. Other minor differences between divisions are also noticeable.

Table 1
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA1

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-2.177
Non-Durbls Manuf	-2.601
Mining	-0.010
Construction	-0.622
Trans.&Public Util.	-1.723
Fin&Ins&Real Est	-4.405
Retail Trade	-2.869
Wholesale Trade	-2.555
Services	-6.273
Agri&For&Fish Serv	-0.178
Total - Private Non-farm	-23.413
Government	-0.480
Farm	0.000
Total Value-added Lost	-23.892

Table 2
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA1

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-426,516	-42,357	-53,513	-522,386
Mining (AGG)	0	-9,073	-3,566	-12,639
Construction (AGG)	-492,379	-117,381	-95,552	-705,313
Manufacturing (AGG)	-1,673,338	-309,801	-178,310	-2,161,449
TCPU (AGG)	-592,448	-440,617	-481,208	-1,514,273
Trade (AGG)	-2,984,921	-532,065	-1,718,100	-5,235,086
FIRE (AGG)	-3,294,403	-1,070,431	-1,791,223	-6,156,057
Services (AGG)	-3,415,967	-1,323,816	-2,051,597	-6,791,380
Government (AGG)	-488,221	-79,337	-95,037	-662,595
Other (AGG)	-2,340	0	-25,349	-27,689
Instutitions (AGG)	0	0	0	0
Total	-13,370,533	-3,924,879	-6,493,457	-23,788,868

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA2

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa2.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 114,579.9 Area (Km^2): 463.691

The outage area contains 36 non-contiguous areas and encompasses all or part of the following:

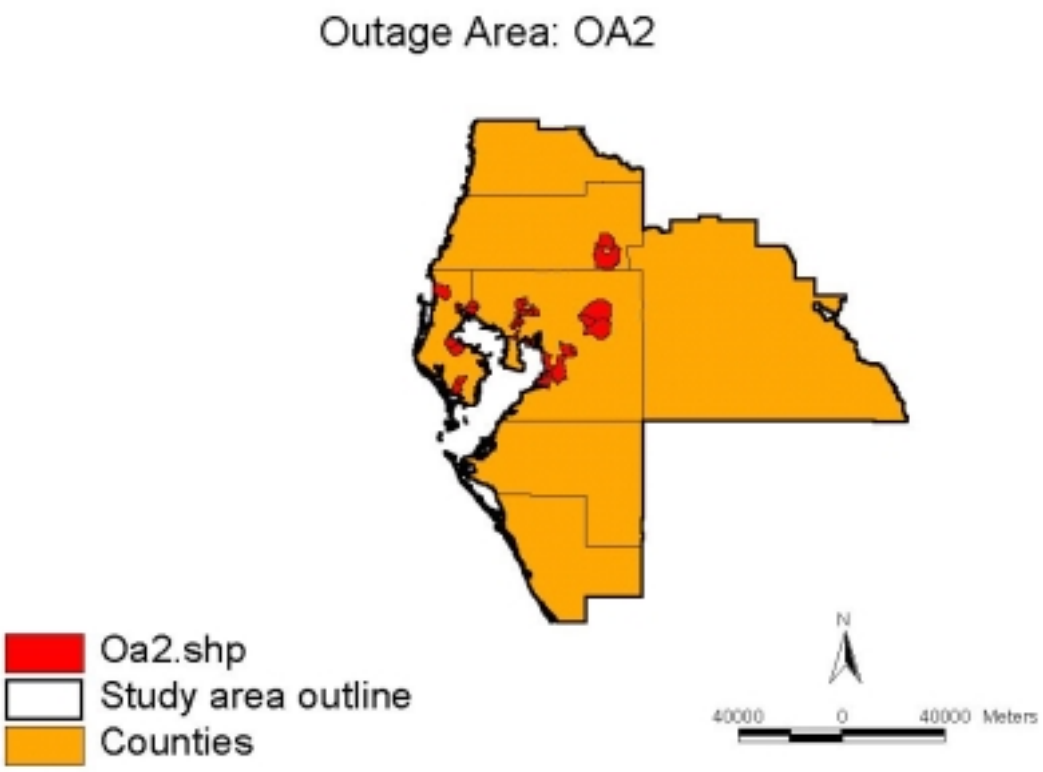
Counties: Hillsborough, Pasco, and Pinellas

Major Cities: Clearwater, Plant City, Saint Petersburg, and Tampa

Zip Codes:

33511	33525	33527	33534	33540	33541	33565	33567	33569	33570
33572	33573	33584	33592	33594	33602	33603	33604	33605	33606
33607	33609	33610	33612	33613	33614	33617	33618	33619	33626
33629	33635	33707	33710	33711	33713	33760	33761	33762	33764
33771	33773	33782	34677	34683	34684	34685	34689	34695	

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 5,297 establishments where 117,276 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 30.890 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 3** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 27.987 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 4** describes the loss by divisions of the economy, as determined using IMPLAN.

Similar to the findings in outage area OA1, the size of the overall effect is reasonably comparable between the two models yet several differences are noticeable at the division level. The REMI combined durables and non-durables Manufacturing divisions total an impact of about $6.28 million while the IMPLAN model reports a total effect of almost $3.19 million in Manufacturing. Most of the difference between models in the Manufacturing division is offset by the difference in total impact. However, an opposing difference in the FIRE division is reported between the models. For the FIRE division, REMI reports an impact of about $3.70 million, while IMPLAN reports an impact of almost $4.30 million. Other minor differences between divisions are also noticeable.

Table 3
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA2

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-3.211
Non-Durbls Manuf	-3.067
Mining	-0.023
Construction	-0.832
Trans.&Public Util.	-3.077
Fin&Ins&Real Est	-3.696
Retail Trade	-3.844
Wholesale Trade	-4.027
Services	-8.538
Agri&For&Fish Serv	-0.224
Total - Private Non-farm	-30.538
Government	-0.352
Farm	0.000
Total Value-added Lost	-30.890

Table 4
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA2

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-266,262	-53,335	-61,586	-381,183
Mining (AGG)	-135	-27,543	-4,104	-31,782
Construction (AGG)	-649,087	-201,453	-109,967	-960,507
Manufacturing (AGG)	-2,510,340	-471,299	-205,209	-3,186,849
TCPU (AGG)	-1,680,936	-745,306	-553,802	-2,980,044
Trade (AGG)	-3,996,234	-781,624	-1,977,287	-6,755,145
FIRE (AGG)	-1,276,579	-963,414	-2,061,441	-4,301,434
Services (AGG)	-4,407,291	-2,057,611	-2,361,094	-8,825,996
Government (AGG)	-299,549	-123,990	-109,374	-532,913
Other (AGG)	-2,150	0	-29,173	-31,323
Instutitions (AGG)	0	0	0	0
Total	-15,088,564	-5,425,577	-7,473,037	-27,987,177

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA3

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa3.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 85,583.24 Area (Km^2): 346.346

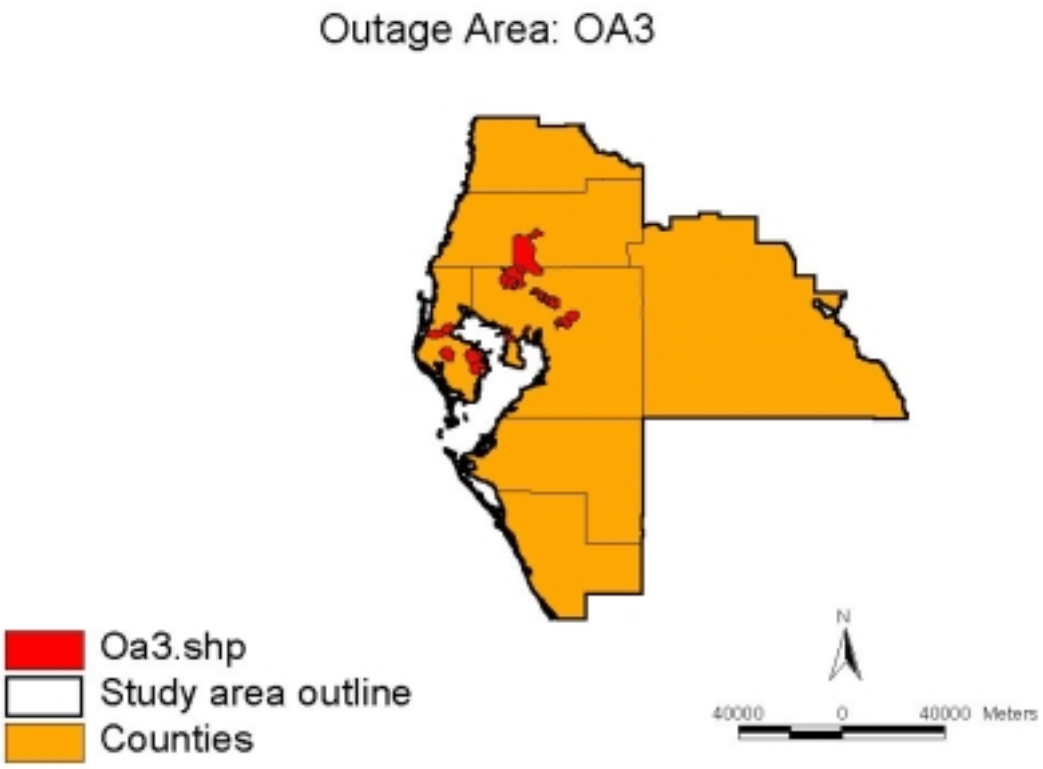
The outage area contains 29 non-contiguous areas and encompasses all or part of the following:

Counties: Hillsborough, Pasco, and Pinellas

Major Cities: Clearwater, Largo, Saint Petersburg, Tampa, and Temple Terrace

Zip Codes: 33510 33549 33556 33584 33592 33602 33605 33606 33607 33609
33610 33611 33612 33613 33617 33618 33619 33624 33629 33637
33647 33702 33703 33704 33714 33716 33756 33759 33762 33764
33765 33770 33771 33773 33777 33781 33782 34639

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 5,827 establishments where 188,942 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 55.261 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 5** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 51.805 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 6** describes the loss by divisions of the economy, as determined using IMPLAN.

Consistent with previous findings in outage areas OA1 and OA2, the size of the overall effect is reasonably comparable between the two models but several differences are noticeable at the division level. Again, the REMI combined durables and non-durables Manufacturing divisions total an impact of about twice the IMPLAN impact, REMI reported an impact of about $8.89 million while the IMPLAN model reports a total effect of almost $4.64 million in Manufacturing. A portion of the difference between models in the Manufacturing division is offset by opposing differences in the FIRE and Services divisions.

Table 5
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA3

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-4.159
Non-Durbls Manuf	-4.732
Mining	-0.064
Construction	-0.945
Trans.&Public Util.	-11.595
Fin&Ins&Real Est	-8.677
Retail Trade	-7.035
Wholesale Trade	-4.052
Services	-13.290
Agri&For&Fish Serv	-0.190
Total - Private Non-farm	-54.739
Government	-0.522
Farm	0.000
Total Value-added Lost	-55.261

Table 6
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA3

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-56,866	-53,388	-108,243	-218,498
Mining (AGG)	-5,254	-17,068	-7,213	-29,536
Construction (AGG)	-677,041	-455,958	-193,277	-1,326,276
Manufacturing (AGG)	-3,285,889	-988,711	-360,674	-4,635,274
TCPU (AGG)	-7,151,624	-1,284,713	-973,359	-9,409,695
Trade (AGG)	-5,276,030	-1,034,438	-3,475,268	-9,785,737
FIRE (AGG)	-4,179,314	-2,003,664	-3,623,178	-9,806,156
Services (AGG)	-7,465,787	-3,393,090	-4,149,847	-15,008,723
Government (AGG)	-1,140,027	-196,912	-192,236	-1,529,175
Other (AGG)	-4,901	0	-51,275	-56,176
Instutitions (AGG)	0	0	0	0
Total	-29,242,733	-9,427,942	-13,134,570	-51,805,245

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA4

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa4.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 95,651.27 Area (Km^2): 387.093

The outage area contains 31 non-contiguous areas and encompasses all or part of the following:

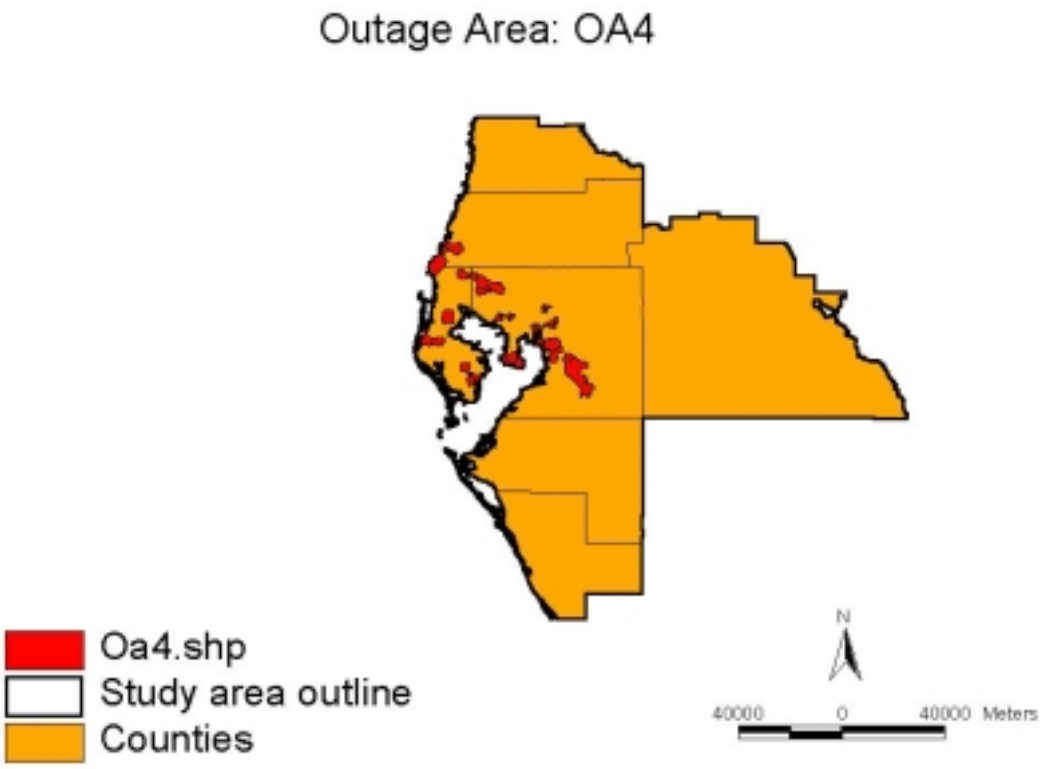
Counties: Hillsborough, Pasco, and Pinellas

Major Cities: New Port Richey, Largo, Saint Petersburg, Tampa, and Tarpon Springs

Zip Codes:

33534	33547	33549	33556	33569	33598	33605	33607	33610	33611
33614	33615	33616	33617	33619	33621	33624	33625	33626	33634
33637	33701	33702	33704	33705	33712	33713	33714	33756	33759
33761	33763	33764	33765	33770	33771	33774	33778	33781	34652
34653	34655	34668	34683	34689	34690	34691	34698		

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 5,841 establishments where 108,329 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 27.076 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 7** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 25.997 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 8** describes the loss by divisions of the economy, as determined using IMPLAN.

Consistent with findings in outage areas OA1 through OA3, IMPLAN results show a smaller total impact than the REMI results. Again, comparison of model results indicates that differences between individual divisions are generally offset by opposing differences in other divisions.

Table 7
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA4

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-1.111
Non-Durbls Manuf	-3.211
Mining	-0.041
Construction	-0.804
Trans.&Public Util.	-2.080
Fin&Ins&Real Est	-4.379
Retail Trade	-3.302
Wholesale Trade	-3.702
Services	-7.215
Agri&For&Fish Serv	-0.135
Total - Private Non-farm	-25.980
Government	-1.096
Farm	0.000
Total Value-added Lost	-27.076

Table 8
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA4

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-127,220	-41,245	-56,854	-225,319
Mining (AGG)	-5,254	-17,868	-3,789	-26,911
Construction (AGG)	-625,603	-147,801	-101,517	-874,920
Manufacturing (AGG)	-1,402,496	-285,594	-189,441	-1,877,530
TCPU (AGG)	-814,925	-577,751	-511,247	-1,903,923
Trade (AGG)	-3,665,835	-592,239	-1,825,350	-6,083,424
FIRE (AGG)	-2,778,841	-1,185,700	-1,903,038	-5,867,580
Services (AGG)	-3,985,137	-1,694,760	-2,179,666	-7,859,563
Government (AGG)	-1,035,746	-110,401	-100,970	-1,247,117
Other (AGG)	-3,700	0	-26,931	-30,631
Instutitions (AGG)	0	0	0	0
Total	-14,444,757	-4,653,358	-6,898,802	-25,996,918

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA5

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa5.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 75,250.67 Area (Km^2): 304.53

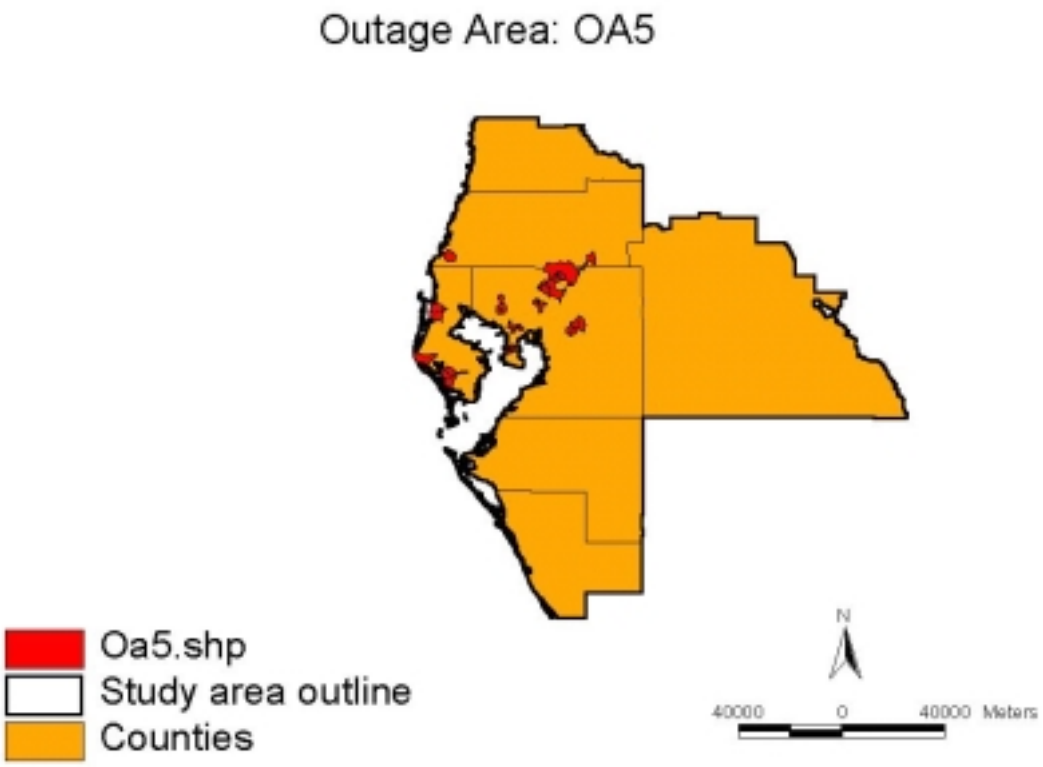
The outage area contains 33 non-contiguous areas and encompasses all or part of the following:

Counties: Hillsborough, Pasco, and Pinellas

Major Cities: Dunedin, New Port Richey, Saint Petersburg, Seminole, and Tampa

Zip Codes: 33510 33511 33527 33541 33543 33549 33584 33592 33594 33602
33604 33605 33606 33607 33609 33611 33612 33613 33614 33615
33616 33617 33620 33624 33625 33634 33637 33647 33707 33708
33709 33710 33713 33714 33755 33761 33763 33765 33772 33773
33774 33776 33777 33778 33785 34652 34653 34655 34683 34690
34691 34698

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 5,738 establishments where 169,658 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 37.482 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 9** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 35.771 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 10** describes the loss by divisions of the economy, as determined using IMPLAN.

Consistent with findings in outage areas OA1 through OA4, IMPLAN results show a smaller total impact than the REMI results. Again, comparison of model results indicates that differences between individual divisions are generally offset by opposing differences in other divisions.

Table 9
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA5

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-1.266
Non-Durbls Manuf	-3.652
Mining	-0.014
Construction	-0.773
Trans.&Public Util.	-3.667
Fin&Ins&Real Est	-7.048
Retail Trade	-6.431
Wholesale Trade	-2.506
Services	-11.175
Agri&For&Fish Serv	-0.159
Total - Private Non-farm	-36.691
Government	-0.791
Farm	0.000
Total Value-added Lost	-37.482

Table 10
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA5

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-29,236	-44,591	-78,526	-152,353
Mining (AGG)	0	-9,386	-5,233	-14,619
Construction (AGG)	-538,271	-259,416	-140,215	-937,902
Manufacturing (AGG)	-1,455,359	-387,404	-261,655	-2,104,417
TCPU (AGG)	-2,021,212	-760,947	-706,133	-3,488,291
Trade (AGG)	-4,663,836	-672,258	-2,521,167	-7,857,261
FIRE (AGG)	-3,906,619	-1,556,846	-2,628,469	-8,091,935
Services (AGG)	-6,715,245	-2,378,123	-3,010,546	-12,103,914
Government (AGG)	-693,485	-146,838	-139,459	-979,782
Other (AGG)	-2,909	0	-37,198	-40,107
Instutitions (AGG)	0	0	0	0
Total	-20,026,171	-6,215,810	-9,528,601	-35,770,582

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA6

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa6.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 77,324 Area (Km^2): 312.919

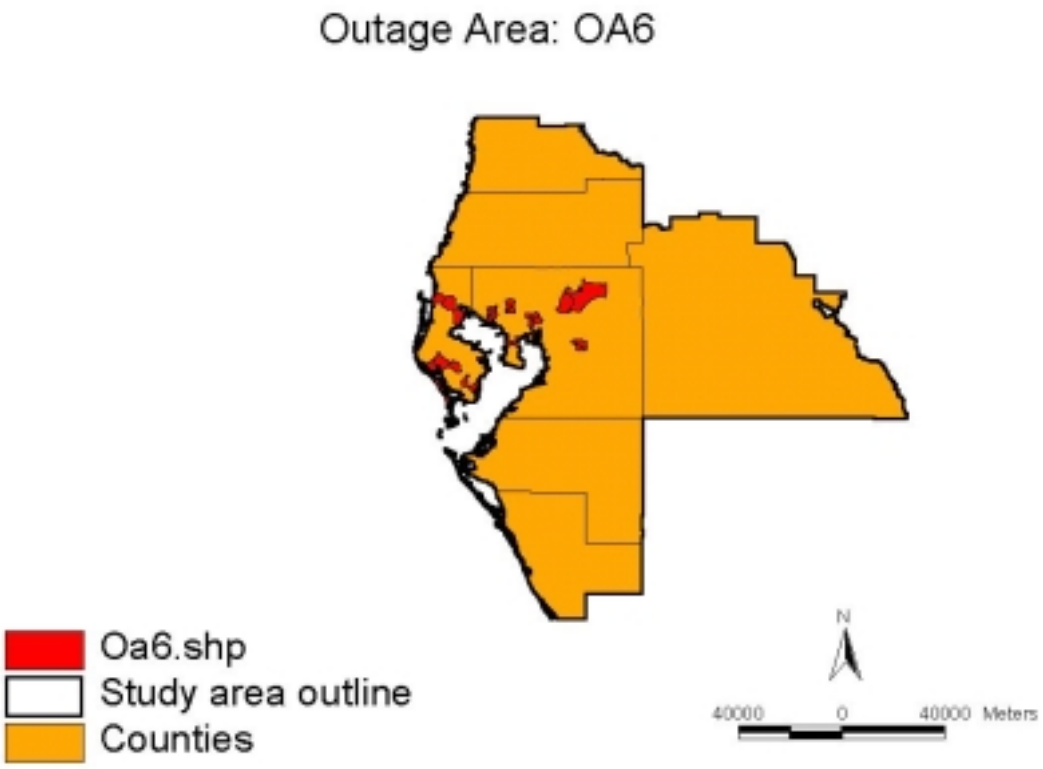
The outage area contains 30 non-contiguous areas and encompasses all or part of the following:

Counties: Hillsborough and Pinellas

Major Cities: Clearwater, Palm Harbor, Pinellas Park, Saint Petersburg, and Tampa

Zip Codes: 33511 33527 33565 33584 33592 33594 33602 33603 33604 33605
33606 33610 33611 33614 33615 33618 33624 33629 33634 33635
33637 33647 33701 33705 33706 33708 33709 33710 33711 33712
33713 33714 33759 33761 33763 33772 33773 33777 33781 34677
34683 34684 34685 34695 34698

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 6,034 establishments where 112,158 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 26.430 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 11** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 23.613 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 12** describes the loss by divisions of the economy, as determined using IMPLAN.

Similar to previously mentioned findings, total IMPLAN results are lower than indicated by REMI. Individual division differences are generally minimal, with the exception of the Manufacturing division, in which REMI shows a combined total effect nearly three times as large as IMPLAN. However, this difference is offset mainly by the lower IMPLAN total effect.

Table 11
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA6

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-1.259
Non-Durbls Manuf	-2.900
Mining	-0.019
Construction	-0.713
Trans.&Public Util.	-2.419
Fin&Ins&Real Est	-4.077
Retail Trade	-3.485
Wholesale Trade	-2.194
Services	-8.400
Agri&For&Fish Serv	-0.180
Total - Private Non-farm	-25.644
Government	-0.786
Farm	0.000
Total Value-added Lost	-26.430

Table 12
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA6

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-105,459	-35,036	-52,706	-193,201
Mining (AGG)	0	-19,450	-3,512	-22,962
Construction (AGG)	-536,899	-172,348	-94,111	-803,359
Manufacturing (AGG)	-963,723	-305,229	-175,621	-1,444,573
TCPU (AGG)	-1,056,987	-484,181	-473,952	-2,015,119
Trade (AGG)	-2,893,503	-536,560	-1,692,190	-5,122,254
FIRE (AGG)	-1,889,713	-929,440	-1,764,211	-4,583,365
Services (AGG)	-4,925,136	-1,559,629	-2,020,658	-8,505,424
Government (AGG)	-700,641	-99,804	-93,604	-894,049
Other (AGG)	-3,668	0	-24,967	-28,635
Instutitions (AGG)	0	0	0	0
Total	-13,075,730	-4,141,677	-6,395,533	-23,612,940

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA7

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: oa7.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 113,709.3 Area (Km^2): 460.167

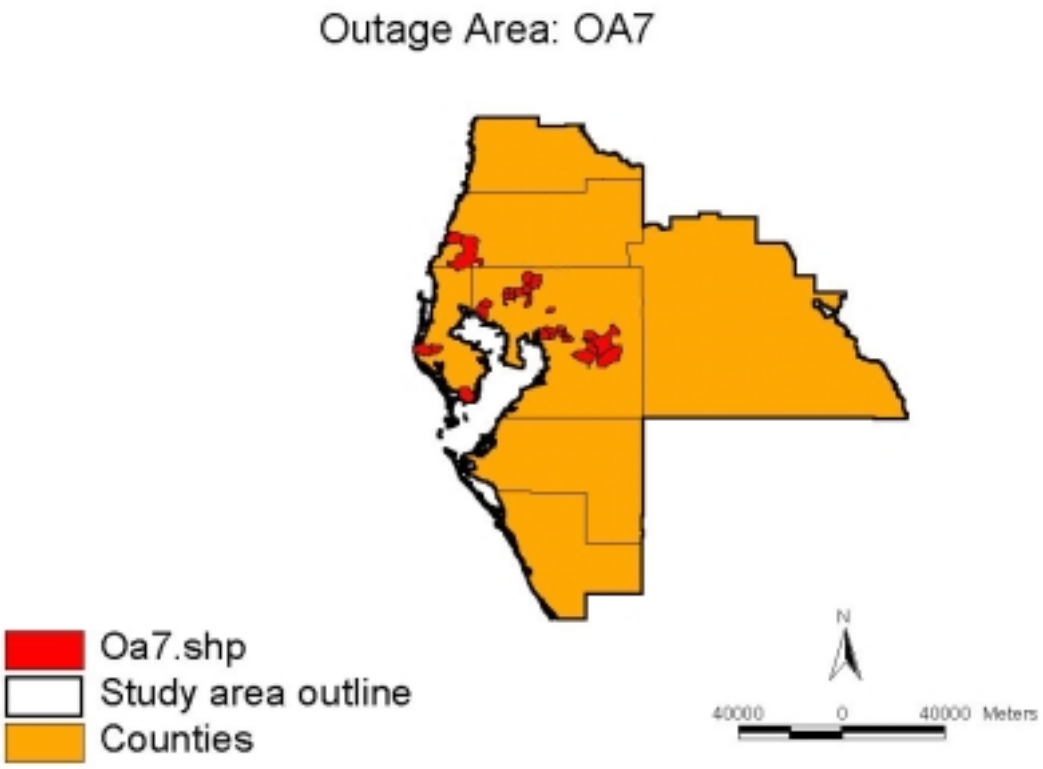
The outage area contains 30 non-contiguous areas and encompasses all or part of the following:

Counties: Hillsborough, Pasco, and Pinellas

Major Cities: New Port Richey, Plant City, Saint Petersburg, Tampa, and Temple Terrace

Zip Codes: 33510 33511 33527 33547 33549 33556 33567 33569 33594 33604 33605 33610 33612 33613 33615 33617 33618 33619 33624 33625 33626 33635 33637 33647 33705 33711 33712 33770 33771 33772 33773 33774 33776 33778 33785 34639 34652 34653 34654 34655 34668 34689 34690

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 5,509 establishments where 99,517 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $ 29.279 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 13** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $ 24.544 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 14** describes the loss by divisions of the economy, as determined using IMPLAN.

Similar to previous findings, total IMPLAN results are lower than indicated by REMI. Individual division differences are generally minimal, with the exception of the Manufacturing division, in which REMI shows a combined total effect over three times as large as IMPLAN. However, this difference is offset mainly by the lower IMPLAN total effect.

Table 13
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA7

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-1.539
Non-Durbls Manuf	-3.050
Mining	-0.064
Construction	-0.794
Trans.&Public Util.	-6.141
Fin&Ins&Real Est	-3.491
Retail Trade	-4.134
Wholesale Trade	-3.359
Services	-5.674
Agri&For&Fish Serv	-0.245
Total - Private Non-farm	-28.491
Government	-0.788
Farm	0.000
Total Value-added Lost	-29.279

Table 14
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: OA7

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-174,827	-46,702	-49,505	-271,034
Mining (AGG)	0	-9,894	-3,299	-13,193
Construction (AGG)	-593,943	-215,871	-88,394	-898,208
Manufacturing (AGG)	-989,484	-245,669	-164,953	-1,400,105
TCPU (AGG)	-3,854,484	-548,375	-445,161	-4,848,021
Trade (AGG)	-4,360,256	-546,784	-1,589,397	-6,496,437
FIRE (AGG)	-1,045,870	-740,512	-1,657,043	-3,443,425
Services (AGG)	-2,321,277	-1,430,031	-1,897,912	-5,649,220
Government (AGG)	-1,326,346	-84,763	-87,918	-1,499,027
Other (AGG)	-2,150	0	-23,450	-25,600
Instutitions (AGG)	0	0	0	0
Total	-14,668,638	-3,868,601	-6,007,031	-24,544,270

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage SANEW

This document reports the results of the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: sanew.shp **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 753,465.1 Area (Km^2): 3,049.182

The outage area contains 226 non-contiguous areas and encompasses all or part of the following:

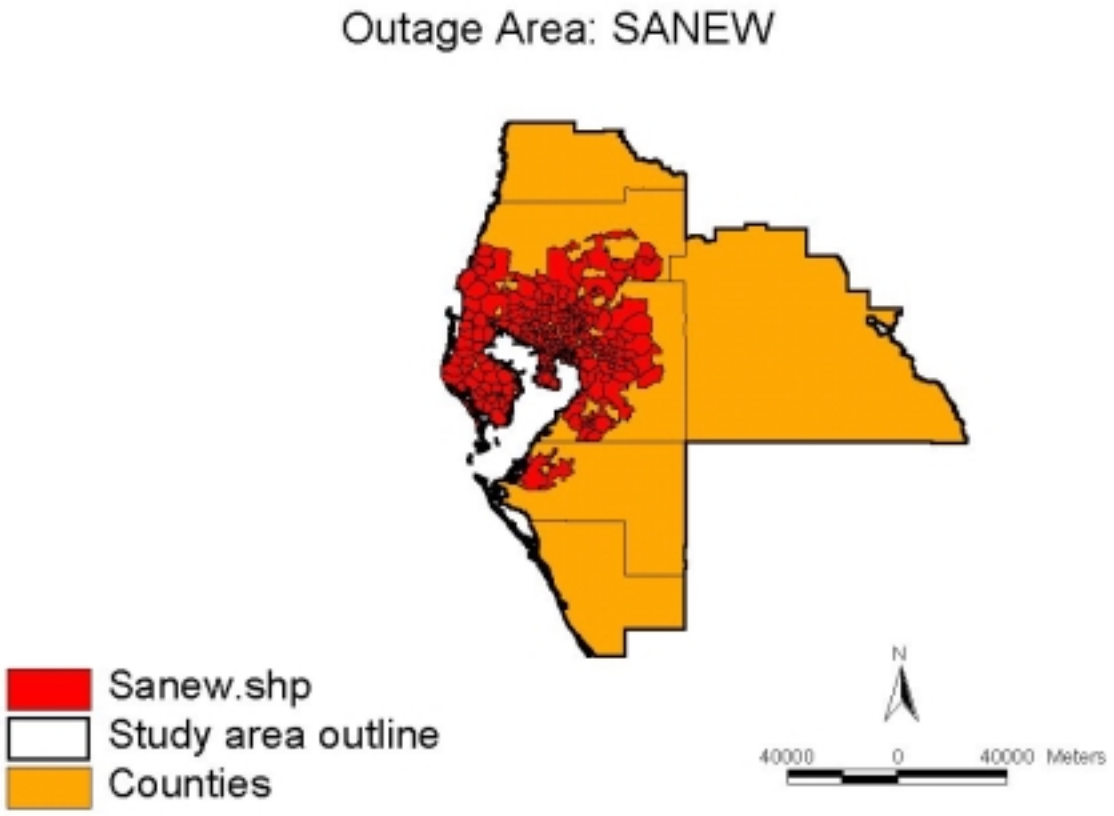
Counties: Hillsborough, Manatee, Pasco, and Pinellas

Major Cities: Clearwater, Dunedin, Largo, New Port Richey, Saint Petersburg, Seminole, Tampa, Tarpon Spring, Temple Terrace, Wesley Chapel, and Zephyrhills

Zip Codes:

33510	33511	33525	33527	33534	33540	33541	33543	33544	33547
33549	33556	33565	33567	33569	33570	33572	33573	33576	33584
33592	33594	33598	33602	33603	33604	33605	33606	33607	33609
33610	33611	33612	33613	33614	33615	33616	33617	33618	33619
33620	33621	33624	33625	33626	33629	33634	33635	33637	33647
33701	33702	33703	33704	33705	33706	33707	33708	33709	33710
33711	33712	33713	33714	33716	33755	33756	33759	33760	33761
33762	33763	33764	33765	33767	33770	33771	33772	33773	33774
33776	33777	33778	33781	33782	33785	34202	34205	34208	34209
34219	34221	34222	34639	34652	34653	34654	34655	34668	34677
34683	34684	34685	34689	34690	34691	34695	34698		

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 41,232 establishments where 961,351 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be 233.967^{*} million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 15** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $232.684 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 16** describes the loss by divisions of the economy, as determined using IMPLAN.

Similar to previous findings, total IMPLAN results are lower than indicated by REMI. Individual division differences are generally minimal, with the exception of the Manufacturing division, in which REMI shows a combined total effect almost twice as large as IMPLAN. This major difference is generally offset by higher IMPLAN effects in other divisions.

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[*] This estimate reflects modifications made to REMI^{TM} Pinellas county baseline to avoid potential double-counting that occurs when ripple effects simultaneously reduce employment in sectors that are catastrophically impacted by the outage. This modification prevents reducing employment by more people than are actually employed in the affected sector.

Table 15
REMI Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: SANEW

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-14.748
Non-Durbls Manuf	-19.852
Mining	-0.292
Construction	-5.870
Trans.&Public Util.	-29.702
Fin&Ins&Real Est	-38.911
Retail Trade	-31.148
Wholesale Trade	-23.545
Services	-62.730
Agri&For&Fish Serv	-1.432
Total - Private Non-farm	-228.229
Government	-5.737
Farm	0.000
Total Value-added Lost	-233.967

Table 16
IMPLAN Results
Tampa Bay - Lost Production due to Outage
Outage Area Name: SANEW

	Value Added per Day			
Industry	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-1,404,925	-361,389	-498,358	-2,264,672
Mining (AGG)	-81,184	-120,194	-33,209	-234,587
Construction (AGG)	-4,445,011	-1,739,623	-889,857	-7,074,491
Manufacturing (AGG)	-12,226,613	-3,190,903	-1,660,562	-17,078,078
TCPU (AGG)	-20,195,792	-5,591,909	-4,481,396	-30,269,098
Trade (AGG)	-29,133,765	-5,032,439	-16,000,313	-50,166,517
FIRE (AGG)	-21,241,322	-9,548,384	-16,681,295	-47,471,002
Services (AGG)	-35,272,477	-15,487,376	-19,106,105	-69,865,955
Government (AGG)	-6,161,463	-956,486	-885,063	-8,003,013
Other (AGG)	-20,965	0	-236,071	-257,036
Instutitions (AGG)	0	0	0	0
Total	-130,183,517	-42,028,703	-60,472,229	-232,684,448

* NOTE: ALL FIGURES ARE 2001$

Results of Test Outage OA – Brookridge Substation

This document reports the results for assessing the economic impact of a business interruption due to a simulated electrical outage. We describe the outage area as follows.

Outage Area Description

Outage Area Name: OA – Brookridge substation **Outage Duration:** 24 hours

Physical Characteristics

Area (acres): 60,216.23 Area (Km^2): 243.688

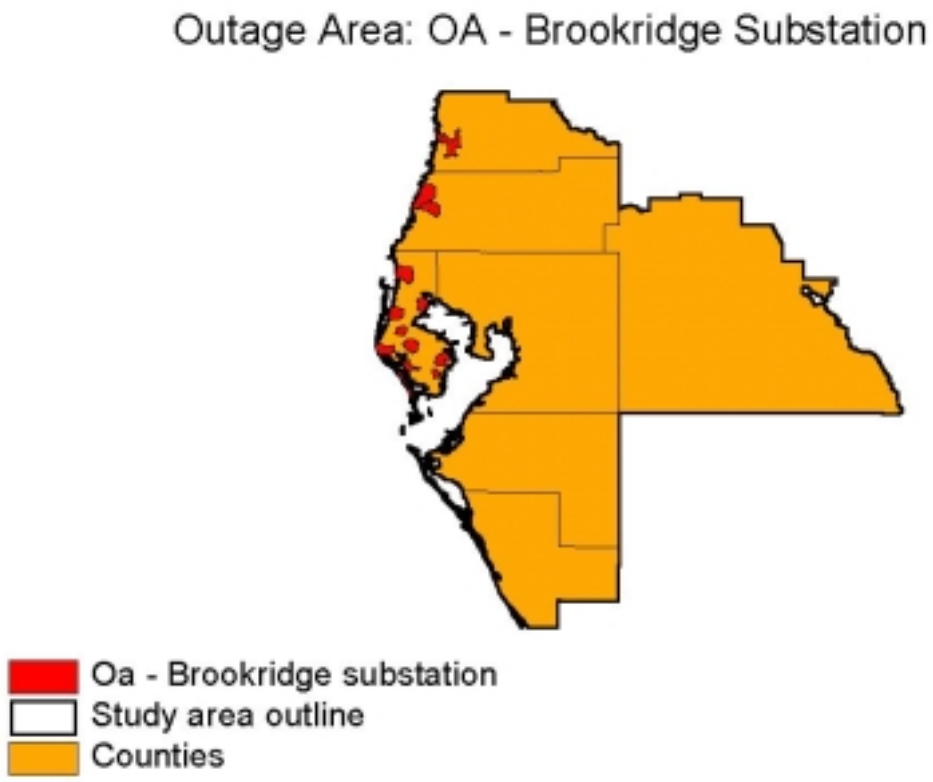
The outage area contains 13 non-contiguous areas and encompasses all or part of the following:

Counties: Hernando, Pasco, and Pinellas

Major Cities: Clearwater, Largo, New Port Richey, Safety Harbor, and Saint Petersburg

Zip Codes: 33701 33702 33703 33704 33705 33706 33708 33709 33710 33712
33713 33714 33755 33756 33759 33761 33764 33765 33767 33770
33771 33772 33773 33774 33776 33777 33778 33781 33782 33785
34606 34607 34613 34614 34654 34667 34668 34669 34683 34684
34689 34695

A map of the general location of the outage area within Tampa Bay follows.



Economic Impact:

The outage area contains 4,990 establishments where 115,963 workers are employed. We estimate, using REMI, that lost production in Tampa Bay due to a 24 hour outage would be $26.664 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 17** describes the loss by divisions of the economy, as determined using REMI. Comparatively, we estimate using IMPLAN that lost production in Tampa Bay due to a 24 hour outage would be $23.753 million, based on a proportional distribution of annual output scaled by man-hours of output. **Table 18** describes the loss by divisions of the economy, as determined using IMPLAN.

Similar to previous findings, total IMPLAN results are lower than indicated by REMI. Individual division differences are generally minimal, with the exception of the Manufacturing division, in which REMI shows a combined total effect almost Three times as large as IMPLAN. This major difference is generally offset by higher IMPLAN effects in other divisions.

Table 17

REMI Results

Tampa Bay - Lost Production due to Outage

Outage Area Name: Brookridge

Division of Economy	Value-added per day (Mil. $01)
Durables Manuf	-1.338
Non-Durbls Manuf	-2.230
Mining	-0.009
Construction	-0.761
Trans.&Public Util.	-1.976
Fin&Ins&Real Est	-3.894
Retail Trade	-6.922
Wholesale Trade	-2.276
Services	-6.805
Agri&For&Fish Serv	-0.065
Total - Private Non-farm	-26.277
Government	-0.387
Farm	0.000
Total Value-added Lost	-26.664

Table 18

IMPLAN Results

Tampa Bay - Lost Production due to Outage

Outage Area Name: BROOKRIDGE

Industry	Value Added per Day			
	Direct*	Indirect*	Induced*	Total*
Agriculture (AGG)	-21,473	-27,395	-50,943	-99,811
Mining (AGG)	0	-9,364	-3,395	-12,759
Construction (AGG)	-598,413	-156,983	-90,962	-846,358
Manufacturing (AGG)	-780,402	-275,191	-169,744	-1,225,336
TCPU (AGG)	-1,006,669	-490,999	-458,092	-1,955,759
Trade (AGG)	-5,215,569	-485,599	-1,635,566	-7,336,734
FIRE (AGG)	-1,794,238	-876,518	-1,705,176	-4,375,932
Services (AGG)	-3,763,644	-1,443,301	-1,953,042	-7,159,988
Government (AGG)	-533,258	-90,092	-90,472	-713,821
Other (AGG)	-2,277	0	-24,131	-26,408
Instutitions (AGG)	0	0	0	0
Total	-13,715,942	-3,855,441	-6,181,523	-23,752,906

* NOTE: ALL FIGURES ARE 2001$

Conclusions

Comparison of REMI and IMPLAN model results indicates that total impacts determined using REMI are consistently higher than total impacts determined using IMPLAN. Impacts at the division level were determined for comparison. Consistently, the most apparent differences were noticed in the Manufacturing division. We found that impacts determined for the Manufacturing division were higher using REMI than impacts determined using IMPLAN by a factor of about two in most cases. Differences between other divisions were not as extreme, and had a tendency to offset the major Manufacturing division differences. **Table 19** shows the percentage difference that IMPLAN results are lower than REMI. In **Panel A** of Table 19, total results are compared. Also in Table 19, **Panel B** through **Panel J**, inclusive, indicate comparisons of each division.

Table 19

Panel A
Total Impact

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	23.892	23.789	0.43%
OA2	30.890	27.987	9.40%
OA3	55.261	51.805	6.25%
OA4	27.076	25.997	3.99%
OA5	37.482	35.771	4.56%
OA6	26.430	23.613	10.66%
OA7	29.279	24.544	16.17%
SANEW	233.967	232.684	0.55%
BROOKRIDGE	26.664	23.753	10.92%
Average			6.99%

* Value-Added per Day, Millions of 2001 $.

Table 19 (continued)

Panel B

Division: Agriculture

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	0.178	0.522	-193.26%
OA2	0.224	0.381	-70.09%
OA3	0.190	0.218	-14.74%
OA4	0.135	0.225	-66.67%
OA5	0.159	0.152	4.40%
OA6	0.180	0.193	-7.22%
OA7	0.245	0.271	-10.61%
SANEW	1.432	2.265	-58.17%
BROOKRIDGE	0.065	0.100	-53.85%
Average			-52.24%

Panel C

Division: Mining

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	0.010	0.013	-30.00%
OA2	0.023	0.032	-39.13%
OA3	0.064	0.030	53.13%
OA4	0.041	0.027	34.15%
OA5	0.014	0.015	-7.14%
OA6	0.019	0.023	-21.05%
OA7	0.064	0.013	79.69%
SANEW	0.292	0.235	19.52%
BROOKRIDGE	0.009	0.013	-44.44%
Average			4.97%

Panel D

Division: Construction

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	0.622	0.705	-13.34%
OA2	0.832	0.961	-15.50%
OA3	0.945	1.326	-40.32%
OA4	0.804	0.875	-8.83%
OA5	0.773	0.938	-21.35%
OA6	0.713	0.803	-12.62%
OA7	0.794	0.898	-13.10%
SANEW	5.870	7.074	-20.51%
BROOKRIDGE	0.761	0.846	-11.17%
Average			-17.42%

* Value-Added per Day, Millions of 2001 $.

Table 19 (continued)

Panel E

Division: Manufacturing

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	4.778	2.161	54.77%
OA2	6.278	3.187	49.24%
OA3	8.891	4.635	47.87%
OA4	4.322	1.878	56.55%
OA5	4.918	2.104	57.22%
OA6	4.159	1.445	65.26%
OA7	4.589	1.400	69.49%
SANEW	34.600	17.078	50.64%
BROOKRIDGE	3.568	1.225	65.67%
Average			57.41%

Panel F

Division: TCPU

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	1.723	1.514	12.13%
OA2	3.077	2.980	3.15%
OA3	11.595	9.410	18.84%
OA4	2.080	1.904	8.46%
OA5	3.667	3.488	4.88%
OA6	2.419	2.015	16.70%
OA7	6.141	4.848	21.06%
SANEW	29.702	30.269	-1.91%
BROOKRIDGE	1.976	1.956	1.01%
Average			9.37%

Panel G

Division: Trade

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	5.424	5.235	3.48%
OA2	7.871	6.755	14.18%
OA3	11.087	9.786	11.73%
OA4	7.004	6.083	13.15%
OA5	8.937	7.857	12.08%
OA6	5.679	5.122	9.81%
OA7	7.493	6.496	13.31%
SANEW	54.693	50.167	8.28%
BROOKRIDGE	9.198	7.337	20.23%
Average			11.81%

* Value-Added per Day, Millions of 2001 $.

Table 19 (continued)

Panel H

Division: FIRE

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	4.405	6.156	-39.75%
OA2	3.696	4.301	-16.37%
OA3	8.677	9.806	-13.01%
OA4	4.379	5.868	-34.00%
OA5	7.048	8.092	-14.81%
OA6	4.077	4.583	-12.41%
OA7	3.491	3.443	1.37%
SANEW	38.911	47.471	-22.00%
BROOKRIDGE	3.894	4.376	-12.38%
Average			-18.15%

Panel I

Division: Services

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	6.273	6.791	-8.26%
OA2	8.538	8.826	-3.37%
OA3	13.290	15.009	-12.93%
OA4	7.215	7.860	-8.94%
OA5	11.175	12.104	-8.31%
OA6	8.400	8.505	-1.25%
OA7	5.674	5.649	0.44%
SANEW	62.73	69.866	-11.38%
BROOKRIDGE	6.805	7.160	-5.22%
Average			-6.58%

Panel J

Division: Government & Other

Outage Area	REMI*	IMPLAN*	IMPLAN less than REMI by % Difference
OA1	0.480	0.691	-43.96%
OA2	0.352	0.564	-60.23%
OA3	0.522	1.585	-203.64%
OA4	1.096	1.278	-16.61%
OA5	0.791	1.020	-28.95%
OA6	0.786	0.923	-17.43%
OA7	0.788	1.525	-93.53%
SANEW	5.737	8.260	-43.98%
BROOKRIDGE	0.387	0.740	-91.21%
Average			-66.61%

* Value-Added per Day, Millions of 2001 $.