
THE ECONOMIC BENEFITS OF THE U.S. DEPARTMENT OF ENERGY FOR THE STATE OF TENNESSEE, 2004

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Executive Summary

The operations of the U.S. Department of Energy (DOE) provide a major source of economic benefits for the state of Tennessee and its residents through the creation of jobs and income as well as expansions in state and local tax bases. DOE has a unique opportunity to help influence the economic success of the region. In order to detail and verify the benefits attributed to DOE operations, the Center for Business and Economic Research at the University of Tennessee began conducting in-depth analyses of the economic impacts of DOE payroll and non-payroll spending on the state of Tennessee in 1999 for the 1998 Fiscal Year. Subsequent analyses were conducted for Fiscal Years 1999, 2000, 2001 and 2003. The current study provides an analysis of the economic benefits for Fiscal Year 2004. The results of the current study provide evidence of DOE's role as a major contributor to the Tennessee economy.

Key findings for FY 2004 include the following (FY 2003 results shown in parentheses):

- **Spending by DOE and its contractors led to an increase of nearly \$3.7 (\$3.2) billion in the state of Tennessee's gross state product in 2004.**
- **Total personal income generated in the state of Tennessee by DOE-related activities was roughly \$1.9 (\$1.7) billion in 2004. Each dollar of income directly paid by DOE in the state translates into a total of \$2.26 (\$2.26) in personal income for Tennessee residents.**
- **DOE spending supported 62,032 (54,555) full-time jobs in the state in 2004, meaning that for every one DOE job, 4.2 (3.8) additional jobs were supported in other sectors of the state economy.**
- **DOE-related spending generated \$74.7 (\$66.7) million in state and local sales tax revenue in Tennessee in 2004.**
- **DOE operations continue to rely on a highly trained and educated workforce. In 2004, 956 (956) employees held Ph.D. degrees, 1,704 (1,668) held a Master's degree and 2,896 (3,461) held a Bachelor's degree.**
- **Other DOE activities serve to improve the quality of life for Tennesseans. While some enhance the productivity of Tennessee industries and workers, others contribute to the well-being of residents in a more personal manner. For example, DOE, its contractors and their employees donated over \$11.1 (\$15.6) million in 2004.**

I. DIRECT BENEFITS OF DOE

DOE spending yields significant direct benefits for the state economy.

- **DOE and its major contractors¹ provided 11,951 (11,287) full-time jobs in Tennessee in 2004 with annual wages and salaries totaling \$655.8 (\$564.4) million.**

During 2004, DOE and its major contractors employed 11,951 full-time equivalent employees living in the state of Tennessee and spent more than \$655.8 million in payroll expenditures. The jobs are relatively high wage jobs with an average annual salary of \$54,873.

- **Total non-payroll spending (or direct procurement spending) by DOE and its contractors totaled more than \$1,135 (\$995) million in 2004.**

Acquisition of goods and services from Tennessee businesses led to non-payroll spending of more than \$1,135 million by DOE and its contractors. Non-payroll spending generates millions of dollars in new income and supports thousands of jobs in a wide array of sectors in Tennessee's economy.

- **DOE and its contractors paid nearly \$18.3 (\$17.7) million in state and local sales taxes in 2003.**

As a result of DOE and contractor purchases of goods and services in Tennessee, \$13.6 million and \$4.7 million were directly contributed to the public coffers of state and local governments, respectively. However, this number understates the total direct benefits to tax revenues resulting from DOE operations because it excludes other forms of tax payments such as payments-in-lieu-of-taxes, and business and property taxes.

¹ BWXT-Y12, LLC; UT-Battelle, LLC; Oak Ridge Associated Universities; Bechtel Jacobs Company, LLC; Wackenhut Services Inc.; DOE Office of Scientific and Technical Information (OSTI); DOE Oak Ridge Office; DOE/National Nuclear Security Administration (NNSA) Site Office; and the Office of Secure Transportation (OST).

II. TOTAL ECONOMIC BENEFITS OF DOE'S DIRECT SPENDING IN TENNESSEE

DOE spending ripples through the state's economy, yielding additional benefits.

- **Tennessee's gross state product increased almost \$3.7 (\$3.2) billion in 2004 as a result of direct, indirect and multiplier effects of DOE spending.**

The total output benefit, measured by changes in gross state product from payroll and non-payroll spending by DOE and its major contractors, was \$3.67 billion in the state of Tennessee in 2004. The output multiplier was 1.84, meaning that for \$1.00 directly spent by DOE in Tennessee, an additional \$0.84 of output was produced in other sectors of the economy.

- **DOE activities in Tennessee gave rise to a total income benefit of \$1.95 (\$1.4) billion in the state in 2004.**

DOE's impact on personal income across the state of Tennessee totaled roughly \$1.95 billion in 2004. The income multiplier was 2.26 indicating that for every \$1.00 DOE and its contractors spent on wages and salaries, an additional \$1.26 in personal income was created for the residents of the state.

- **DOE operations supported 62,032 (54,555) full-time jobs in the state of Tennessee in 2004.**

The total spending generated in Tennessee as a result of DOE operations supported a total of 62,032 jobs in the state. This means that for every direct job provided by DOE, an additional 4.19 jobs were supported in other sectors of the state's economy. This relatively high implied employment multiplier reflects in part the high average annual salary of DOE-related employees in the state.

- **The total state and local sales taxes attributed to DOE operations totaled more than \$74.7 (\$66.7) million in 2004.**

DOE operations give rise to significant increases in sales tax revenue for state and local governments in Tennessee. In 2004, the total state sales tax attributed to DOE was \$55.6 million, while local tax coffers benefited by an additional \$19.1 million in local sales tax revenue.

Table A: Summary of Economic Benefits of DOE in Tennessee, 2004
(dollars in millions)

Impact	Direct	Total
Output	\$1,999.6	\$3,670.6
Income	\$863.8	\$1,952.8
Sales Tax	\$18.3	\$74.7
Employment	11,951	62,032

III. OTHER BENEFITS AND INITIATIVES

Many of the benefits arising from DOE activities are not easily quantified. At the same time, these broader activities have an important positive impact on the state and its future well-being in addition to the quantifiable economic benefits.

- **DOE, its contractors and their employees donated over \$11.1 (\$15.6) million in charitable contributions, community grants, and equipment to organizations across Tennessee in 2004.**
- **In 2004, around 2,000 (1,983) guest researchers generated 12,000 (11,000) overnight stays in the Knoxville-Oak Ridge area.**
- **The American Museum of Science and Energy drew 90,000 (78,302) visitors during Fiscal Year 2004.**

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THE ECONOMIC BENEFITS OF THE U.S. DEPARTMENT OF ENERGY FOR THE STATE OF TENNESSEE IN 2004

I. INTRODUCTION

Since the U.S. Department of Energy (DOE) first sited its facilities in Tennessee in the 1940s, its operations have made significant contributions to the state of Tennessee, its residents and local governments. DOE's on-going operating budget yields significant benefits to the state economy through the creation of jobs and income, increases in state output and expansions in state and local tax bases. Even though DOE's primary presence in the state is in Anderson and Roane Counties, located adjacent to the Knoxville Metropolitan Statistical Area, the economic benefits accrue statewide. The spillover of benefits into the rest of the state can be attributed to the ripple effect of initial economic benefits as well as the numerous programs offered by the DOE to companies located within the state.

The Center for Business and Economic Research (CBER) at the University of Tennessee started conducting an in-depth analysis of the annual economic benefits for Tennessee attributable to the operations of DOE in 1999. The current report represents the sixth analysis and presents the economic benefits of DOE for Fiscal Year 2004. The remainder of the report consists of two sections. First, the next section provides a profile of the activities of DOE. Second, Section III provides a detailed analysis of the economic benefits for Tennessee in terms of output, income, jobs and sales revenue arising from activities of DOE and its major contractors.

II. PROFILES OF DOE ACTIVITIES²

The DOE is present in Oak Ridge in three distinct capacities: 1) the DOE Oak Ridge Office (ORO); 2) the Y-12 Site Office of the National Nuclear Security Administration (NNSA), an independent agency of the DOE; and 3) the Office of

² Profiles provided by U.S. Department of Energy and its contractors.

Scientific and Technical Information (OSTI). ORO and the NNSA use several contractors in the management and operation of their facilities in Oak Ridge.

Based in Oak Ridge, Tennessee, the DOE's facilities are rich in history, dating back to World War II when the organization played a major role in the production of materials for the Manhattan Project. Since then, ORO's Oak Ridge facilities have expanded far beyond that first mission and today host programs implementing DOE mission elements in four major DOE programs: Science; Environmental Management; Nuclear Fuel Supply; and National Security.

The DOE's 33,749-acre Oak Ridge Reservation is located within and adjacent to the corporate limits of the City of Oak Ridge, Tennessee, in Anderson and Roane counties. There are three major plant complexes on the Oak Ridge Reservation: the Oak Ridge National Laboratory (ORNL); the East Tennessee Technology Park (ETTP); and the NNSA's Y-12 National Security Complex. Also located in the City of Oak Ridge are the Office of Scientific and Technical Information (OSTI), the Oak Ridge Institute for Science and Education (ORISE) and the American Museum of Science and Energy (AMSE). Together, these facilities and their capabilities represent a unique technological and educational resource and a major component of the growing East Tennessee Technology Corridor.

Oak Ridge Office (<http://www.oakridge.doe.gov>)

ORO is responsible for the major programs at ORNL, ETTP, and ORISE. ORO's programs are located in Oak Ridge; however, ORO also supports and provides services to 10 DOE Office of Science (SC) laboratories throughout the nation. ORO also provides support to the Pacific Northwest Laboratory Site Office. ORO has an additional role to provide business, technical and administrative support to the SC complex as a partner in the SC Integrated Support Center (ISC). ORO manages and operates the Payments Processing Center for the entire DOE complex and the National DOE Centers for Metals Recycling and Electronic Recycling.

Oak Ridge National Laboratory

(<http://www.ornl.gov>)

ORNL is a multi-program science and technology laboratory managed for DOE by UT-Battelle, LLC, since 2000. Scientists and engineers at ORNL conduct basic and applied research and development to create scientific knowledge and technological solutions that strengthen the nation's leadership in key areas of science, increase the availability of clean abundant energy, restore and protect the environment, and contribute to national security. ORNL also performs other work for the DOE, including isotope production, information management, and technical program management, and provides research and technical assistance to other organizations. Originally known as Clinton Laboratories, ORNL was established in 1943 to carry out a single, well-defined mission: the pilot-scale production and separation of plutonium for the World War II Manhattan Project. From this foundation, the Laboratory has evolved into a unique resource for addressing important national and global energy and environmental issues. Today, ORNL pioneers the development of new energy sources, technologies, and materials and the advancement of knowledge in the biological, chemical, computational, physical, engineering, environmental and social sciences. ORNL's six major scientific competencies include neutron science, energy, high performance computing, complex biological systems, advanced materials, and national security.

ORNL wins three R&D 100 awards, pushing total to 119

During FY 2004, researchers at the Department of Energy's Oak Ridge National Laboratory won three R&D awards from R&D Magazine, which since 1963 has given the awards for the 100 most significant technological innovations of the year. ORNL's total of 119 awards is second only to General Electric. The following inventions received honors:

Highly Selective, Regenerable Perchlorate Treatment System, developed by Baohua Gu, Gilbert Brown, Bruce A. Moyer, and Peter V. Bonnesen. The Highly Selective, Regenerable Perchlorate Treatment system uses a unique, highly specific resin to trap the perchlorate, destroy it, and regenerate itself so it can be reused.

Advanced Heating System for High-Performance Aluminum Forgings, developed by Craig Blue, Puja Kadolkar, Peter Engleman, Charles Howell, Jackie Mayotte, Vinod Sikka and Evan Ohriner of ORNL; Robert Kervick of Komtek of Worcester, Mass.; Howard Mayer of Queen City Forging Company of Cincinnati; George Mochnal of Forging Industry Association of Cleveland; Teiichi Ando and Hui Lu of Boston's Northeastern University; and Charles Blue of Infrared Heating Technologies of Oak Ridge. The Advanced Heating System uses an optimized combination of radiant and convection heating for processing materials which reduces heating time and energy consumption and produces high-performance forgings with significantly improved tensile and fatigue properties.

SniffEx, developed by Thomas Thundat, Lal Pinnaduwege, Tony Gehl, Vassil Boiadjev and Eric Hawk of ORNL; David Hedden of the University of Tennessee; Eric Houser of the Naval Research Laboratory; Linda Deel of the Bureau of Alcohol, Tobacco, Firearms, and Explosives; and Richard Lareau of the Transportation Security Administration. SniffEx is a compact, low-cost explosive vapor sensor for detecting and locating a variety of explosives, including plastic-based explosives.

Oak Ridge National Laboratory is the home of highly sophisticated experimental user facilities. These research laboratories are designed to serve not only staff scientists and engineers, but also researchers from universities, industry, foreign institutions, and other government laboratories. They simultaneously advance national research and development and fulfill the DOE missions by minimizing unnecessary duplication of effort, promoting beneficial scientific interactions, and making the most effective use of costly and, in many cases, unique equipment. ORNL is assembling

world class tools for nanoscale R&D, including the \$1.4 billion Spallation Neutron Source and the Center for Nanophase Materials Sciences. ORNL is also home to the DOE's National Leadership Computing Facility, which will be the world's fastest unclassified computing facility. The diverse and sophisticated research conducted by staff scientists, coupled with the availability of unique resource equipment, is attracting a growing number of guest researchers.

Oak Ridge Institute for Science and Education (<http://www.ornl.gov/orise.htm>)

The Oak Ridge Institute for Science and Education (ORISE) was established by the U.S. Department of Energy to undertake national and international programs in education, training, health, and the environment. ORISE and its programs are operated by Oak Ridge Associated Universities (ORAU) through a contract with the U.S. Department of Energy. Established in 1946, ORAU is a consortium of 91 doctoral-granting colleges and universities that serves the government, academia, and the private sector in important areas of science and technology.

ORISE supports the mission of the Department of Energy through seven primary program areas.

- In *Science and Engineering Education*, ORISE prepares tomorrow's scientific workforce by administering research participation, fellowship, scholarship, and internship programs.
- Through its *Worldwide Emergency Response and Training* activities ORISE responds and prepares others to respond to unique emergencies such as terrorist attacks or radiation accidents.
- ORISE conducts *Workforce Health and Safety Research and Training* that helps organizations protect the health and safety of their employees.
- The ORISE *Environmental Monitoring* programs help DOE preserve the environment and protect the public through radiological hazardous site characterization and cleanup verification.
- ORISE utilizes *Specialized Training* to develop and implement comprehensive technical training and continuing education programs that enhance employee performance.
- ORISE builds *Research and Training Networks* to bring together resources to eliminate redundant efforts and reduce costs.
- ORISE assembles *Collaborative Research Partnerships* to foster mutually beneficial relationships among researchers nationwide.

East Tennessee Technology Park (http://www.oakridge.doe.gov/env_mgmt.html and <http://www.ettpreuse.com>)

Decades of activities on the Oak Ridge Reservation in support of the government's research and national security missions have left a legacy of contamination, which requires management and/or cleanup and disposal. Approximately 10 percent of the Reservation's lands require cleanup. The East Tennessee Technology Park (ETTP), also known as the Heritage Center, is the home of the former gaseous diffusion plant and is a primary focus for DOE's Environmental

Management Program. Most of the cleanup work that is required at ETTP is the decontamination and demolition of buildings.

Cleanup of ETTP is an important component of DOE's accelerated cleanup and closure plan. Under DOE's Accelerated Cleanup approach, the department has established a milestone for cleanup of ETTP by the end of 2008. The cleanup is managed for DOE by Bechtel Jacobs Company LLC, which both self-performs and subcontracts work.

Reindustrialization is integral to DOE's strategy to accelerate cleanup at ETTP. The current focus of the Reindustrialization Program is to transfer facilities and land to the Community Reuse Organization of East Tennessee (CROET). Approximately twenty-six facilities are slated for transfer to CROET; the remaining buildings will be demolished and the land will be cleaned up by DOE. If all 26 facilities are transferred, DOE will save nearly \$70 million. These savings will be realized because the new property owner will be responsible for ultimate demolition of the buildings; thus, DOE will not fund these actions. Once cleanup of ETTP is complete, CROET plans to establish a Brownfield industrial complex on the property. Prior to the transfers, CROET will continue to lease facilities from DOE and sublease them to private-sector tenants, as it has been doing since 1996.

ETTP also is the location of a unique former governmental research facility which has been leased to the United States Enrichment Corporation, Inc. (USEC) for refurbishment to demonstrate an advanced uranium enrichment centrifuge machine.

Wackenhut Services Incorporated

In January 2000, DOE/ORO contracted with Wackenhut Services Incorporated (WSI) to provide protective services for the Oak Ridge Complex. WSI brought to this contract a team comprised of three small businesses: PAI Corporation; Critique, Inc.; and NCI. Under this contract, the WSI-OR team provides physical, information and personal protective services for Y-12 National Security Complex, ORNL, ETTP, and the Federal Office Building Complex. The WSI-OR team employs over 770 Tennesseans who protect the DOE's Oak Ridge resources.

National Nuclear Security Administration, Y-12 Site Office

(<http://www.oro.doe.gov/nnsa/>)

The NNSA carries out the national nuclear security responsibilities of the DOE. These responsibilities include maintaining a safe, secure, and reliable stockpile of nuclear weapons and associated materials, capabilities and technologies; promotion of international nuclear safety and nonproliferation; and administration and management of the naval nuclear propulsion program. As required by the National Defense Authorization Act for Fiscal Year 2000, the national security functions and activities performed by certain elements of the DOE were transferred to the NNSA. Management responsibility for operations at the Y-12 National Security Complex (formerly known as the Y-12 Plant) transferred to the Y-12 Site Office (YSO) under the NNSA.

Y-12 National Security Complex (<http://www.y12.doe.gov/index.html/>)

The DOE's National Security mission in Oak Ridge is carried out at the Y-12 National Security Complex. Operated by BWXT Y-12, LLC, for DOE's NNSA, the Y-12 National Security Complex is a manufacturing facility that plays an integral role in NNSA's Nuclear Weapons Complex. Programs at Y-12 include manufacturing and reworking nuclear weapon components, dismantling nuclear weapon components returned from the national arsenal, serving as the nation's storehouse of special nuclear materials, preventing the spread of weapons of mass destruction, and providing special production support to other programs. The Y-12 National Security Complex was part of the Manhattan Project. Its job was to process uranium for the first atomic bomb. Construction of Y-12 started in February 1943; enriched uranium production started in November of the same year. For almost 60 years, Y-12 has been one of the DOE's premier manufacturing facilities. Every weapon in the stockpile has some components manufactured at the Y-12 National Security Complex. Today, NNSA's Y-12 National Security Complex manufacturing facility stretches over approximately 800 acres with more than 575 structures that contain more than 7.0 million square feet of floor space.

The Office of Scientific and Technical Information (<http://www.osti.gov>)

Research and development (R&D) can only be successful if the knowledge gained through the R&D process is shared. DOE's Office of Scientific and Technical Information (OSTI), as part of DOE Headquarters Office of Science, advances science and sustains technological creativity by making R&D findings available and useful to DOE researchers and the American people. OSTI fulfills this responsibility through leading-edge e-government information systems. Among other systems, OSTI's Information Bridge (www.osti.gov/bridge), Energy Citations Database (www.osti.gov/energycitations), and E-Print Network (www.osti.gov/eprints) provide unique access to all forms of R&D information of interest to DOE and the U.S. scientific community. Patrons of OSTI's vast, electronic R&D information collections include DOE and other federal and contractor researchers, academic institutions, science-attentive citizens, and U.S. industry. These patrons are using OSTI's systems 38 million times annually.

OSTI coordinates an agency-wide program for the corporate management of R&D information involving over 60 DOE Headquarters Offices, Field Offices, National Laboratories, and over 4,000 other contractor facilities. OSTI also partners with 11 federal agency counterparts in providing Science.gov, a premier "one-stop" web system for citizens and researchers to access the government's R&D collections. Science.gov is an OSTI-hosted gateway to over 1,800 sites and databases of federal R&D information, over 360 of which are DOE's.

Internationally, OSTI represents DOE and the United States in two multilateral information exchange agreements, which add to the wealth of scientific knowledge available to the domestic science community. OSTI obtains and provides domestic access to more than 80,000 foreign research summaries annually.

What DOE Facilities Offer Tennessee

The presence of DOE and its contractors in Tennessee gives rise to many benefits, both quantitative and qualitative. Obviously, the facilities discussed above

provide employment and income for residents of the state. The jobs provided are most often high-skilled, high-paying jobs resulting in a high quality workforce comprised of some of the top researchers in their field. The presence of DOE also provides the state with national recognition as a leader in manufacturing, advanced materials, neutron sciences, biological sciences and transportation technologies. With its R&D capacity and technology sharing programs, DOE plays a significant role in enhancing Tennessee's competitive position in attracting private firms to locate within the state. In addition, DOE is active in bringing federal research grant money to the state and its institutions of higher education. The DOE facilities provide an excellent resource to the University of Tennessee through expanded research capabilities and academic programs. The remainder of the report details the more easily quantifiable economic benefits attributed to the operations of DOE supported facilities in Tennessee and enumerates important qualitative benefits to households, firms and workers.

III. JOB, INCOME, OUTPUT AND SALES TAX BENEFITS OF DOE IN TENNESSEE IN 2004

In this section of the report, estimates of quantifiable DOE benefits are developed and presented. The benefit categories considered are output for the state economy, income and jobs that accrue to Tennessee residents, and sales tax revenues for state and local residents.

DOE Expenditure Data

The data used as input into the economic impact model consisted of detailed expenditure data for the 2004 Fiscal Year and were provided by DOE and its major contractors. In addition, the Office of Secure Transportation (OST), a Field Office of DOE located outside the state but with expenditures in Tennessee, provided the ORO with the detail of those expenditures. Omitted are the contributions of smaller contractors, credit unions and federal employees. Therefore, the benefits detailed below represent a conservative estimate of the actual benefits attributable to DOE's presence in Tennessee.

Steps were taken in the data collection process to prevent the double counting of contracted and subcontracted spending. Expenditures were disaggregated into 36 major industrial sectors for input into the model. Table 1 displays DOE-sponsored spending in Tennessee by sector for Fiscal Year 2004. Total payroll, pension and non-payroll spending in the state in 2004 was \$1,999.6 million, representing a 14.6 percent increase over 2003.³

Payroll spending represented the largest expenditure category, accounting for \$655.8 million or 32.8 percent of the total spending in Tennessee. Total payroll spending – including payroll and pension disbursements – totaled \$863.8 million. Other notable spending categories include business and miscellaneous services.

³ See "The Economic Benefits of the U.S. Department of Energy for the State of Tennessee in 2003," Center for Business and Economic Research, The University of Tennessee, Knoxville.

DOE contracts out the vast majority of its operations to private companies. The two largest DOE contracts in Tennessee in 2004 were for BWXT Y-12 LLC for the operation of the Y-12 National Security Complex and Bechtel Jacobs Company LLC, cleanup contractor for DOE's ETTP. Together these two contractors accounted for 61.0 percent of the total DOE-related expenditures in Tennessee. Other major contractors include UT-Battelle, LLC for the operation of the ORNL and Wackenhut Services Incorporated, which provides security for the Oak Ridge Reservation.

Table 1: DOE-Related Expenditures in Tennessee by Industrial Sector, 2004

Sector	Expenditures
Farm products and agricultural, forestry and fishing services	\$24,425
Construction	28,967,436
Apparel and other textile products	1,879,429
Paper and allied products	2,826,734
Printing and publishing	150,365
Chemicals, allied, petroleum and coal products	3,378,253
Lumber and wood products and furniture and fixtures	13,299
Stone, clay and glass products	70,861
Primary metals industry	2,211
Fabricated metals products	1,148,189
Industrial machinery and equipment	20,855,894
Electronic and other electrical equipment	3,089,460
Other transportation equipment	956,377
Instruments and related products	4,708,760
Miscellaneous manufacturing industries	91,574
Transportation	12,149,688
Communication	2,939,828
Electric, gas, and sanitary services	18,421,879
Wholesale trade	19,571,568
Retail trade	9,017,510
Depository and non-depository institutions	6,435,715
Insurance	239,383
Real Estate	6,410,389
Hotels and other lodging places, recreation services	232,222
Personal and repair services (except auto)	2,414,056
Business services	199,846,297
Eating and drinking places	166,947
Health services	711,613
Legal services	692,573
Engineering and management services	195,440,671
Miscellaneous services	474,187,469
Payroll	655,786,102
Pensions	208,008,840
Health Insurance	118,764,584
Total Tennessee Expenditures	\$1,999,600,602
Total Non-payroll Expenditures	\$1,135,805,660

Summary of Benefits

Direct benefits of DOE-funded activity in Tennessee in Fiscal Year 2004 include \$655.8 million in payroll spending, \$1,135.8 million in non-payroll spending, \$208.0 million in pensions, \$18.3 million in state and local sales tax and 11,951 full-time jobs. The initial injection of money works its way through the state's economy to produce even more substantial impacts via indirect and multiplier effects. Total economic benefits of DOE spending in Tennessee include a \$3,670.6 million increase in output or gross state product (GSP), a \$1,952.8 million increase in personal income, \$74.7 million in state and local sales tax revenue and the support of 62,032 full-time equivalent jobs (see Table 2). A complete discussion of these benefits is presented in the following sections.

Table 2: Summary of Economic Benefits of DOE in Tennessee, 2004

Output (GSP)	\$3,671 million
Personal Income	\$1,953 million
Sales Tax Revenue	\$74.7 million
Employment	62,032 jobs

Output Benefits

The output benefit of DOE-funded activities is measured as the increase in gross state product from its expenditures within the state. In 2004, the output benefit totaled \$3,670.6 million. Table 3 provides a breakdown of the total benefit by initial spending source. The leading source of output benefits was non-payroll spending which accounted for \$2,459.3 million or 67.0 percent of the total output effect. Payroll spending contributed an additional \$914.1 million or 24.9 percent of the total benefit, and pension disbursements and visitor spending gave rise to the remaining increases. As a result of spending and re-spending in the state's economy, DOE-related expenditures resulted in an implicit output multiplier of 1.84. This indicates that for every dollar spent by DOE in Tennessee, the state's GSP is increased by \$1.84.

Table 3: DOE Output Benefit in Tennessee by Source, 2004 (in millions)

Payroll Spending	\$914.1
Non-payroll Spending	\$2,459.3
Pension Disbursements	\$289.9
Visitor Spending	\$7.3
Total Output Benefit	\$3,670.6

Income Benefits

The total increase in personal income in Tennessee attributable to DOE spending was \$1,952.8 million in 2004. The total income benefit can be divided between direct, indirect and multiplier benefits. Direct income effects accrue as a result of spending on wages, salaries and pension disbursements. In 2004, these effects accounted for more than \$863.8 million, a 15.4 percent increase over the same period in 2003. Indirect effects arise from DOE purchases of goods and services and spending

by visitors to DOE-related facilities. Finally, multiplier effects occur as DOE payroll and non-payroll spending ripples through the state's economy. In 2004, non-payroll expenditures accounted for \$739.2 million in indirect and multiplier income benefits. Visitor spending gave rise to \$2.3 million in income benefits. The remaining \$347.5 million in benefits are attributable to the multiplier effect of payroll and pension disbursements. Table 4 provides a summary of the income benefit to the state of Tennessee as a result of DOE activity in 2004.

Table 4: DOE Income Benefit in Tennessee by Source, 2004 (in millions)

Direct Effects	
Payroll Spending	\$655.8
Pension Disbursements	\$208.0
Indirect/Multiplier Effects	
Payroll Spending	\$263.8
Non-payroll Spending	\$739.2
Pension Disbursements	\$83.7
Visitor Spending	\$2.3
Total Income Benefit	\$1,952.8

The implicit income multiplier, which is calculated by dividing the total income benefit by direct spending on income, is 2.26. In other words, every dollar of income paid directly to the employees of DOE or its contractors results in the creation of \$2.26 in total state income.

Employment Benefits

The total employment benefit of DOE-related expenditures in Tennessee for Fiscal Year 2004 was 62,032 full-time equivalent (FTE) jobs. The direct employment of DOE and its major contractors was 11,951. A decomposition of direct employment is provided in Table 5. BWXT Y-12, LLC and UT-Battelle, LLC represented the two largest DOE-related employers in the state with 4,635 and 3,881 employees residing in Tennessee, respectively. Combined, these two contractors accounted for 71.3 percent of the total direct employment effect.

Table 5: DOE Direct Employment Benefit in Tennessee by Entity, 2004

Division/Contractor	
BWXT Y-12, LLC	4,635
UT-Battelle, LLC	3,881
Bechtel Jacobs Company	1,462
Wackenhut Services Inc.	776
ORAU	533
ORO	499
OST	108
OSTI	57
Total Direct Employment	11,951

While DOE-related employment rose only 5.9 percent from 2003 (11,287 to 11,951 full-time equivalent jobs), other employment – including jobs supported through the purchase of goods and services within the state, visitor spending, and the induced effects of DOE employees spending their income in Tennessee – grew by 13.7 percent. A breakdown of the employment impacts by source is provided in Table 6.

Table 6: DOE Employment Benefit in Tennessee by Source, 2004

Direct Effects	
DOE-related Employees	11,951
Indirect/Multiplier Effects	
Payroll Spending	12,001
Non-payroll Spending	34,142
Pension Disbursements	3,807
Visitor Spending	131
Subtotal	50,081
Total Employment Benefit	62,032

The implied employment multiplier for DOE-related activities in Tennessee for FY 2003 is 5.19 which means that for every job created directly by DOE an additional 4.19 jobs are supported throughout the state. The resulting employment multiplier is notably higher than for most other industries, suggesting that DOE-related activities have a larger capacity to support jobs, due to the higher than average salary of \$54,873 received by DOE-related employees and the extensive use of contracted employees.

Comparing the number of DOE full-time equivalent employees with other top employers in Tennessee in 2004 indicates that DOE-related employment is a significant contributor to the state's overall employment. With 11,951 DOE-related employees, DOE employs slightly more people in Tennessee than the *fourth largest* non-governmental employer, Kroger Limited Partnership Inc. As shown in Table 7, Tennessee's largest employer is Wal-Mart Associates, which employs 35,700 people.

Table 7: Tennessee's Ten Largest Employers (Non-Governmental), 2004

Company	Employment in Tennessee (in thousands)	Product/Service
Wal-Mart Associates	35.7	Department Stores
FedEx Corp.	33.7	Cargo Carrier
Vanderbilt University	18.0	University/Hospital
Kroger Limited Partnership, Inc.	11.8	Retail Groceries
Lebonheur Childrens Medical Center	8.0	Childrens Hospital
United Parcel Service	7.6	Parcel Delivery Service
Eastman Chemical Company	7.5	Plastics, Fibers, Chemicals
Nissan Motor Mfg. Corp. USA	7.1	Auto Assembly Plant
Saturn Corp.	6.7	Auto Assembly Plant
U.S. Xpress Inc.	6.5	Courier Services

Source: Tennessee Department of Economic Development,
Tennessee's 50 Largest Employers (Non-governmental),
<<http://state.tn.us/ecd/pdf/top50empl.pdf>> January, 2004.

Sales Tax Benefit

The total contribution of DOE-related activities to state and local sales tax revenue in the state of Tennessee for FY 2004 is estimated to be \$74.7 million. Of that total, approximately 74 percent or \$55.6 million accrues to the state's sales tax coffers and the remaining 26 percent or \$19.1 million accrues to local governments.

The contribution of DOE to state and local sales tax revenue arises from several sources. First, there is the direct payment of sales tax by DOE and its contractors. Additional taxes are paid by DOE-related employees as they spend their income, as well as by visitors to DOE facilities as they make sales-taxable purchases during their stay. Finally, taxes accruing from the activities of businesses and workers supported through direct, indirect, and multiplier-generated income can be attributed to DOE. Table 8 provides a breakdown of the sales tax benefit. In addition to sales taxes, DOE-related activities give rise to other fiscal benefits for state and local governments such as payments-in-lieu-of-taxes, property taxes and business taxes. The current study limits its analysis to sales tax revenue. For this reason, the overall fiscal benefit of DOE in Tennessee is significantly larger than the sales tax benefit detailed in this section.

Table 8: DOE Sales Tax Revenue Benefit in Tennessee, 2004 (in millions)

Direct Payments		
State		\$13.6
Local		\$4.7
Indirect/Multiplier		
State		\$42.0
Local		\$14.4
Total Sales Tax Revenue Benefit		\$74.7

Additional DOE Contributions to Tennessee

In addition to the substantial economic benefits of DOE's presence in the state documented above, there exist many other avenues by which DOE and its contractors contribute to the state's economy and well-being through the various programs it offers and supports. These programs include community involvement; technology partnerships resulting in the establishment of new businesses and technical assistance to Tennessee firms; contributions to Tennessee educational institutions; and reuse of government assets, DOE grants and job creation initiatives to offset the downsizing of government operations in East Tennessee. These DOE-supported programs have been instrumental in reshaping the state's economy by leading to new products and processes and by improving the overall well-being and competitiveness of the state's economic base.

One of the more personal ways in which DOE benefits the community at large is through charitable contributions. DOE, its contractors and their employees made significant contributions to charitable causes in 2004. The donations ranged from local United Way campaigns to donations of equipment to area schools. In total, over \$11.1 million in charitable contributions can be directly attributed to DOE operations in Tennessee. A detail of the donations by firm is provided in Table 9. Of course, community involvement extends beyond monetary donations as staff and employees of these firms are active in civic organizations and volunteer programs. Therefore the figures presented in Table 9 understate the overall benefits that accrue to the state.

Table 9: DOE Community Charitable Contributions by Entity, 2004

	Corporate Contributions	United Way, CFC, etc.	Other Charitable Contributions	Donation of Equipment	Matching Funds for Education	TOTAL
BWXT Y-12	127,890	651,232	177,589	5,944,345	21,720	\$6,922,777
OSTI	--	7,630	--	--	--	\$7,630
BJC	--	161,237	489,438	--	89,000	\$739,675
UT-Battelle	1,204,298	768,325	--	725,138	--	\$2,697,761
ORO	--	60,815	--	--	--	\$60,815
ORAU	430,096	65,969	--	22,300	--	\$518,365
Wackenhut	73,000	15,000	110,000	--	--	\$198,000
TOTAL	\$1,835,284	\$1,730,208	\$777,027	\$6,691,783	\$110,720	\$11,145,023

Trends in DOE Benefits in Tennessee

Since FY1998, CBER has estimated the benefits attributed to the DOE in Tennessee with FY2002 being the only exception. Figure 1 displays trends in estimated output, income and job benefits for Tennessee. Aside from a slight decline from 1998 to 2000, the benefits from the DOE have steadily increased through this most recent fiscal year.

