

TENNESSEE

FY2013 Economic Impact



DEPARTMENT OF ENERGY SPENDING

The Missions	1
Benefits DOE Creates in Tennessee	2
Global Impact	4
DOE Profiles	6
Detailed Data Analysis	14
Summary of Benefits	16
Transforming Oak Ridge for Future Missions	20
Appendix	24
Acronyms	25

The Missions

of the U.S. Department of Energy's Oak Ridge Reservation are critically important to our state, nation, and world. How can science and engineering at its very basic levels enhance our security, raise the quality of our lives, and improve our environment? People come to work every day in Oak Ridge to think about those issues and help solve problems that affect all of us.

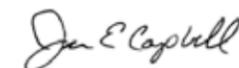
Assessing the economic impact of that activity is not a simple matter. On the following pages we put together a snapshot of Oak Ridge's impact on the state of Tennessee using data and information from the 2013 fiscal year. The study looks at payroll disbursements, nonpayroll spending, and pensions and taxes paid, as well as the ripple effects of spending across the state. It assesses procurement activity, charitable giving, and more.

But as you look at these numbers, we want you to remember there is much more going on than statistics alone reveal. Howard Baker Sr., Oak Ridge's first congressman in the 1940s, put it this way in a speech he delivered in 1959:

"Oak Ridge can never become just another attractive American city. Its fame and its honors based upon past achievements are already too great for this, and its heavy responsibilities for the future of both America and the world preclude the possibility of a quiet, completely normal existence."

This study is part of a series of studies begun by the Department of Energy in 1998 and performed by the University of Tennessee's Center for Business and Economic Research. This year, with the help of private sponsors, we have continued that work. We want to thank all those—too many to name—who helped us gather the data, collate it, and put it into readable form.

Sincerely,


Jim Campbell

President, East Tennessee Economic Council


Dr. Matt Murray

Director, Howard H. Baker Center for Public Policy



Benefits DOE Creates in Tennessee

The presence of the Department of Energy (DOE) in the state of Tennessee generates significant economic benefits. Everyday operations create jobs and income for residents and increase state and local tax revenues. To provide estimates of the economic benefits DOE has on the state of Tennessee, the Center for Business and Economic Research at the University of Tennessee-Knoxville (UT) initiated an in-depth examination of DOE activities, beginning with the 1998 fiscal year. The current study, conducted by the Howard H. Baker Jr. Center for Public Policy at UT and the East Tennessee Economic Council (ETEC), summarizes the key economic benefits conveyed by DOE on Tennessee using data from fiscal year 2013 (FY13). Results from this study confirm the substantial impacts of DOE's activities on the state as well as on its residents.

KEY FINDINGS FOR FISCAL YEAR (FY) 2013 INCLUDE:

- Overall spending by DOE and its contractors added approximately \$3.6 billion to Tennessee's state gross domestic product (SGDP) in FY13.
- DOE-related activities generated roughly \$2.2 billion in total personal income in Tennessee in 2013. Each in-state dollar of income directly paid by DOE translates to a total of \$1.89 in personal income for Tennessee residents.
- 40,646 full-time jobs were created in Tennessee by DOE in 2013, which includes both direct and indirect. This means that for every one DOE job, 3.6 other jobs were created across the state.
- Spending by DOE and its contractors generated \$142 million in state and local sales tax revenue in Tennessee in 2013.
- DOE-related employees are well educated and highly trained. In 2013, a total of 1,345 employees held Ph.D. degrees; 1,789 held master's degrees; and 3,351 held bachelor's degrees.
- In addition to output, income, tax, and employment effects, DOE entities and their employees donated roughly \$3.9 million to various charities in FY13.

There are several changes in this study compared with previous studies. Translating direct effects into total effects through multiplier analysis requires the use of Regional Input-Output Modeling System (RIMS II) multipliers, which were updated for the Tennessee region in 2010. The new multipliers were applied to this study. Additionally, the measure of direct

DOE-related sales tax revenue benefit in Tennessee has been restructured. The direct payments of state and local sales taxes now include taxes collected from retirees, current payroll, museum expenditures, and the standard sales taxes paid by each entity. Another change from the FY13 DOE impact study involves the entities (division/contractors), a change from 9 to 16 total entities with some overlap. The two largest employers associated with DOE are UT-Battelle, LLC and B&W Y-12, LLC; they were accounted for in the FY08 and FY13 studies.

DIRECT BENEFITS OF DOE

DOE-related spending produces noteworthy direct benefits for the state economy.

- **Approximately 11,230 full-time jobs were directly provided by DOE and its major contractors within the state of Tennessee in 2013, with annual wages and salaries totaling \$810.1 million.**

In addition to the \$810.1 million spent on payroll, \$339.8 million was spent on pension disbursements, bringing total income paid to current and former employees for FY13 to \$1,149.9 million. The average annual salary for a DOE-related employee in 2013 was \$72,135, significantly above the statewide average.

- **Non-payroll expenditures (or direct procurement spending) by DOE totaled more than \$718.6 million in 2013.**

This non-payroll spending created sizeable increases in new income and jobs in various sectors of the state economy.

- **DOE and its contractors directly paid nearly \$89.2 million in state and local sales taxes in 2013.**

When DOE acquires goods and services from Tennessee businesses, it contributes to the state and local sales tax base. In 2013, direct tax payments to state and local governments totaled \$66.7 million and \$22.5 million, respectively. However, these figures only represent direct revenue generated by the sales tax; thus, it understates the total tax revenue benefits resulting from DOE-related operations in the state.

TOTAL ECONOMIC BENEFITS OF DOE'S DIRECT SPENDING IN TENNESSEE

Spending by DOE produces additional benefits when direct spending generates new jobs and new income, sending ripples through the state economy.

- **In 2013, Tennessee's SGDP increased by more than \$3.6 billion as a result of direct, indirect, and multiplier effects of DOE-related expenditures.**

Changes in SGDP represent benefits of DOE on total state output from payroll and non-payroll expenditures. This figure reached \$3.6 billion in the state of Tennessee in 2013. The output multiplier was 1.76, which suggests that for every dollar directly spent by DOE in Tennessee, SGDP increased by \$1.76.

- **Total income benefits from DOE-related activities in Tennessee totaled \$2.2 billion in 2013.**

For every dollar DOE and its contractors spent on wages, salaries, and pensions, \$1.89 was created in total state income.

- **DOE-related operations supported 40,646 full-time jobs in the state of Tennessee in 2013.**

This suggests that for every direct job provided by DOE, 3.6 jobs were supported across the Tennessee economy. The significant size of the multiplier reflects, in part, the high average annual salary of DOE-related employees in the state and the notable spending that flows from this income.

- **Total state and local sales taxes associated with DOE-related operations were roughly \$142.1 million in 2013.**

DOE-related operations in 2013 gave rise to considerable increases in sales tax revenue for state and local governments in Tennessee. Total state sales taxes attributed to DOE were \$106.1 million; sales tax revenue generated at the local level reached \$36 million.

Table A: Summary of Economic Benefits of DOE in Tennessee, FY13

Impact	Direct	Total
Output (SGDP)	\$2,026,714,700	\$3,562,340,543
Personal Income	\$1,149,881,515	\$2,173,301,708
Sales Tax Revenue	\$89,164,025	\$142,131,137
Employment	11,230	40,646

OTHER BENEFITS AND INITIATIVES

Many of the benefits of DOE-related operations are not as easily quantified. Nonetheless, these activities have a meaningful and positive impact on Tennessee, its residents, and the future well-being of those residents.

- DOE, its contractors, and employees donated more than \$3.9 million in charitable contributions, community grants, and equipment to schools and organizations across Tennessee in 2013.
- The American Museum of Science and Energy hosted 81,459 visitors during FY13.

THE ECONOMIC BENEFITS OF DOE FOR THE STATE OF TENNESSEE

Since DOE located its facilities in Tennessee in the 1940s, its operations have made significant contributions to the state, its residents, and local governments. DOE's ongoing 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.

Global Impact

Even though the 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 to the numerous programs offered by DOE to companies located within the state.

The first in-depth analysis of the annual economic benefits for Tennessee, attributable to the operations of DOE, was undertaken in 1998. The current report represents the ninth analysis and presents the economic benefits of DOE for FY13. The remainder of the report consists of three sections:

- (1) a profile of DOE's activities (page 6);
- (2) a detailed analysis of the economic benefits for Tennessee in terms of output, income, jobs, and sales tax revenue from activities of DOE and its major contractors (page 16); and
- (3) a summary of highlights and noteworthy accomplishments of FY13 (page 18).

For further analysis, see page 16.

A 1960s accomplishment was never accorded the acclaim it merited. According to former Oak Ridge historian Bill Wilcox, it was an unusual cooperative program involving Oak Ridge National Laboratory (ORNL), the technicians at the Oak Ridge Gaseous Diffusion Plant, Jonas Salk, and the Eli Lilly Foundation to develop an "ultracentrifuge."

The challenge was very simple and very difficult.

How do you separate the good materials from the bad to mass produce high-quality vaccines? Today, we don't think about what it takes to get our routine flu shot or polio vaccination. But in the 1960s, a cross-disciplinary team based in Oak Ridge and led by a biologist named Norman Anderson took up the challenge with world-changing impact. The work, commissioned by the National Institutes of Health, was based on taking technology out of the lab and putting it to work.

"The central theme remains the exploration of technologies and skills, originally developed for Atomic Energy Commission programs, for application to basic biomedical problems," reported a 1965 ORNL summary of the effort. "While swords are not easily beaten into scalpels, the possibility of new incisive edges for research tools would appear to justify the effort."

In 1960, ORNL's biology division, with support from the National Cancer Institute, opened a Biophysical Separations Laboratory, taking advantage of centrifuge designs by Paul Vanstrum and fellow researchers at the Oak Ridge Gaseous Diffusion Plant. The team there had devised improved centrifuges to produce enriched uranium for nuclear reactor fuel. In 1961 a biology team, headed by Norman Anderson, with advice from Jonas Salk of polio vaccine fame, adapted centrifuge technology to separating viruses from human leukemic plasma,

hoping to identify a cure for leukemia. This striking use of nuclear separations technology to advance science and medical research led in several directions.

One of those directions became known as the zonal centrifuge, a hollow cylinder subdivided into sectors, whirling at high speeds that can separate substances at the molecular level into their constituents according to size and density. Anderson and his team experimented with centrifuges whirling up to 141,000 revolutions per minute and learned the machines could separate impurities from the viruses causing polio and Hong Kong flu. By cleansing vaccines of foreign proteins, the zonal centrifuge could produce a vaccine pure enough to minimize the fever reactions that often accompanied immunizations. By the late 1960s, commercial zonal centrifuges, based on the ORNL invention, produced vaccine for millions of people and purified rabies vaccines for their pets.

"Use of this centrifuge essentially eliminated vaccination deaths from anaphylactic shock and



Norman Anderson working on the zonal centrifuge in his lab at K-25 in the 1960s

allowed vaccination in supermarkets under minimal supervision," said Anderson in an article published two years ago in the journal *Clinical Chemistry*. "Almost 40 years later, it is still in use around the world, with minimal modifications for vaccine manufacture."

In 2012, Anderson, still active at 90, proposed new uses for the machine using the viral DNA and RNA, concentrated, and free-of-host nucleic acids. These acids could then be shotgun-sequenced to screen for new viruses, while providing a running index of the known viruses "going around."

IMPACT

DOE Profiles

The Department of Energy operates a variety of facilities in Oak Ridge, mirroring the scope of the Department's missions.

The four largest missions—in terms of dollars—are science and energy research, national security programs, environmental management, and science education. And, there are other programs the Department performs in Tennessee, including managing the Office of Scientific and Technical Information, supporting the nation's nuclear energy/enrichment programs, providing support for the agency's small business programs, and more. On the following pages we will give a brief snapshot of: (1) how those programs are managed, and (2) what those programs are at the end of FY13. The management of these programs is performed in several ways. The Department uses management and operations contracts to operate its biggest facilities—Oak Ridge National Laboratory and the Y-12 National Security Complex. It uses various types of contract vehicles to perform environmental management, security, and other missions.

OAK RIDGE OFFICE

www.oakridge.doe.gov

As one of DOE's most diverse field locations, the Oak Ridge Office's (ORO) responsibilities include management of the Oak Ridge Integrated Support Center for the Office of Science. The center provides critical support services in such areas as legal, personnel, finance, procurement, security and emergency management, and employee health and safety on a national and local level. It is also responsible for management of the 32,000-acre Oak Ridge Reservation (ORR), which addresses joint issues and activities among major organizations such as ORNL, the East Tennessee Technology Park (formerly the K-25 Site), and the National Nuclear Security Administration Production Office. 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 SITE OFFICE

www.science.energy.gov/oso

The Oak Ridge National Laboratory Site Office (OSO) is an organization within the U.S. Department of Energy's Office of Science with responsibility to oversee and manage the Management and Operating (M&O) contract for ORNL and the Oak Ridge Institute for Science and Education (ORISE) in Oak Ridge, Tennessee.

ORNL is one of ten Office of Science laboratories and is a multi-program laboratory with a primary mission of delivering breakthrough science and technology in the areas of neutron science, energy, high-performance computing, systems biology, materials science, and national security. ORISE creates and promotes collaborative partnerships among academia, government, and industry to strengthen the nation's scientific research and education enterprise. OSO is responsible for program implementation, acquisition management, and laboratory stewardship at ORNL and ORISE. Through its oversight role, OSO is affecting the safe and efficient operation of ORNL and ORISE while enabling the pursuit of visionary research and development in support of DOE's missions.

NATIONAL NUCLEAR SECURITY ADMINISTRATION PRODUCTION OFFICE

www.nnsa.energy.gov/fieldoffices/npo

The mission of the NNSA's Production Office (NPO) is to ensure the safe, secure, and cost-effective operation of the Y-12 National Security Complex and Pantex Plant. NPO employees perform program oversight, contract and administrative management, and technical evaluation and assessment to meet this mission. Y-12 serves as the nation's only source of secondaries, cases, and other nuclear weapons components and provides feedstock to fuel the U.S. Navy. Y-12 is a leader in materials science and precision manufacturing and serves as the main storage facility for enriched uranium. Y-12 also supports efforts to reduce the risk of nuclear proliferation and performs complementary work for other government agencies.

NATIONAL NUCLEAR SECURITY ADMINISTRATION, UPF PROJECT OFFICE

www.y12.doe.gov/upf

An integral part of Y-12's transformation efforts and a key component of the National Nuclear Security Administration's Uranium Center of Excellence, the Uranium Processing Facility (UPF) is one of two facilities at Y-12 whose joint mission will be to accomplish the storage and processing of all enriched uranium in one much smaller, centralized area. A team of federal and contractor employees is working on final designs for the multi-billion dollar facility. Safety, security, and flexibility are key attributes of the facility, which is in the design phase. UPF, which replaces facilities that date back to World War II, will be built to modern standards and will engage new technologies through a responsive and agile design. Upon completion, UPF will be a comprehensive uranium processing facility, appropriately sized and capable of meeting national security demands.

OAK RIDGE OFFICE OF ENVIRONMENTAL MANAGEMENT

www.energy.gov/orem

OREM's program mission is to complete the cleanup of the ORR to protect the region's health and environment; to ensure the DOE's vital missions of science, energy, and national security; and to make clean land available for future use. OREM's

ongoing role across the reservation is a result of the environmental legacies left by the Manhattan Project at K-25 (now East Tennessee Technology Park), X-10 (now ORNL), and Y-12. In December 2013, OREM's contractor completed demolition at the K-25 site ahead of schedule and under budget, making way for future projects and historic preservation. At Y-12, OREM is focused on mercury remediation projects that will remove the legacy from the site and make way for continued modernization. ORNL has seen a campus transformation and safety improvement that was predicated by OREM's removal of excess and contaminated facilities. Progress made to shrink the footprint of the ORR and successfully disposition the legacy material can be attributed to OREM, whose goal is to reduce environmental, safety, and health risks in a cost-effective manner and within a framework supported by its stakeholders.

OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

www.osti.gov

DOE's Office of Scientific and Technical Information (OSTI) makes DOE research and development findings, from the Manhattan Project to the present, available and useful to DOE researchers and the public. OSTI collects, manages, preserves, and disseminates all forms of scientific and technical information (STI) produced by DOE. These forms of STI include technical reports, datasets, multimedia, journal articles, and more. OSTI offers discovery tools, such as SciTech Connect, that rapidly search this STI and offer downloadable research results.

OSTI manages the National Library of Energy BETA, a new search tool designed to make it easier for American citizens to access information about DOE from across the DOE Complex, by virtually integrating information from Energy.gov (the DOE website) and all DOE program offices, national laboratories, and other facilities. Over the next few fiscal years, OSTI will be integral in offering public access to DOE's peer-reviewed scholarly publications. OSTI also partners with 15 federal agency counterparts to provide Science.gov, a premier "one-stop" Web system for citizens and researchers to access the U.S. government's research and development collections. Overall, OSTI extends the reach and impact of DOE research results and brings the world's research to DOE.



Y-12 NATIONAL SECURITY COMPLEX

www.y12.doe.gov

Plant History

Y-12 was constructed as part of the World War II Manhattan Project, and building began in early 1943. Y-12's original mission was the electromagnetic separation of uranium-235 for use in the first atomic bomb. After World War II, Y-12 became a high-precision manufacturing facility and played a major role in the production of components for modern thermonuclear weapons. Since the end of the Cold War, Y-12's primary missions have been the remanufacture of nuclear weapons components and the dismantlement and storage of strategic nuclear materials from retired nuclear weapons systems.

Y-12 National Security Complex uses its uranium expertise—held over from its original mission as an enrichment facility for uranium during World War II—by acting, among other vital missions, as a secure storage site for the nation's supply of the same material. DOE's primary national security mission in Oak Ridge is carried out at Y-12. In addition to protecting the nuclear arsenal, Y-12 provides feedstock to fuel the U.S. nuclear Navy; manufactures and reworks nuclear weapon components; dismantles nuclear weapon components returned from the national arsenal; prevents the spread of weapons of mass destruction through nuclear nonproliferation; and provides special production support to other programs, including training. Today, NNSA's Y-12 National Security Complex manufacturing facility stretches over approximately 800 acres with some 300 structures that contain nearly 6 million square feet of floor space, but that footprint is changing as the site modernizes.

In addition to its main mission of maintaining national security by ensuring a safe, secure, and reliable U.S. nuclear deterrent, Y-12 has developed other unique program areas.

Global Security

Y-12 has contributed to global nuclear nonproliferation efforts by safely removing weapons and vulnerable material from more than 25 countries across the globe. This highly enriched uranium is then downblended for reuse, in a non-weapons form, in research reactors and to produce medical isotopes and commercial power.



Security and Training

Y-12 provides security solutions to other federal customers, other countries, commercial entities, universities and medical institutions, among others, and provides expertise for physical security in areas such as medical, nuclear, radiological, and chemical facilities. Y-12's experts train personnel both domestically and internationally.

Naval Reactors

Over the past 10 years, working with the Naval Reactors Program, Y-12 has supplied the U.S. Navy with feedstock from weapons removed from the nation's nuclear weapons stockpile to fuel nuclear-powered submarines and aircraft carriers. The Naval Nuclear Propulsion Program is an integrated program carried out between NNSA's Defense Programs and Naval Reactors.

OAK RIDGE NATIONAL LABORATORY

www.ornl.gov



ORNL, like the rest of the ORR, was built to support the Manhattan Project. After the war, the graphite reactor, now an historical landmark, was used to produce radioactive isotopes for medical purposes. Now the largest science and energy laboratory in the DOE Complex with the most diverse energy portfolio, ORNL is home to the world's second most powerful open scientific computing facility; the world's most intense pulse neutron source; and a world-class research reactor, continuing a legacy begun in peacetime to use science to improve the world. ORNL's mission is to deliver scientific discoveries and technical breakthroughs that will accelerate the development of solutions in clean energy and global security and in doing so create economic opportunity for the nation. ORNL's impact is intensified by its drive to commercialize technologies that have resulted in new industries and jobs and to invigorate graduate research and education.

ORNL's scientific programs focus on materials, neutron science, energy, high-performance computing, systems biology, and national security. Following are highlights of the cutting-edge facilities and capabilities in ORNL's focus areas:

Manufacturing Demonstration Facility

The MDF is composed of on-site labs at ORNL as well as at the National Transportation Research Center and the Carbon Fiber Technology Facility. MDF helps industry adopt new manufacturing technologies to reduce life-cycle energy and greenhouse gas emissions, lower production cost by reducing and integrating process steps, and create new products and opportunities for high-paying jobs.

High-Performance Computing

ORNL is home to one of the world's most powerful supercomputers, Titan, along with a suite of other machines that comprise the nation's most powerful open scientific computing facility. Because ORNL has expertise in a wide range of scientific disciplines, the supercomputing capabilities are uniquely used to solve problems across and among multiple areas.



Spallation Neutron Source

The SNS is a singular facility that provides the world's most intense pulsed neutron beams for scientific research and industrial development. Uniquely, SNS is open to researchers around the world through an independent proposal selection process by the neutron scattering community.

ORNL Visitor Data for 2013

Making the laboratory’s resources available to researchers, students, and other government organizations is one of the vital ORNL missions. Last year more than 20,000 people (see chart below) came to the lab to:

- Access ORNL’s user facilities for experiments or analysis
- Attend seminars and conferences
- Participate in public tours and other activities.

The most significant economic impact comes from people who are working at the laboratory’s user facilities. These scientists must have a User Agreement and can stay for an extended period of time. They can request use of ORNL’s centrally managed computer systems and other services. In 2013, a total of 1,501 people came with user agreements in place.

Consultants, leased employees, subcontractors, vendors, and construction workers also fit into the general category of visitors who provide service to the lab. In addition, retirees who return to work on projects and others with ORNL cyber-access-only requests are included in this list.

FY13 Visitors to ORNL	
Visitor Type	Count of Badge
Facility User	1,501
Foreign National Employee	218
ORNL Detailee	1
PreHire	28
Resource Use Only	702
Service to ORNL	8,155
Visitor/Interviewee	9,982
Total	20,587

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

www.orise.gov

ORISE is a DOE asset committed to strengthen the U.S. scientific research and education enterprise by enhancing work force development and global competitiveness. It works to build public trust and confidence in the management of worker and public health and environmental cleanup initiatives.



In addition, ORISE helps enhance our nation’s preparedness to respond to emergencies related to terrorist and nuclear security incidents, natural disasters, and other health and safety threats.

East Tennessee communities have benefited from much of this work through educational opportunities via enriched work force development and Science, Technology, Engineering, and Mathematics (STEM) programming, direct infusion of dollars for community activities, and a marked enhancement to local economic development through cleanup verification that facilitates reindustrialization of underutilized DOE land and facilities.

OAK RIDGE ENVIRONMENTAL MANAGEMENT

www.energy.gov/orem

The Oak Ridge Reservation is one of the DOE’s most unique and complex sites, encompassing three major campuses and spanning almost 32,000 acres. Each campus performs a diverse set of missions but all share a crucial need for environmental cleanup.

The Environmental Management (EM) program addresses this need by removing the hazards left behind from research and defense operations during the Manhattan Project and Cold War. The EM program works daily with dozens of contractors to reverse decades of environmental contamination, and open the door for growth in science, national security, reindustrialization, and next generation energy.



East Tennessee Technology Park

Substantial cleanup activities continue at the former uranium enrichment complex. Contaminated facilities are being removed, while clean facilities are getting a second life by transitioning them to privately owned businesses. Progress is occurring daily to transform the site into a self-sustaining, privately owned industrial park.

Environmental Management at Oak Ridge National Laboratory

EM’s vision for the laboratory is to be a safe, thriving center for the nation’s most advanced energy research. To fulfill this vision, extensive cleanup of the central campus must be completed, and the inventory of U-233, a special nuclear material stored onsite, must be dispositioned. The central campus area is littered with hazardous and outdated facilities that hinder new development for DOE’s evolving missions. Recent work has addressed several key concerns, but much remains to be accomplished to pave the way for the Office of Science to modernize the site.

Environmental Management at Y-12 National Security Complex

At Y-12, EM is working to drastically reduce the site’s footprint and address mercury in the soil and surface water resulting from past operations. DOE-EM is working to ensure a brighter, safer future for the

Y-12 National Security Complex so it can better perform its mission—securing and protecting our nation.

Transuranic Waste Processing Center

Through years of defense-related research, a great deal of transuranic material was generated and stored in Oak Ridge. In 2003, the TRU Waste Processing Center was constructed to treat the many forms of waste found around the Oak Ridge Reservation. The EM program is steadily working to remove all transuranic waste from Oak Ridge.

COMMUNITY REUSE ORGANIZATION OF EAST TENNESSEE

www.croet.com

Established in 1995, CROET and its subsidiaries own, develop, and manage more than 300 acres of former DOE property at ETPP and the Oak Ridge Science & Technology Park. ETPP includes Heritage Center and the Oak Ridge Science & Technology Park and is managed by Halcyon, LLC.

CROET’s award-winning program to revitalize former DOE properties in Oak Ridge has resulted in the creation of hundreds of jobs and millions of dollars in capital investment.



EAST TENNESSEE TECHNOLOGY PARK

www.ettpreuse.com

DOE's ETPP is getting a second life through reindustrialization, a unique process in which parts of the vast complex, located in Oak Ridge, Tenn., are available for lease or purchase.

ETPP is home to two distinct business centers: Heritage Center and Horizon Center. Heritage Center is located at the site of a former gaseous diffusion plant, which is currently undergoing cleanup. Several buildings have been identified for potential reuse, and there are several hundred acres of land available for new construction.

The site plan for Heritage Center also includes preservation that is, in some way, associated with DOE activities dating back to the famous Manhattan Project. Heritage Center has facilities for lease and/or sale that are ideal for all types of industry—from textiles and machining to assembly and manufacture. High-tech companies with needs for office space and telecommunications access also are moving into this center.

In contrast, Horizon Center is a 1,000-acre greenfield site designed to provide building locations and amenities desired by high-tech companies while still preserving the area's scenic beauty.



NATIONAL STRATEGIC PROTECTIVE SERVICES

www.nspssl.com

National Strategic Protective Services (NSPS), a joint venture of Triple Canopy and Securiguard, protects our nation's strategic, critical infrastructure. NSPS delivers a highly skilled, capable work force and recently completed its first year of protective force services at DOE's Oak Ridge, Tenn., facilities.

THE AMERICAN CENTRIFUGE MANUFACTURING PROGRAM

www.centrusenergy.com

Since 2002, USEC (now Centrus, as of September 2014) has been developing and demonstrating a highly efficient uranium enrichment gas centrifuge technology called the American Centrifuge at its facilities in Oak Ridge and Piketon, Ohio. The goal is to deploy this technology in its American Centrifuge Plant in Ohio. The American Centrifuge Plant will utilize USEC's AC100 centrifuge machine, which has been developed, engineered and manufactured in the United States. The AC100 design is a disciplined evolution of classified U.S. centrifuge technology originally developed by DOE and successfully demonstrated during the 1980s.



Department of Energy Reservation in Oak Ridge:

Oak Ridge Office

- Integrated Support Center

Office of Science

- Oak Ridge National Laboratory Site Office
 - Oak Ridge National Laboratory
 - Oak Ridge Institute for Science and Education

National Nuclear Security Administration

- National Nuclear Security Administration Production Office
 - Y-12 National Security Complex
 - Uranium Processing Facility Project Office
- Office of Secure Transportation Eastern Command

Office of Environmental Management

- Oak Ridge Office of Environmental Management

Office of Scientific and Technical Information

Office of Nuclear Energy

- Nuclear Energy Oak Ridge Site Office

Detailed Data Analysis

JOB, INCOME, OUTPUT, AND SALES TAX BENEFITS OF DOE IN TENNESSEE FOR FY13

Following are estimates of the quantifiable DOE-related benefits from income, jobs, and tax revenue creation. The appendix contains an overview of the model used to generate these results.

DOE EXPENDITURE DATA

In the analysis to follow, estimates of the economic benefits of DOE and its contractors are based on actual spending figures from DOE in 2013. The economic impact model uses detailed expenditure data provided by DOE and its major contractors as inputs to generate impact estimates. Because some contributions from smaller contractors are omitted from this study, the highlighted benefits represent a conservative estimate relative to the true economic benefits of DOE for the state of Tennessee.

During the data collection process, steps were taken to prevent double counting of contracted and subcontracted spending. Expenditures were disaggregated into 59 major industrial sectors for input into the model. Table 1 displays DOE-sponsored spending in Tennessee by sector for FY13. Total payroll, pension, and non-payroll spending in the state were approximately \$2,026.4 million in 2013, which is a 5.3 percent decrease from 2008.

There are three main components of the analysis: (1) the direct effects of the DOE, (2) the indirect effects, and (3) the multiplier effects. As DOE and its contractors provide jobs and pay employees, income from employment is created directly. In addition, income and employment are generated indirectly when DOE purchases goods and services from Tennessee manufacturers, service providers, and vendors—firms that, in turn, hire workers, earn profits, and generate income. The multiplier process results in the creation of income and employment as workers spend their incomes in-state and as other firms generate sales, earn profits, and hire new employees.

The direct, indirect, and multiplier effects are aggregated to yield the total income, employment,

and tax revenue impacts of DOE. Direct effects are attributable to the actual operation of DOE, including hiring of DOE and contractor staff (the direct employment impact) and payments to these workers (the direct income effect). Indirect effects result from DOE-related purchases of goods and services as well as spending by visitors to the American Museum of Science and Energy. Finally, the multiplier effect occurs as the direct and indirect incomes are spent and re-spent within the state economy. For example, DOE-related employees spend a portion of their wages and salaries in the local community on goods and services such as housing, clothing, and food. Likewise, the owners of businesses receiving these payments will use a portion of the proceeds to pay employees and earn profits, continuing the cycle. Throughout each subsequent round of spending, a portion of the direct and indirect income leaks out of the local economy through federal taxes, payments to non-residents, savings, and spending outside the local area. As a result, additional impacts on the state economy and its residents are diminished.

The largest DOE-related expenditure category in 2013 was payroll spending, accounting for \$810 million, or 40 percent, of total in-state spending. Total payroll spending, including both payroll and pension disbursements, totaled \$1,149.9 million. Other notable spending categories include professional, scientific, and technical services, which were \$269.8 million in 2013.

DOE subcontracts many of its operations to private companies. The two largest DOE contracts in Tennessee in 2013 were B&W Y-12, LLC for the operation of the Y-12 National Security Complex and UT-Battelle, LLC, a not-for-profit partnership that manages Oak Ridge National Laboratory. Together, these two contractors accounted for 77.7 percent of the total DOE-related expenditures in Tennessee. Other major contractors include Oak Ridge Associated Universities (ORAU) and UCOR (URS/CH2M Oak Ridge LLC).

Table 1: DOE-Sponsored Expenditures in Tennessee by Industrial Sector, FY13

<i>Sector</i>	<i>Expenditures (in dollars)</i>
Mining (except oil and gas)	16,200
Utilities	4,871,164
Construction	26,056,668
Wood Product Manufacturing	218,900
Nonmetallic Mineral Product Manufacturing	2,172,945
Primary Metal Manufacturing	17,200
Fabricated Metal Product Manufacturing	2,161,137
Machinery Manufacturing	5,171,422
Computer and Electronic Product Manufacturing	9,402,537
Electrical Equipment and Appliance Manufacturing	5,584,489
Other Transportation Equipment Manufacturing	1,691,627
Furniture and Related Product Manufacturing	99,900
Miscellaneous Manufacturing	96,127
Textile and Textile Product Mills	294,900
Apparel, Leather, and Allied Product Manufacturing	1,315,658
Paper Manufacturing	1,353,581
Printing and Related Support Activities	15,890
Chemical Manufacturing	2,615,843
Wholesale Trade	13,345,033
Retail Trade	16,295,507
Air Transportation	54,494
Truck Transportation	834,642
Transit and Ground Passenger Transportation	657,677
Publishing Industries, except Internet	20,550,135
Broadcasting and Telecommunications	999,592
Internet and Other Information Services	172,000
Federal Reserve Banks, Credit Intermediation, and Related Services	0
Securities, Commodity Contracts, and Investments	0
Insurance Carriers and Related Activities	297,000
Real Estate	50,145,621
Rental and Leasing Services and Lessors of Intangible Assets	972,018
Professional, Scientific, and Technical Services	269,777,454
Management of Companies and Enterprises	152,676,216
Administrative and Support Services	2,244,004
Waste Management and Remediation Services	63,639,079
Educational Services	54,303,777
Ambulatory Health Care Services	427,272
Hospitals and Nursing and Residential Care Facilities	0
Social Assistance	0
Amusements, Gambling, and Recreation	0
Accommodations	10,732
Food Services and Drinking Places	2,435,194
Other Services	5,612,211
Postal Service	0
Payroll	810,070,740
Pensions	339,810,775
Health Insurance	157,961,386
Total expenditures in Tennessee	\$2,026,448,745
Total non-payroll expenditures in Tennessee	\$718,605,844

Summary of Benefits

A total of \$810.1 million was directly paid to employees in the form of payroll expenditures related to DOE activities in FY13. An additional \$339.8 million was spent on pensions. A total of \$718.6 million in direct non-payroll expenditures was generated, along with \$89.2 million in direct sales tax contributions. After each of these monetary portions was injected into the state economy, additional income and employment effects were generated via the indirect and multiplier processes mentioned previously.

Table 2 shows the substantial overall economic benefits of DOE-related spending in Tennessee in 2013—including direct, indirect, and multiplier effects. As a result of DOE-related operations, output (measured by SGDP) increased by \$3.6 billion, personal income increased by \$2.2 billion, state and local sales tax revenue grew by \$142.1 million, and 40,646 full-time equivalent jobs were created.

Output (SGDP)	\$3,562,340,543
Personal Income	\$2,173,301,708
Sales and Use Tax Revenue	\$142,131,137
Employment	40,646

Output Benefits

To gauge the output benefits of DOE-related operations, an estimate of the increase in SGDP is included. A total of \$3.6 billion was generated in output benefits in FY13 from DOE and its contractors. A breakdown of the four categories that contributed to this output benefit is provided in Table 3. The largest portion of the output benefit came from non-payroll spending, which amounted to \$1.75 billion (or 49.01 percent of the total, as shown in Figure 1), while \$1.28 billion (35.8 percent) was traced to payroll spending. Additionally, pension disbursements produced \$535.5 million, and visitor spending created \$4.4 million, making up 15.0 percent and less than 1 percent of the total output benefit, respectively.

Table 3: DOE Output Benefit in Tennessee by Source, FY13

Payroll Spending	\$1,276,671,487
Non-payroll Spending	1,745,772,151
Pension Disbursements	535,541,781
Visitor Spending	4,355,124
Total output benefit	\$3,562,340,543

Income Benefits

Another important measure of economic benefits created by DOE is personal income, which includes all wages, salaries, profits, interest, rents, and other forms of income earned by residents in the state economy. This measure is noteworthy because it reflects gains that accrue directly to state residents. Figure 2 and Table 4 summarize these benefits for FY13. The total increase in personal income in Tennessee attributed to DOE-related spending was \$2.2 billion in FY13.

This number is split into two categories: direct effects, which made up \$1,149.9 million (or 52.9 percent), and indirect/multiplier effects, which made up \$1,023.4 million (or 47.09 percent) of all income benefits. Among the direct effects, \$810.1 million was spent on payroll and \$339.8 million on pensions. There are several indirect effects to consider that arise from DOE-related purchases of goods and services and spending by visitors. Non-payroll spending generated \$535.2 million, and visitor spending generated \$1.3 million. Furthermore, the multiplier effects from DOE-related payroll spending and pensions created \$343 million and \$143 million in benefits, respectively.

Figure 1: DOE Output Benefit in Tennessee by Source, FY13

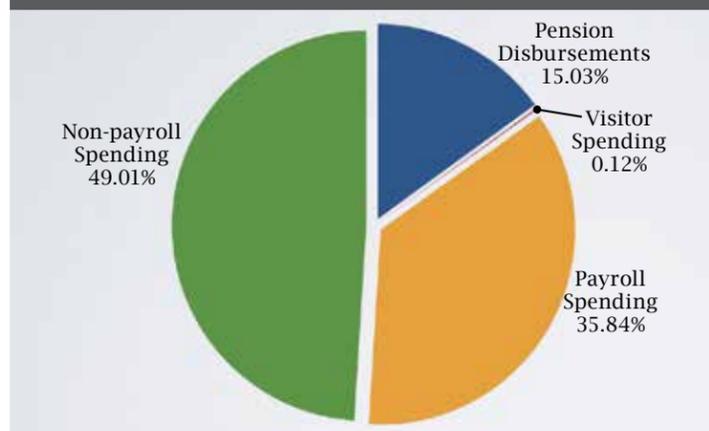


Figure 2: DOE Income Benefit by Source, FY13

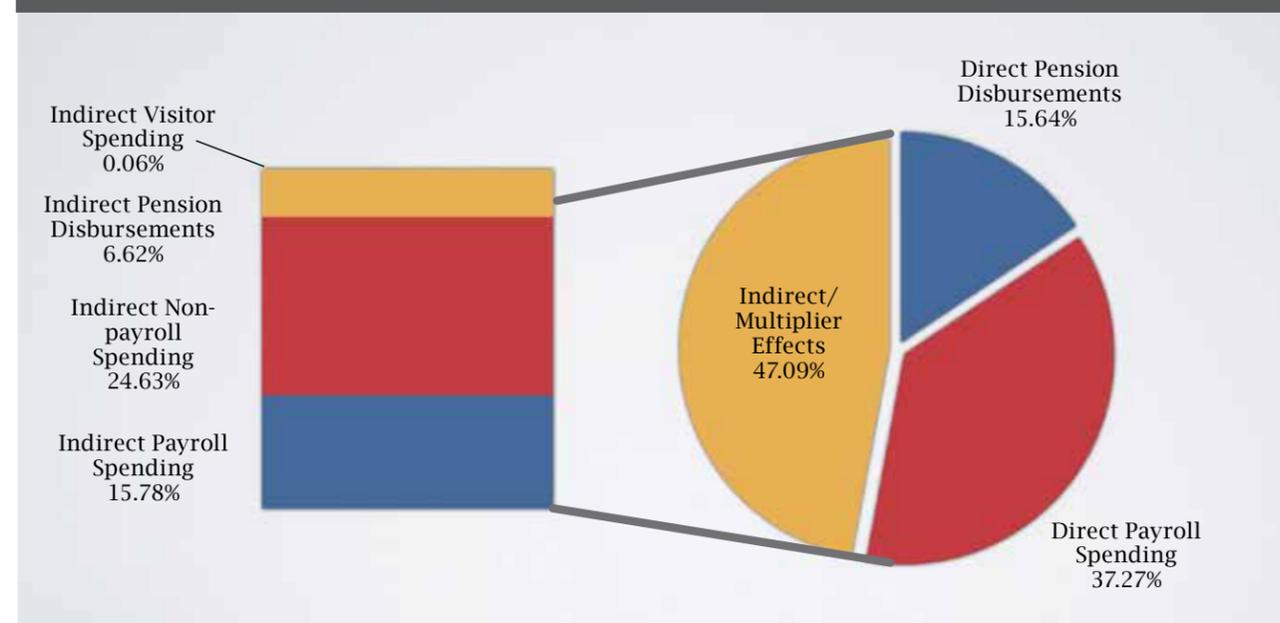


Table 4: DOE Income Benefit in Tennessee by Source, FY13

Direct Effects	
Payroll Spending	\$810,070,740
Pension Disbursements	339,810,775
Indirect/Multiplier Effects	
Payroll Spending	342,983,951
Non-payroll Spending	535,225,430
Pension Disbursements	143,875,882
Visitor Spending	1,334,930
Total income benefit	\$2,173,301,708

The implicit multiplier associated with income benefits (calculated by dividing the total income benefit by direct spending on payroll and pensions by DOE) is 1.89. This suggests that every dollar of income paid directly to workers of DOE and its contractors created \$1.89 in total state income in FY13.

Employment Benefits

Table 5 summarizes the direct employment figures of DOE and its contractors in Tennessee, by business entity, for FY13. There are 16 entities included in this analysis, with direct employment totaling 11,230. B&W Y-12, LLC employed the most workers in FY13

(4,398), while UT-Battelle, LLC had the next highest number of employees (4,330). These two contractors, combined, accounted for 77.7 percent of DOE-related employment in FY13. Total direct employment related to DOE fell by approximately 1,143 employees since 2008, representing a 9.2 percent decrease in workers.

Table 5: DOE Direct Employment Benefit in Tennessee by Entity, FY13

Division/Contractor	Employees
B&W Y-12, LLC	4,398
UT-Battelle, LLC	4,330
ORAU	862
UCOR	618
NSPS	215
USEC Inc.	137
WAI	162
OREM	129
BEI-JES Oak Ridge	83
Isotek	76
NNSA Y-12	72
Alliant	42
US DOE-OSTI	41
GET-NSA	28
ES&H	19
SUMMIT	18
Total direct employment	11,230

The total employment benefit of DOE-related expenditures in Tennessee FY13 was 40,646. In addition to the 11,230 direct hires, 29,416 jobs were created indirectly and through the multiplier, accounting for 72.4 percent of the overall employment impact of DOE. These indirect effects arise from DOE-related purchases and visitor spending along with multiplier effects associated with payroll spending and pensions.

Direct Effects	
DOE-related Employees	11,230
Indirect/Multiplier Effects	
Payroll Spending	11,443
Non-payroll Spending	13,094
Pension Disbursements	4,800
Visitor Spending	79
Total employment benefit	40,646

The FY13 employment multiplier for DOE-related operations in Tennessee (applied in Table 6) was 3.62. This suggests that for every job directly created by DOE, an additional 3.62 jobs were generated in-state in FY13. Given the high average salary of DOE-related employees (\$72,135) and significant degree of subcontracting, it is not surprising that the employment multiplier associated with DOE-related operations is relatively large.

Sales Tax Benefit

DOE-related expenditures created a significant amount of state and local sales tax revenue in FY13, which is highlighted in Table 7. More than \$142 million was paid in sales taxes in Tennessee from DOE-related expenditures. Of this amount, \$89.2 million (62.7 percent) was generated from direct expenditures made in the state. Additionally, \$53 million (37.3 percent) was generated from indirect and multiplier effects. Most of the revenue (from direct, indirect, and multiplier effects) went to the state government, but a sizeable portion was contributed to local governments across the state.

Table 7: DOE Sales Tax Revenue Benefit in Tennessee, FY13

Direct Payments	
State	\$66,692,133
Local	22,471,891
Indirect/Multiplier	
State	39,401,677
Local	13,565,435
Total sales tax revenue benefit	\$142,131,137

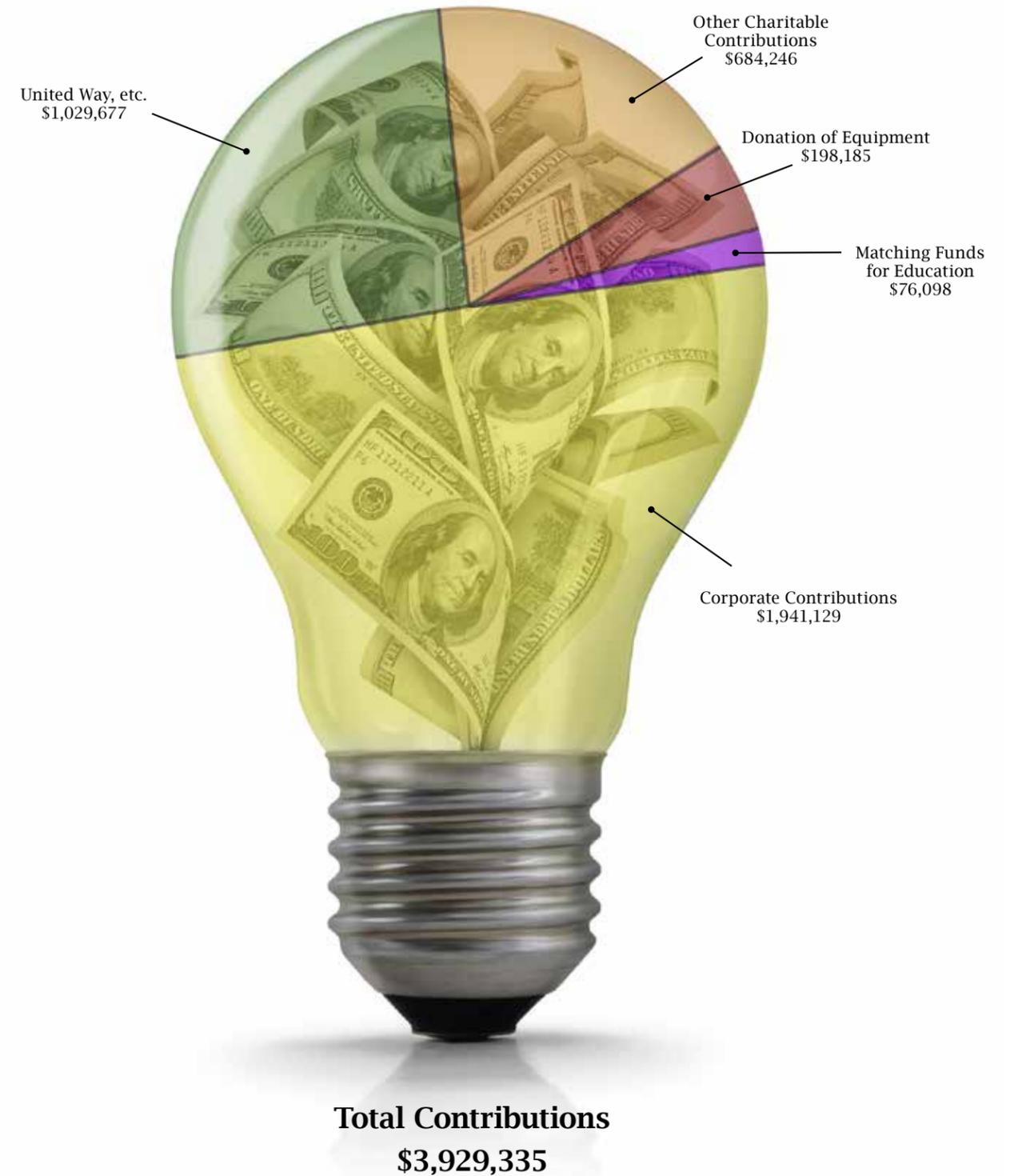
It is important to note that DOE-related activities also offer other fiscal benefits for state and local governments such as property tax revenue, business tax revenue, and payments in lieu of taxes. For example, DOE employees pay sales tax on their homes, just as other businesses contribute to the property tax base. Because the analysis in this study only considers sales tax revenue generated by DOE and its contractors, the total fiscal benefits of DOE in Tennessee are understated.

Additional DOE Contributions to Tennessee

There are several benefits associated with DOE-related activities in the state of Tennessee in addition to the economic benefits mentioned previously. For example, DOE supports a variety of programs that focus on community engagement; technology partnerships; and contributions to the Tennessee educational system, reuse of government assets, grants, and job-creation initiatives. Each of these programs has increased the overall well-being of residents in Tennessee.

Perhaps one of the more personal ways in which DOE benefits the community at large is through charitable contributions. In FY13, DOE, its contractors, and employees donated a substantial amount of money to a variety of community-related charities, schools, and other organizations. Table 8 summarizes these contributions by entity and by donation source. Overall, more than \$3.9 million was donated by DOE, its contractors, and its employees in FY13. Although these monetary contributions play a key role in the local economy, there are various activities related to community involvement that are not captured in this study. This suggests that these numbers understate the overall benefits that accrue to the state from DOE-related operations.

Figure 8: DOE Community Charitable Contributions by Entity, FY13



Transforming Oak Ridge for Future Missions

The list is staggering. Piece by piece, the DOE's facilities in Oak Ridge are being transformed. The new buildings include science labs, national security facilities, a STEM education hub, and several advanced manufacturing demonstration centers. ORNL, ORISE, Y-12, and ETPP look like new places today, laying the foundation for a new generation of work to support the government's diverse missions in East Tennessee.

At ORNL just 15 years ago, 80 percent of the space being used for the world's leading science and energy research was more than 30 years old, and much of it dated back to the Manhattan Project of 1942–45. Y-12 was much the same—with its manufacturing and engineering teams spread out over a sprawling complex in Bear Creek Valley.

Today, using a good bit of creativity and a lot of hard work, both campuses are transformed. ORISE, likewise, has created a campus for STEM excellence. ORNL, Y-12, and ORAU all have plans to continue that transformation as future needs and missions arise.

OAK RIDGE NATIONAL LABORATORY

ORNL's story is well documented. In 2002, no one at the laboratory worked in a building that was less

than 10 years old. Today, more than half the people at ORNL work in buildings constructed since that time. About 1.27 million square feet of new space has been built, and the total campus has increased in size by 35 percent.

As a side note, even through this expansion, ORNL has decreased its energy bills by one percent and decreased water usage and municipal wastes.

Some of the new facilities at ORNL include:

- The world's most powerful computing complex for open science
- A Joint Institute for Biological Sciences
- A carbon fiber technology demonstration plant
- A Manufacturing Demonstration Facility
- A Radiochemical Engineering Design Center
- A research facility that simulates and tests building materials
- The Spallation Neutron Source, Joint Institute for Neutron Sciences, and upgrades to the High Flux Isotope Reactor, together make ORNL the neutron sciences center of the world.

In addition, ORNL's work environment is enhanced by facilities, including a coffee shop and credit union, a fitness center, improved parking structures, a conference center and small hotel for visiting scientists, a biomass steam plant, solar charging stations for electric cars, and more.

Today ORNL has 15 Leadership in Energy and Environmental Design (LEED) certified buildings, including six rated as gold, and 23 other high-

performance sustainable buildings. The campus itself, replanted with Tennessee native plants, is a model for sustainable development.

As envisioned by ORNL leaders, the lab has improved functionality, created an environment in which to recruit and maintain the best staff, enhanced safety, and controlled operational and maintenance costs.

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION



On the ORISE south campus, government-owned property, seven buildings have been safely demolished, totaling 46,138 square feet of old barns, labs, and storage buildings.

In 2001, ORISE completed a 4,090 square-foot expansion of Building SC-10 to house Beryllium Laboratory Operations. In 2003, ORISE constructed a 5,573 square-foot building to house facility management office operations and in 2005 constructed a new Warehousing Facility totaling more than 22,020 square feet. Building SC-300 was constructed in 2011. This 2,243 square-foot building houses a teaching laboratory and classroom. In 2013,

ORISE also completed another 4,152 square-foot expansion of the SC-10 building to provide additional space for the three laboratories: the Cytogenetics Biodosimetry lab, Beryllium lab, and Radiochemistry lab.

Y-12 NATIONAL SECURITY COMPLEX

Y-12, likewise, faced significant facilities issues as the 21st century dawned. Staff and operations were spread across a complex built during World War II. Today, the news is about the major new manufacturing facility, known as the Uranium Processing Facility (UPF) to be built at the complex over the next decade. That building, when constructed, will replace WWII-era manufacturing and chemical facilities. Basic site work is already under way on what will be the largest new construction project in the state.

The most visible changes over the last decade in Bear Creek Valley are the Jack Case Center and New Hope Center, two new facilities constructed through third-party financing. These facilities contain 550,000 square feet of technical support and administrative space and replaced 1940s wooden structures.

The facility that enhances Y-12's role as the nation's uranium center of excellence is the Highly Enriched Uranium Materials Facility. This new 150,000 square-foot state-of-the-art facility provides the capability for secure storage of enriched uranium. Operational in 2010, this facility was a major Y-12 landscape changer and streamlined and enhanced security operations at Y-12.

Following is a general summary of other major facilities and site changes at Y-12 over the past decade:

- A new purification facility, 10,000 square-foot building to meet a high-priority production needs; completed in 2005, this was the first new production facility built at Y-12 since 1970.



- A new steam plant/potable water/compressed air facility, which combined three major utility projects funded through NNSA's Facility Infrastructure and Recapitalization Program (FIRP). These facilities replaced the 1950s coal-fired steam plant, provided an entirely new potable water supply system, and upgraded the vital compressed-air system.
- Bear Creek Road was rerouted prior to initiation of site preparation for the new UPF. The remainder of the road is currently being rerouted by the UPF project. This new road has made a major improvement and operational efficiency to the Y-12 site.
- Facilities for quality evaluation and depleted uranium consolidation were relocated and consolidated to allow Y-12 to cease operations in two aged manufacturing facilities, totaling approximately 1 million square feet. It also consolidated and updated operational functions to enhance synergy and productivity.

Just as important, Y-12 is making room for new missions by cleaning up outdated facilities. Through FIRP, 1.4 million square feet of non-process-contaminated structures—primarily

1940s vintage—were demolished to support site consolidation, make way for new facilities, and reduce annual operating cost.

Y-12 managers also used American Recovery and Reinvestment Act funds to clean up legacy material, demolish several existing facilities, remove legacy materials from facilities excess to Y 12 needs, and perform select mercury-reduction activities. Still to come are other new facilities, including three in the final planning stages: a new emergency operations and response center, a fire station, and a lithium production facility. These projects will make a great impact not only on production operations but on critical emergency management functions.

EAST TENNESSEE TECHNOLOGY PARK

The EM organization facilitated changes at ETPP, the former site of the nation's first uranium enrichment plant. DOE, working with the state and Environment Protection Agency, are cleaning up the site and preparing it for new missions.

Three of the five huge process buildings have been demolished and many of the support facilities remediated. Some remaining facilities are already being used by private sector tenants.

To date, DOE has worked with CROET, the City of Oak Ridge, and the state to transfer infrastructure, emergency response services, and 700 acres of property for reuse. More can be transferred and leased as cleanup continues.

"It's incredibly exciting to see the economic development potential of this property," Tennessee Governor Bill Haslam said after an ETPP site visit in March 2014. "As a state, we have a real vested interest in what happens here."

TRENDS IN THE ECONOMIC BENEFITS OF DOE

Studies similar to the one presented have been conducted since 1998, with the exceptions of 2002, 2005, 2007, and 2009–2012. Figure 3 illustrates the trends in the main results from each of the studies. The overall trend indicates that output and income benefits have plateaued while employment has begun a downward trend.

Figure 3: Trends in the Economic Benefits of DOE

