



NOW HIRING: THE GROWTH OF AMERICA'S CLEAN ENERGY & SUSTAINABILITY JOBS



EDF Climate Corps fellow Lillian Mirviss helped Gap Inc. implement on-site solar installations at three of its distribution centers.



CLIMATE CORPS

America's transition into an environmentally sustainable economy has been accelerated by investments in workforce development made by corporations, philanthropic foundations, and non-profit organizations. EDF Climate Corps is one of the leading initiatives working to connect, empower, and inspire leaders who will enable this transition to a more sustainable economy.

EDF Climate Corps connects talented graduate students with various public, private and non-profit organizations in the U.S. to drive forward innovative energy and sustainability initiatives. Since 2008, EDF has recruited and placed more than 700 EDF Climate Corps fellows in over 400 organizations. In 2017 alone, more than 1,000 graduate students applied for just over 100 spots.

Through a 10-week fellowship, students design customized solutions to real-world challenges in energy efficiency, renewable energy, energy management and sustainability strategy. To date, fellows have identified over \$1.5 billion in energy savings for their host organizations and supported a wide range of strategic energy management initiatives.

EDF Climate Corps allows young professionals to launch or accelerate sustainability careers and draws top talent into a growing market. Fellows go on to play leading roles in the sustainability economy. For example, as of 2016, almost 70% of EDF Climate Corps alumni work in sustainability.¹ Alumni and host organizations also stay connected and engaged with the EDF Climate Corps network throughout their careers.

ABOUT ENVIRONMENTAL DEFENSE FUND

Environmental Defense Fund (EDF) is one of the world’s largest environmental nonprofit organizations, with more than two million members and a staff of over 500 scientists, economists, policy experts, and other professionals around the world. EDF finds practical and lasting solutions to the world’s most serious environmental problems. Working with leading businesses, scientists and academics, EDF is taking a leading role in minimizing the environmental, economic and human health risks associated with rising greenhouse gas emissions. EDF Climate Corps is an EDF initiative that empowers business professionals to advance climate solutions.

ACKNOWLEDGMENTS

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Cover image source: Fotolia

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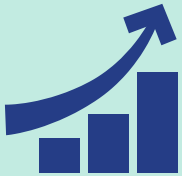
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KEY HIGHLIGHTS:

CLEAN ENERGY AND SUSTAINABILITY JOBS IN THE U.S.



Sustainability jobs represent a large and growing portion of the U.S. workforce across multiple sectors.

These jobs span energy efficiency and renewable energy, as well as waste reduction, natural resources conservation and environmental education.² This report estimates that sustainability now collectively represents 4-4.5 million jobs in the U.S., up from 3.4 million in 2011.^{3, 4}



Due to the on-site nature of many renewable and energy efficiency jobs, these jobs cannot be outsourced and can pay above average wages.

Many jobs in the solar and energy efficiency space are in installation, maintenance and construction, making them inherently local and contributing to the growth of local economies. Average wages for energy efficiency jobs are almost \$5,000 above the national median, and wages for solar workers are above the national median of \$17.04 per hour.⁵



Clean energy and sustainability jobs are present in every state in America.

The benefits are not limited to one region. Workers in all states across the country have access to some type of clean energy or sustainability job opportunity.

4 MILLION JOBS

Advanced Vehicles
174,000

Renewable Energy
769,000

Public Sector
890,000

Energy Efficiency
2.2 Million



RENEWABLE ENERGY

The renewable energy sector has seen rapid growth, driven largely by significant reductions in manufacturing and installation costs. In 2015, renewable energy jobs in the U.S. reached 769,000, the result of a compound annual growth rate (CAGR) of nearly 6% since 2012.⁶ Job creation in this sector has outstripped the fossil fuel industry: For example, jobs in fossil fuel extraction and support services slumped, with a -4.25% CAGR over the same period.⁷ **Solar and wind jobs have grown at rates of about 20% annually in recent years and are each creating jobs at a rate 12 times faster than that of the rest of the U.S. economy.**^{8, 9}



ENERGY EFFICIENCY

The energy efficiency sector has seen substantial growth due in part to rising investments from building developers and owners that have been fueled by state and local building efficiency policies and incentives. **There are approximately 2.2 million energy efficiency workers nationwide**, the majority of which are in small businesses working on the construction and installation of energy efficient systems.¹⁰ Studies have also shown that energy efficiency investments create more jobs than those in fossil fuel industries, estimated at approximately 8 jobs (direct and indirect) per \$1M invested compared to about 3 jobs in fossil fuels.¹¹



TRANSPORTATION

Advancements in clean vehicle manufacturing and rising consumer demand have helped accelerate the automotive industry's transition toward alternative fuel vehicles in recent years. **Clean vehicles employed more than 174,000 workers in 2016, up 48% from 2015.**¹² Hybrid vehicles have experienced especially rapid growth and now represent more than 70% of these jobs. Continued progress in this sector is expected, fueled by rising adoption, expanded charging infrastructure, as well as state and local government incentives and regulations.



PUBLIC SECTOR

Government agencies not only develop policies and programs that accelerate the growth of sustainability job markets, they also directly employ a significant number of sustainability-focused staff. **Past estimates of "green jobs" in government total nearly 890,000** with the majority (76%) at the local and state level.¹³ There is reason to believe that the increased focus on energy, climate, clean transport and other sustainability issues is further growing the public sector's green workforce requirements.



CORPORATE SUSTAINABILITY

Consumers are increasingly demanding more sustainable goods and services as well as corporate commitments to environmental responsibility. There is strong evidence that companies are increasing investments in sustainability. For example, a 2016 GreenBiz survey found that **three quarters of firms now have dedicated sustainability budgets** and 40% had grown these budgets over the previous two years. In addition, 46% of large firms have hired additional sustainability staff in the last two years.¹⁴ As companies continue to imbed sustainability throughout their organizations, job opportunities are likely to grow.

INTRODUCTION

Over the past several decades, the United States has been transitioning into a more environmentally sustainable and energy efficient economy. New business models and goods and services, such as energy efficiency and renewable energy, have emerged, while traditional businesses and institutions have made significant efforts to reduce the environmental footprint of their operations. This report highlights the role of this transition in boosting the American economy and creating millions of sustainability jobs across the nation.

Clean energy is used in this report to refer collectively to renewable energy and energy efficiency technologies and markets.

Sustainability jobs are wide-ranging and reflect one or more of the following functions:

- Jobs in sectors that produce **goods and services that benefit the environment**;
- Jobs in which employees focus on **making processes more environmentally friendly and resource efficient**;¹⁵ and
- Jobs focused on improving and communicating an organization's **environmental and social impacts**.

This report discusses the current status, key trends and potential future developments in renewable energy and energy efficiency, and summarizes some of the major advances in other sectors such as local/state government, transportation and the private sector. In many cases, these sectors are vastly outpacing the rest of the U.S. economy in growth and job creation and are generating more jobs per dollar invested. Many of these jobs have higher than average wages, create local economic benefits and are widely available in markets across the U.S. Throughout this report, sustainability professionals from the EDF Climate Corps network are profiled to help highlight the diverse skills and expertise of those working in sustainability.



EDF Climate Corps fellow Affuembey Enow Affuembey examines equipment at Southern University.

SECTOR PROFILE: RENEWABLE ENERGY

Growth and Status of Renewable Energy Jobs

Renewable energy deployment has risen dramatically in the U.S. in recent years and now makes up the largest share (64%) of new electricity generation capacity installed in the U.S. each year.¹⁶ Solar photovoltaic (PV) and wind have been leading this growth, driven by significant reductions in manufacturing and installation costs. For example, solar PV panel production costs dropped 72% between 2010 and 2015,¹⁷ making solar PV cost-competitive with fossil-fuel-generated power in many markets. This has driven a tenfold expansion in solar deployment since 2010, from 876 to 10,727 megawatts installed annually.¹⁸ Wind power also continues to see year-on-year growth and has more than doubled total installed capacity to 74 GW between 2009 and 2015.¹⁹

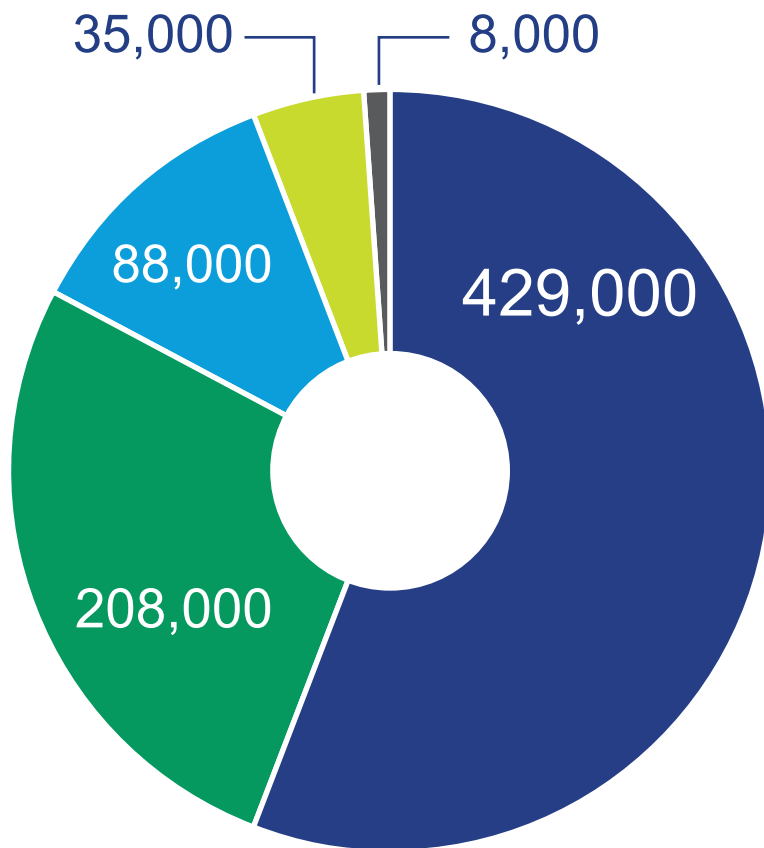
Renewable energy now makes up **64%** of new electricity generation capacity installed in the U.S. each year.



Image source: Fotolia

Fig. 1

RENEWABLE ENERGY JOBS BREAKDOWN BY GENERATION TECHNOLOGY (2015)



 Bioenergy

 Solar

 Wind

 Geothermal

 Small Hydropower

Source: IRENA, 2016

Concurrent with this growth in generation capacity, employment in renewable energy has been growing rapidly. Solar employment opportunities are currently growing at a rate 12 times faster than the rest of the U.S. economy²⁰ and wind turbine technician is currently the fastest growing profession in the U.S.²¹ Overall, renewable energy jobs in the U.S. have grown at a compound annual growth rate (CAGR) of 6% since 2012, rising to 769,000 in 2015 (see Figure 1).^{22, 23} This stands in stark contrast to the boom and bust cycles that characterize employment in fossil fuel extraction industries. Over the past 5 years, annual growth rates in oil and gas extraction, coal mining and processing jobs have ranged from 9% to -22%, and jobs in these sectors have seen an overall decline (CAGR of -4.25%).²⁴

Solar employment opportunities are currently growing at a rate **12 times** faster than the rest of the U.S. economy.

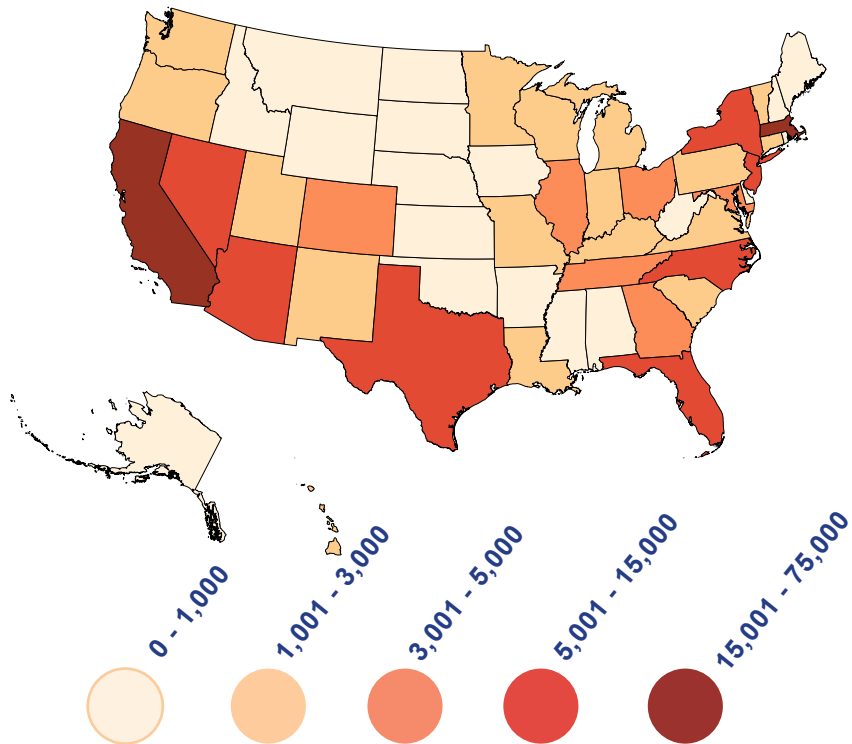
Not only is the renewable energy economy creating jobs faster than the fossil fuel industry, it also creates more jobs per dollar invested. For example, researchers at the University of Massachusetts Amherst estimate that investments in renewable energy generate roughly three times more direct and indirect jobs than comparable investments in fossil fuels.²⁵

What do Renewable Energy Jobs Look Like?

The renewable energy economy spans a wide variety of job types and is distributed throughout all 50 states. In the solar energy sector, 80% of jobs are demand-side services (e.g. installation, sales, etc.), most of which are inherently local jobs that cannot be outsourced.²⁶ Wind industry jobs are divided more evenly among three primary activities—manufacturing (21,000 jobs); project development, transportation and installation (38,000 jobs); and operations and maintenance (29,000 jobs).²⁷ While wind and solar resources and policy environments vary across the U.S., most states boast a strong job market for at least one of these leading technologies (see Figure 2 and 3 below).

Fig. 2

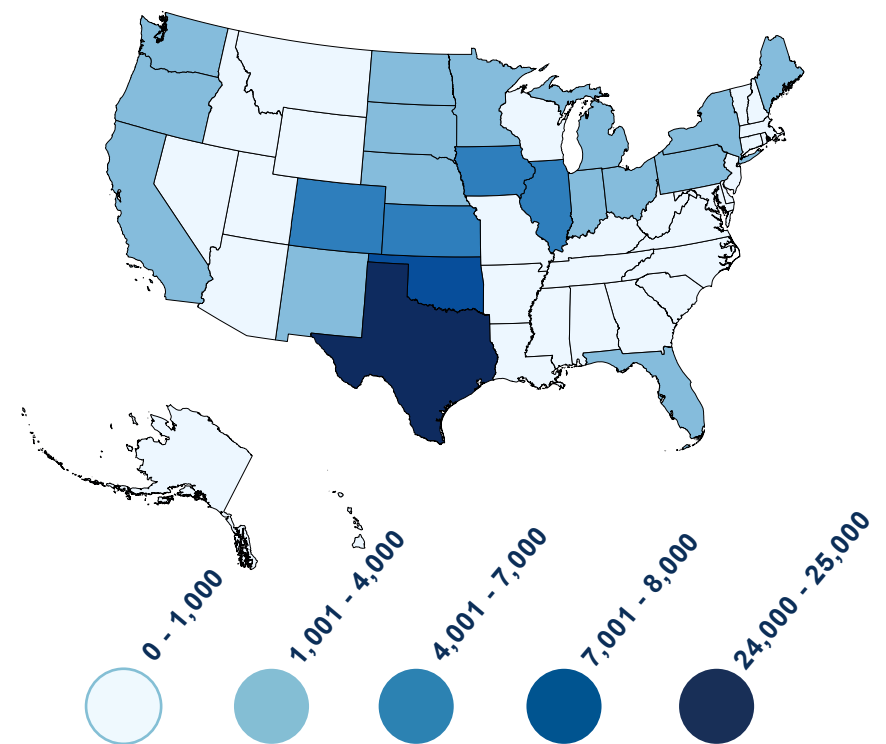
SOLAR JOBS DISTRIBUTION BY STATE



Source: The Solar Foundation, 2015

Fig. 3

WIND JOBS DISTRIBUTION BY STATE



Source: The Wind Energy Association, 2015



Image source: Fotolia

In contrast to wind and solar, bioenergy jobs are primarily focused on the production of raw agricultural materials, sourcing and transport of waste materials, refining, processing, and distribution.²⁸ The majority of the U.S. biorefineries are in the Midwest, particularly Iowa, Nebraska, South Dakota, Minnesota, Kansas, Indiana, Ohio, and Wisconsin.

Renewable energy jobs include:

- Component manufacturing
- Project development
- Construction and installation
- Financing
- Engineering
- Sales and distribution
- Systems analysis
- Operations and maintenance

Future Developments in the Renewable Energy Sector

Looking ahead, wind and solar are both projected to see significant growth in the coming decades, due largely to continued cost reductions. Bloomberg New Energy Finance estimates that wind and solar will account for 64% of new power generating capacity added globally between now and 2040.²⁹ Solar in particular is predicted to emerge as the least-cost generation technology in most countries by 2030 and account for over \$3 trillion in new investment. In the U.S., the 2015 congressional extension of the investment tax credit (ITC) is expected to result in an additional 220,000 solar jobs between now and 2023.³⁰ Growth estimates for biomass and biofuels show that U.S. production in those industries could expand even more rapidly than the renewable sector overall, at around 86% by 2030.³¹ Bioenergy industry growth would drive similar investments in new jobs due to the high labor-intensity of operations and maintenance.



Doug Herling

Origination Manager, Pioneer Green Energy

Doug has always had an interest in energy and an aptitude for data analysis. After working a few years in carbon accounting and investment portfolio management, Doug decided to pursue an MBA in energy entrepreneurship and renewable energy finance at the University of Texas at Austin. In the summer of 2014, Doug became an [EDF Climate Corps fellow](#), where he worked with [JPMorgan Chase & Co.'s Energy and Sustainability team](#) to identify a common solution for water and energy efficiency opportunities throughout its real estate portfolio.

Doug evaluated three specific conservation measures that could result in significant energy and cost savings as well as provide a positive environmental impact to the firm. This EDF Climate Corps experience helped Doug develop and hone an analytical framework and communication strategy that has enabled him to excel in his renewable energy career.

Now an origination manager at Pioneer Green Energy, Doug does a mix of energy marketing and renewable energy project development. EDF Climate Corps helped Doug develop an understanding of how companies make energy procurement decisions, which helps when marketing power purchase agreements to Fortune 500 companies seeking to reduce their carbon footprint. The origination work involves in-depth financial modelling and analyzing future energy prices in order to structure these agreements. The project development work involves communicating renewable energy benefits to communities throughout Texas, managing complex permitting processes and negotiating tax agreements. Doug's favorite part of this work is the range of interactions he has in the course of a typical day—which might include site planning with ranchers, tax abatement negotiations with school districts, educational work with community organizations, and financial planning with corporate procurement experts.³²

SECTOR PROFILE:

ENERGY EFFICIENCY

Growth and Status of Energy Efficiency Jobs

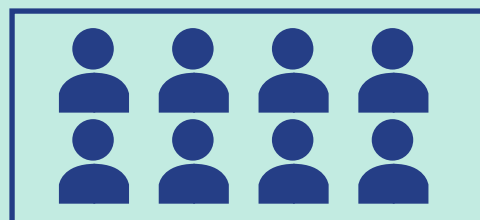
Energy efficiency is a significant and growing segment of the U.S. economy. Increased investments in building energy efficiency—fueled in part by state and local efficiency policies and incentives—have made substantial contributions to the rapid growth of this sector.

Energy efficiency investments go far beyond reducing utility bills for companies and consumers and contribute significantly to local economic development and job creation. There are currently almost 2.2 million people working in energy efficiency nationwide, a 7% increase from 2015.³³ About 1.4 million work in construction and installation, more than double the number of workers in fossil fuel mining, extraction and electric power generation combined.³⁴

There are almost **2.2 MILLION** people working in energy efficiency nationwide, a **7%** overall growth from 2015.

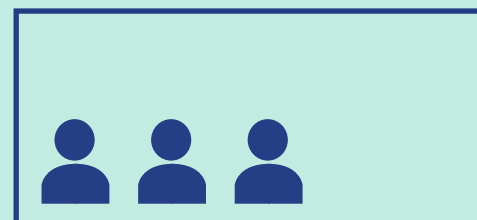
JOBS CREATED PER \$1 MILLION INVESTED*

Building Retrofit and Industrial Efficiency:



8

Fossil Fuels:



3

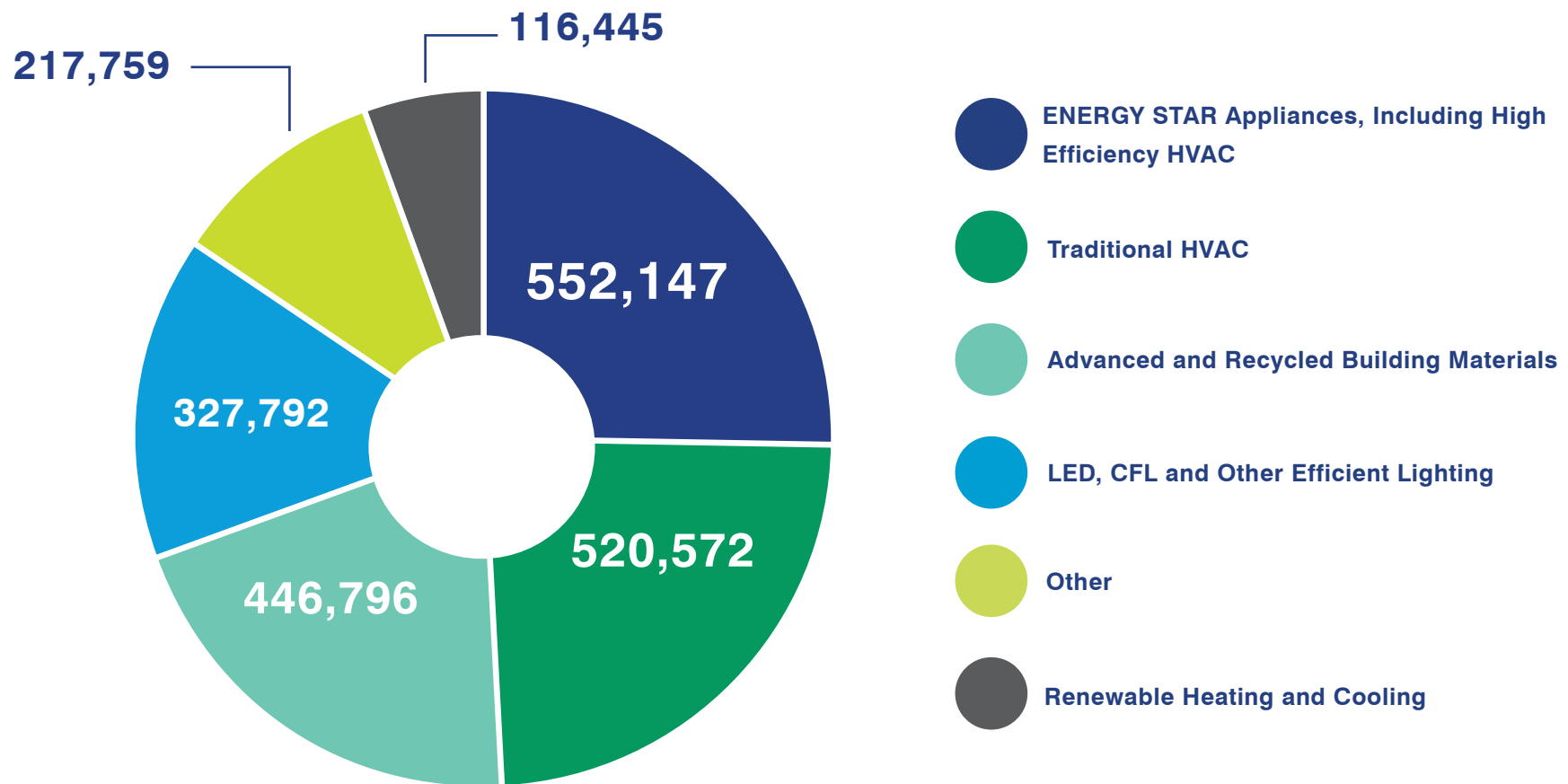
*Jobs include direct and indirect jobs; source: Garrett-Peltier, 2016

What do Energy Efficiency Jobs Look Like?

Energy efficiency jobs span product design and manufacturing, to equipment installation and building retrofit. Most of the construction and installation jobs are local due to the on-site nature of efficiency work.³⁵ About 63% of energy efficiency employees work in construction firms installing building control equipment (another 18% work in professional and business services).³⁶ Employment in this sector is driven by various energy efficiency sub-technologies, including advanced and recycled building materials, efficiency lighting and renewable heating and cooling, with 25% in ENERGY STAR appliances including high efficiency heating, ventilation and air conditioning (see Figure 4).³⁷

Fig. 4

ENERGY EFFICIENCY EMPLOYMENT BY SUB-TECHNOLOGY (2016)



Source: Department of Energy, 2017

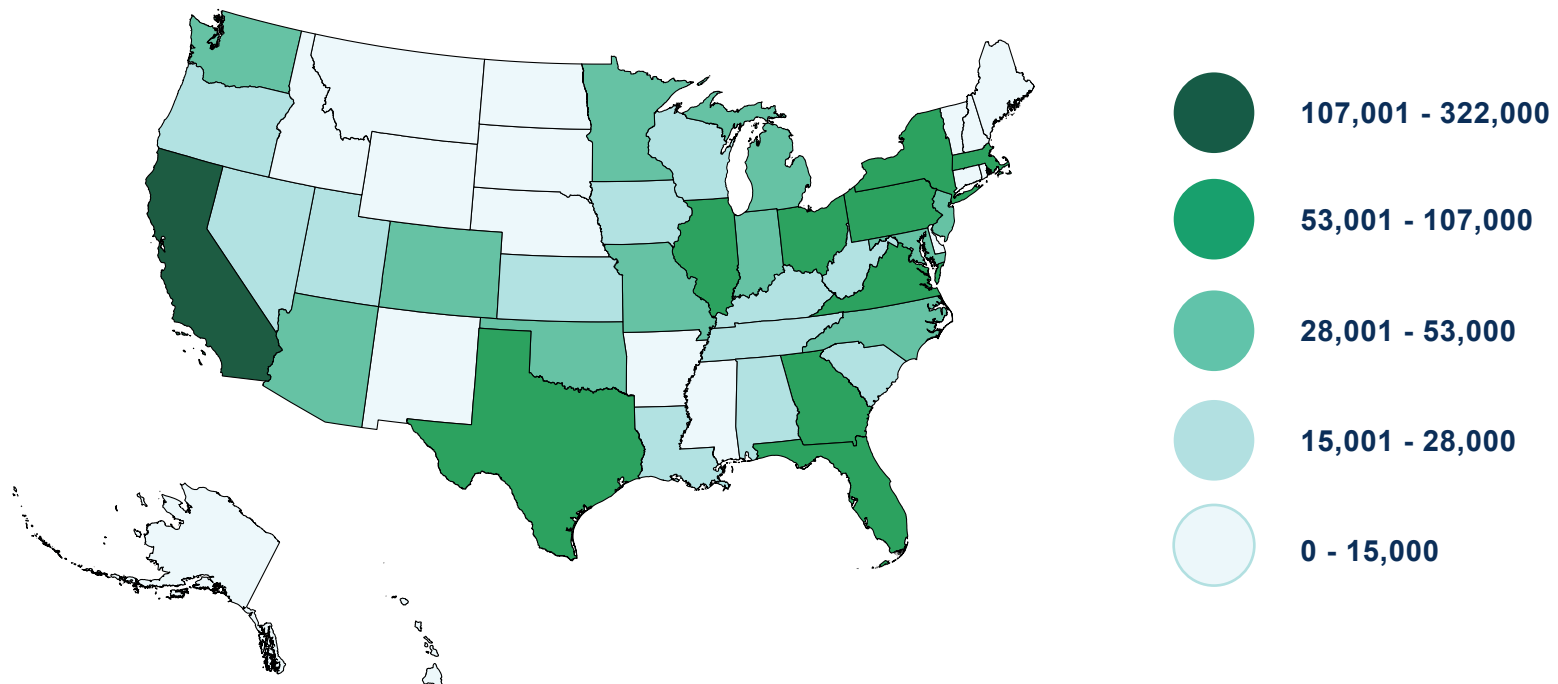
Furthermore, **energy efficiency jobs generally pay higher than average wages and are available to workers without college or advanced degrees.** Nearly half of energy efficiency jobs are currently held by employees with a high school diploma, or less, and average wages are almost \$5,000 above the national median.³⁸

These jobs are also distributed throughout the U.S.—the majority of states have at least 15,000 energy efficiency jobs and states like Ohio, Massachusetts and Illinois each have more than 75,000 (see Figure 5).³⁹ The majority of energy efficiency employees in the U.S. work for small businesses, with about 70% working for companies with 10 employees or less.⁴⁰

About 70% of energy efficiency employees work for companies with **10 employees** or less.

Fig. 5

ENERGY EFFICIENCY JOBS DISTRIBUTION BY STATE (2016)



Source: *Environmental Entrepreneurs*, 2016

Future Developments in the Energy Efficiency Sector

Energy intensity in the commercial sector is expected to decrease by an average of 0.5% per year from 2015-2040, due to continued investments in energy efficient lighting, heating, cooling, and ventilation systems, as well as increasingly stringent building codes and standards (based on projections from the Energy Information Administration).⁴¹

Reduced energy expenditures also drive job and economic growth by creating more productive economic impacts. Spending on non-energy goods and services has been shown to have a greater positive impact on the domestic economy than spending on energy. For example, one dollar of avoided utility bill expenditures spent elsewhere has a 2.24 times greater effect in terms of improving wages and increasing production of goods and services.⁴² In this way, energy bill savings can be spent as if it were additional income, stimulating non-energy sectors—which tend to be more labor intensive—and leading to net job increases throughout the whole economy.⁴³

ONE DOLLAR of avoided utility bill spent in non-energy sectors has **2.24 TIMES** the effect in terms of increasing wages and production of goods and services.



Image source: Fotolia



Gina Melekh

Expert Business Analyst, Energy Efficiency Products Management, Pacific Gas and Electric Company

Gina Melekh had always been interested in environmental issues, but wasn't sure she could make a career out of it. A degree in finance and a master's degree in software and technology led her into banking and after over a decade, she decided to make a career transition by pursuing a master's degree at Presidio Graduate School in San Francisco, which specializes in sustainable business management. When she completed her studies, Gina joined the [EDF Climate Corps](#) class of 2014, where she was tasked to help the City

of Baltimore develop a Strategic Energy Management Plan. At the end of her fellowship, the City hired her full time to complete and present the plan to the City Sustainability Commission, which voted on the document to become a city ordinance.

Today, Gina tackles innovative energy efficiency solutions at Pacific Gas and Electric Company as an expert business analyst. She divides her time between energy efficiency portfolio optimization and managing a pilot project in water and energy nexus. This initiative aims to collect smart meter data to look into possible interdependencies between the use of energy and water with and without water conservation messaging. Gina sees consumer behavior change as one of the key levers to reaching efficiency goals and hopes insights from smart water, electricity and gas meters will support that process. In addition to the rising importance of integrated building solutions, Gina sees firsthand how regulation, policy and ambitious goals are drivers of innovation and is excited that companies like hers are working hard to find ways to meet their targets. On what her career transition has meant for her professional development, Gina says, "I am incredibly grateful to have a professional career path that allows me to contribute, in quantifiable ways, to the new clean energy economy."

OTHER GREEN GOODS AND SERVICES: TRANSPORTATION, CORPORATIONS AND THE PUBLIC SECTOR

Renewable energy and energy efficiency together represent the largest segment of sustainability jobs, but other “green goods and services” sectors present significant and growing opportunities. Public and private sector entities are increasingly setting goals related to sustainability, such as cutting greenhouse gas emissions and providing products and services that reduce environmental impacts. Large corporations have been increasing investments in sustainability initiatives, which has led to new positions in the companies’ sustainability departments and the integration of sustainability functions across existing staff. The public sector has also been a stable employer of sustainability-focused staff at the local, state and federal level, with an estimated combined headcount of nearly 890,000 people in 2011.⁴⁴

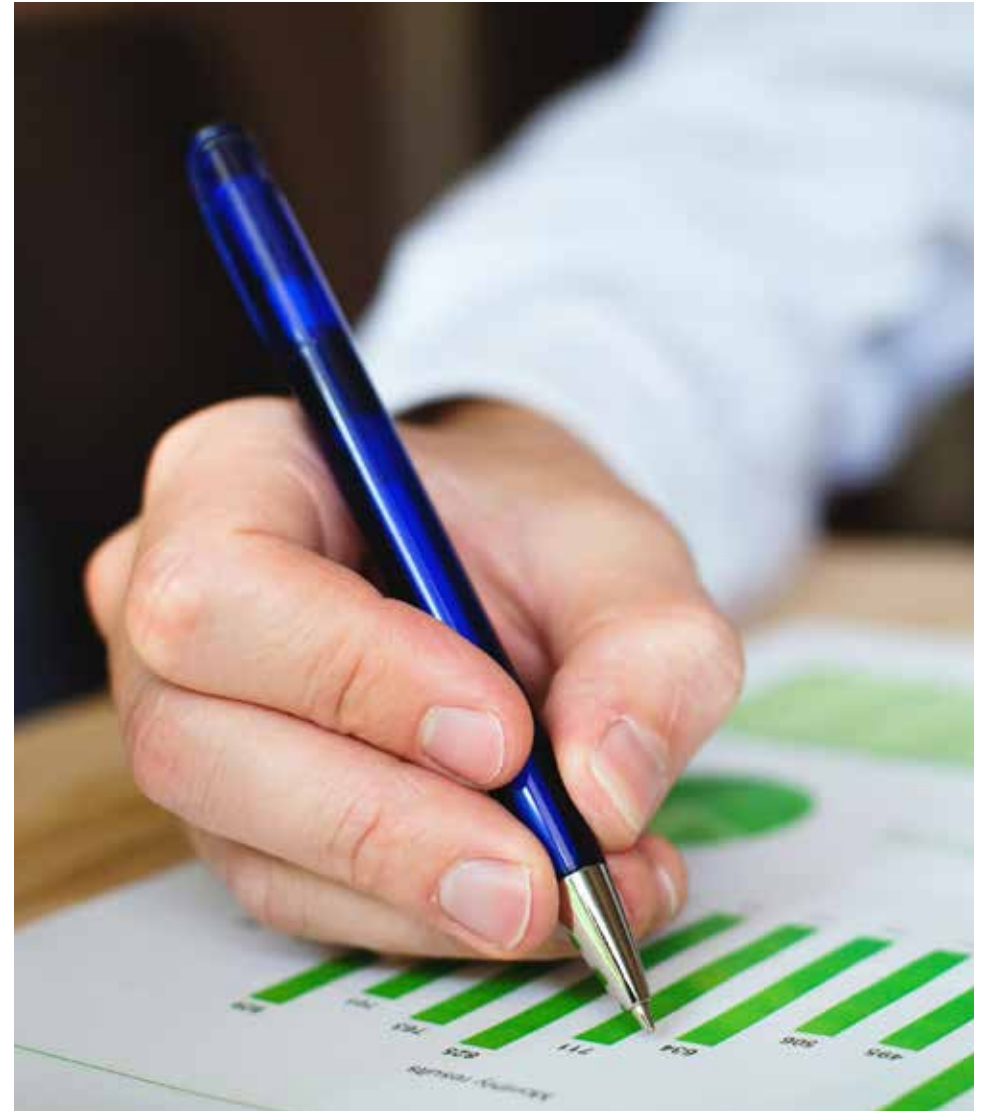
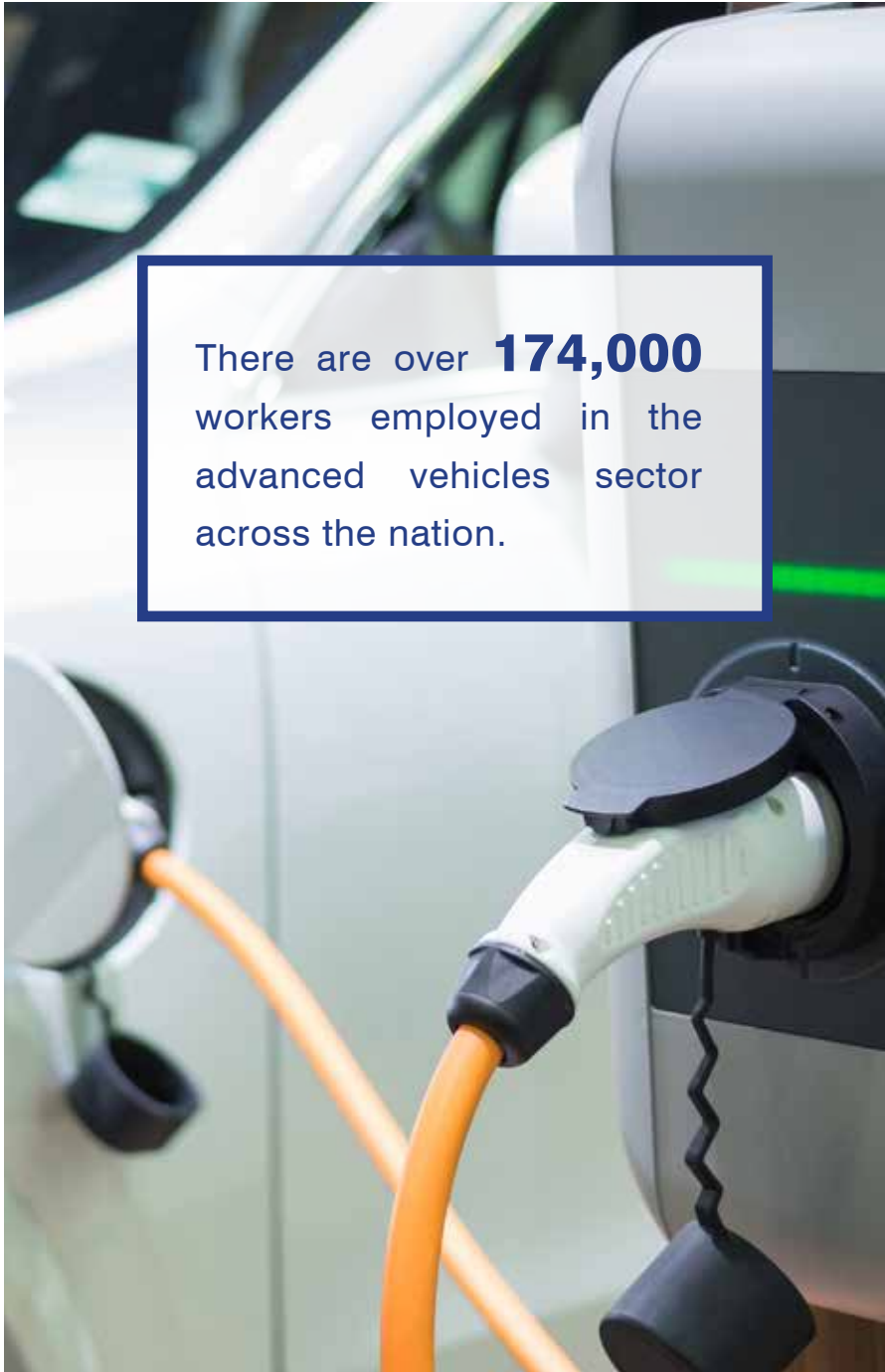


Image source: Fotolia



There are over **174,000** workers employed in the advanced vehicles sector across the nation.

Advanced Vehicles and Transportation

Alternative-fuel and advanced vehicles are another growing sector in the U.S. Significant technological developments in motor vehicle manufacturing combined with rising consumer demand have encouraged the automotive industry to invest in clean-fuel vehicles, such as hybrid-electric, plug-in hybrid, electric, and fuel cell vehicles. As of 2016, this sector employed over 174,000 workers across the nation.⁴⁵ Generally, jobs in advanced vehicles range from electrical and mechanical engineers, to factory workers and assemblers, to automotive repair technicians. Many of these occupations are found in the electric vehicles industry which employs over 35,000 workers. Electric vehicle manufacturers have made great leaps in technology and consumer acceptance, which has provided additional employment opportunities in manufacturing.⁴⁶ For example, Tesla Motors, the American electric vehicle and energy storage company, has been propelling job growth in this sector.⁴⁷ In 2014, the company announced it will begin manufacturing electric motors and batteries in its Nevada-based Gigafactory for its Model 3 Sedan electric vehicle line and increase employment from 1,000 to 6,500 in the coming years.⁴⁸ Continued progress in this sector—driven by further consumer adoption of advanced vehicles, expansion of fueling and charging infrastructure as well as state and local government regulations that push for clean-fuel vehicles—is expected to generate even more employment opportunities in the future.

Image source: Fotolia

Public Sector

Government plays a valuable supporting role in the growth of clean energy and sustainability markets by implementing policies and programs that create a strong enabling environment. The public sector also employs a significant number of sustainability-focused staff, contributing directly to building the sustainability workforce. Few sources of data exist on public sector green jobs, but a 2011 BLS study estimated that there were 424,201 green jobs at the local government level, 248,539 at the state level and 213,340 at the federal level.⁴⁹ Sustainability commitments and activities at the city and state level in particular have been growing in recent years, including policies and targets related to climate adaptation, greenhouse gas emissions reductions, renewable energy, sustainable transportation, water, solid waste management and market development.⁵⁰ City participation in leading climate initiatives has also been rising: For example, global participation in the CDP Cities program rose from 48 in 2011 to over 570 cities in 2016, a fifth of which were in the U.S.⁵¹ More and more states are adopting renewable portfolio standards,⁵² with 28 states setting a standard and eight states setting goals related to the development of renewable energy.⁵³ These are examples of growing public sector activity on a range of sustainability issues that directly translate to jobs in public agencies responsible for their development and implementation.



The public sector employs nearly **890,000** sustainability-focused staff at the local, state and federal level.

Image source: Fotolia



A 2016 GreenBiz survey found that **three quarters** of firms surveyed had dedicated sustainability budgets and **40%** had increased these budgets over the previous two years.

Image source: Fotolia

Corporate Sustainability

Private sector sustainability jobs generally focus on one of two broad areas: (1) meeting market demand for sustainable product and service offerings (“green goods and services”) and (2) improving the environmental and social performance of the company (“corporate sustainability”).⁵⁴ While there are little data available on the number of employees responsible for management of corporate sustainability, there is evidence that companies are increasing investments in this area. For example, a 2016 GreenBiz survey of approximately 1,000 corporate sustainability executives found that three quarters of firms surveyed had dedicated sustainability budgets (up from only half in 2010) and 40% had grown these budgets over the previous two years.⁵⁵ Large firms have also been increasing investments in their sustainability departments: 46% hired additional sustainability staff between 2014 and 2016. Furthermore, these growth rates may understate actual investments due to the fact that many firms are integrating sustainability functions across the company rather than isolating responsibilities in a separate department.⁵⁶



Aaron Schreiber-Stainthorp

Sustainability Specialist, Francis Ford Coppola Winery

After finishing his B.S. in Environmental Studies, Aaron wanted to pursue a career with an environmental benefit. He went on to pursue a master's degree in Sustainability Management from American University and then joined the [EDF Climate Corps](#) upon graduation. During his fellowship, he worked with Jackson Family Wines where he focused on improving the wastewater treatment and efficiency of the winery. In this role, he focused on improving the wastewater treatment and efficiency of the winery. Leveraging this experience, he accepted a position as a Sustainability Specialist with the Francis Ford Coppola Winery

and now focuses on identifying areas to improve efficiency throughout the winemaking process. Through a recent wastewater treatment upgrade, the winery doubled its treatment capacity and saw a 50% reduction in energy use.

As a sustainability specialist, Aaron has an incredibly varied day. His job functions relate to research and data analysis—understanding all operations of the winery and vineyard and looking for new solutions. He works to support the winery's employee green team, and works with colleagues in procurement and wine makers to understand where new efficiencies may be found in operations. Aaron also supports a collaboration of Sonoma County wineries that are sharing best practices on efficiency and sustainability improvements to support the creation of each of their 5-year sustainability plans.

On why he chose a career in corporate sustainability, Aaron states “Working with any organization, there are always obstacles to implement change, but when you do, the impact is huge.” While realizing efficiencies across wineries and making technology upgrades are among Aaron's accomplishments in his role, he is most proud of his department's work to drive behavior change in employees and empower colleagues to start their own sustainability initiatives.⁵⁷

CONCLUSION

Clean energy and sustainability industries are well-established and growing steadily, creating jobs that are delivering a win-win for the economy and the environment. These jobs are local, pay above average wages, and cover a wide range of geographic locations, providing economic opportunities and stability to Americans across the country.

And growing investments in clean energy and sustainability are translating to tangible economic impacts throughout the U.S. economy. Research shows that sustainability investments and energy savings create real economic upside: creating more jobs per dollar invested, keeping more energy spending in the domestic economy, and creating high-paying job opportunities that improve lives and stimulate local economies.

Policy makers at the local, state, and federal level should recognize the positive economic impacts of this new job class and strongly support the policies and programs that encourage growth and investment in renewable energy, energy efficiency, green transportation and more. Efforts to roll back or weaken environmental and energy policies will negatively impact current and future U.S. jobs while slowing clean energy innovation. Environmental progress and economic growth can and must go hand-in-hand.



EDF Climate Corps fellow Jennifer Cole worked with North Carolina Interfaith Power & Light to develop a framework for installing energy efficiency programs within congregations.

1. Resources include EDF Climate Corps program details; EDF Climate Corps alumni network; 2016 EDF Climate Corps Network Survey Results.
2. Green Goods and Services are defined by the Bureau of Labor Statistics as falling into one or more of these five groups: “production of energy from renewable sources; (2) energy efficiency; (3) pollution reduction and removal, greenhouse gas reduction, and recycling and reuse; (4) natural resources conservation; and (5) environmental compliance, education and training, and public awareness.”
3. The 4 – 4.5 million clean energy and sustainability jobs estimate is based on aggregation of recent and/or best available job data from the International Renewable Energy Agency (IRENA, 2016), Bureau of Labor Statistics (BLS, 2013), and Department of Energy (DOE, 2017). The low end of the range (4 million) includes the following: 769,000 in renewable energy (RE) (IRENA), 2.2 million in energy efficiency (EE) (DOE), 890,000 in the public sector (BLS), and 174,000 in advanced vehicles (DOE), for a total of 4,029,000 jobs. The low end conservatively assumes no growth in public sector green jobs since 2011 and entirely excludes many industries included in the 2013 BLS study for which more current data is unavailable (termed “other green goods and services (GGS)” below). The higher end of the range (4.5 million) likewise assumes no public sector growth but adds an estimated 491,000 of current “other GGS” jobs, which was derived as follows: (1) 2011 RE and EE jobs were estimated by backcasting from IRENA 2012 and DOE 2015 data, conservatively assuming an annual growth rate of 6%; (2) “other GGS” for 2011 was estimated by subtracting the following from the BLS study’s 3.4 million total jobs estimate: public sector (890,000), transportation equipment manufacturing (45,367), and backcasted 2011 RE and EE data (600,396, and 1,483,423), for a net “other GGS” estimate of 384,734; and (3) 2016 “other GGS” was estimated by applying a 5% annual growth rate to the 2011 “other GGS” estimate of 384,734, for a 2016 total estimate of 491,029. This growth rate was consistent with the total GGS growth from 2010 to 2011 estimated by BLS (3.2-3.4M) and is consistent with (or conservative compared to) the growth of other green jobs sectors during this period, as discussed above and throughout this report.
4. U.S. Bureau of Labor Statistics. 2013. *Employment in Green Goods and Services*. Retrieved from <https://www.bls.gov/news.release/pdf/ggqcew.pdf>
5. The Solar Foundation. 2016. *State Solar Jobs Census*. Retrieved from <http://www.thesolarfoundation.org/solar-jobs-census/states/>
6. CAGR estimates based on annual renewable energy and jobs reports released by the International Renewable Energy Agency. Links for current and historical reports can be accessed here: <http://www.irena.org/menu/index.aspx?CatID=141&PriMenuID=36&SubcatID=2729&mnu=Subcat>
7. CAGR estimates based on U.S. Bureau of Labor Statistics (BLS) datasets for NAICS codes 21, 211, 212, 2121, and 213112. Estimate of -4.25% is based on Oil and Gas Extraction and Coal Mining data, and support services. For raw BLS data and descriptions, see <https://www.bls.gov/iag/tgs/iag21.htm>. Coal-specific data can be found here: <http://www.eia.gov/coal/annual/>
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