IN DEMAND: Clean Energy, Sustainability and the New American Workforce

EDF ENVIRONMENTAL DEFENSE FUND | CLIMATE CORPS

MEISTER CONSULTANTS GROUP | A CADMUS COMPANY

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.

ACKNOWLEDGMENTS

Environmental Defense Fund and Meister Consultants Group, a Cadmus Company (MCG), co-authored this report. Lead authors include James Daudon, Megan Lynch, Kalee Whitehouse, and Jon Crowe, as well as Ellen Shenette, Natalie McKeon, Karley Kranich and Daniel Hill at EDF. The report was designed by Pixels & Pulp.

CONTENTS

EDF CLIMATE CORPS

EDF Climate Corps, a network of professionals united to advance climate solutions, brings together an arsenal of top talent, resources and expertise to help organizations meet their sustainability and energy goals.

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 during a 10-week fellowship. Since 2008, EDF has recruited and placed more than 800 EDF Climate Corps fellows in over 400 organizations and fellows have identified over $1.5 billion in energy savings for their host organizations, while supporting a wide range of strategic energy management initiatives.

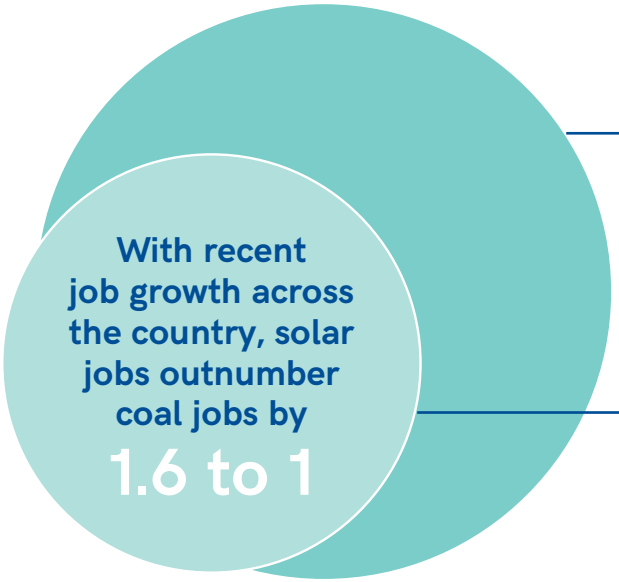
The fellowship program is just the beginning. EDF Climate Corps serves as a launching point for young professionals to accelerate their sustainability careers and delivers top talent into a growing market. Fellows become part of a network of professionals that go on to play leading roles in the sustainability economy.

Photo: Lillian Mirviss helped Gap Inc. implement solar at three distribution centers.

KEY HIGHLIGHTS

The U.S. employs
over 4 million
workers in the clean energy and sustainability economy.

*As of 2016.



SOLAR JOBS

according to the most recent data, solar employs **260,000 workers**.

COAL JOBS

The coal industry now employs **160,000 workers**, less than one quarter as many Americans as the renewable energy industry.

Highlight 1

The clean energy and sustainability economy continues to be a large and growing source of jobs for over 4 million workers in the U.S., with wind and solar energy jobs outpacing those in the coal industry.

Wind and solar energy jobs now outnumber coal and gas jobs in 30 states.[1] This compares to the coal industry which employs 160,000 workers, less than one quarter of those employed in the renewable energy industry. These sectors create high-quality, local jobs in all 50 states, frequently pay higher than average wages and offer numerous career and educational pathways for individuals looking to work in the clean energy and sustainability economy.

Highlight 2

Changes to incentives and policies at the federal, state and local levels continue to impact the clean energy economy, leading to an uncertain outlook for job growth.

Incentives and policies related to renewable energy and energy efficiency technologies drive demand for projects and jobs within the sector. For instance, 2017 marked a year of uncertainty at the federal level centered on the future of renewable energy tax incentives and a potential tariff on imported solar modules. These conversations have led to concerns about the future of tax equity investments in renewable energy, and the future cost of solar modules respectively—both of which could have implications for the growth of renewable energy jobs in coming years.

Highlight 3

Businesses and local governments are key drivers of the clean energy and sustainability economy, and can build demand to support job growth.

An influx of goals and targets as part of commitments, such as RE100 and We Are Still In, are helping drive continued growth of renewable energy and energy efficient technologies in the U.S. For example, through the Future Energy Jobs Act, Illinois' leading utility will provide $30 million in funding for job-training programs.[2] The legislation also expands energy efficiency programs and strengthens the state's renewable portfolio standard. Similarly, companies are investing in energy efficiency technologies, and have procured more than 3 gigawatts of renewable energy in 2017 alone.[3]

1 Includes D.C. Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

2 Future Energy Jobs Act. Master Factsheet. Retrieved from http://www.futureenergyjobsact.com/resources/pdf/FEJA-Fact-Sheet.pdf

3 Rocky Mountain Institute. Corporate Renewable Deals: BRC Deal Tracker. Retrieved from http://businessrenewables.org/corporate-transactions/

THE OUTLOOK FOR THE CLEAN ENERGY ECONOMY

The clean energy and sustainability economy remains a large and growing source of employment for millions of Americans. Today more than 4 million workers[4] have public and private sector positions in renewable energy, energy efficiency, advanced vehicles, energy storage and advanced grid technologies, and sustainability-related fields. The clean energy workforce has skyrocketed in recent years thanks to reductions in technology costs, increased demand for clean energy and efficiency technologies, policies and investments supporting the growth of these sectors.

Continued demand for renewable energy and efficiency in the U.S. provide numerous assets to U.S. workers and the economy. These sectors offer high-quality opportunities for U.S. workers, and alternative pathways for individuals seeking career transitions and skilled labor positions. These sectors create jobs in all 50 states, frequently pay higher than average wages, offer numerous career and educational opportunities, and are often local jobs—supporting an on-site workforce to construct, install, operate, and maintain technologies that drive towards renewable energy solutions and efficiency.

Since publication of EDF Climate Corps' sustainability jobs report ("Now Hiring: The Growth of America's Clean Energy and Sustainability Jobs") in January 2017, the outlook for some sectors, solar in particular, has started to show the impacts of an increasingly uncertain policy environment. Nevertheless, 2017 also marked a year of countervailing actions in support of the clean energy economy. A wave of goals and investments by subnational government entities, nonprofits and businesses in greenhouse gas mitigation, renewable energy supply and clean technology, have helped drive continued growth of renewable energy and efficiency in the U.S.

This report details the status and growth of clean energy and sustainability jobs in the U.S. using the most recent available data;[5] highlighting quality jobs in the renewable energy, energy efficiency, alternative vehicles, and energy storage and advanced grid sectors. Additionally, the report discusses the role of businesses and government entities as catalysts for the clean energy economy. Individuals working in these sectors are featured throughout to highlight examples of the backgrounds, career paths and the skills needed to succeed in clean energy and sustainability fields.

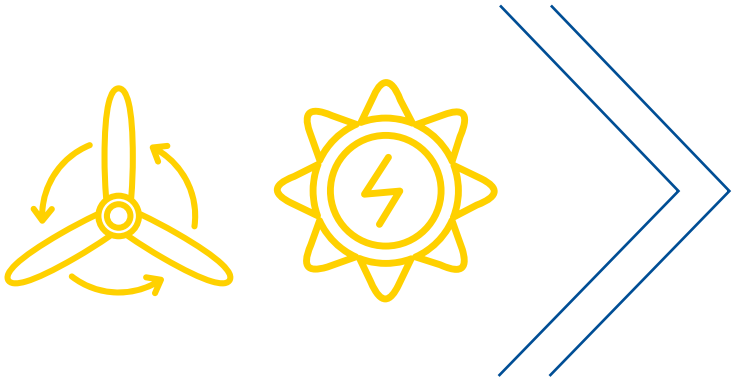
4 The 4 million clean energy and sustainability jobs estimate is based on aggregation of recent and/or best available job data from the International Renewable Energy Agency (IRENA, 2017), Bureau of Labor Statistics (BLS, 2013), and Department of Energy (DOE, 2017). This figure includes the following: 777,000 in renewable energy (RE) (IRENA), 90,800 in energy storage and advanced grid technologies (DOE), 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 4,132,000 jobs. It should be noted that Now Hiring: The Growth of America's Clean Energy and Sustainability Jobs report did not include energy storage and advanced grid positions within the total.

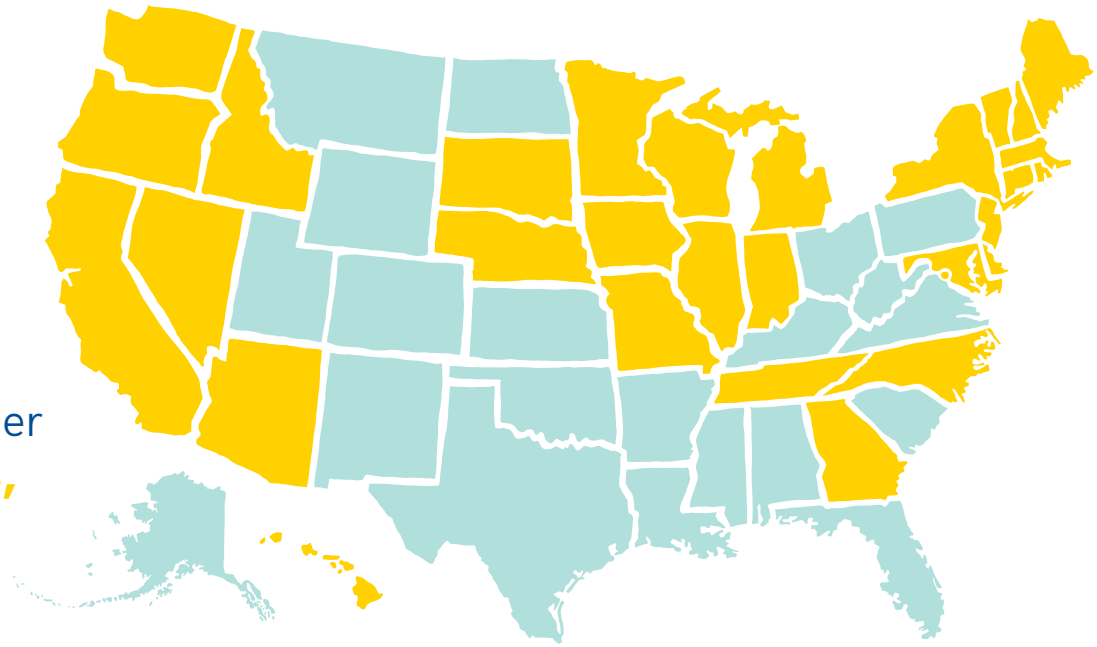
5 Publicly available data sources were relied on for the research presented in this report. Many sources reference 2016 job numbers as the most recent year of available data. Due to this lag, some policy and market developments in 2017 may not be fully reflected in the data.

SECTOR PROFILE:

RENEWABLE ENERGY

Photo: Jenny Cole worked with North Carolina Interfaith Power & Light to develop a framework for installing energy efficiency programs within congregations.





Wind and solar energy jobs now outnumber coal and gas industry jobs in **30 states,** with California and Texas employing the most workers in those industries.

*30 states include D.C.

The renewable energy industry provides high-quality, local jobs that can pay above average wages. An estimated 777,000 people worked in the renewable energy industry at the beginning of 2017.[6] This was led by wind and solar employment, which grew by 16 percent and 24.5 percent respectively from the previous year.[7] Wind and solar energy jobs now outnumber coal and gas industry jobs in 30 states.[8] Assuming stable policy and market conditions, job growth in this industry is expected to continue and solar installers and wind turbine technicians are projected to be America's two fastest-growing jobs over the next decade.[9] However, shifting policy environments and market conditions will continue to influence development of the rapidly maturing renewable industry, increasing the uncertainty for the industry's outlook and projected job growth.

6 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

7 Ibid.

8 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

9 Bureau of Labor Statistics. 2017. Fastest Growing Occupations. Retrieved from https://www.bls.gov/ooh/fastest-growing.htm

Renewable Energy Market

Renewable energy continues to increase its share of electricity production, and now accounts for 15 percent of all electricity generated throughout the country.[10] The majority of this growth is attributed to **solar and wind installations, which comprised 65 percent of installed electric capacity in 2016 and for the third year in a row exceeded the annual installed capacity of all other electricity sources combined.[11]**

Despite market growth, the renewable energy industry is constantly impacted by changing policy landscapes, which created some uncertainty in 2017 as key incentive structures were reevaluated. At the federal level, the 2016 clean energy market growth was buoyed by extensions of the Investment Tax Credit

10 Energy Information Administration. 2017. How much of U.S. energy consumption and electricity generation comes from renewable energy sources. Retrieved from https://www.eia.gov/tools/faqs/faq.php?id=92&t=4

11 SEIA. 2017. Solar Industry Data. Retrieved from https://www.seia.org/solar-industry-data

(ITC) for solar, wind and geothermal, and the Production Tax Credit (PTC) for wind.[12] In 2017, Congress considered changes to both credits during negotiations to pass the new tax bill. Although the tax credits were unchanged in final legislation, the adjustment to the Base Erosion Anti-Abuse Tax (BEAT) provision has the potential to reduce 20 percent of the credit's value under certain circumstances, and the ultimate impacts of the bill remain uncertain.[13] In addition to the tax bill, the White House ruled on the Section 201 U.S. International Trade Commission (U.S. ITC) safeguard case in January 2018 to impose a 30 percent tariff on imported solar modules.[14] **With this new tariff, solar installations are estimated to decline by nine percent, with utility-scale solar the hardest hit.[15]**

States continue to drive policy that supports clean energy deployment, with leaders such as California and Minnesota offering 255 and 187 different policy and incentive programs supporting clean energy, respectively.[16] However, in 2017, incentives and mandates were reevaluated in leading markets such as Massachusetts and Ohio. In Massachusetts, the design and rollout of the anticipated Solar Massachusetts Renewable Target incentive program (SMART) to replace the existing renewable energy credit incentive and net metering program for solar has been delayed, resulting in stalled solar projects in the state and unclear next steps.[17] Meanwhile, in early 2017, Ohio's House of Representatives passed legislation to undo the state's renewable energy mandate.[18] The effort ultimately failed to get enough votes to override Governor Kasich's veto,[19] but led to some unpredictability in the market.

12 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

13 Greentech Media. December 2017. Final Tax Bill Amends BEAT Provision to Keep Some PTC and ITC Value. Retrieved from https://www.greentechmedia.com/articles/read/final-tax-bill-amends-beat-provision-to-keep-ptc-and-itc-value#gs.RUHIgas

14 Office of the United States Trade Representative. January 2018. President Trump Approves Relief for U.S. Washing Machine and Solar Cell Manufacturers. Retrieved from https://ustr.gov/about-us/policy-offices/press-office/press-releases/2018/january/president-trump-approves-relief-us

15 Greentech Media. October 2017. The Potential Impact of Solar Tariffs in 12 Charts. Retrieved from https://www.greentechmedia.com/articles/read/the-potential-impact-of-solar-tariffs-in-12-charts#gs.4XMwLUA

16 NC Clean Energy Technology Center. 2017. Find Policies and Incentives by State. Retrieved from http://www.dsireusa.org/

17 Greentech Media. October 2017. States Lead the Way on Energy Efficiency, but How Effective Are They? Retrieved from https://www.greentechmedia.com/squared/read/states-lead-the-way-on-energy-efficiency-but-how-effective-are-they#gs.MJ=GQgE

18 Toledo Blade. 2017. Ohio House Oks bill to replace renewable energy mandates. Retrieved from http://www.toledoblade.com/Energy/2017/03/30/Ohio-House-OKs-bill-to-replace-renewable-energy-mandates.html

19 Cleveland.com. 2018. GOP voters support green energy, oppose coal, nuclear bailouts, statewide poll finds. Retrieved from http://www.cleveland.com/business/index.ssf/2018/01/gop_voters_support_green_energ.html

GAP INC. TURNS TO RENEWABLE ENERGY

GAP INC., enlisted EDF Climate Corps fellow Lillian Mirviss to investigate renewable energy opportunities at its North American distribution centers.

Mirviss identified three potential sites for solar projects, which over the life of the contracts could **SAVE UP TO $5.4 MILLION** in total net operating costs **AND SAVE 2,400 METRIC TONS OF CO_2 EMISSIONS**.

In 2017, partially due to both policy dynamics and market forces, the solar industry tracked noticeably behind its record-setting 2016 pace. For the first time since the inception of the U.S. Solar Market Insight report, the price of solar increased across all market segments during the third quarter. This increase was attributed in part to the uncertainty surrounding the Section 201 petition, which led to a shortage on solar modules due to concerns of increased prices and inventory.[20] Furthermore, although the 2,387 megawatts of solar capacity installed during the first quarter of 2017 was the strongest start to a year, **third-quarter solar installations were 51 percent behind 2016 levels[21] and cumulative 2017 installations were 22 percent behind the record-setting 2016 pace.[22]** In addition to policy factors, the maturation of solar markets in leading states and changes in customer acquisition practices by solar companies have led to reduced 2017 installations.[23] Despite this decline, **through the first three quarters of 2017, solar accounted for 25 percent of installed electric capacity in the U.S., second only to natural gas.[24]** The industry has now experienced a 68 percent annual growth rate in installed capacity over the last decade.[25] While the outlook remains positive for the industry, changes in the policy environment will continue to impact market projections.

Despite fluctuations in the solar market, the wind industry continued strong with 2,892 megawatts installed as of the end of third quarter 2017—slightly ahead of the pace of installations in 2016.[26] Additionally, **the amount of wind capacity either under construction or in "advanced development" at the end of the third quarter was 27 percent higher than in 2016**, demonstrating that the industry continues to have a strong pipeline of projects.[27]

20 Greentech Media and Solar Energy Industry Association. December 2017. U.S. Solar Market Insight. Retrieved from https://www.seia.org/us-solar-market-insight

21 Greentech Media and Solar Energy Industry Association. December 2017. U.S. Solar Market Insight. Retrieved from https://www.seia.org/us-solar-market-insight

22 Ibid.

23 Ibid.

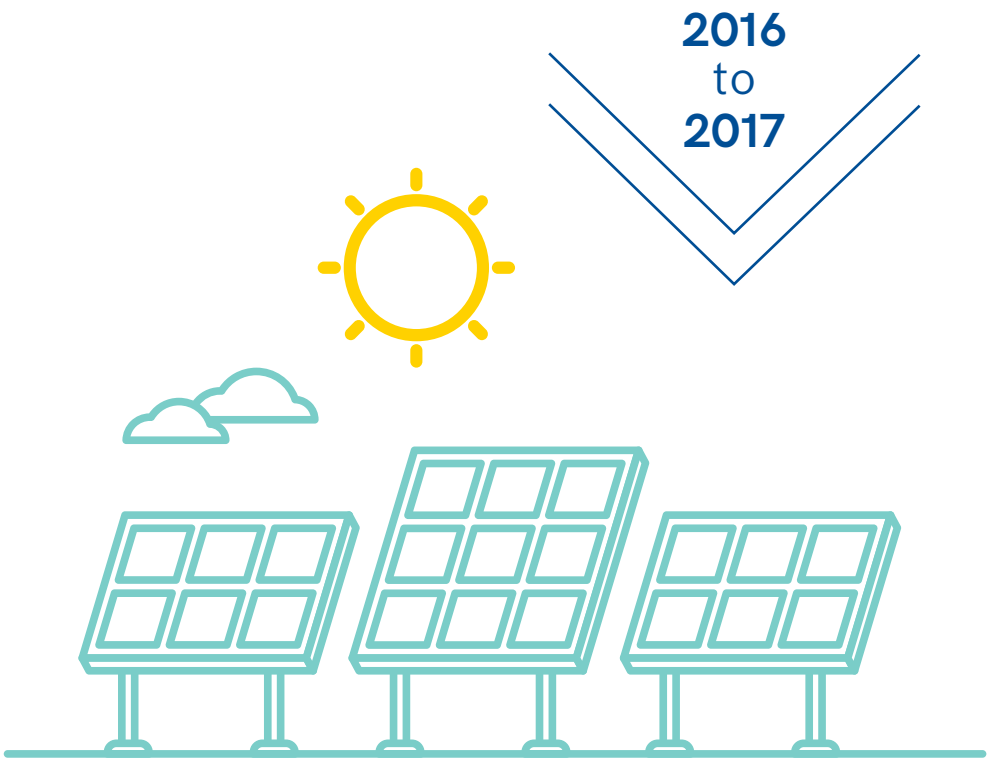
24 Ibid.

25 SEIA. 2017. Solar Industry Data. Retrieved from https://www.seia.org/solar-industry-data

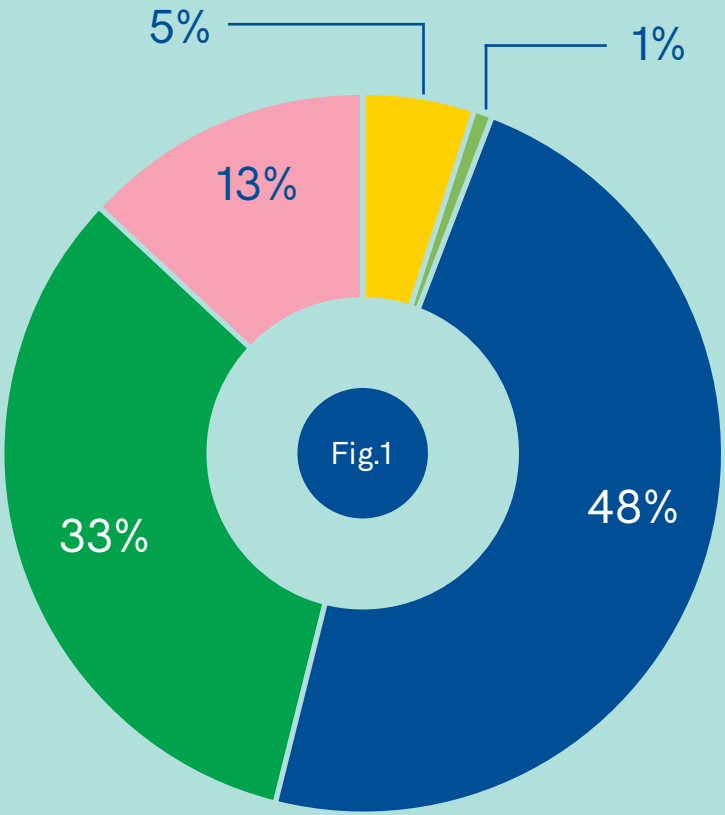
26 American Wind Energy Association. December 2017. U.S. Wind Industry Third Quarter 2017 Market Report. Retrieved from https://www.awea.org/3q2017

27 Ibid.

Third-quarter solar installations were **51% behind** 2016 levels and cumulative 2017 installations were **22% behind** the record-setting 2016 pace.



RENEWABLE ENERGY: WHERE ARE THE JOBS?



RENEWABLE ENERGY GENERATION TECHNOLOGY

- BIOENERGY
- SOLAR
- WIND
- GEOTHERMAL
- SMALL HYDROPOWER

Source: International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

Renewable Energy Jobs

The renewable energy sector employs 777,000[28] people, roughly the same as the U.S. telecommunications industry.[29] Figure 1 summarizes the renewable energy jobs by generation technology. Bioenergy (biofuels, biomass and biogas) remains the largest employer, while the solar industry is second. **With recent job growth, total clean energy jobs across the country now outnumber coal and gas jobs by nearly 1.5 to 1.[30] The coal industry now employs 160,000 workers, less than one quarter as many Americans as the renewable energy industry.[31]**

The solar industry **grew 24.5 percent to employ 260,000 workers, adding jobs at nearly 17 times the rate of the overall economy in 2016.[32]** Solar growth was driven by utility-scale projects, which accounted for 70 percent of all solar capacity installed.[33] These large-scale solar installations created more project management jobs, which rose 50 percent from the previous year.[34] The solar industry growth was also supported by the longer-term certainty provided by the extension of the Federal ITC at the 30 percent rate through 2019 with a clear phase-out.[35]

28 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

29 Bureau of Labor Services. 2016. Employment by Major Industry Sector. Retrieved from https://www.bls.gov/emp/ep_table_201.htm

30 This figure compares the 777,000 clean energy sector jobs in America reported by International Renewable Energy Agency with the 558,357 coal and gas jobs in America reported by the Department of Energy. Sources: Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf; International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

31 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf

32 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

33 Ibid.

34 Ibid.

35 Ibid.

Renewable energy continues to grow:

WIND +16%

SOLAR +24.5%

BIODIESEL +23%

*Sub-sector growth rates (2016).

Wind employment exceeded 100,000 jobs in 2016, and grew 16 percent from the previous year.[36] Growth in the wind industry was partially supported by the five-year extension of the federal PTC, which for the first time since 1998 was expected to be in place for more than two consecutive years. The longer term of this incentive has likely helped encourage business owners to make more supply commitments, build more projects and hire more workers.[37]

Finally, the most recent data indicates that production of biodiesel grew 23 percent to employ 61,000 workers.[38] Biodiesel is a leading alternative to fossil fuels, and is receiving significant investment from the Department of Defense, which has a goal to obtain 25 percent of its energy from alternative sources by 2025.[39]

36 Ibid.

37 Wind Power Monthly. 2016. Analysis: PTC phase-out could herald lower cost of energy. Retrieved from https://www.windpowermonthly.com/article/1380732/analysis-ptc-phase-out-herald-lower-cost-energy

38 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

39 Bureau of Labor Statistics. N.d. Careers in Biofuels. Retrieved from https://www.bls.gov/green/biofuels/biofuels.htm

The distribution of jobs across the renewable energy sector varies depending on the generating technology. As always, employment in the solar and wind industries is heavily weighted in local or on-site positions such as system installation, sales and distribution, project development, and operations and maintenance—jobs which are difficult to outsource. Additionally, **the fastest-growing jobs in the solar and wind industries pay wages that meet or exceed national averages.**[40]

Over half of solar jobs (54 percent) are in the installation of systems on homes, businesses and other buildings, as well as the installation of utility-scale solar projects.[41] Similarly, nearly 80 percent of all wind jobs are on-site jobs. Operations and maintenance jobs in the wind industry grew by over 33 percent in 2016 from the previous year—over twice the rate of overall industry growth.[42]

The average wage for solar installation workers is $26 per hour, the average wage for solar sales and distribution workers is $45 per hour,[43] **and the median salary for a wind technician is $25 per hour.** Wages for these jobs meet or exceed average compensation for private jobs in all nonfarm sectors during the same period.[44]

In addition to providing well-paying jobs, the solar industry offers pathways for workers in low-wage jobs to move to more sustainable wage employment in twelve months or fewer. Apprentice and entry-level construction workers who have completed a training program can quickly advance to higher-wage positions earning $20 to $22 per hour.[45]

40 Bureau of Labor Statistics. 2017. Fastest Growing Occupations. Retrieved from https://www.bls.gov/ooh/fastest-growing.htm; The Solar Foundation. 2017. National Solar Jobs Census. Retrieved from https://www.thesolarfoundation.org/national/; Bureau of Labor Statistics. 2017. "Table B-3. Average hourly and weekly earnings of all employees on private nonfarm payrolls by industry sector, seasonally adjusted. Retrieved from https://www.bls.gov/news.release/empsit.t19.htm

41 International Renewable Energy Agency. Renewable Energy and jobs: Annual Review 2017. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

42 Ibid.

43 The Solar Foundation. 2017. National Solar Jobs Census. Retrieved from https://www.thesolarfoundation.org/national/

44 Bureau of Labor Statistics. 2017. Table B-3. Average hourly and weekly earnings of all employees on private nonfarm payrolls by industry sector, seasonally adjusted. Retrieved from https://www.bls.gov/news.release/empsit.t19.htm

45 The Solar Foundation. 2017. National Solar Jobs Census. Retrieved from https://www.thesolarfoundation.org/national/

FEATURED JOB:

Renewable Energy

BEN METCALF

Project Development Manager, Galehead Development, Cambridge, MA

Ben did not initially see himself working in the clean energy economy. After obtaining a degree in economics, his interest in politics and international relations drew him to a career in the military. Ben decided to shift his career focus while serving as an Operations Officer for the U.S. Navy in Tegucigalpa, Honduras.

To prepare for a new career path, Ben decided to pursue an MBA in finance and data analytics at the Rady School of Management at the University of California San Diego. In the summer of 2016, Ben joined the EDF Climate Corps program and was placed with the Boston Housing Authority (BHA). In this role, Ben initiated a solar plus battery storage project at one of BHA's elderly housing developments, laying the groundwork for a-first-of-its-kind demonstration project for increasing resiliency and reducing GHG emissions.

After an additional deployment in Kuwait with the U.S. Navy Reserve, Ben is now leveraging his experiences as a Project Development Manager for Galehead Development, a market and project mobilization platform for clean energy resources. In this role, Ben primarily focuses on utility-scale solar development. His responsibilities are generally split between developing a market strategy for deploying solar projects for utilities and working on obtaining the necessary permits and approvals for current installations. Through his work in the solar industry, Ben is well aware of the uncertain regulatory environment for solar projects, but he is confident there is a positive long-term trend in the solar industry that will create diverse career pathways for future clean energy workers.

Future Developments in the Renewable Energy Sector

The future of the renewable sector remains uncertain and depends partially upon how the policy landscape evolves in the coming years. The most significant near-term impact on the sector is the White House's decision to impose a 30 percent tariff on solar modules manufactured abroad. With these new tariffs, the demand for solar is estimated to drop nine percent[46] and some industry groups are estimating the potential job loss to be as high as 23,000 workers.[47]

While the impact of uncertainty in the current market will have a delayed effect on market growth projections, a number of studies suggest a strong future for renewable energy industry employment. **The Bureau of Labor Statistics project that solar PV installers and wind turbine service technicians will be the two fastest growing jobs in America from 2016 to 2026, roughly doubling during that period.**[48] Supporting this projection is an early 2017 report that expects the wind industry to employ nearly a quarter of a million Americans by 2020 (Figure 2). Furthermore, over the next three years, the industry is expected to generate $85 billion in economic impact, primarily from manufacturing and installation expenses.[49]

46 Greentech Media. October 2017. The Potential Impact of Solar Tariffs in 12 Charts. Retrieved from https://www.greentechmedia.com/articles/read/the-potential-impact-of-solar-tariffs-in-12-charts#gs.4XMwLUA

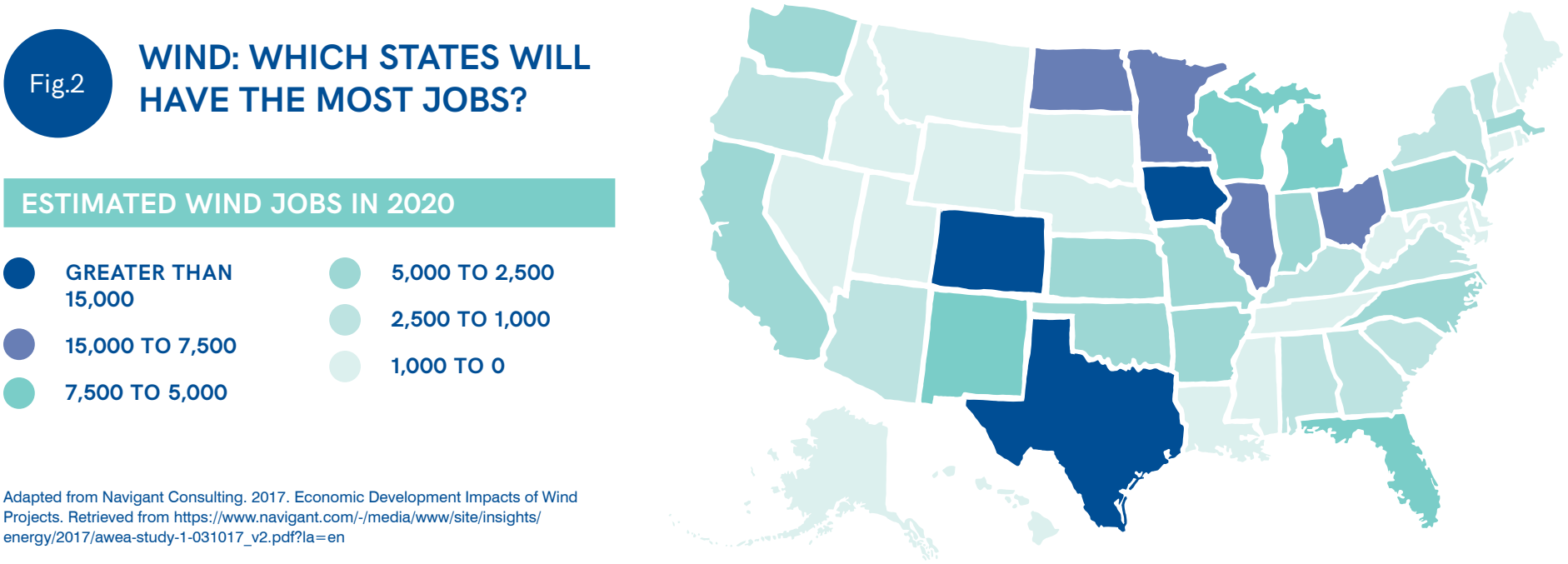
47 Solar Energy Industries Association. January 2018. President's Decision on Solar Tariffs is a Loss for America. Retrieved from https://www.seia.org/news/presidents-decision-solar-tariffs-loss-america

48 Bureau of Labor Statistics. 2017. Fastest Growing Occupations. Retrieved from https://www.bls.gov/ooh/fastest-growing.htm

49 Navigant Consulting. 2017. Economic Development Impacts of Wind Projects. Retrieved from https://www.navigant.com/-/media/www/site/insights/energy/2017/awea-study-1-031017_v2.pdf?la=en

Fig.2

WIND: WHICH STATES WILL HAVE THE MOST JOBS?



Adapted from Navigant Consulting. 2017. Economic Development Impacts of Wind Projects. Retrieved from https://www.navigant.com/-/media/www/site/insights/energy/2017/awea-study-1-031017_v2.pdf?la=en

SECTOR PROFILE:

ENERGY STORAGE & ADVANCED GRID

Photo: Alexandra Bothner helped Boston Scientific Corporation track and develop a communications strategy around its energy performance.

Supporting the deployment of renewable energy resources such as wind and solar, the energy storage and advanced grid sectors have expanded significantly in recent years. Energy storage, which plays an important role in helping to create a reliable and flexible grid sourced by renewable energy,[50] is becoming an increasingly important technology as more renewables are integrated into the grid. The important role of these technologies is translating into rapid market growth. **The energy storage market grew 46 percent between 2016 and 2017, with 28.6 megawatts deployed in Q3 2016 and 41.8 megawatts deployed in Q3 2017.[51] Additionally, the market is projected to grow nine times between 2017 and 2022.[52]**

Recent policies and developments have further supported the growth of the energy storage sector. For example, New York recently set a statewide energy storage target of 1,500 megawatts by 2025.[53] Similar to those set in California, Massachusetts and Oregon, the targets help reduce regulatory barriers in order to further develop market growth.[54] These investments are helping grow the energy storage sector rapidly, translating directly into new jobs. **In 2016, employment in energy storage increased 235 percent from the previous year to reach 90,800 jobs, with battery storage accounting for over half of these jobs.[55]**

Beyond energy storage, states are acting to support advanced grid technologies, including advanced metering infrastructure,

50 Union of Concerned Scientists. How Energy Storage Works. Retrieved from https://www.ucsusa.org/clean-energy/how-energy-storage-works#.WkbKkd-nHIU

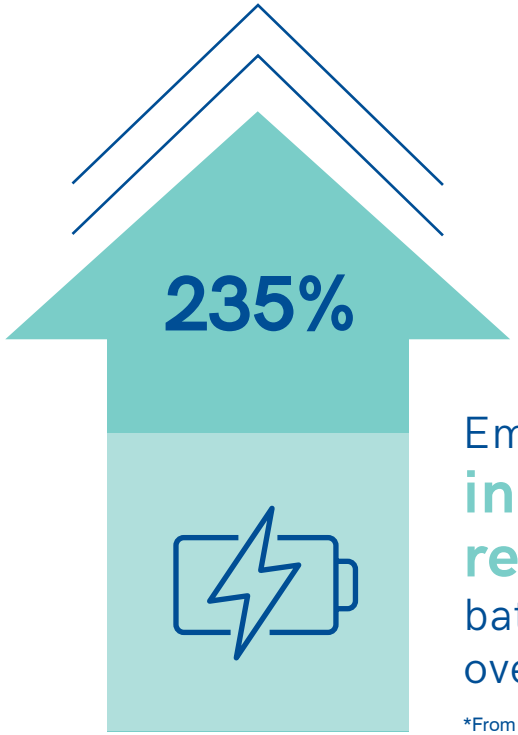
51 Greentech media. 2017. U.S. Energy Storage Monitor Q4 2017. Retrieved from: http://www2.greentechmedia.com/Q4USESM17?_ga=2.91548185.2006485898.1514565395-823982238.1508255916

52 Ibid

53 Office of Governor Cuomo. Governor Cuomo Unveils 20th Proposal of 2018 State of the State: New York's Clean Energy Jobs and Climate Agenda. Retrieved from https://www.governor.ny.gov/news/governor-cuomo-unveils-20th-proposal-2018-state-state-new-yorks-clean-energy-jobs-and-climate

54 Greentechmedia. December 2017. New York Governor Approves Energy Storage Target, Months After the Bill Passed. Available at: https://www.greentechmedia.com/articles/read/new-york-approves-energy-storage-target

55 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.



Employment in energy storage **increased 235% to reach 90,800 jobs**, with battery storage accounting for over half of these jobs.

*From 2015-2016

smart grid technologies and microgrids, among others.[56] According to a report by the North Carolina Clean Energy Technology Center, there were 184 actions[57] on grid modernization across 33 states and D.C. as of November 2017, with almost a quarter of these actions specifically focused on the deployment of advanced grid technologies.[58]

Increasing support for an advanced grid have resulted in sector job growth. The field now employs over 55,000 workers.[59] Approximately 20,000 jobs are in smart-grid technologies, 15,000 are in microgrid technologies that help increase the reliability of electricity and 20,000 are in other forms of grid modernization that support renewable energy deployment.[60] Since a major benefit of these technologies is increasing grid resiliency and reliability, the field is expected to grow as grids modernize and climate-induced hazards become more frequent and extreme.

56 North Carolina Clean Energy Technology Center. November 2017. The 50 States of Grid Modernization: Q3 2017 Quarterly Report. Retrieved from https://nccleantech.ncsu.edu/wp-content/uploads/GridMod_Q32017_Final.pdf

57 "Action" is defined as a relevant legislative bill, regulatory docket, utility rate case, or rulemaking proceeding

58 North Carolina Clean Energy Technology Center. November 2017. The 50 States of Grid Modernization: Q3 2017 Quarterly Report. Retrieved from https://nccleantech.ncsu.edu/wp-content/uploads/GridMod_Q32017_Final.pdf

59 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

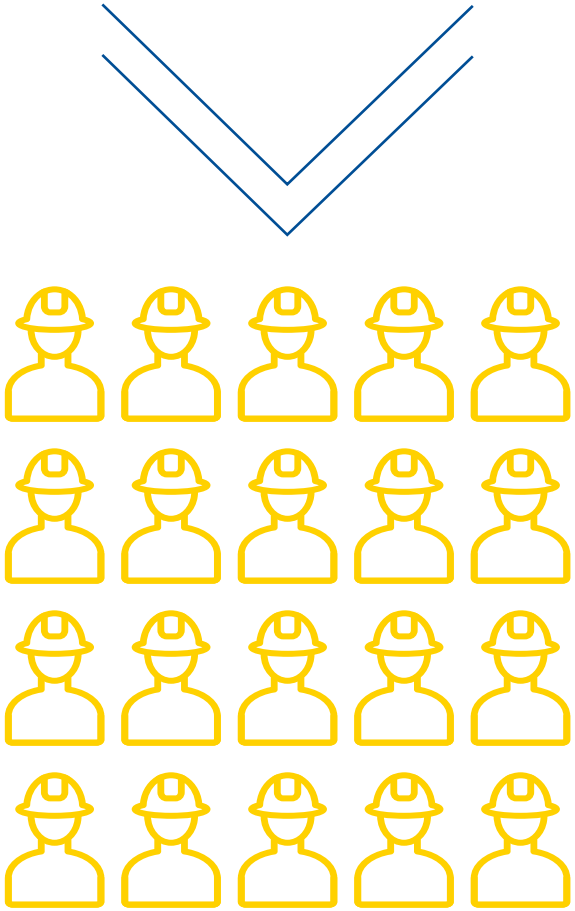
60 ibid

SECTOR PROFILE:

ENERGY EFFICIENCY

Photo: Junyin Zhang and Kaifu Han helped two IKEA suppliers improve their footprint in an effort to meet IKEA's supply chain goals.

$1 Million



On average, $1 million spent on an energy efficiency project supports the **CREATION OF 20 TOTAL JOBS.**

(including direct, indirect and induced jobs)

Energy Efficiency Market Update

Energy efficiency continues to be a growing sector as people, companies and government entities seek to reduce energy costs, build more efficiency into their operations and support local economic growth. Annual investments globally of billions of dollars[61] in energy efficiency technologies, have led to 12 percent avoided energy use since 2016.[62] **In the U.S., energy intensity—the amount of energy needed to produce one unit of GDP—declined by 2.9 percent in the same year.[63] This savings in energy productivity equates to an "energy productivity bonus" of over $500 billion;[64] comparable to the size of North Carolina's economy—the tenth highest state economy in the U.S.**

Energy efficiency investments directly and indirectly create jobs, and induce jobs within the economy. For example, investments in weatherization create direct jobs in sales and installation, indirect jobs in equipment manufacturing and distribution and still other induced jobs as wages in those industries are spent in others. Dollar for dollar, investments in energy efficiency create more jobs than an equivalent investment in the utility sector or fossil-fuels.[65] On average, $1 million spent on an energy efficiency project supports the creation of 20 total jobs (including direct, indirect and induced jobs).[66]

61 Navigant Research estimated that this included $64 billion in building efficiency, and $8 billion in industrial efficiency in 2015 alone. American Council for an Efficient Energy Economy. 2017. Energy Efficiency – Jobs and Investments. Retrieved from https://aceee.org/sites/default/files/ee-jobs-money-web.pdf

62 International Energy Agency. Energy Efficiency 2017. Retrieved from: https://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

63 Energy productivity bonuses are measured by the IEA as the "difference between actual GDP and the notional level of GDP that would have been generated had energy intensity stayed at the previous year's level." IEA estimated that the global energy productivity bonus in 2016 was equivalent to $2.2 trillion. IEA includes energy efficiency of buildings, industry, and vehicles within these figures. International Energy Agency. Energy Efficiency 2017. Retrieved from: https://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

64 International Energy Agency. Energy Efficiency 2017. Retrieved from: https://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

65 ACEEE. N.d. Energy Efficiency and Economic Opportunity. Retrieved from http://aceee.org/files/pdf/fact-sheet/ee-economic-opportunity.pdf

66 ACEEE. N.d. Energy Efficiency and Economic Opportunity. Retrieved from http://aceee.org/files/pdf/fact-sheet/ee-economic-opportunity.pdf

Energy Efficiency Sector Employment

Employment in energy efficiency continues to grow and represents the majority of the sustainability economy workforce in the U.S. The latest numbers suggest that there are at least 2.2 million energy efficiency workers nationwide.[67]

Even in states with major fossil fuel industries, energy efficiency employment rivals oil, gas and coal. Kentucky, for example, has an estimated 24,000 workers in energy efficiency, compared to about 12,200 coal generation jobs statewide.[68] Similarly, the number of energy efficiency jobs in Texas is almost on par with the number of jobs in oil extraction and refinement.[69]

Energy efficiency jobs cover a range of positions and technologies and are ubiquitous across industries. This sector employs people in positions related to the production and installation of energy efficient technologies, green building design and building retrofits. **The majority of energy efficiency workers are in construction, representing 21 percent of the 6.5 million jobs in the construction industry, and cannot easily be outsourced due to the local nature of these positions.[70]** Energy construction jobs include installation, retrofits and repairs of energy efficiency technologies within the industrial, commercial and residential building sectors. These positions are concentrated in installation and construction of HVAC, efficient heating and cooling equipment, insulation and building materials, and lighting (See figure 3). Of the industries within the energy efficiency sector, construction firms are the biggest employer of the energy efficiency workforce.

The latest numbers indicate that manufacturing jobs related to the production of energy efficiency materials and building products make up 2.3 percent of the total manufacturing jobs in the U.S.—approximately 289,000 workers in 2016.[71] The outlook for manufacturing positions in energy efficiency is positive. Manufacturing employers in 2016 predicted manufacturing positions in energy efficiency would grow 4.9 percent over 2017.[72] The majority of manufacturing positions in this sector are related to the production of high-efficiency heating and cooling and the production of advanced building materials and insulation (See figure 3). The manufacturing industry is the second largest employer of energy efficiency workers in the U.S.

67 The Department of Energy defines Energy Efficiency Employment as "the production or installation of energy efficiency products certified by the Environmental Protection Agency's ENERGY STAR ® program or installed pursuant to the ENERGY STAR ® program guidelines or supporting services thereof." Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

68 US Department of Energy. 2017. 2017 US Energy and Jobs Report State Charts. Retrieved from https://energy.gov/downloads/2017-us-energy-and-employment-report

69 American Council for an Efficient Energy Economy. 2017. Energy Efficiency – Jobs and Investments. Retrieved from https://aceee.org/sites/default/files/ee-jobs-money-web.pdf

70 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

71 Manufacturing energy efficiency job numbers do not include workers who have jobs related to energy efficient manufacturing processes of other types of products and materials, (excluding those that contribute to energy efficiency in industrial manufacturing processes). Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

72 Ibid.

CENTERBRIDGE PARTNERS L.P. LEVERAGES ENERGY EFFICIENCY

CENTERBRIDGE PARTNERS L.P., a private investment firm, hired EDF Climate Corps fellow Astha Ummat to reduce operating expenses by finding ways to conserve energy at Great Wolf Resorts, a family of indoor water park resorts. Through low-hanging energy efficiency upgrades, as well as solar energy and battery storage projects, the company could **SAVE OVER $1.5 MILLION IN ANNUAL COST**.

Investments in energy efficiency also help support local job growth and small businesses. Of approximately 165,000 companies that employ people in energy efficiency, the majority are considered small businesses with fewer than ten employees.[73] These jobs tend to be local in nature as workers must be on-site to install and maintain equipment and conduct site visits.[74] Positions in energy efficiency often offer above-average wages and career pathways to individuals with varied backgrounds and educational achievement.

73 American Council for an Efficient Energy Economy. 2017. Energy Efficiency – Jobs and Investments. Retrieved from https://aceee.org/sites/default/files/ee-jobs-money-web.pdf

74 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

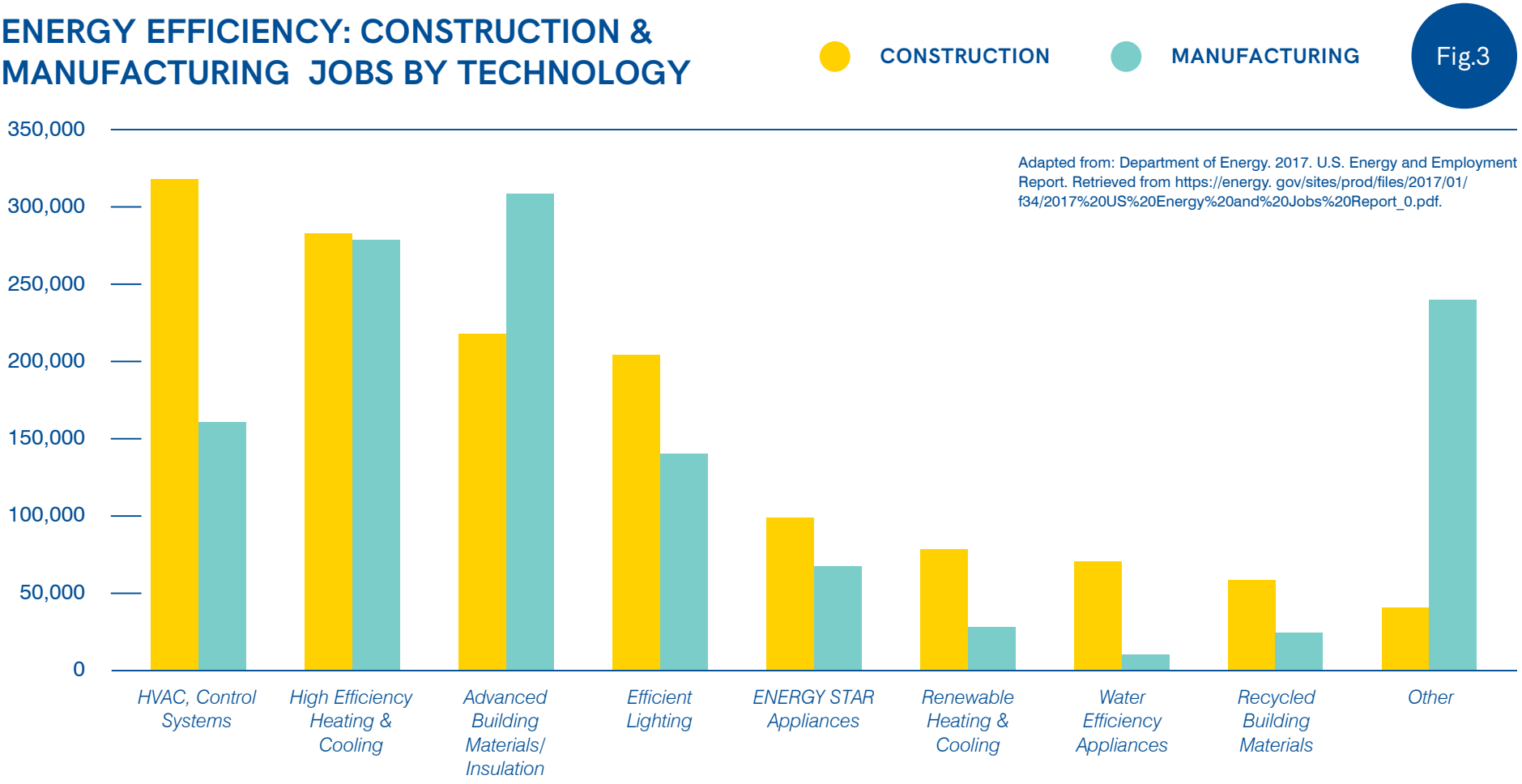
A study by The Brookings Institution found that 49.3 percent of jobs in energy efficiency required a high school diploma or less[75] and 75 percent of positions within the energy sector were considered "green collar" or "middle-wage" jobs.[76]

75 The Brookings Institution defines jobs in energy efficiency to include those related to: "appliances, battery technologies, electric vehicle technologies, energy-saving building materials, energy-saving consumer products, fuel cells, green architecture and construction, HVAC and control systems, lighting, professional energy services, public mass transit, smart grid, water efficient products," and is therefore larger than the Department of Energy's definition. Muro, M., Rothwell, J., & Saha, D. The Brookings Institution & Battelle Technology Partnership Practice. 2011. Sizing the Clean Economy, A national and Regional Green Jobs Assessment. Available at: https://www.brookings.edu/wp-content/uploads/2016/06/0713_clean_economy.pdf

76 The Brookings Institution defines "green collar jobs" as "those having a median wage that falls within 20 percentage points of the national median wage." (2010 dollars). Ibid.

ENERGY EFFICIENCY: CONSTRUCTION & MANUFACTURING JOBS BY TECHNOLOGY

Fig.3



Adapted from: Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

FEATURED JOB:

Energy Efficiency

Dara Ward held a variety of roles in organizations focused on environmental issues before she found her fit studying energy management at Columbia University's School of International and Public Affairs. While at Columbia, she gained valuable tools and resources to influence decision makers and have an impact on energy usage, a skillset she brings to her current position as Energy and Sustainability Manager for the St. Vrain Valley School District in Colorado. In this role, Dara oversees a variety of energy efficiency projects across the 57 district buildings and has mobilized a network of teachers, staff, parents and students to increase the district's focus on sustainability.

Dara's interest in energy efficiency was bolstered during her EDF Climate Corps fellowship at adidas Group following her first year at Columbia. During her fellowship, Dara found lighting, HVAC, data center and equipment upgrades that could help adidas Group meet many of their sustainability targets. In addition to driving energy efficiency upgrades at the multinational shoe and apparel company, Dara's EDF Climate Corps fellowship helped prepare Dara for her current role in the St. Vrain Valley School District.

Dara is now a catalyst for growing employment in the energy efficiency sector. As an Energy and Sustainability Manager, she analyzes school district building data to identify project opportunities. She then works with schools and various local contractors to implement a variety of projects and programs across the district's 52 schools and five administrative buildings. These projects not only provide jobs to local contractors, but also become integrated into educational programs, encouraging students to pursue careers in energy and sustainability. During her five years working at the school district, Dara has found that students and parents are increasingly asking for more opportunities to ingrain sustainability into facility operations and student education to better prepare graduates for jobs in the growing sustainability field.

DARA WARD

Energy and Sustainability Manager, St. Vrain Valley School District, Boulder, CO

Photo: Ellen Abramowitz helped Sims Metal Management analyze the technical and financial opportunities for battery storage and identify sites suited for implementation.

Future Developments in the Energy Efficiency Sector

Driven largely by the many benefits of energy efficiency, including energy savings, local job creation and the local economy, investments in the sector are expected to continue, and data for the projected number of jobs in the sector in 2017 is expected to show a nine percent increase, adding 198,000 jobs nationwide.[77] Some of the industries with efficiency workers are predicted to grow at faster rates, specifically those related to construction and wholesale trade and distribution which are expected to outpace job growth in manufacturing and professional services.[78] **Globally, in 2026, the market for energy efficient building technologies is expected to have grown by 58 percent from 2017 levels—reaching over $360 billion.**[79] This projected growth is supported by renewed investments and commitments in the sector. Recently several states such as Nevada, Colorado, Illinois, Michigan, and Ohio took steps to set new energy efficiency statewide targets.[80] In 2016, U.S. utilities saved over 25 million megawatt hours of electricity from energy efficiency initiatives.[81] These investments and targets continue to signal a strong outlook for job growth within the energy efficiency sector.

77 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

78 Ibid.

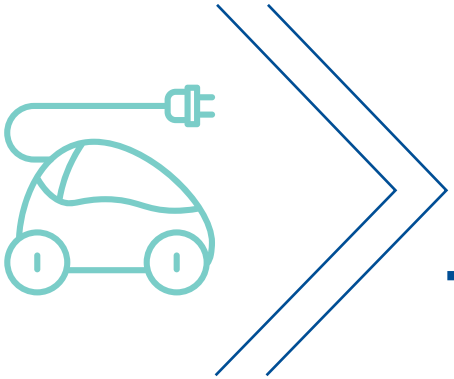
79 Navigant Research defines the energy efficient building technologies market as energy efficient building products in "nine key segments: HVAC, lighting, controls, water efficiency, water heating, building envelope, other, and commissioning and installation services." Navigant Research. 2017. Energy Efficient Buildings Global Outlook. Retrieved from https://www.navigantresearch.com/research/energy-efficient-buildings-global-outlook

80 Berg, Weston, et al. 2017. The 2017 State Energy Efficiency Scorecard. ACEEE. Retrieved from http://aceee.org/sites/default/files/publications/researchreports/u1710.pdf

81 Ibid.

SECTOR PROFILE:

ADVANCED VEHICLES & TRANSPORTATION



174,000

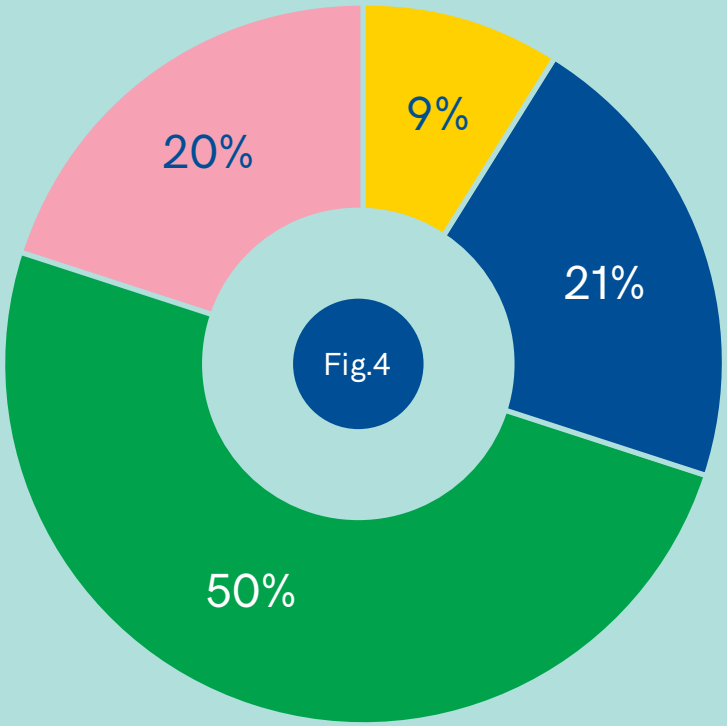
This sector directly **EMPLOYED 174,000 AMERICANS**, including electrical and mechanical engineers, factory workers and assemblers.

*As of 2016.

The advanced vehicles and transportation sector includes jobs related to hybrid-electric, plug-in hybrid, electric, and fuel cell vehicles. This sector employs Americans directly in the auto industry in technology development and vehicle manufacturing positions. Like the energy efficiency industry, the advanced vehicle industry also induces employment by reducing society-wide vehicle expenditure, enabling savings to be spent elsewhere in the economy to spur growth and create jobs.

Photo: Goksenin Ozturkeri helped Colgate-Palmolive by working on projects related to implementing fuel cells and electric vehicle charging stations.

ADVANCED VEHICLES: WHERE ARE THE JOBS?



ADVANCED VEHICLE TECHNOLOGY

- ELECTRIC
- PLUG-IN ELECTRIC
- HYBRID ELECTRIC
- FUEL CELL & HYDROGEN

Source: Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

A 2017 study found that the total social benefits for plug-in electric vehicle adoption in the U.S. are as high at $34.2 billion per year by 2035, with benefits mostly coming from the private fuel savings being spent throughout the economy.[82] **The same study found that depending on electricity costs and how aggressively EVs are deployed, the sector could add an average of 52,000 to 109,000 jobs annually throughout the economy from 2015 to 2040.** These jobs would be the result of reduced vehicle fuel and maintenance costs being spent throughout the economy.

In addition to anticipated induced benefits, in 2016 this sector directly employed 174,000 Americans, including electrical and mechanical engineers, factory workers and assemblers.[83] Advanced vehicle jobs are spread throughout the country, as more than 1,200 U.S. factories and engineering facilities in 48 states are creating technology that improves fuel economy for new vehicles.[84]

In 2017, major American automakers made commitments to further invest in the manufacturing of electric vehicles and hybrids, demonstrating that the industry is gaining momentum. For example, **General Motors Corporation has plans to add 20 new battery electric and fuel cell vehicles to its portfolio by 2023.[85] In early 2018, Ford released plans to invest $11 billion in electric vehicle technology development over the next five years and offer 40 different hybrid and fully electric vehicles by 2022.[86]** These investments come amid global commitments by countries such as the United Kingdom and China to phase out the combustion engine.[87]

82 NREL. 2016. National Economic Value Assessment of Plug-In Electric Vehicles. Retrieved from https://www.nrel.gov/docs/fy17osti/66980.pdf

83 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

84 NRDC, Bluegreen Alliance. 2017. Supplying Ingenuity II: U.S. Suppliers of Key Clean, Fuel-Efficient Vehicle Technologies. Retrieved from https://www.bluegreenalliance.org/wp-content/uploads/2017/05/Supplying-Ingenuity-vFINAL-low-res.pdf

85 Reuters. 2017. As Ford pushes into electric vehicles, U.S. union aims to save jobs. https://www.reuters.com/article/us-autos-ford-motor-union/as-ford-pushes-into-electric-vehicles-u-s-union-aims-to-save-jobs-idUSKBN1CA2EI

86 BBC News. 2018. Ford to boost investment in electric cars by 2022. Retrieved from: http://www.bbc.com/news/technology-42689637

87 Carey, Nick. White, Joseph. Ford plans $11 billion investment, 40 electric vehicles by 2022. Retrieved from: https://www.reuters.com/article/us-autoshow-detroit-ford-motor/ford-plans-11-billion-investment-40-electrified-vehicles-by-2022-idUSKBN1F30YZ

CATALYSTS FOR THE CLEAN ENERGY ECONOMY

Government and businesses are key catalysts for supporting the clean energy and sustainability economy. In the U.S., these entities are taking actions that are helping to drive demand for renewable energy, advanced grid and storage, energy efficiency, and advanced transportation vehicles. 2017 marked an important year for public commitments and investments by these entities.

While the job impacts of these actions are difficult to quantify, they undoubtedly spur the demand for renewable energy and energy efficiency technologies—furthering the need for the sustainability workforce.

- **455 U.S. CITIES**
- **15 STATES**
- **1,780 BUSINESSES**
- **325 INSTITUTIONS OF HIGHER LEARNING**

have committed to the **Paris Climate Agreement Goals**.

*Under the *We Are Still In* pledge.

Public Sector

Federal, state and local governments help support the need for jobs in the clean energy and sustainability sector through demand for these technologies and directly employing sustainability focused staff.[88] Sustainability commitments at the city and state level have been growing in recent years; including policies and targets related to climate resilience, greenhouse gas emissions reductions and renewable energy supply.[89] For example, 29 states and D.C. have adopted a renewable portfolio standard (RPS), committing to sourcing a percentage of their electricity energy from renewable sources, and eight states have set renewable energy goals.[90] RPS standards have driven renewable energy growth by requiring the procurement of 146 terawatt hours[91] of renewable energy since 2000—approximately 50% of all U.S. renewable energy growth in that time period.[92]

88 According to a 2011 BLS study estimated that there were 421,201 green jobs at the local government level, 248,538 at the state level, and 213,340 at the federal level. U.S. Bureau of Labor Statistics. 2013. Employment in Green Goods and Services. Retrieved from https://www.bls.gov/news.release/pdf/ggqcew.pdf

89 C40 Cities. 2016. The Power of C40 Cities. Retrieved from http://www.c40.org/cities

90 SEIA. Renewable Energy Standards. Retrieved from https://www.seia.org/initiatives/renewable-energy-standards

91 1 terawatt hour (TWh) is equal to 1 million megawatt hours (MWh)

92 Lawrence Berkeley National Lab. 2017. U.S. Renewable Portfolio Standards: 2017 Annual Status Report. Retrieved from https://emp.lbl.gov/sites/default/files/2017-annual-rps-summary-report.pdf

Local leadership in climate initiatives is also growing. **As of 2017, over 50 U.S. cities participating in the Ready for 100 Initiative have adopted, and 5 cities[93] have met, 100 percent clean energy goals.[94]** Additionally, **455 U.S. cities, as well as 15 states and 325 institutions of higher learning, have committed to the Paris Climate Agreement goals** under the *We Are Still In* pledge.[95] To meet these ambitious commitments, local and state governments are taking actions that increase demand for clean energy and sustainability jobs across a range of sectors. For example, to meet emissions reduction goals, the City of Atlanta has contracted $160 million in energy retrofits in municipal buildings,[96] thus supporting local jobs in the energy efficiency sector.

To further support clean energy jobs, many municipalities and government agencies are developing green workforce training programs. As of 2014, the Department of Labor, the Department of Energy and the National Science Foundation had supported the creation of **258 green job training programs across the U.S.** through the Trade Adjusted Assistance Community College and Career Training grant program, with 110 focused on providing training for energy efficiency jobs and 148 focused on renewable energy jobs.[97] Several states have recently passed legislation to further support the development of these training programs. For example, through the Future Energy Jobs Act, Illinois' leading utility will provide $30 million in funding for job-training programs, in addition to expanding energy efficiency programs and strengthening the state's renewable portfolio standard.[98] Similarly, **New York's Clean Energy Jobs and Climate Agenda aims to drive green job growth by investing $15 million in the state's clean energy workforce development and training programs.[99]**

93 Aspen, CO, Burlington, VT, Greensburg, KS, Rock Port, MO, and Kodiak Island, AK. Sierra Club. N.d. 100% Commitments in Cities, Counties, and States. Retrieved from https://www.sierraclub.org/ready-for-100/commitments

94 Sierra Club. N.d. 100% Commitments in Cities, Counties, and States. Retrieved from https://www.sierraclub.org/ready-for-100/commitments

95 America's Pledge. October 2017. Phase One Report: States, Cities, and Businesses in the United States are Stepping up on Climate Action. Retrieved from https://www.bbhub.io/dotorg/sites/28/2017/11/AmericasPledgePhaseOneReportWeb.pdf

96 City of Atlanta. November 2017. City of Atlanta Passes "EV Ready" Ordinance into Law. Retrieved from: https://www.atlantaga.gov/Home/Components/News/News/10258/1338?backlist=/

97 United States Department of Energy. 2014. Energy & Manufacturing Workforce training Topics List Version. Retrieved from https://energy.gov/sites/prod/files/2014/02/f7/Energy%20and%20Manufacturing%20Topics%20List-v%201-7.xlsx

98 Future Energy Jobs Act. Master Factsheet. Retrieved from http://www.futureenergyjobsact.com/resources/pdf/FEJA-Fact-Sheet.pdf

99 New York State Energy and Research Development Authority. Governor Cuomo Unveils 20th Proposal of 2018 State of the State: New York's Clean Energy Jobs and Climate Agenda. Retrieved from https://www.nyserda.ny.gov/About/Newsroom/2018-Announcements/2018-01-02-Governor-Cuomo-Unveils-20th-Proposal-of-2018-State-of-the-State

FEATURED JOB:

Municipal Energy Management

With a background in science and engineering and project management, Anand was pursuing his MBA at Case Western Reserve University when he realized he wanted to transition his career into the sustainability field. While completing his degree, he joined EDF Climate Corps working with Genzyme, a leading biotechnology company, to evaluate which energy conservation measures (ECMs) would be technically and financially feasible for the company.

Now working as the City of Cleveland's Energy Manager, Anand balances a wide range of responsibilities from education and outreach, to program and policy development and implementation. He has developed a range of initiatives and programs to support Cleveland's ambitious climate agenda, which includes a greenhouse gas reduction goal of 80 percent below 2010 emissions by 2050 and interim reduction goals of 16 percent by 2020 and 40 percent by 2030.[100] One such project he cites as instrumental to creating change is the implementation of an energy data management system for city owned and operated facilities. This system improved the city's ability to track and monitor energy data and was used to develop their internal climate action plan for city operations.

Looking towards the future, Anand is optimistic about the role of cities in continuing the momentum towards a clean energy economy, as well as the future of clean energy jobs. In his work, he has noticed a greater number of cities and organizations directly employing sustainability staff in addition to a general expansion of blue- and white-collar jobs.

100 Sustainable Cleveland. Climate Action. Available at http://www.sustainablecleveland.org/climate_action

ANAND NATARAJAN

Energy Manager, Mayor's Office of Sustainability, City of Cleveland, OH

Corporate Sustainability

Like cities and states, businesses are also making public commitments to support the growth of the clean energy economy. Recently, 1,780 U.S. businesses have committed to the Paris Climate Agreement goals under the *We Are Still* In pledge[101] and 117 companies have made a commitment to sourcing 100 percent of energy for operations from renewable energy sources under the RE100 initiative.[102] Mars, for example, has committed to sourcing 100 percent of its over 2.4 million megawatt hours of electricity usage, by the year 2050.[103] As of 2017, committed companies collectively represent demand for 150 terawatt hours of electricity annually, which is equivalent to the annual demand of Poland. These commitments are already translating to aggressive goals and bold initiatives. In 2017, for example, **Walmart's Project Gigaton set the goal of avoiding 1 gigaton of greenhouse gas emissions from the company's supply chain by 2030, an amount equivalent to the annual emissions of Germany.[104]**

In the U.S., companies continue to invest in renewable energy. **By December of 2017, the Rocky Mountain Institute Business Renewable Center tracked over 3 gigawatts of corporate renewable energy procurement deals in 2017 alone, outpacing the 1.61 gigawatts procured during the whole of 2016.**[105] For example, Apple recently constructed a 50 megawatt solar farm in Arizona to power the company's global command data center, which is equal to the power consumption of about 12,000 homes.[106] Companies are making renewable energy investments to meet internal goals related to greenhouse gas emissions reductions, reduce energy costs, mitigate energy price fluctuation risk, strengthen investor confidence and improve competitiveness. While the generation of renewable energy to support company operations has numerous benefits, it also supports indirect job growth by generating positions in the renewable energy sector and among third party contractors who increasingly support the execution of contracts for renewable power or equipment.[107]

101 We Are Still In. 2017. We Are Still In Video. Retrieved from https://www.wearestillin.com/news/we-are-still-video

102 The Climate Group & Carbon Disclosure Project (CDP). RE100. Retrieved from http://there100.org/re100

103 The Climate Group & Carbon Disclosure Project (CDP). RE 100 Mars. Retrieved from http://there100.org/mars

104 GreenBiz. April 2017. Why Walmart's Project Gigaton is corporate America's 'moonshot'. Retrieved from https://www.greenbiz.com/article/why-walmarts-project-gigaton-corporate-americas-moonshot

105 Rocky Mountain Institute. 2017. Corporate Renewable Deals: BRC Deal Tracker. Retrieved from http://businessrenewables.org/corporate-transactions/

106 Apple Newsroom. Apple joins RE100, announces supplier clean energy pledges. Retrieved from https://www.apple.com/newsroom/2016/09/apple-joins-re100-announces-supplier-clean-energy-pledges/

107 PwC. 2016. Corporate renewable Energy Procurement Insights. http://www.pwc.com/us/en/sustainability-services/publications/assets/pwc-corporate-renewable-energy-procurement-survey-insights.pdf

BOSTON SCIENTIFIC SETS SIGHTS ON CARBON NEUTRAL

BOSTON SCIENTIFIC, a medical devices company, tasked EDF Climate Corps fellow Alex Bothner with developing a strategic road-map and communications plan for their decision to **SET A GOAL OF BECOMING CARBON NEUTRAL** in their manufacturing and distribution sites by 2030.

EDF PARTNERS TAKING ACTION:

EDF partners have committed to a variety of targets, goals and initiatives to support the clean energy economy. Examples of actions EDF's partners have taken include:

SETTING TARGETS:

Joining RE100, We Are Still In or Low-Carbon USA

Setting Science Based Targets

ENGAGING THE PUBLIC SECTOR:

Committing to putting a price on carbon

Supporting the Clean Power Plan by filing public comments to the EPA on the proposed repeal

Participating in the Ceres Business for Innovative Climate and Energy Policy (BICEP), or C2ES Business Environmental Leadership Council

Hosting an EDF Climate Corps fellow

PARTICIPATING IN NETWORKS:

Participating in the Renewable Energy Buyers Alliance

Participating in We Mean Business

Joining Business for Social Responsibility (BSR)

CONTINUING THE MOMENTUM

The clean energy and renewable job market in the United States is expected to grow, even with the uncertainty in some sectors. In 2017, a wave of investments and commitments have fueled continued growth, boosted local economies and supported millions of well-paying jobs for people across the country. New cutting-edge technologies are gaining momentum as solutions for today's energy problems, and innovative collaborations between the private and public sectors are demonstrating the demand for a clean energy future.

The energy storage and advanced grid sector is an example of advanced technology integration translating into rapid market growth. The demand for these technologies have resulted in an over 200 percent increase in jobs in this sector in 2016 from the previous year, as well as increasing resiliency and reliability as these technologies become integrated into the grid.[108] Investments in these technologies are creating an entire workforce dedicated to these sectors – an opportunity that didn't exist a few years back – and continued growth is projected for the future.

Recognizing the urgent need for action on climate change and the benefits of a low-carbon economy, the public and private sectors can continue to be catalysts for change. Making continued investments and supporting initiatives related to climate resilience, greenhouse gas emissions reductions, and renewable energy will help sustain clean energy job growth. This support will help create high-paying job opportunities that improve lives, stimulate local economies and make entities more resilient.

108 Department of Energy. 2017. U.S. Energy and Employment Report. Retrieved from https://energy. gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

EDF CLIMATE CORPS
18 Tremont Street, Suite 850
Boston, MA 02108
www.edfclimatecorps.org

For more information, please contact:
info@edfclimatecorps.org

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