FACEBOOK

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The Impact of Facebook's
U.S. Data Center Fleet
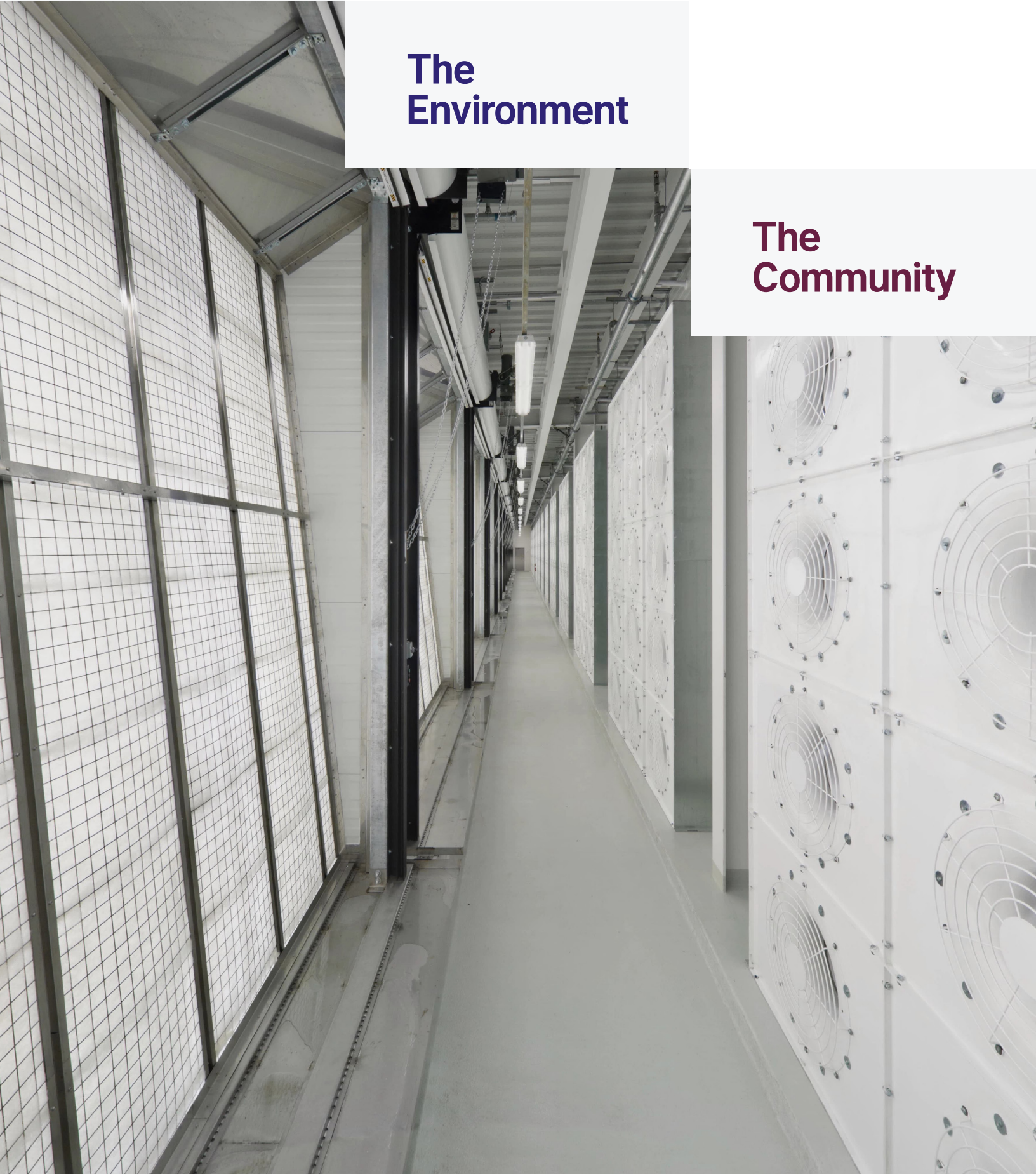
2017–2019

OCTOBER 2020

The Economy

The Environment

The Community

Introduction

Facebook's fleet has grown to thirteen data centers in the United States. Eight of these data centers are now serving traffic. RTI International analyzed Facebook's domestic data center fleet, focusing on how their construction and operations have affected the economy, the environment, and communities over the last three years. This report includes detailed results of data center investment and activity from 2017 through 2019. All dollar values included in this report are inflation adjusted to 2019.
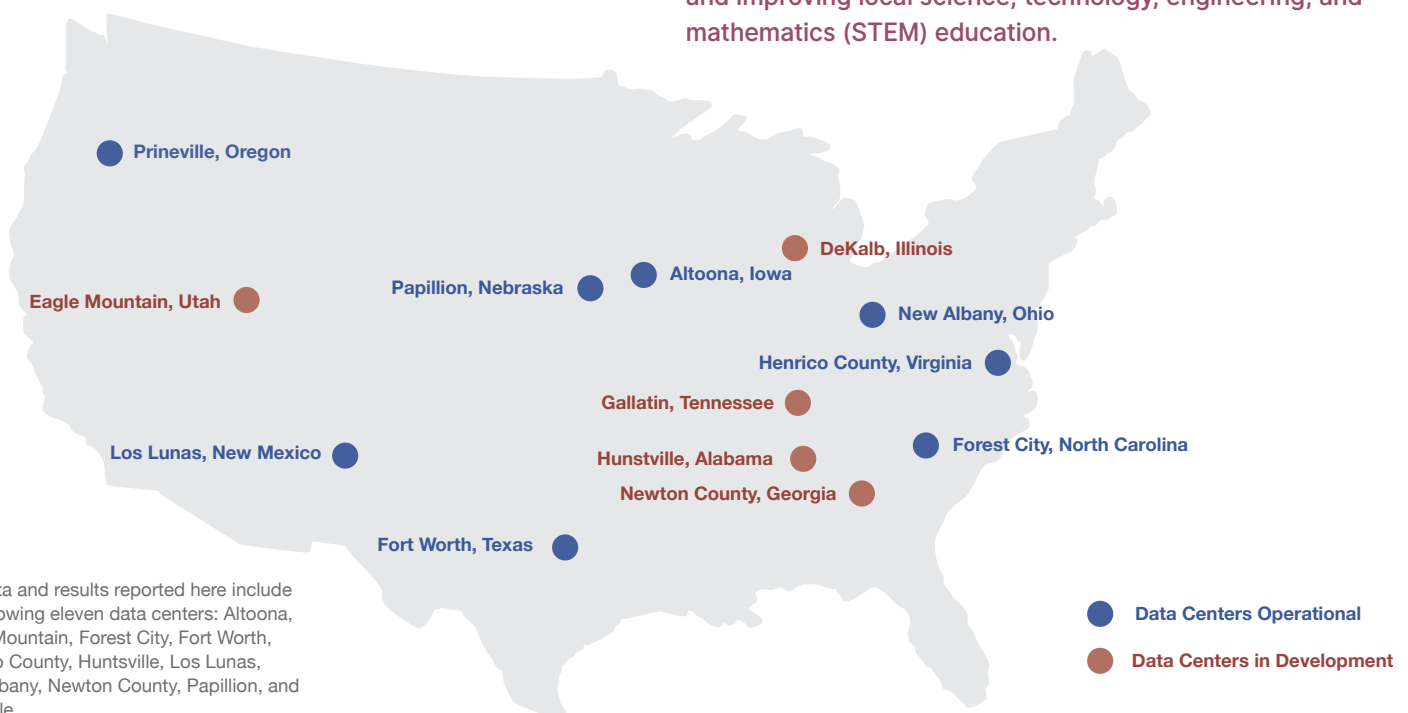
Please see the previous impact study for detailed results of data center investment and activity from 2010 through 2016.

The Economy: RTI analyzed Facebook's expenditures for U.S. data center construction and operations and estimated that, when accounting for multiplier effects, Facebook data centers have contributed a cumulative $18.6 billion in gross domestic product (GDP) to the U.S. economy from 2017 through 2019, or $6.2 billion per year. This contribution estimate was primarily driven by up-front capital investments in construction. Facebook invested over $173 million in data center operations, on average, each year. RTI estimated that 18 jobs were supported in the economy for every $1 million in data center operating expenditures.

The Environment: Facebook has invested heavily in data center efficiency and renewable energy to minimize the environmental footprint of its services. RTI estimated that U.S. Facebook data centers have reduced greenhouse gas emissions by over 3 million tons since 2011, the equivalent of taking over 660,000 cars off the road. In 2019, U.S. Facebook data centers saved 4.6 billion gallons of water, equivalent to the annual water use of 40,000 American households. In addition, Facebook has invested heavily in renewable energy with 987 megawatts (MW) of wind and solar capacity coming online between 2017 and 2019.

The Community: Facebook data centers have had a local impact through their community development efforts, which include direct grantmaking, volunteering, and a range of other partnership activities. From 2017 through 2019, Facebook made over 300 donations. The majority of Facebook's charitable investments were focused on putting the power of technology to use for community benefit and improving local science, technology, engineering, and mathematics (STEM) education.

2020 Data Center Fleet

- Prineville, Oregon
- DeKalb, Illinois
- Eagle Mountain, Utah
- Papillion, Nebraska
- Altoona, Iowa
- New Albany, Ohio
- Henrico County, Virginia
- Gallatin, Tennessee
- Los Lunas, New Mexico
- Hunstville, Alabama
- Forest City, North Carolina
- Newton County, Georgia
- Fort Worth, Texas

● Data Centers Operational
● Data Centers in Development

The data and results reported here include the following eleven data centers: Altoona, Eagle Mountain, Forest City, Fort Worth, Henrico County, Huntsville, Los Lunas, New Albany, Newton County, Papillion, and Prineville.
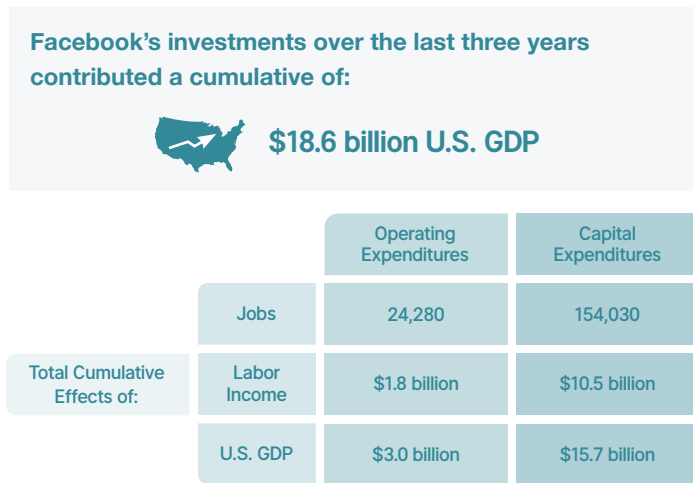
The Economy

Facebook's 2017 through 2019 investments in data center construction and operations totaled $11.5 billion, and these investments contributed a cumulative $18.6 billion to the U.S. GDP.

# The Economy

Total Cumulative Effects

The total cumulative effects of Facebook's data center investments over the last three years included direct, indirect, and induced contributions to the economy. Investments in Facebook's data center workforce drove the company's $3 billion cumulative U.S. GDP contribution from operating expenditures. Facebook's cumulative contribution to U.S. GDP from capital expenditures was driven by spending across the sectors outlined below as well as others in the supply chain such as wholesale trade, metal, HVAC, and switchboard manufacturing: $9.7 billion of $15.7 billion total effects.

Facebook's investments over the last three years contributed a cumulative of:

$18.6 billion U.S. GDP

		Operating Expenditures	Capital Expenditures
	Jobs	24,280	154,030
Total Cumulative Effects of:	Labor Income	$1.8 billion	$10.5 billion
	U.S. GDP	$3.0 billion	$15.7 billion

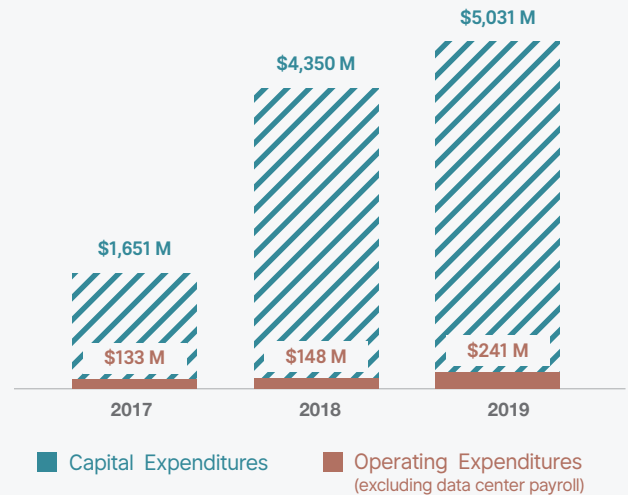Results may not total due to rounding.

Spending Multiplier

Multipliers represent how Facebook data center activities have had a larger connection to the economy as a whole. As more data centers have been constructed, expanded on, and become operational, the spending multiplier has grown. For every $1 million in data center capital expenditures, the economy experienced an additional $954,000 in labor income and $1.4 million in GDP. **For every $1 million in data center operating expenditures, the economy experienced an additional $1.3 million in labor income and $2.2 million in GDP.**

Jobs Supported

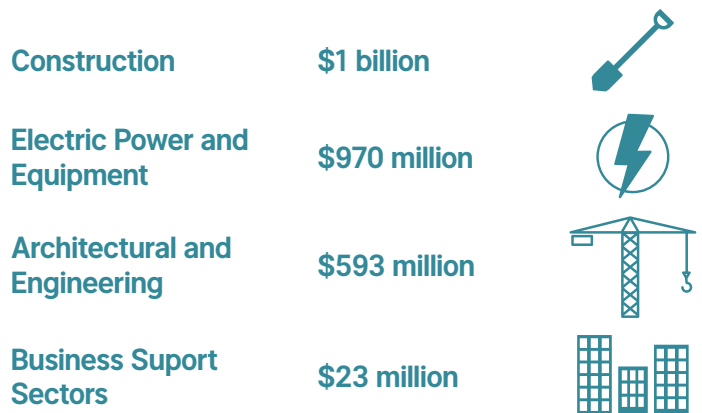|		
$1 million in operating	18	👥👥👥👥👥👥👥👥👥
$1 million in capital	14	👥👥👥👥👥👥👥
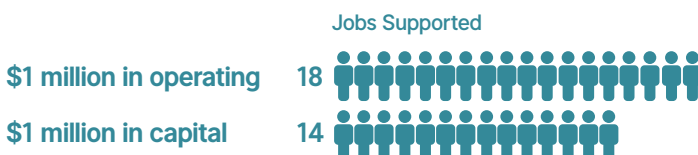
Data Center Spending Trends

Facebook's 2017 through 2019 investments in data center construction and operations totaled $11.5 billion. Capital expenditures represented 95% of the total ($11 billion), and operating expenditures represented the remaining 5% ($500 million) of the three year total.

Chart — Data Center Spending Trends:

Year	Capital Expenditures	Operating Expenditures
2017	$1,651 M	$133 M
2018	$4,350 M	$148 M
2019	$5,031 M	$241 M

■ Capital Expenditures　■ Operating Expenditures (excluding data center payroll)

Industry Impact

Facebook data center spending had the largest total economic contribution to the construction, electric power and equipment, architectural and engineering, and business support sectors. U.S. GDP effects for these sectors include:

Construction	**$1 billion**
Electric Power and Equipment	**$970 million**
Architectural and Engineering	**$593 million**
Business Suport Sectors	**$23 million**

These results include multiplier effects.

The Economy

Analysis Overview: To assess Facebook's economic contributions, RTI determined (1) the direct effects of total data center spending and (2) the secondary effects of data center investments to quantify how Facebook spending rippled through local economies where data centers are located and also the national economy. This expenditure-based method is called a bill-of-goods approach. The bill-of-goods approach is the most effective way to customize the input-output (I-O) models so that the analysis and results best reflect Facebook's activities over time within local economies across the U.S. RTI used IMPLAN 2018 software to complete the I-O analysis.

Annual Impacts from 2017 through 2019

Facebook's expenditures have contributed over $6 billion in U.S. GDP each year. The company's data center investments have supported an additional $4 billion in labor income and more than 59,000 jobs, on average, each year elsewhere in the economy.

U.S. GDP	**$6.2 billion**
Labor Income	**$4.1 billion**
Jobs	**59,440**

These results include multiplier effects.

Additional Impacts

Facebook's most mature data centers, located in Altoona, Forest City, and Prineville, had a positive impact on employment and wages in the information sector. On average, data centers in these three regions contributed to an 87% increase in information-sector employment and a 107% increase in information-sector wages four years after Facebook opened its first data center in those locations.
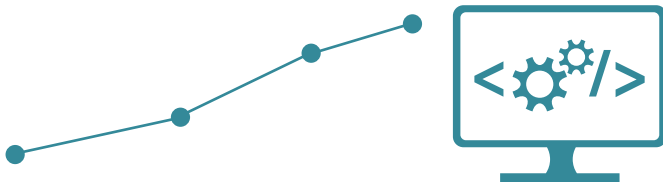
Data Center Workforce

Facebook's rapid expansion has changed the local workforce at data center locations dramatically over the last three years. Since 2017, Facebook has increased its direct data center employment by 164% and contracted employment by 139%.

164% Data Center Employment
139% Contracted Employment
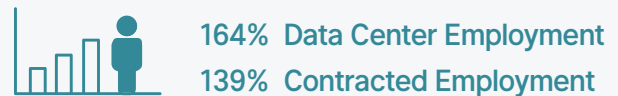
In 2019, direct data center employment totaled more than 850 people. In addition to direct employees, Facebook contracted with a range of companies to fulfill daily operational needs. These contractors quadrupled the on-site workforce total.

Key Terms:

Direct Effects: The economic activity directly created by the event/project/industry. In this analysis, direct contributions are the direct construction and operations investments of Facebook.

Gross Domestic Product (GDP): A measure of the overall size or sum of economic activity in terms of the value of goods produced and services provided, minus the value of intermediate inputs.

Indirect Effects: The economic activity supported in relevant supply chains for goods and services.

Induced Effects: The economic activity associated with spending by workers and households whose jobs and labor income are supported directly or indirectly (i.e., the economic activity that results from direct and indirect effects).

Secondary Effects: The cumulative indirect and induced effects.

Spending Multiplier: The ratio of the total economic contribution to Facebook expenditures.

$$\text{Spending Multiplier} = \frac{\text{Total Contribution}}{(\text{Facebook Expenditure}/10^6)}$$

Total Effects: The cumulative direct, indirect, and induced effects.

The Environment

Minimizing environmental impact and maximizing energy and water efficiency have been motivating principles for Facebook in the design of its data centers since the Prineville Data Center opened in 2011. Facebook has pursued this effort by pushing the boundaries of efficient data center design and supporting its data centers with renewable energy.

The
Environment

When the Prineville Data Center opened in 2011, Facebook deployed innovations across each major component of the facility. Streamlined design and high-efficiency power supplies reduced electricity loss inside the facility. Leveraging open air cooling instead of traditional chiller units saved electricity and water. Efficient server and rack design also saved water and electricity because servers can stay cool more easily.

Minimalist Design = Maximum Efficiency

A key element of Facebook's approach to data center design is to strip away all unnecessary elements in the design that could lead to increased energy, water, and materials use. Electrical systems are streamlined to cut out unnecessary equipment and energy loss, while cooling systems leverage a ductless architecture, minimizing materials use. This mentality extends to server and rack design as well, where Facebook designs out unnecessary parts, including the enclosures. These servers are both easier to repair and keep cool.
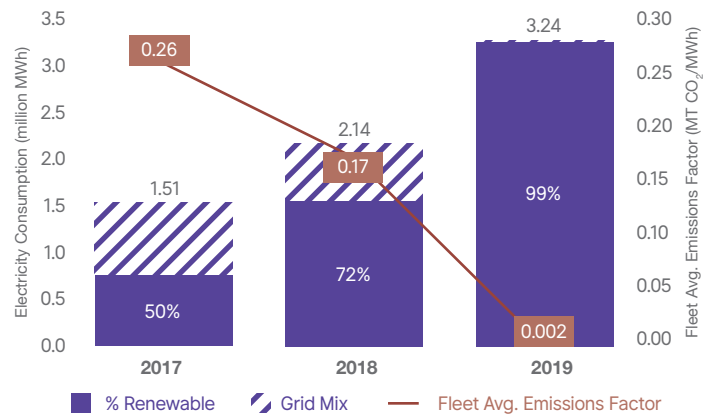
Energy Efficiency

Early investments in efficiency have resulted in significant energy savings at Facebook's data centers. Compared to an average data center in the United States, Facebook data centers used 32% less energy. Compared to the average performance of a hyperscale or large colocation data center, Facebook data centers used 8% less energy. RTI estimated that Facebook has saved over 800,000 MWh of electricity consumption since 2011 compared to other hyperscale and large colocation data centers. Compared to the industry average data center, Facebook data centers have saved 4.7 million MWh since 2011.[1]

Energy Efficiency Compared to Industry Averages

Facebook used 32% less energy

Hyperscale/Large Colocation

Industry Average
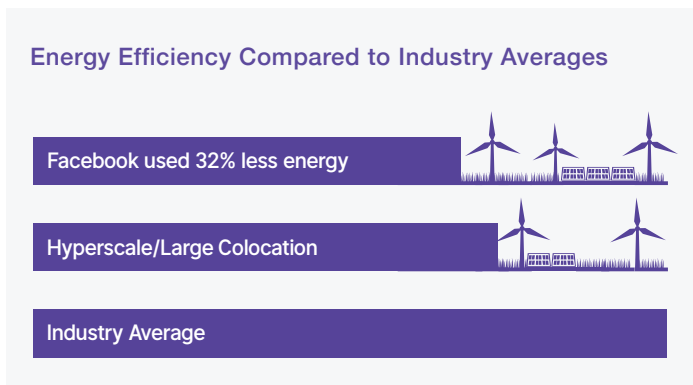
Renewable Energy

To reduce the carbon footprint of its data centers, Facebook has invested heavily in renewable energy with 987 MW of wind and solar capacity in the United States coming online between 2017 and 2019. Since 2014, every new Facebook data center has been 100% renewable from day one of operations. By the end of 2020, Facebook expects its global operations to be supported by 100% renewable energy.
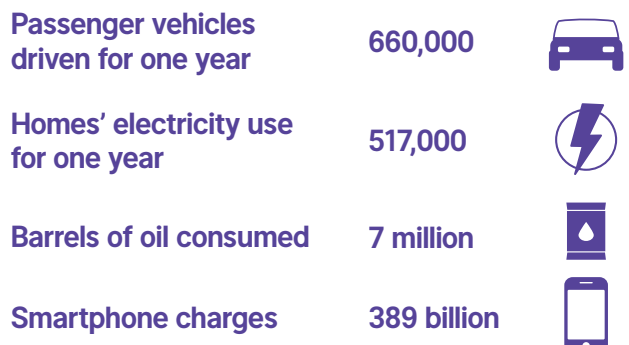

These results are for Facebook's U.S. data center fleet.

Reducing Emissions

The combined efforts of designing high-efficiency data centers and investing heavily in renewable energy have helped Facebook data centers avoid 3.1 million metric tons of CO_2 emissions since 2011. **For the first time in 2019, Facebook also offset more than 100 metric tons of carbon emissions from employee business travel and air travel to major international events.**

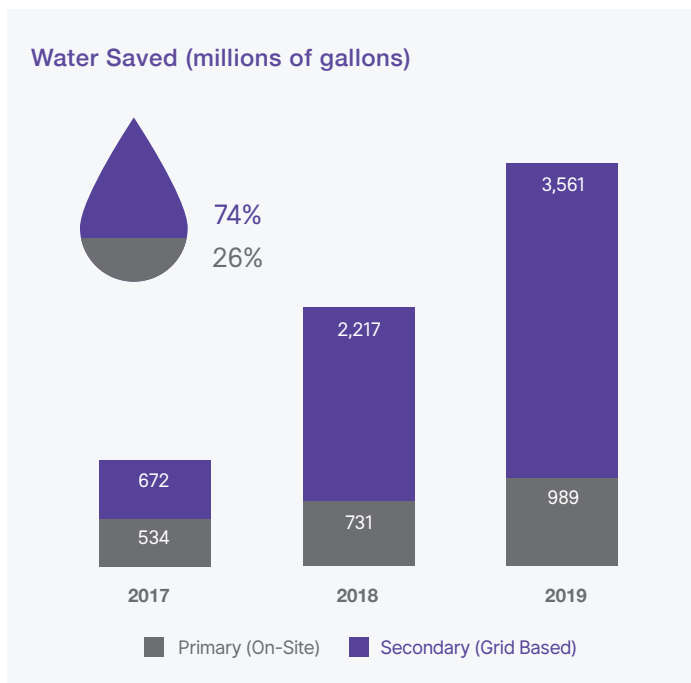Facebook has reduced emissions equivalent to:

Passenger vehicles driven for one year	660,000	
Homes' electricity use for one year	517,000	
Barrels of oil consumed	7 million	
Smartphone charges	389 billion	

[1] Our savings estimates are based on historical PUE data available in Uptime Institute's report "Is PUE actually going UP?" by Lawrence, A., (2019), and WUE estimates available in Lawrence Berkeley National Laboratory's "United States Data Center Energy Usage Report" by Shehabi, A., et al. (2016).

The Environment

Water Efficiency

Facebook's investments in energy efficiency and renewable energy also saved water. Every U.S. Facebook data center uses open air cooling, which has reduced water withdrawl in the cooling system by at least 80%. Compared to a traditional chiller cooling system, Facebook data centers saved nearly 1 billion gallons of water on-site (primary) in 2019.

Facebook also worked to reduce its secondary water use by reducing its consumption of carbon-intensive electricity, which required significant water for steam and cooling. Through efficiency and renewable energy procurement, Facebook saved 3.6 billion gallons of electricity grid-based (secondary) water consumption in 2019.

Water Saved (millions of gallons)

74%
26%

3,561

2,217

672

534

731

989

2017 **2018** **2019**

■ Primary (On-Site) ■ Secondary (Grid Based)

Beyond its operations, Facebook has committed to water stewardship by supporting water restoration projects that promote long-term watershed sustainability in water-stressed regions. In 2019, Facebook invested in four water restoration projects to restore over 54 million gallons of water supply each year in its New Mexico and Oregon data center communities. **The Middle Rio Grande Water Restoration Project in New Mexico (pictured on the right) will restore 32.5 million gallons of water a year to the local watershed.**

Pushing the Industry Forward

In addition to investing in efficiency at its own data centers, Facebook continues to share its data center design insights with the larger data center industry through the Open Compute Project, a nonprofit organization focused on open sourcing innovations in sustainable server and data center design. The Open Compute Project has accelerated a shift toward more efficient server and data center design, originally targeted primarily at hyperscale data centers. Over time, other segments of the industry, including telco, financial services, and smaller colocation data centers, have begun to adopt these innovations, enabling Facebook and the Open Compute Project to support continued innovation in the industry.[2]

Facebook has also supported sustainability outcomes across all industries by partnering with key industry organizations. As a member of the Renewable Energy Buyers' Alliance (REBA), Facebook collaborates with other companies to share best practices and scale corporate renewable energy procurement. Through the Responsible Business Alliance (RBA), Facebook contributes to driving sustainability in global supply chains. And as a member of the World Resource Institute's Aqueduct Alliance, Facebook encourages best practices in water stewardship. In addition to its commitment to the We Are Still In coalition, Facebook supports H.R. 9 (Climate Action Now Act).

Middle Rio Grande Water Restoration Project

Before

After

Photos by Paul Tashjain, Audubon New Mexico

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[2] In 2020, Omida published a market impact study of Open Compute Project–certified equipment, highlighting Open Compute's growing traction in new segments of the tech industry. Accessed: https://www.opencompute.org/files/Executive-Presentation-OCP-Impact-Study-20-0227-cg.pdf.

The Community

Alongside Facebook's economic and environmental contributions, data centers affect the local communities around their campuses. Facebook builds community partnerships and supports local initiatives through monetary, volunteer, and in-kind investments.

The Community

From 2017 through 2019, Facebook provided over 300 grants to local organizations. Facebook has provided over 570 grants and more than $7.4 million to communities since their community engagement efforts began in 2011. The majority of these investments went to nonprofits and schools (K–12). Grants were available to programs and projects that focused on one or more of the following areas in local communities:

- Addressing critical community needs by putting the power of technology to use for community benefit;
- Connecting people online and offline;
- Improving local science, technology, engineering, and mathematics education.

In interviews with RTI, local stakeholders detailed their priorities and Facebook's impact beyond the company's grantmaking efforts. These leaders were focused on how to prepare youth for competitive careers, increase job opportunities, and foster a quality place to live for residents. Facebook was described as a "hometown company" that has been engaged, transparent, and committed to these regional development goals.

The company's local involvement and influence have been felt most significantly in public education systems. Facebook's education efforts have included monetary investments alongside hands-on support in classrooms and broader communication and networking efforts. See the following pages for details on educational efforts in Crook County, Oregon, and Rutherford County, North Carolina.

Facebook's mission is to give people the power to build community and bring the world closer together.
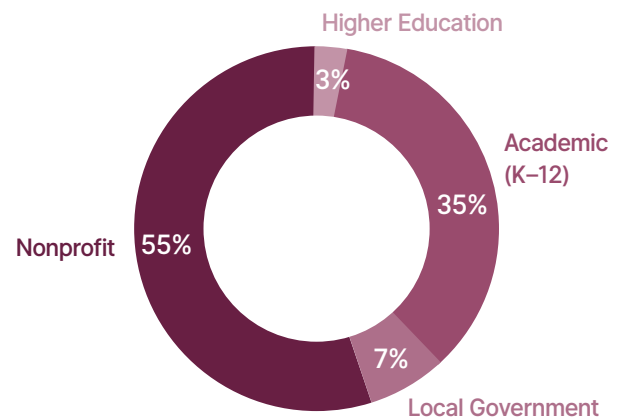
Mission

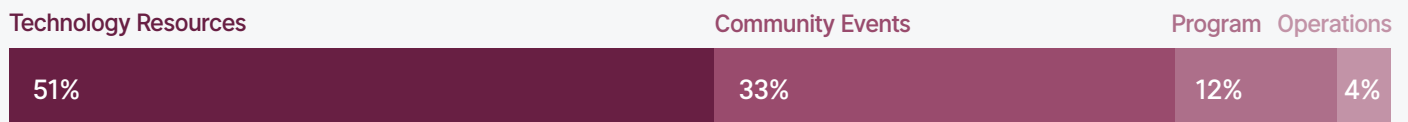### COVID-19 Partnership and Support

In response to COVID-19, Facebook has offered support to data center communities focused on education resources, small business support, and other assistance to nonprofits that serve those who are struggling with the impacts of the pandemic. As of August 2020, Facebook had donated $10.9 million in COVID relief in data center communities, which resulted in:

Students Supported	89,600
Internet Access Provided (devices & hotspots)	9,597
Meals Served	705,000+

Types of Organizations

Higher Education 3%

Academic (K–12) 35%

Nonprofit 55%

Local Government 7%

Types of Projects

Technology Resources	Community Events	Program	Operations
51%	33%	12%	4%

The Community

Hands-on education that grows curiosity and inspires careers.

The Crook County School District's vision is to align educational opportunities directly with the skills and experiences that kids need to build a quality career path in an increasingly competitive economy. Facebook's $200,000 donation in 2019 to Crook County High School furthered this vision by providing the money needed to revamp the career and technical education (CTE) program. This grant was a part of the school's greater effort to prepare students with current cross-industry knowledge and support the region's future workforce demands. The donation enabled a range of equipment, software, and hardware purchases that increased students' access to business operations and graphic design programs, robotics technology, and welding and metal equipment, among many other career-focused resources.[3]

Facebook has supported over $500,000 in donations to the Crook County School District since 2011 to increase tech education, heighten access to state-of-the-art science equipment, and provide computers in schools.[4] In 2020, in response to urgent COVID-related district needs, Facebook provided an additional $450,000 to support remote learning.[5]

Although many reports focus on the dollar amounts, Sara Johnson, the Crook County School District Superintendent, commented that "this is just the edge of how Facebook has gotten involved." She added that "the company doesn't throw money at our needs; instead they find ways to engage so that we're partners learning from each other." Steve Forrester, the Prineville City Manager, added that the Crook County School District has transitioned from one of the poorest in the region to one of the most impressive. He noted how important this transition is for students and how it affects the region's economic development efforts. Recruiting companies and talent is more feasible with assets like a top school district.

Efforts by Facebook have been magnified by their contracting partners such as Facebook's general contractor and local subcontractors. Collectively, these companies are taking steps beyond monetary investment to improve the employability of Crook County students through direct skill building and hands-on experiences. These opportunities develop a deeper knowledge in local youth about how their current interests translate to quality career paths. This type of engagement fosters curiosity in the short term and supports talent retention and strong workforce development in the long term.

[3] "Facebook Grants $200,000 for CTE." Accessed: http://crookcounty.k12.or.us/2019/10/10/facebook-grants-200000-for-cte/.

[4] RTI analysis of Facebook charitable giving from 2011 through present.

[5] "Facebook Donates $450,000 for Technology Upgrades." May 6, 2020. Accessed: http://crookcounty.k12.or.us/2020/05/06/facebook-donates-450000-for-technology-upgrades/.

The Community

Investments in technology are investments in equity.

The Rutherford County School District's mission for nearly a decade has been to connect each student directly to technology. In fact, Rutherford County was the largest implementer of North Carolina's one-to-one initiative in 2011.[6] For many local leaders, investments in technology are investments in equity. With an infinite amount of information, teaching tools, and experiences available through state-of-the-art software, hardware, and other equipment, students have opportunities to develop skills and gain experiences that will influence their long-term career paths.

Facebook's $300,000 donation in 2019 to the Rutherford County Schools Education Foundation furthered this vision by providing the money needed to create STEAM and robotics labs in all district elementary, middle, and high schools—18 schools in total.[7] This grant was a part of the district's larger effort to weave career-oriented topics and hands-on experiences throughout students' curriculum rather than develop stand-alone programs. Brad Teague, the Rutherford County School District Chief Operating Officer, noted that this grant "leapfrogged their timeline by 10 years." This effort would have taken at least 10 years, "and then we would have had to immediately start over

to keep everything current. Facebook's support has enabled our school district to dream big and then implement that big dream."

STEAM efforts have been critical to pursuing two key objectives within the district: helping students reach their education goals and fostering teachers' professional development. Kim Carpenter, the Rutherford County School District Chief Technology Officer, outlined the distinct ways that focused STEAM support has furthered these priorities:

For students: STEAM resources (1) lowered educational barriers for kids who do not have technology at home, (2) provided immersion experiences for kids who learn better in hands-on environments, and (3) encouraged collaboration among peers and individual critical thinking skills.

For teachers: STEAM resources provided access to (1) a variety of teaching tools that allowed for individualized instruction in large classrooms, (2) current information far beyond textbooks for lesson creation, and (3) skill development opportunities that transformed teaching methods and classroom management know-how.

Facebook has supported nearly $500,000 in total donations to the Rutherford County School District since 2013 to increase the technology resources available to students. The District has created classrooms that are student focused and support dynamic environments that prepare local youth for a competitive world. Kids, teachers, and parents alike are inspired and engaged. As a result, many stakeholders find Facebook's partnership "hard to quantify and way bigger than the funds themselves."

[6] RTI Interview with local stakeholder. March 4, 2020.
[7] Kepley-Steward, Kristy. ABC13 News. "Facebook grant provides $300,000 to Rutherford County School for S.T.E.A.M. initiative." November 16, 2019. Accessed: https://wlos.com/news/local/facebook-grant-provides-300000-to-rutherford-county-school-for-steam-initiative.

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