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# Tools for Investors and Startups to Reduce the Climate Impact of Cloud Computing

## Executive Summary

Much of the recent discourse on climate change in the tech and investing world has been on two solutions — *developing new tech-enabled solutions* to mitigate climate impact or *investing in them*. What isn't being discussed enough are the ways companies *can already make a difference today* **by addressing the enormous footprint of cloud computing and cleaning up their software supply chains**. In addition, due to *sharp decreases in the price of renewable energy and storage*, a cleaner software supply chain can also become a cheaper one that is ultimately better for the bottom line.

While there are many players in the tech ecosystem, including large companies and cloud providers, investors and startups have a particular ability to influence the cloud computing footprint. Investors are well positioned to have broad impact as they have direct influence on both their portfolio companies and the tech industry as a whole. Investors can and should contribute to the climate fight by asking their portfolio companies to address their climate impact. With investor support, startup founders can work to understand their carbon footprint, identify actions they can take to reduce it, and share their plans with employees and users.



# Background

## Where are we in the climate fight and why do we need to take action now?

To avoid the worst effects of climate change, scientific consensus from the United Nations Intergovernmental Panel on Climate Change (IPCC) states that [CO<sub>2</sub> emissions must decline 40 to 60 percent by 2030 \(and reach net-zero by 2050\) to keep our planet from warming more than 1.5°C](#). We are not on track to meet these goals today,<sup>1</sup> and hitting them will require significant and immediate change from all industries.

## What is the impact of computing and software companies on the climate?

Software is powering our modern economy. [Seven of the top ten most valuable companies in the world](#) are internet/software companies. While there has been [recent attention](#) placed on [cleaning up physical supply chains](#), we also need to turn our focus towards reducing the carbon footprints of software supply chains—by cleaning up the energy used to produce and transfer digital products, while moving to real-time use of renewable energy sources.

Global emissions from digital products and computing are [projected to reach 4 percent next year](#), while *cloud computing alone* accounts for over 2 percent of emissions today—equivalent to [all of aviation](#) (during normal operations). Software companies also pack a big punch: if placed on a list of the biggest U.S. cities, the annual emissions produced by just three companies (Amazon, Google, Microsoft) come in second, ahead of Los Angeles and Chicago.<sup>2</sup> And within software companies, data centers are the single largest sources of emissions and energy use (ranging from 70 to 88 percent), far exceeding other business operations such as offices and travel.<sup>3</sup>



### **How does the climate impact of energy consumption relate to its cost?**

There are several factors to consider when evaluating the climate impact of different energy sources: supply (the amount of energy that can be produced); demand (how much energy is needed by consumers); and the carbon intensity or emissions factor (emissions produced per unit of energy produced). Renewable energy sources such as wind and solar have low emissions factors, but widely fluctuating supply depending on the time of day and location. For example, solar energy is abundant during sunny days but nonexistent at night. Natural gas and coal have much higher emission factors (ranging 10–80x more than solar and wind<sup>4</sup>), but are not dependent on external factors and can increase production rates in real time to meet demand.

If looking at emissions alone, shifting energy consumption towards periods of the day where renewable energy sources are abundant will result in far fewer emissions. Renewables also compete well on cost: not only have some [renewable technologies reached cost competitiveness with conventional sources](#) like gas and coal, their costs continue to fall sharply. Therefore by shifting your energy sources to renewable energy (and ideally timing consumption to when renewable sources are most plentiful), you will save on both emissions and money.

### **What difference can software companies make?**

There are many actions software companies of all sizes can take to understand and reduce their climate impact. Large players that design, build, and manage their own data centers can take direct action by increasing their efficiency and shifting to purchases and production of renewable energy. Companies that rely on cloud providers or vendors to power their business and products can join coalitions to influence the computing industry. Startups and small companies that choose off-the-shelf cloud providers and software solutions can still have an impact by making changes now that will compound as they grow, and contributing as a larger group through collective action. Software companies that rely heavily on computing to run their businesses can have an immediate impact by building a better understanding of the real-time energy produced where they are, and



trying to adjust their consumption accordingly. All software companies can make a difference, regardless of their size.

*For more detail and examples of what different-sized software companies can do, see Appendix A.*

## Why Startups

Although often dismissed for being too small, or too focused on growth and survival to prioritize addressing their climate impact, startups can have a huge climate impact. Startups are more agile than large established software companies, and have the ability to change cloud providers and software vendors with limited disruption to their business. Moreover, any changes made early can quickly compound over time as startup products and companies scale.

Unfortunately, even startup founders who have a personal desire to take action lack the time, resources, and information to do so easily.<sup>5</sup> By giving them tools to make it simpler to understand and address their climate impact, meaningful individual and collective action is possible even without slowing down company growth.

## Why Investors

Investor choices shape the tech industry. By choosing which companies to invest in, and what questions to ask of their companies, investors influence the broader behaviors of the ecosystem. They can create positive incentives for founders to take the time to understand their climate impact, and support them in doing so by distributing information and tools to them at scale. By encouraging and accelerating the shift to lower-cost renewable energy, they are also improving the bottom line for the industry. Such activity can benefit investors as well; the move to renewable energy will decrease energy costs and improve the industry bottom line over time.



## Recommendations

Investors need to ask portfolio companies to assess their own climate impact and carbon footprint. Armed with the right tools and investor support, startup founders can do this assessment with minimal cost and still make meaningful changes.

### **Actions for startups:**

- ▶ Read the [Startup Climate Guide](#) to learn about the climate impact of your software supply chain (including cloud providers and software services), and identify concrete ways to measure and improve it;
- ▶ Use heuristics for employee travel, operating costs, and cloud operations to pull together a basic carbon footprint assessment;
- ▶ Learn from what other companies have done to identify actions to take to reduce that carbon footprint; and
- ▶ Share your work and encourage other startups to do the same.

For investors, the work doesn't stop even after individual startups take action. There are continued opportunities for investors to influence new companies while providing additional resources and keeping their portfolio companies accountable.

### **Actions for investors:**

- ▶ Review the results from the entire portfolio to identify trends and actions you can take as a firm. For instance:
  - ▶ Share the [Startup Climate Guide](#) and provide more advanced climate measurement services to startup founders; and
  - ▶ Learn from individual company results and invest in shared guides and toolkits for portfolio companies to use.
- ▶ Make climate an ongoing part of the conversation in quarterly board meetings and deal reviews. For instance:
  - ▶ Review climate impact reports and potential actions to take at regular board meetings; and
  - ▶ Discuss climate impact with new companies and incorporate their action plans into investment evaluation criteria.

# Conclusion

Taking actions to reduce the climate footprint of startups can have myriad positive benefits for the broader tech ecosystem. Companies who understand and are transparent about their climate impact can make immediate reductions, push the tech industry forward as climate stewards, and accelerate the movement towards renewable energy. Investors who support those companies can establish a baseline understanding of their own climate impact and identify systemic ways to help entire portfolios go green. This creates transparency for funders, while attracting (and retaining) environmentally-conscious investors and employees. It can also lead to second-order effects that go beyond computing, as collective action accelerates the move to cheaper and cleaner renewable energy production globally. Even small actions matter in the climate fight, and investors and startups have the unique opportunity to amplify their impact.



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### ABOUT THE HUB

The Aspen Tech Policy Hub is a Bay Area policy incubator, training a new generation of tech policy entrepreneurs. We take tech experts, teach them the policy process, and support them in creating outside-the-box solutions to society's problems.

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## Appendix A

### What can software companies do to reduce the carbon footprint of cloud computing?

**Cloud computing must shift to use renewable energy in order to reduce the industry's carbon footprint.** Different stakeholders can take different actions based on their size and market influence:

#### Software Companies Who Operate Their Own Data Centers:

Large players who design, build, and manage their own data centers can take direct action by increasing their efficiency and **shifting to purchases and production of renewable energy**. They can:

- ▶ Purchase renewable energy for direct consumption by choosing sites that produce clean energy, and leveraging power purchase agreements to increase the amount produced; and
- ▶ Design, build and operate efficient data centers.

#### Examples

- ▶ Both Google and Facebook have designed industry-leading efficient data centers and made significant commitments to renewable energy. According to data center efficiency measures (PUE), their data centers are 50 percent more energy efficient than the industry average.<sup>6</sup>
- ▶ Google and Facebook take the top two spots for [world's largest corporate buyers](#) of renewable energy, with Amazon and Microsoft also in the top ten.

#### Software Companies Who Can Directly Influence Cloud Providers:

Companies who **have significant computing needs and rely on cloud providers or vendors to power their business and manage data center operations** can take immediate action in two ways:

- ▶ Directly influence their cloud providers to shift to renewable energy (especially effective for the largest companies); and
- ▶ Join industry coalitions (such as Renewable Energy Buyers Alliance ([REBA](#)), [RE100](#), [EP100](#), etc.) to increase the collective bargaining power to influence supply-chain partners, utilities, and policy makers to adopt renewable energy.

## Examples

- ▶ Companies like Salesforce leverage the [Corporate Colocation Buyers Principles](#) to clean up their data centers through better procurement guidelines, information requests, and joint advocacy.
- ▶ In Virginia last spring, companies such as [Akamai](#), [Apple](#), [LinkedIn](#) and [Salesforce](#) signed a [joint letter to Dominion](#) (who has monopoly control of the state's retail energy market) to advocate for investing in renewable energy and storage, instead of its current plan to build gas-fueled power plants.

## Software Companies Who Rely On Cloud Providers:

**Startups and small companies who choose off-the-shelf cloud providers and software solutions** can still have an impact by making changes now that will compound as they grow, and contributing as a larger group through collective action. They can:

- ▶ Review company reports and apply climate-impact criteria to their evaluation and communication with cloud providers and software vendors; and
- ▶ Increase their understanding by asking for more transparency from companies that don't currently disclose or take climate action.

## Examples

- ▶ In 2018, [Shopify](#) decommissioned their data servers and shifted entirely to [Google Cloud](#), reaching carbon neutrality due to Google Cloud's commitment to 100% renewable energy.
- ▶ Toronto-based startup [Lending Loop](#) committed to [migrating their Amazon Web Services servers to 100% carbon neutral regions in 2020](#) and switched their transportation benefit to use [Lyft](#) which offsets their rides.

## For All Software Companies:

**All software companies who rely heavily on computing to run their businesses** can build a better understanding of the real-time energy produced where they are, and try to adjust their consumption accordingly. Specific actions will depend on the emissions factors and energy constraints of each region, but here are some ideas:



- ▶ Research the local energy system of your home office or major data center locations. In California, the [California ISO publishes information](#) on daily prices and demand.
- ▶ Match high-demand (e.g., data analysis, machine learning processes) or scheduled actions (e.g., nightly report generation, load tests) with times where clean energy is most plentiful.
- ▶ Model this understanding of real-time energy impact with company events, such as by hosting “solar-powered hackathons” where increased development and computing time is synchronized to match with clean energy availability.

## References

- 1 In the [IPCC Special Report: Global Warming of 1.5° C](#), FAQ1.2 (How close are we to 1.5° C?) shows that based on the current warming rates, we are on track to exceed 1.5° C by 2040.
- 2 This figure was calculated from averaging the total annual emissions reported by Amazon (2018), Google (2019) and Microsoft (2019), using an average American per-capita emission amount of 16.5 tCO2e per year, and comparing those amounts to the 2018 populations of US cities. See: [World Bank average US per capita emissions](#) and [List of United States cities by population](#).
- 3 Data centers are some of the most energy-intensive buildings around, consuming [10 to 50 times the energy per floor space of a typical commercial office building](#). For companies who have reported on this topic, data centers are the single largest consumer of energy and producer of emissions across their operations.

Data Center Operations (% of Overall Energy Consumption or Emissions Produced)				
Etsy (2017)	Salesforce (2019)		Shopify (2018)	Microsoft (2019)
70% Energy	88% Energy	70.93% Emissions	73.88% Emissions	80.71% Emissions

- 4 [50th percentile emissions factors \(g CO2 equivalent per kWh of energy\)](#) show wind (12) and solar photovoltaic systems(46) have far lower rates than those of natural gas (469) and coal (1001).
- 5 From a [climate survey of 15 early-stage startups](#) conducted from February through March 2020, we saw a clear gap between wanting to take action and having the information and knowledge to do so. Only one company of those surveyed had taken deliberate action to reduce their footprint through their software choices by migrating their cloud provider (AWS) to clean regions.

Startup Climate Survey Results				
60% – Don't know what their footprint is at all (40% had some knowledge)	87% – Interested in taking action to reduce it	73% – Would invest in energy efficiency	47% – Would change what goes into their supply chain	40% – Would change development practices or software tools

- 6 [Google](#) and [Facebook](#) have data center power usage effective (PUE) measures of around 1.11 and 1.10 respectively, which is much better than the [industry average of 1.67 in 2019](#).