




FURTHER / FASTER

Google Sets Its Sights on
24/7 Clean Energy to
Power Its Global Supply



In the Venn diagram of energy and technology, American utilities and one Mountain View, California company, are facing the same problem: how to power consumers' increasingly digital lives with the least impact on the grid and the environment. With more than fourteen data centers in North America, and nine locations in Europe, Asia, and South America, Google understands the sheer scale of decarbonizing the global electricity supply as it sets its sights on delivering carbon-free energy for every hour, of every day, at every location.

Enter Michael Terrell, Google's Director of Energy.



A descendant of Alabama coal miners and a graduate of Yale's School of Forestry and Environmental Studies and the University of Michigan's School of Law, Michael has been carefully studying the intersection of technology, energy, and conservation since his days with the Clinton administration.

A believer in the idea that you don't have to recreate the future from scratch, Michael sits down with ILLUME Founder, Anne Dougherty to talk about Google's vision to turn one plant into a data center, and how uncovering embedded value in the nation's existing utility infrastructure might just hold the key to our industry's just transition.

Anne Dougherty: *We bring many aspects of our histories and our stories to the work we do. What brought you to your climate work and how does that history inform the work you are doing with Google today?*

Michael Terrell: It's a long story, but my family was in the coal business. My grandfather, my dad, my uncle, and I ran a coal mining company in Alabama where I was born and raised. I spent a lot of time at the strip mines when I was a kid which led to an interest in rocks. I majored in Geology and Forestry in college and spent my summers working for the U.S. Park Service and Forest Service in the Western United States. I became interested in the intersection of national resource policy and public policy, which led me to Washington, D.C. where I worked in the White House for several years. This was an incredible experience that exposed me to Al Gore and his climate advocacy, which was incredibly compelling even back then. I also got a lot of exposure to the scientists and folks who were working on these issues. Not only did I come from a family that was in the coal business, but I came from a family with a lot of entrepreneurs. I wanted to recapture that business spirit, which led me to Google. I have a strong interest in solving big problems, like climate change, and am enthusiastic about the private sector's ability to build and scale new solutions to help us do that. The opportunity I have at Google allows me to mix those things.

Along those lines, you have worked to procure six gigawatts (GW) of power for Google. You are also moving to 100% renewable or clean energy for 24/7 for global energy supply for Google. What are the fundamental principles that are guiding your strategy and moving you in the direction you are moving in?

MT: We are a very large electricity consumer and we have looked at how to tackle emissions associated with our electricity consumption. We initially started doing this by purchasing carbon offsets and then we set a goal to match 100% of our annual electricity consumption with renewable energy purchases. That's what's helped us to procure over six GW of renewables. Now we're moving to the next step, which is to buy carbon free *energy for every hour, of every day at every location*—what we call 24/7 carbon-free energy—the last step in this journey. We set a goal to achieve this by 2030.

In terms of the how, I've been involved with just about every Google energy initiative since the beginning. And we have found that when you approach it from the perspective of trying to solve fundamental challenges in the business, this can give you a path for new approaches that you can then scale. This is how we approached our electricity purchasing and move to renewable energy. We saw the challenge as one that we needed to solve as part of our electricity supply for our data centers around the world. We started talking to our utility suppliers, renewable energy developers, and others in the energy industry looking for solutions we could put in place that were directly related to how we supply our data centers with electricity. That helped guide us to look for solutions that are grown out of the business, and solutions that can help solve these problems that make business sense and can be scaled. We worked with our CFO to structure these deals in a way that made sense for the business and in a way that we could scale across the business. Because of this we have been able to go further and faster than we even thought we could.





Google has a truly global geographic reach and the energy demanded by this reach is incomparable. How do you think about the scale of your work?

MT: Ultimately, we want to transition the entire global energy system, which is a huge challenge. For a company of our scale, we're looking at gigawatt scale solutions as we have operations all over the world. That piece is particularly challenging because as people in the electricity industry know, there is an incredible amount of variation in the market structures and the market dynamics from a place like Singapore to a place like Iowa to a place like Belgium. We are working all around the world trying to work at large scale to drive solutions in the space.

Are there any policies that Google would like to see move forward to further your efforts?

MT: As many of your readers know, policy plays a huge role in the direction of the energy future, and it's certainly an area where we have been very heavily engaged for a long time. In terms of policies, we started with breaking down barriers to allow corporations to procure renewable energy on their own. We found that in many markets where we operated, the utility provider didn't offer a carbon-free solution and we were not allowed to procure one. We worked to change the laws in places like North Carolina and Georgia where we have set up purchase programs with the utilities and the regulatory commissions. In Taiwan we worked to change the law to allow corporations to purchase clean energy, and now you see Google and other companies doing that in those markets. That was how we got our start.



But obviously if you want to tackle this program and move the grid towards greater decarbonization, you need to look at a whole suite of policies. There is no one silver bullet. That includes internalizing the externalities associated with greenhouse gas emissions through, for example, the price of carbon. Also, this includes looking at how we can deploy clean energy technologies faster, and what incentive programs or other mechanisms can be put in place to do that. We need to reform the energy markets themselves. One of the things we found is that there is lots of value in managing grids on a regional scale through competitive markets. That really helps to bring more players into the market and manage the variability of renewables over large areas—the regionalization of energy markets, per se. Finally, you have empowering energy consumers, giving buyers a path to clean energy who want to be there now. The more we can empower energy buyers, the better.





Your work to convert coal plants to data centers, specifically your work with TVA, changed the way I thought about the challenge. We often think about transitioning economies as a one-for-one endeavor, from say coal to renewable energy generation. In this model, we fail to think in terms of replaceable economies or opportunities. As we transition to carbon neutral energy sources, channeling the creativity Google brought to bear on the TVA project, are there certain ways we need to shift our thinking or change the way that we are conceiving of the problem in order to better address the challenge in front of us?

MT: We don't have to build the future completely from scratch. We have a strong foundation from which to build. We certainly saw that in the case of the data center in Alabama. When I was standing on the ground at that site with a large coal plant, a very large switchyard, a large transmission infrastructure, it reminded me of standing onsite at a Google data center which also has large infrastructure, substation, transmission...that sort of thing.

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I'm wondering if you can indulge me in taking part in a 'blue sky' exercise. What's next for Google after you accomplish 24/7 renewable generation?

MT: I've been in this space for 25 years. And what's most exciting is that the future seemed very, very far off. And the future is now. We're starting to see changes in the energy space that have only been talked about in theory for a long time. We're seeing transformation from all angles: whether it's clean power generation, whether it's energy storage, whether it's the way we deliver and manage power, whether it's smart electricity use, and flexible demand, whether it's electric vehicles. It's just an exciting time. This is an area where you have those opportunities and where I think it could lead to a lot of improvements. On the one hand, change can cause apprehension, but because of the challenges we're facing with climate change and needing to continue to grow the economy and have growth and opportunity for everyone, I'm super optimistic about the opportunities that are in front of us. We're starting to see the fruits of a lot of investment and a lot of hard work starting to translate into real tangible changes.





Embedded Value:

How the energy sector can leverage existing infrastructure and mental models to transition economies

In 2018, Google invested \$600 million to convert a coal plant into a data center in Jackson County, Alabama. This resulted in over 100 jobs in a variety of full-time and contractor roles, including computer technicians and engineers, as well as various food service, maintenance, and security roles. Michael Terrell explains how the company breathed new life into a community sitting atop aging utility infrastructure.

“We found that there are decades of embedded value in the system that don’t have to be completely lost and can be transformed into something new. The [Alabama] site was in a very robust section of the power grid with infrastructure that we could utilize and take advantage of. It was a win-win-win for us, the utility, and the community.”

This is a game changer because the energy industry often thinks about transitioning economies as a one-for-one exercise (i.e., from coal to renewable energy generation) rather than thinking in terms of replaceable economies or opportunities for those jobs or positions. So, we asked Michael to share a few lessons from the Google experience that can be replicated by energy suppliers, like utilities, and non-traditional entities.

Have an openness to change.

“We operate in a very dynamic environment that is changing all the time (and faster than ever) because of the pace of technology. Lean towards change and keep an open mind.”

Work with new partners to drive the future you want to see.

“Welcome the notion that there are so many new players in the energy space now that bring ideas, and technologies, and opportunities that didn’t exist even ten, twenty years ago. From long time players in the industry to new entrants, I think it’s the alchemy of all of that working together that is so exciting.”

Think of leveraging value as a ‘long play’.

“We redeveloped industrial sites in Oregon, Ohio, and Finland. It takes a little bit more time and effort, but the return is also greater. Getting back to policy, we should be looking for ways to harness the value of these sites and repurpose them for the future because there is an enormous amount of opportunity there. Not just for data centers, but for other uses.”

Are there any specific emerging technologies, innovations, or ideas that really excite you at this moment? Are there things that you find particularly inspirational?

MT: If you had told me ten years ago that we would have opportunities to purchase carbon-free energy in places like the Southeast United States, and for prices that are competitive with grid power, I would have not believed it. We've seen historic cost declines in existing technologies like wind and solar. Now you are starting to see cost curves apply to battery storage and it's creating a lot of opportunities. Also, we're seeing emerging technologies in the power generation space. Whether it's large utility-scale storage, or long multi-day, long duration storage, or green hydrogen or carbon capture, or advanced nuclear—these are interesting opportunities. On the demand side we started shifting our data center loads around, not only in time but in space. We have also rolled out a new product for Nest thermostat customers that helps them manage their energy more intelligently, so lots of technology opportunities on the demand side. We're using machine learning to optimize the cooling in our data centers and to help us manage our wind portfolio in the United States. I think there are lots of exciting developments that are hopefully going to scale and are going to help us realize this future that we have all been driving toward.

Google has tremendous brand influence. How do you rally the private sector to join you in this decarbonization effort?

MT: What is so interesting about the business community and the opportunity to help solve problems like climate change, is that we all intersect the economy in different ways. It's fascinating how if you look and really dig deep and examine where your business or where your technology intersects the economy, that you can really go big in that way. Google was a large power consumer, so we really leaned in on that area to try to see how we could transform that element of our business and, in doing so, bring a lot of others along with us.

We've now seen the corporate renewable energy purchasing space go from just us and a couple of other players, to now hundreds of companies and tens of gigawatts of annual corporate purchase agreements. Now we're looking at our platforms, whether it's Nest thermostats, or it's our information technology platforms. This notion of getting the electricity system to 24/7 carbon free, it's not a pipe dream anymore. It's something that's possible. And there are already several electricity grids around the world where we operate data centers where already over 90% of the hours of the year are carbon free.

So how can we take that further, faster? Through the 24/7 carbon free energy compact, a partnership amongst Google and other companies and organizations and the United Nations to rally people to this goal of 24/7 carbon-free energy. Because the technology and technology pathways, and the market pathways are there in a way they have never been there before. And we think it's achievable. We think it's achievable sooner rather than later.

My advice for companies is to focus on your intersection with the economy and how you can drive change for your own business and your own space, but also for everyone. Because if we all do really well at the things that we are good at, then we can lead to a lot of positive change. ■





Michael Terrell is the Director of Energy at Google where he leads global strategy and 24/7 carbon-free energy initiatives for Google's data centers and global energy portfolio. In this role, he has advanced new approaches to Google's procurement of over 6GW of renewable power, pioneered groundbreaking renewable energy purchase programs, and delivered landmark projects such as converting coal plants to data centers. Michael is a regular lecturer on climate and energy at Stanford University and serves as Board Chair of the Renewable Energy Buyers Alliance. Prior to joining Google, Michael worked in energy and climate law and policy. He held several roles in the federal government, including the White House Council on Environmental Quality, where he helped guide U.S. policy on energy and environmental issues. He holds a JD from the University of Michigan, a master's degree from Yale University's School of the Environment, and a BS from the University of the South.

