

the past two years and says both demand and competition are now growing. A typical system generates about 1 kilowatt. “People like this system because it has no noise and has no effect on the environment, especially small stores that don’t need a high amount of energy to turn on their lights, TVs, and other devices,” he explains.

Longer-lasting lithium batteries have eclipsed lead batteries in many energy storage markets, but ABB Group microgrids specialist Rob Roys says lead varieties may be a better fit for Iraq, with its daily power outages. “Lead-acid batteries do better when deep cycled” or substantially discharged and recharged, explains Roys.

Solar systems cost many times more than a generator up front but actually deliver cheaper energy because they consume zero fuel, according to Ramyar Ali, assistant manager for Aras Green Energy, a four-year-old renewable-equipment firm based in Sulaimani.

According to the International Energy Agency, power from generators burning government-subsidized fuel costs Baghdad residents 17 to

25 cents per kilowatt-hour. The Abu Dhabi-based International Renewable Energy Agency, meanwhile, recently estimated that rooftop PV in Germany was already generating power for 16 to 18 cents per kilowatt-hour two years ago.

Utility-scale solar and wind plants could someday also supplement the oil- and gas-fired generation that supplied 96 percent of Iraq’s grid power in 2015. Large solar plants are particularly attractive, say experts in Iraq, since they are relatively quick to build and can supply peak usage in the summer, when air conditioners drive demand furthest beyond the national grid’s limits.

But Samad Hussain, a top environmental official in the Kurdistan Regional Government in Erbil, says international firms that finance and build renewable power plants are apprehensive about security threats in Iraq. They also worry about getting paid, he says, because many Iraqi consumers do not pay their government power bills.

Othman Hama Rahim, a renewable-energy researcher at the Kurdistan Institution for Strategic Studies and Scientific Research, cites several domestic challenges to incorporating more renewables into Iraq’s energy mix. One is dust storms, which may necessitate regular cleaning of solar panels. Another is that Iraq’s energy leaders remain focused on exploiting its fossil fuel resources. As Hama Rahim puts it: “We have oil. This is another factor retarding renewable power generation here.”

—PETER FAIRLEY

➔ **POST YOUR COMMENTS** at <https://spectrum.ieee.org/iraqsolar0618>

# TECH GIANTS RACE TO BUILD ORBITAL INTERNET

**Public filings suggest Facebook is quietly developing a satellite-based Internet to rival efforts by SpaceX and OneWeb**



**Facebook may soon join** SpaceX and OneWeb in the rush to deliver the Internet from orbit.

A recent filing with the U.S. Federal Communications Commission (FCC) revealed details of a multimillion-dollar experimental satellite from a stealthy company called PointView Tech. The satellite, named Athena, will boast a data speed 10 times as fast as that of SpaceX’s Starlink Internet satellites, the first of which launched in February.

However, PointView appears to exist only on paper. In fact, the tiny company seems to be a new subsidiary of Facebook, formed last year to keep secret the social media giant’s plans to storm space.

Many technology companies believe the future of the Internet is orbital. Around half the people on the planet lack a broadband Internet connection. SpaceX aims to put nearly 12,000 Starlinks into low Earth orbit (LEO), to deliver gigabit-speed Internet to most of Earth’s surface. Rival OneWeb, funded by Japan’s SoftBank, chipmaker Qualcomm, and Richard Branson’s Virgin Group, plans similar global coverage using perhaps 2,500 LEO satellites.

In early 2019, PointView’s Athena will also head out to LEO, on an Arianespace Vega rocket. Athena is about the same



PETER FAIRLEY



size and weight (150 kilograms) as SpaceX's and OneWeb's satellites, but Athena will use high-frequency millimeter-wave radio signals, which promise much faster data rates. The company estimates that its system, which will operate in the E band (from 60 to 90 gigahertz), will deliver data at download speeds of up to 10 gigabits per second, with uplink speeds topping 30 Gb/s. PointView now wants to find out if that system could provide fixed and mobile broadband service to underserved areas, according to its FCC application.

Space companies based in the United States must get permission from the FCC before launching any technology into orbit, and they often start building satellites and ground stations long before filing the paperwork. According to records in Delaware, PointView was incorporated there in April 2017. The company has filed no annual reports and has no named directors or shareholders. Instead, a paper trail leads to Facebook, in California.

To start, PointView Tech has the same corporate agent in Delaware as other Facebook subsidiaries, including FCL Tech, the company that managed its early connectivity tests. PointView's

application to the FCC was also filed by the same Washington, D.C., law firm—and even the same lawyer—that wrote previous FCC applications for Facebook. (Neither the law firm nor Facebook responded to requests for comment).

PointView specifies in its application three ground stations in the Los Angeles area that will send data to Athena in orbit and receive it in turn. One is a so-called satellite teleport near Ventura that is shared by a number of satellite companies. The second is Mount Wilson Observatory, in the hills above L.A., another popular site for communications hardware.

But the third location, described in the application as housing a backup antenna, is an anonymous business park in the Northridge area of the city. Facebook was reported to have leased nearly 7,500 square meters of office space there in October last year, and the building is currently undergoing refurbishment.

In May, Facebook listed three job openings for its Northridge office, all related to communications and connectivity. An extraterrestrial product manager, for instance, is expected to have “in-depth technical knowledge of satellite [and]...millimeter-wave communication systems.” One current Facebook

staff member's LinkedIn profile says that he is working on “millimeter-wave communication product design & development” for satellites.

Facebook has long been interested in millimeter-wave systems. As early as 2015, FCL Tech filed an FCC application to “test potential new communication applications using the E band” from drones, in and around Los Angeles. In 2016, Facebook and its global connectivity spin-out Internet.org announced the first flights of its high-altitude solar-powered Aquila drones using E-band technology, and tests continued through 2017.

The company has also been thinking about satellites. In a 2016 letter to the FCC, the company wrote, “Facebook recognizes the important role that satellite plays in improving and expanding connectivity.... In remote, sparsely populated areas, where there are significant gaps in infrastructure and the economic barriers of installing that infrastructure are considerably higher, satellite services may provide the most efficient means to connect.”

There are technical barriers to using E-band radio from orbit, however. High-frequency millimeter waves fade quickly and are easily absorbed by rain and particles in the air. Part of Athena's two-year mission will be to determine just how big of a problem that is. “PointView plans to publish many of its experimental findings,” including measurements of atmospheric attenuation, says its application.

And because Athena is in low Earth orbit, it will fly above the three ground stations only a couple of times each day, and for less than 8 minutes at a time. If Facebook is serious about providing global connectivity, it will need to copy SpaceX and OneWeb and have thousands of satellites in orbit simultaneously.

—MARK HARRIS

*An extended version of this article appears in our Tech Talk blog.*

➤ **POST YOUR COMMENTS** at <https://spectrum.ieee.org/secretinternet0618>