The countries in the region have lots of sunlight and stand to gain from cheaper freshwater, given the dearth of local sources. Switching to solar also means they could export more oil for US $65 a barrel, instead of selling it to desalination plants for subsidized prices.

Renewable energy “actually is cost competitive” for some remote desalination plants, says engineering researcher John Lienhard, of MIT. But for others, that calculation depends on the type of solar power used and the kind of desalination that occurs there.

Concentrated solar power (CSP), which uses circles of mirrors to direct sunlight toward a solar tower filled with thermal salts, generates electricity more consistently. It can also store heat for several hours, which certain types of desalination plants can use to evaporate saltwater.

PV is less than half the price of CSP during the day, but it produces only electricity—not heat. That makes PV a better fit for reverse-osmosis desalination than for evaporation techniques.

However, the Persian Gulf and the Red Sea are so saline that desalting seawater may drive up electricity costs for reverse osmosis. In such places, evaporative desalination paired with CSP might be best because the costs of evaporation do not increase with salinity.

In fact, the Saudi government announced plans a few years ago to build 25 gigawatts of CSP capacity by 2032, and a 2015 study concluded that combining CSP with evaporative desalination could make sense in the Middle East and in the U.S. Southwest. But nobody has put any solar technology into commercial desalination practice.

The original contractor on the Al Khafji site, which was designed to perform reverse osmosis using solar PV, narrowly avoided bankruptcy. SWCC divided the project into parts, handing the solar-PV component to one contractor and the desalination part to another. In the end, the desalination plant might run on the grid instead of on solar.

The setback has not fazed the Saudi government. In March, King Abdullah Economic City, in Saudi Arabia, broke ground on its own solar-PV–powered desalination plant, which will also lean on the grid.

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—LUCAS LAURSEN

The medical professionals tasked with caring for our minds don’t have an easy job. To diagnose people with neuropsychiatric diseases, doctors can perform brain scans, but such scans are expensive and the results are sometimes inscrutable. The other options include conducting time-consuming cognitive tests, or relying on doctors’ own subjective analyses.

Seeing an opportunity, a number of startups have devised quantitative methods to diagnose diseases or assess mental health while patients complete routine activities, like talking on a smartphone, typing on a keyboard, or scrolling through a website. Here are three companies that say they can lift the “fingerprints” of mental disorders from people’s mundane behaviors.

MINDSTRONG HEALTH

This Silicon Valley company began by collecting reams of data from smartphone sensors and usage logs in a clinical study with help from researchers at Stanford University. Many psychiatrists have wondered if data about a patient’s movements and social activity can provide a window into mental health—for example, a person who stays in one place and doesn’t call anyone might feel isolated and depressed. But cofounder and CEO Paul Dagum says that such data hasn’t proved predictive.

“My days are really busy,” he says. “On a Saturday, when I’m not getting any calls or emails and I’m in my living room reading a book, I’m not depressed—I’m actually very happy.”

Mindstrong found clearer signals in the rhythms of a person’s typing and scrolling on a smartphone screen—data that can be gathered from people’s everyday activities. “These human-computer interactions...
interactions, measured in millisecond response times, are predictive of a person’s cognitive and emotional state,” Dagum says.

Mindstrong’s technology is already being used in pharmaceutical companies’ trials for drugs targeting schizophrenia and depression; changes in test subjects’ metrics indicate their response to medication. The startup is also working on several clinical projects. In the Aurora study, 12 hospital trauma centers are offering patients the Mindstrong app upon discharge, so that physicians can monitor them for signs of post-traumatic stress disorder. And in an upcoming study of postpartum depression, 4,000 women will be proffered the app during visits to their obstetricians.

**NEURAMETRIX**

From San Francisco comes a startup focused on typing cadence—how long people hold down each key, and how long it takes them to move their fingers from one key to another. Data that can be harvested by looking at keystroke combinations provides a unique signature for an individual, says CEO Jan Samzelius. Doctors can then keep an eye out for changes that may indicate trouble.

“We don’t care how fast people type, or if they hunt and peck,” Samzelius says. “If you’re healthy, you should be incredibly consistent over all times of day, all days of the week, because the habit is hardwired into your brain. But when the brain gets attacked by disease, that wiring starts to break.”

Samzelius hopes this measure of brain health will first be used to manage care for people with Parkinson’s disease, depression, and Alzheimer’s disease. These disorders all change typing cadences in particular ways, he says, citing an internal study about Parkinson’s that he claims distinguished patients from healthy people with 99.9 percent accuracy.

NeuraMetrix wants health-care providers to use its app to monitor patients’ conditions, and it’s also offering an app directly to consumers. That consumer app doesn’t provide an evaluation, a feature that could have gotten the company in trouble with government regulators. “At the moment, the app just says, ‘Here’s your consistency score,’” Samzelius says. It also shares the typical score range for a healthy person—and lets users draw their own conclusions.

**WINTERLIGHT LABS**

The third startup, Toronto-based WinterLight, takes samples of a person’s speech to help clinicians diagnose and monitor Alzheimer’s patients. Cofounder Liam Kaufman says the company originally considered more than 400 variables that could be drawn from speech. Then it used statistics to narrow the field to the 30 or 40 variables most useful in recognizing the signature of Alzheimer’s. Other variables may prove helpful for other disorders, such as depression and schizophrenia.

Kaufman says that the traditional cognitive test for Alzheimer’s is a pen-and-paper test administered in the clinic by doctors. With WinterLight’s technology, patients could routinely record their own speech at home, and the company’s algorithms would raise a red flag if they detect worrisome changes.

The company is initially selling its app to pharmaceutical companies searching for Alzheimer’s drugs; no medication yet exists to stop the disease’s progression. With drug development costs in the billions, Kaufman says, “these companies are looking for new ways to monitor response to therapy that are quicker and more reliable.”

Another version could be used in senior-care homes. The cognitive assessments used in these facilities today “create a lot of anxiety,” Kaufman says, because many patients know when they’re flunking a memory test. People being evaluated through the WinterLight system simply describe what they see in a picture. “It’s less obvious that there’s a right answer,” he says, “so people don’t get stressed out.”

—ELIZA STRICKLAND