In the U.S., approximately 6.6 million kilometers of black top crisscross along the entire country. In China, 4.2 million kilometers establish the global power as the second largest road network in the world. All these many miles of blacktop remain motionless throughout the day, absorbing an incredible amount of heat and light. This energy finds no outlet, instead welling up only to cool again as the crisp night air ushers in a sky as black as the streets. In short, the streets form a nationwide grid that absorbs solar energy that is put to no use. The combination of expanding roadways, cheaper solar cells, and environmental trends make the decision to implement solar energy roadways an easy one.

The idea has been around for only a short time. Contractors refer to the technology as "photovoltaic pavement." It has found use in parking lots, driveways, highways, streets, and even recreational paths. In 2013, students at George Washington University's Solar Institute partnered with Onyx Solar to install a walking path through campus. Onyx, a Spanish solar firm, maintains a large presence in the solar research community, partnering with universities such as MIT, the Technical University of Madrid, and the University of Barcelona. George Washington University called this project "solar pavement." Similar efforts abound, with SolaRoad in the Netherlands and even an alternative implementation that uses the solar energy to heat homes' water. Even local companies like Solar Roadways, a company run out of Idaho, see the enormous opportunity offered by a nationwide network of sun-drenched surfaces. Solar Roadways currently has a project under development to replace current parking lots, driveways, and roads with photovoltaic cells in order to generate electricity.

While the concept of photovoltaic pavement only originated within the past several years, the first implementation had already arrived by 2016. In Tourouvre Orne, France,

the Societe Nouvelle Aeracem created "Wattway," their first attempt at a solar street. The one kilometer stretch of pavement only opened to traffic on December 22. In theory, the short bank of cells will provide enough power to illuminate the town's streetlights. The panels that make up this French prototype consist of three layers. First is the road surface layer, constructed of high strength photovoltaic cells which attract solar rays. It also has a degree of traction to prevent tire slipping. Second is the electronic layer, which contains a miniature processor board that heats up the panels during snowfall. This layer detects the weight of snow atop it and adjusts the amount of heating accordingly. Third is the base plate layer, which distributes the collected power to the grid so that it can either charge electric vehicles or make its way into homes.

This brand new technology deserves all of the attention that it can muster. With 0.2% of the earth's surface now covered by pavement (it doesn't sound like a lot, but trust me, it is), we have seldom seen an opportunity so drastic to affect widespread environmental energy production. The incredibly steep drop in the price per watt of solar energy merely increases the tantalizing appeal of widespread adoption of this technology. In 1977, solar energy cost about $77 per watt. Today, solar energy has dipped to a staggering $3 per watt. After tax incentives, that price drops even further to $0.64 per watt.

Now that we've identified that the potential to create energy is enormous and the cost of solar is ever decreasing, the only step left is to figure out how to best use it. Fortunately, many different groups have already begun to mull this one over. The Korea Advanced Institute of Science and Technology has started developing an Online Electric Vehicle, which has electrical circuits embedded into the street in order to use the harvested solar energy to power vehicles by electromagnetic induction. While this certainly isn't the

first implementation of Faraday's concept, it does allow one to charge electric vehicles without fumbling about for a socket. Other companies have sought to use the power generated to create luminescent road markings that charge during the day then discharge gradually via a capacitor during the night.

Speaking of capacitors, the addition of the Tesla Powerwall adds yet another advantage to smart roadways. Should a house have panels on its roof as well as its roads, it will receive ample energy throughout its day. All it needs now is a large enough capacitor to mediate the energy storage and consumption throughout the night. Enter the Powerwall. It is a rechargeable lithium-ion battery station manufactured by Tesla. With enough power, the device allows users to live entirely off the grid. Enthusiasm of the technology has grown tremendously. The initial run of power packs sold out for the next year, earning the company over $800 million. As of last October, Tesla had deployed nearly 300MWh of its batteries, helping its customers store power from a variety of sources.

The average American consumes about 901 kWh per month. A typical rooftop solar system generates about 701.5 kWh per month. If solar roadways were able to make up the deficit, it is not unrealistic to anticipate that within the next decade micro-grids and independently powered homes could become the norm, eliminating the need for mass power production at all.

This technology has the potential to make each and every home green by reducing their reliance on the electric grid. By raising a portion of their energy needs from the sunlight harvested by pavement, homes will reduce their ecological impact drastically. This will reduce electricity costs for both the consumer and the planet. The only obstacle that solar roads must hurdle before widespread adoption is cost. Though the price of panels has

dropped immensely, smart pavement sill costs a pretty penny. The Missouri Department of Transportation constructed a test zone for the technology at a rest stop along route 66 in winter of last year. While only covering about 200 square feet of sidewalk, the project cost the department $100,000. Covering the entirety of the American road network would be a bold undertaking. As the expenses continue dropping, however, expect "solar roadways" to find its way into more and more environmental debates.