records, the Intergovernmental Panel on Climate Change (IPCC) issued its latest report. For the first time it estimated an emissions budget for the planet—the total amount of carbon we can release if we don't want the temperature rise to exceed 2 degrees Celsius (3.6 degrees Fahrenheit), a level many scientists consider a threshold of serious harm. The count started in the 19th century, when the industrial revolution spread. The IPCC concluded that we've already emitted more than half our carbon budget. On our current path, we'll emit the rest in less than 30 years.

Changing that course with carbon capture would take a massive effort. To capture and store just a tenth of the world's current emissions would require pumping about the same volume of CO₂ underground as the volume of oil we're now extracting. It would take a lot of pipelines and injection wells. But achieving the same result by replacing coal with zero-emission solar panels would require covering an area almost as big as New Jersey (nearly 8,000 square miles). The solutions are huge because the problem is—and we need them all.

"If we were talking about a problem that could be solved by a 5 or 10 percent reduction in greenhouse gas emissions, we wouldn't be talking about carbon capture and storage," says Edward Rubin of Carnegie Mellon University. "But what we're talking about is reducing global emissions by roughly 80 percent in the next 30 or 40 years." Carbon capture has the potential to deliver big emissions cuts quickly: Capturing the CO₂ from a single thousand-megawatt coal plant, for example, would be equivalent to 2.8 million people trading in pickups for Priuses.

The first American power plant designed to capture carbon is scheduled to open at the end of this year. The Kemper County coal-gasification plant in eastern Mississippi will capture more than half its CO₂ emissions and pipe them to nearby oil fields. The project, which is supported in part by a DOE grant, has been plagued with cost overruns and opposition from both environmentalists and government-spending hawks. But Mississippi Power, a division of Southern Company, has pledged to persist. Company leaders say the plant's use of lignite, a low-grade coal that's plentiful in Mississippi, along with a ready market for its CO₂, will help offset the heavy cost of pioneering new technology.

The technology won't spread, however, until governments require it, either by imposing a price on carbon or by regulating emissions directly. "Regulation is what carbon capture needs to get going," says James Dooley, a researcher at DOE's Pacific Northwest National Laboratory. If the EPA delivers this year on President Obama's promise to regulate carbon emissions from both existing and new power plants—and if those rules survive court challenges—then carbon capture will get that long-awaited boost.

China, meanwhile, has begun regional experiments with a more market-friendly approach—one that was pioneered in the U.S. In the 1990s the EPA used the Clean Air Act to impose a cap on total emissions of sulfur dioxide from power plants, allocating tradable pollution permits to individual polluters. At the time, the power industry predicted disastrous economic consequences. Instead the scheme produced innovative, progressively cheaper technologies and significantly cleaner air. Rubin says that carbon-capture systems are at much the same stage that sulfur dioxide systems were in the 1980s. Once emissions limits create a market for them, their cost too could fall dramatically.

If that happens, coal still wouldn't be clean—but it would be much cleaner than it is today. And the planet would be cooler than it will be if we keep burning coal the dirty old way.
Part two | The visible impacts

The world gets huge amounts of energy from coal—and puts huge energy into extracting it from the ground. The carbon that ends up in the atmosphere is just a ghostly echo of an industry of monumental scale and impact.
It burns nearly half the world’s coal, mostly to support a 13-fold increase in electricity generation since 1980. Demand is still growing. So is public outrage over the filthy air in Chinese cities, which has been linked to 1.2 million deaths a year.
SHUOZHOU, CHINA

Amid the withered stalks of last year's corn, a farmer prepares for spring near a power plant in Shanxi Province. The facility, which supplies electricity to Beijing, 200 miles away, covers local fields, crops, and people with soot.
MADISON, WEST VIRGINIA
They call it mountaintop removal. For each ton of coal taken from the Hobet 21 mine, 20 cubic yards of mountain are blasted away, then dumped in valleys. Hundreds of square miles of Appalachian ridges have been dismantled that way.
NORFOLK, VIRGINIA
At the Lambert's Point Coal Terminal, railcars loaded with coal line up to fill waiting ships. Some 20 million tons of coal—about 2 percent of U.S. production—move through this terminal each year, most of it from Appalachia.
WRIGHT, WYOMING
The Black Thunder mine, one of the world's largest, covers 75 square miles of public and private land. Trucks the size of houses haul more than 90 million tons of coal a year to trains, which carry most of it to eastern power plants.
INDIA

It has 300 million people without electricity and the fifth largest coal reserves in the world. The pressure to produce coal is taking its toll on miners, many of whom work in illegal and enormously dangerous mines.
JHARKHAND, INDIA
A young boy carries a chunk of coal into the mining camp where he lives. His family will burn the coal to make coke—a cleaner and hotter-burning fuel—which they'll either sell or use themselves for heating and cooking.
JHARKHAND, INDIA
Northeastern India has a long history of coal mining, and fires ignited by mining accidents almost a century ago still smolder in deeply buried coal deposits. In this mining camp, the air is thick day and night with smoke from coal fires.
MEGHALAYA, INDIA
A miner (left) works in one of hundreds of coal mines in eastern India that are neither sanctioned nor regulated by government. He lies on his back in low-ceilinged, unsupported passageways, without protective clothing, using a pick and shovel to load his cart. Coal is lifted out of the mine shaft two tons at a time (top) and trucked to a depot (above), where it is sorted by size and quality.
MEGHALAYA, INDIA
A coal miner climbs a shaky ladder to daylight.
A 19th-century mine in the U.S. or Europe might have looked just as hellish; mines there are safer now. But coal’s environmental costs have grown—and become global.