

The 2012 Apocalypse — And How to Stop It

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<http://www.wired.com/wiredscience/2009/04/2012storms>

For scary speculation about the end of civilization in 2012, people usually turn to followers of cryptic Mayan prophecy, not scientists. But that's exactly what a group of NASA-assembled researchers described in a chilling report issued earlier this year on the destructive potential of solar storms.

Entitled "[Severe Space Weather Events — Understanding Societal and Economic Impacts](#)," it describes the consequences of solar flares unleashing waves of energy that could disrupt Earth's magnetic field, overwhelming high-voltage transformers with vast electrical currents and short-circuiting energy grids. Such a catastrophe would cost the United States "\$1 trillion to \$2 trillion in the first year," concluded the panel, and "full recovery could take 4 to 10 years." That would, of course, be just a fraction of global damages.

Good-bye, civilization.

Worse yet, the next period of intense solar activity is expected in 2012, and coincides with the presence of an [unusually large hole](#) in Earth's geomagnetic shield. But the report received relatively little attention, perhaps because of 2012's supernatural connotations. Mayan astronomers supposedly predicted that 2012 would mark the calamitous "birth of a new era."

Whether the Mayans were on to something, or this is all just a chilling coincidence, won't be known for several years. But according to Lawrence Joseph, author of "[Apocalypse 2012: A Scientific Investigation into Civilization's End](#)," "I've been following this topic for almost five years, and it wasn't until the report came out that this really began to freak me out."

Wired.com talked to Joseph and John Kappenman, CEO of electromagnetic damage consulting company [MetaTech](#), about the possibility of geomagnetic apocalypse — and how to stop it.

Wired.com: *What's the problem?*

John Kappenman: *We've got a big, interconnected grid that spans across the country. Over the years, higher and higher operating voltages have been added to it. This has escalated our vulnerability to geomagnetic storms. These are not a new thing. They've probably been occurring for as long as the sun has been around. It's just that we've been unknowingly building an infrastructure that's acting more and more like an antenna for geomagnetic storms.*

Wired.com: *What do you mean by antenna?*

Kappenman: *Large currents circulate in the network, coming up from the earth through ground connections at large transformers. We need these for safety reasons, but ground connections*

provide entry paths for charges that could disrupt the grid.

Wired.com: *What's your solution?*

Kappenman: *What we're proposing is to add some fairly small and inexpensive resistors in the transformers' ground connections. The addition of that little bit of resistance would significantly reduce the amount of the geomagnetically induced currents that flow into the grid.*

Wired.com: *What does it look like?*

Kappenman: *In its simplest form, it's something that might be made out of cast iron or stainless steel, about the size of a washing machine.*

Wired.com: *How much would it cost?*

Kappenman: *We're still at the conceptual design phase, but we think it's do-able for \$40,000 or less per resistor. That's less than what you pay for insurance for a transformer.*

Wired.com: *And less than what you'd willingly pay for insurance on civilization.* **Kappenman:** *If you're talking about the United States, there are about 5,000 transformers to consider this for. The [Electromagnetic Pulse Commission](#) recommended it in a report they sent to Congress last year. We're talking about \$150 million or so. It's pretty small in the grand scheme of things.*

Big power lines and substations can withstand all the other known environmental challenges. The problem with geomagnetic storms is that we never really understood them as a vulnerability, and had a design code that took them into account.

Wired.com: *Can it be done in time?*

Kappenman: *I'm not in the camp that's certain a big storm will occur in 2012. But given time, a big storm is certain to occur in the future. They have in the past, and they will again. They're about one-in-400-year events. That doesn't mean it will be 2012. It's just as likely that it could occur next week.*

Wired.com: Do you think it's coincidence that the Mayans predicted apocalypse on the exact date when astronomers say the sun will next reach a period of maximum turbulence?

Lawrence Joseph: I have enormous respect for Mayan astronomers. It disinclines me to dismiss this as a coincidence. But I recommend people verify that the Mayans prophesied what people say they did. I went to Guatemala and spent a week with two Mayan shamans who spent 20 years talking to other shamans about the prophecies. They confirmed that the Maya do see 2012 as a great turning point. Not the end of the world, not the great off-switch in the sky, but the birth of the fifth age.

Wired.com: Isn't a great off-switch in the sky exactly what's described in the report?

Joseph: The chair of the NASA workshop was Dan Baker at the Laboratory for Atmospheric and Space Physics. Some of his comments, and the comments he approved in the report, are very strong about the potential connection between [coronal mass ejections](#) and power grids here on Earth. There's a direct relationship between how technologically sophisticated a society is and how badly it could be hurt. That's the meta-message of the report.

I had the good fortune last week to meet with John Kappenman at MetaTech. He took me through a meticulous two-hour presentation about just how vulnerable the power grid is, and how it becomes more vulnerable as higher voltages are sent across it. He sees it as a big antenna for space weather outbursts.

Wired.com: Why is it so vulnerable?

Joseph: Ultra-high voltage transformers become more finicky as energy demands are greater. Around 50 percent already can't handle the current they're designed for. A little extra current coming in at odd times can slip them over the edge.

The ultra-high voltage transformers, the 500,000- and 700,000-kilovolt transformers, are particularly vulnerable. The United States uses more of these than anyone else. China is trying to implement some million-kilovolt transformers, but I'm not sure they're online yet.

Kappenman also points out that when the transformers blow, they can't be fixed in the field. They often can't be fixed at all. Right now there's a one- to three-year lag time between placing an order and getting a new one.

According to Kappenman, there's an as-yet-untested plan for inserting ground resistors into the power grid. It makes the handling a little more complicated, but apparently isn't anything the operators can't handle. I'm not sure he'd say these could be in place by 2012, as it's difficult to establish standards, and utilities are generally regulated on a state-by-state basis. You'd have quite a legal thicket. But it still might be possible to get

some measure of protection in by the next solar climax.

Wired.com: Why can't we just shut down the grid when we see a storm coming, and start it up again afterwards?

Joseph: Power grid operators now rely on one satellite called [ACE](#), which sits about a million miles out from Earth in what's called the gravity well, the balancing point between sun and earth. It was designed to run for five years. It's 11 years old, is losing steam, and there are no plans to replace it.

ACE provides about 15 to 45 minutes of heads-up to power plant operators if something's coming in. They can shunt loads, or shut different parts of the grid. But to just shut the grid off and restart it is a \$10 billion proposition, and there is lots of resistance to doing so. Many times these storms hit at the north pole, and don't move south far enough to hit us. It's a difficult call to make, and false alarms really piss people off. Lots of money is lost and damage incurred. But in Kappenman's view, and in lots of others, this time burnt could really mean burnt.

Wired.com: Do you live your life differently now?

Joseph: I've been following this topic for almost five years. It wasn't until the report came out that it began to freak me out.

Up until this point, I firmly believed that the possibility of 2012 being catastrophic in some way was worth investigating. The report made it a little too real. That document can't be ignored. And it was even written before the THEMIS satellite [discovered a gigantic hole](#) in Earth's magnetic shield. Ten or twenty times more particles are coming through this crack than expected. And

astronomers predict that the way the sun's polarity will flip in 2012 will make it point exactly the way we don't want it to in terms of evading Earth's magnetic field. It's an astonishingly bad set of coincidences.

Wired.com: If Barack Obama said, "Let's prepare," and there weren't any bureaucratic hurdles, could we still be ready in time?

Joseph: I believe so. I'd ask the President to slipstream behind stimulus package funds already appropriated for smart grids, which are supposed to improve grid efficiency and help transfer high energies at peak times. There's a framework there. Working within that, you could carve out some money for the ground resistors program, if those tests work, and have the initial momentum for cutting through the red tape. It'd be a place to start.