

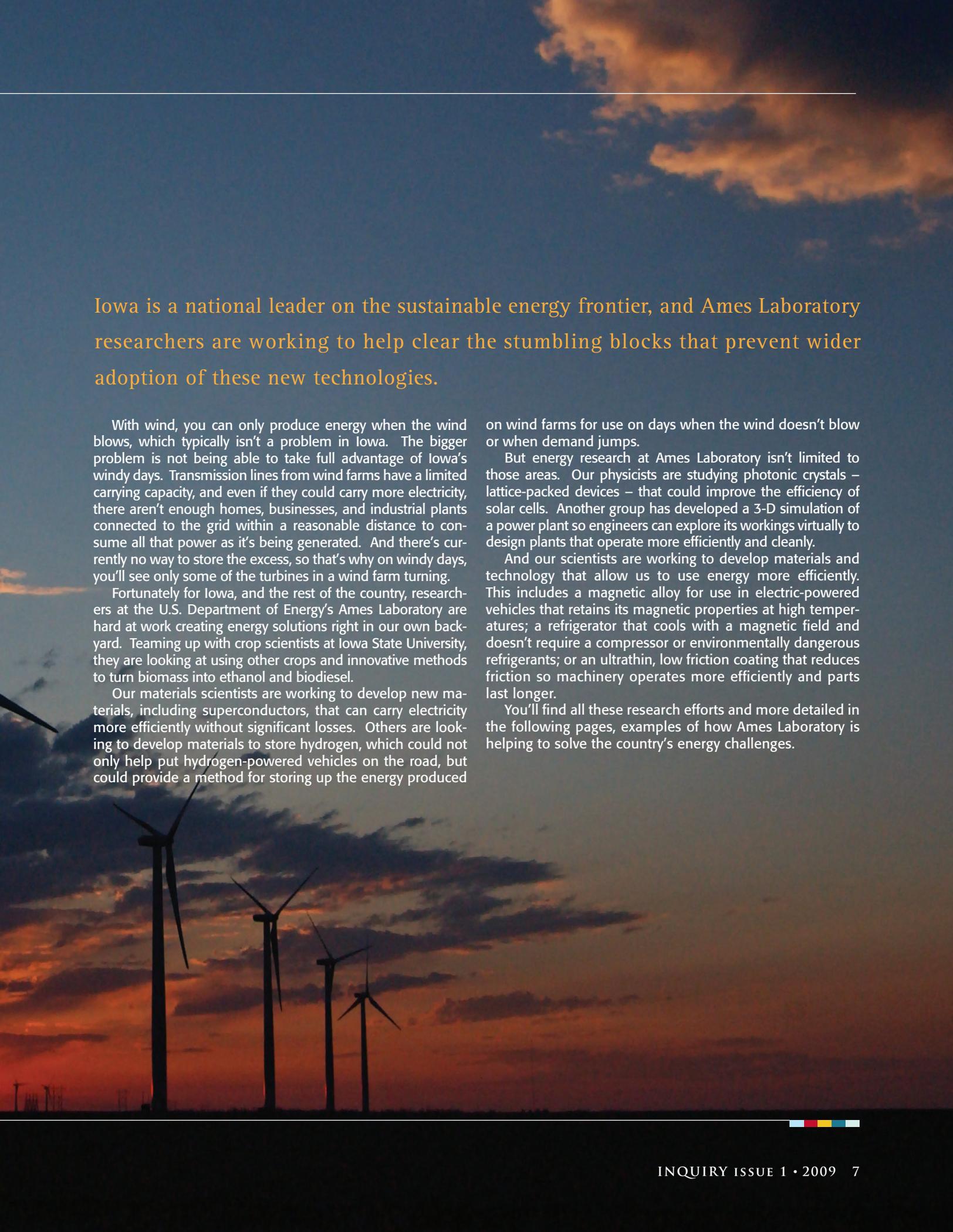
A New Dawn for Energy Research

WHEN IT COMES TO RENEWABLE ENERGY, IOWA is at the forefront. The leading corn producer in the country, Iowa has 35 ethanol plants with eight more under construction for a total capacity of 3.5 billion gallons a year — about one third of the overall U.S. capacity. The state also ranks near the top in biodiesel production.

Most industry sources also put Iowa near the top in wind energy production with more than 1,100 working turbines spread out among 47 wind farms. The state has roughly 2,800 megawatts of capacity with another 20 megawatts of capacity under construction. Yet this is only a fraction of Iowa's average potential output of 62,900 megawatts.

While these two energy sources are extremely important, they aren't without their problems. While corn is renewable, it requires significant inputs for the initial production and the distillation process. Some even argue that it is wrong to use food crops for fuel and that doing so unnecessarily raises not only the cost of your breakfast cornflakes, but the eggs and bacon on your plate (due to increased cost of livestock feed) and thousands of other products using corn-based sweeteners.

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Iowa is a national leader on the sustainable energy frontier, and Ames Laboratory researchers are working to help clear the stumbling blocks that prevent wider adoption of these new technologies.

With wind, you can only produce energy when the wind blows, which typically isn't a problem in Iowa. The bigger problem is not being able to take full advantage of Iowa's windy days. Transmission lines from wind farms have a limited carrying capacity, and even if they could carry more electricity, there aren't enough homes, businesses, and industrial plants connected to the grid within a reasonable distance to consume all that power as it's being generated. And there's currently no way to store the excess, so that's why on windy days, you'll see only some of the turbines in a wind farm turning.

Fortunately for Iowa, and the rest of the country, researchers at the U.S. Department of Energy's Ames Laboratory are hard at work creating energy solutions right in our own backyard. Teaming up with crop scientists at Iowa State University, they are looking at using other crops and innovative methods to turn biomass into ethanol and biodiesel.

Our materials scientists are working to develop new materials, including superconductors, that can carry electricity more efficiently without significant losses. Others are looking to develop materials to store hydrogen, which could not only help put hydrogen-powered vehicles on the road, but could provide a method for storing up the energy produced

on wind farms for use on days when the wind doesn't blow or when demand jumps.

But energy research at Ames Laboratory isn't limited to those areas. Our physicists are studying photonic crystals – lattice-packed devices – that could improve the efficiency of solar cells. Another group has developed a 3-D simulation of a power plant so engineers can explore its workings virtually to design plants that operate more efficiently and cleanly.

And our scientists are working to develop materials and technology that allow us to use energy more efficiently. This includes a magnetic alloy for use in electric-powered vehicles that retains its magnetic properties at high temperatures; a refrigerator that cools with a magnetic field and doesn't require a compressor or environmentally dangerous refrigerants; or an ultrathin, low friction coating that reduces friction so machinery operates more efficiently and parts last longer.

You'll find all these research efforts and more detailed in the following pages, examples of how Ames Laboratory is helping to solve the country's energy challenges.