

Two aging coal plants puff away on the outskirts of Pristina, the capital of the regionally-disputed Eastern European territory of Kosovo. The question facing the world is what to do when they can no longer continue to generate electricity.

"The government is moving in completely the wrong direction," says Visar Azemi, the coordinator of KOSID, a consortium for sustainable development in Pristina. Right now, the government plans to build a new coal power plant, but Azemi and his colleagues argue in a 13 October analysis in *Environmental Research Letters* that a mix of renewables is both cheaper and better for health and the environment.

Kosovo's two existing coal plants have been showing their age. The territory experiences regular blackouts and shortages of electricity supply. In 2008, *Balkan Insight* reported that at one of the two plants—scheduled to close in the next one to three years—there had even been an explosion that killed a worker. Compounding the country's problems, about 35 percent of Kosovo's electricity is lost, in part from equipment issues and in part from people using electricity without paying, Azemi says.

For several years, the World Bank has been considering financing the Kosovar government and ContourGlobal's plan to build a new coal plant. About 95 percent of the territory's power generation comes from a plentiful supply of local brown coal called lignite. Lignite is relatively easy to extract—it's only about 10 meters beneath the surface of the coal field, and conveyor belts take it directly from ground to the mouth of the power plant, where it's burned to drive steam turbines. But the coal's quality is so low you get about half the hours the electricity out of it as you'd get from high quality coal while releasing extra pollutants. In the new analysis, Azemi and his colleagues estimated the cost of building a new coal plant in 2017 to be between €1.9 to 2.2 billion.

They then calculated the costs of several alternative strategies, including various combinations of solar, wind, mini-hydroelectric, natural gas, and the retrofitting of existing coal plants. The estimates suggest that each of the alternative strategies would cost less than €1.5 to 1.8 billion based on current prices.

Realistically, no strategy would be all-or-nothing—the researchers' analysis for the coal plant includes using existing mini-hydroelectric power, for example—but University of California Berkeley energy researcher Daniel Kammen says a renewable strategy with a major emphasis on solar and wind is the most compelling of all the alternative possibilities. "It would be a financial mistake to not take the renewable path," says Kammen, a science envoy for The United States State Department who studies renewable strategies in the Balkans and worked on the analysis. "It just seems like a no-brainer."

He's says he's not telling the Kosovar government what to do, but besides the financial

benefits, he believes switching to a renewable mix is needed to ensure that Kosovo can eventually meet the increasingly stringent carbon dioxide emission limits of the European Union, whose ranks it hopes to join.

Michael Holland, a freelance energy and environmental consultant in the United Kingdom who has studied renewable energy policy in the Balkan countries, was not involved in the study. He writes in an email that the default position in western Balkan countries like Kosovo is to use coal. The study "puts cost numbers on the alternatives to coal, and it shows [coal] to be the worst bet."

"You can debate this," he writes, "but here we have actual numbers that can be debated rather than unsupported views."

One criticism of switching to a large renewable mix, however, is from a conservative Washington think tank called the Heritage Foundation. Economic, energy, and environmental policy analysts argued on its website that the situation in Kosovo must be resolved quickly lest it cause a health and economic crisis and that the coal option is the shortest route.

Kammen agrees that something needs to be done soon. He says, however, that it would take three to five years longer to build the coal plant than to build up solar and wind capacity and the associated electricity storage facilities for each.

The Heritage Foundation did not respond to requests for comment.

A natural alternative that comes to mind might be to import energy from other countries. But Kammen points out that the Balkans' history of disputes and wars makes imports tricky. During the 1998 and 1999 Kosovo conflict, ethnic Albanians fought against ethnic Serbs and the Yugoslavian government—consisting of the republics of Serbia and Montenegro—until NATO forces intervened. In 2008, Kosovo declared itself independent from Serbia. Although the United States and several European Union member states recognize it as a sovereign nation, Serbia does not. "The tensions are very high," Kammen says.

Kosovo does buy power from its neighbors. For example, it receives nuclear-generated electricity from Romania, and could theoretically receive natural gas from a nearby pipeline in Albania. But getting energy from far-away countries, such as Germany or Italy, would require transmission lines or pipelines through hostile states that could "easily cut off power," Kammen says.

"Energy independence or near independence," he says, means something "really significant... not just economically but [for] their existence as a country."

A competing idea to the coal plant came from the energy company Envidity in 2012. To reduce the CO₂ emissions from traditional coal plants, the company proposed building a

facility capable of gasifying the lignite underground and then burn the gas for electricity. Kammen says a gasification facility would be even more expensive than the coal plant and sees it as even less practical. "I just do not know where this idea came from," he says.

Envidity did not respond to requests for comment.

For now, the World Bank is still considering the new coal plant option. Kammen says "Kosovo is too poor to build this plant without international financing," so the country is in turn waiting on the World Bank, which Azemi says is running environmental assessments. Azemi describes the political situation in Kosovo surrounding the coal plants as a case of "corruption" and that building a new plant would not serve the needs of the people. Besides a grid based on renewables, he wants three things to happen.

First, public and private buildings could be insulated to use less electricity—reducing demand. Then, the more functional coal plant, called Kosovo B, could be retrofitted. Finally, all the technical and commercial energy losses could be reduced.

Ronald Roedel, an emeritus professor at Arizona State University and a solar energy advocate who has studied Kosovo's situation, says one idea for integrating renewables is to build a solar complex on top of the lignite mine. It's at an ideal location, he argues, and the geography works because the energy transmission infrastructure is already there. "What a perfect way of taking the spoiled land and turn it into something useful," he says.

He says he's talking with several companies about the project, but it's slow going. "We're just trying to be marriage counselors," he says.

The World Bank, the United States Treasury Department, Kosovo Electricity Distribution and Supply Company J.S.C, the Republic of Kosovo Ministry of Economic Development, and the Republic of Kosovo Ministry of Foreign Affairs did not respond to requests for comment.

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