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A Practical Route to Our Renewable Energy Future

Introduction:

The U.S. is the largest user of energy in the world, accounting for 50 percent of the world's total energy consumption. Any change in global energy use will require burning less fossil fuels — oil, gas, and coal — and more renewable energy sources such as solar panels, wind turbines, and hydropower.

Why should we change energy sources? First of all, depletion of fossil fuels is inevitable, they will eventually run out. In the course of becoming scarce remaining fossil fuels will be under the control of nations which may or may not be willing to sell to us. Second, combustion of fossil fuels puts greenhouse gases in the atmosphere contributing to global warming and climate change. Third, pollution from fossil fuels poses many health risks: smog, particulates, heavy metals and carcinogens. Fourth, an opportunity exists for the U.S. to develop renewable energy technologies and be a leader in the world market for them.

But is it practical to change to renewables? Current renewable technologies can meet our engergy demands now. A square 100 miles on a side using photovoltaic panels (PVs) to convert sunlight to electricity would supply all the electricity used by the United States. If other renewable energy sources were included in the mix, the area required for PVs would be smaller.

We spoke with Dr. John Turner of the National Renewable Energy Laboratory in Golden, Colorado, about the pathways that can lead to a renewable based energy infrastructure.

ER: Dr. Turner, what is your training?

JT: I got my bachelor's degree in chemistry at Idaho State University and my Ph.D. in electrochemistry at Colorado State University in Fort Collins, Colorado. I did a postdoctoral fellowship at the California Institute of Technology in Pasadena, California, in the area of semiconductor electrochemistry. That led to my first job here at the National Renewable Energy Laboratory in 1979. My work the first ten years or so involved fundamental studies of semiconductors in liquid solutions; then about ten years ago, because of my background and experience in electrochemistry, I started working on hydrogen generation. Most of the components of the hydrogen economy are electrochemical in nature; that is, electrolyzers use electricity to split water into hydrogen and oxygen; and fuel cells combine the hydrogen and oxygen to generate electricity.

So with a background of twenty years in electrochemistry, I started to look at hydrogen systems, attend conferences; and I've become very knowledgeable concerning fuel cell technologies, electrolyzer technologies, and of course consider myself an expert in my own research on hydrogen generation from sunlight and water. The Department of Energy Hydrogen Program has funded my research for the last nine years.

Also, in my twenty-one years at the National Renewable Energy Lab, I have spent a lot of time working or talking with colleagues in their various areas of expertise, so I'm familiar with just about any area of renewable energy technology, from biomass to wind to photovoltaics.

ER: What is the National Renewable Energy Lab?

JT: The National Renewable Energy Lab originally started its life as the