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From: Ed Clark [ethog3@gmail.com]
Sent: 3/6/2019 12:10 PM
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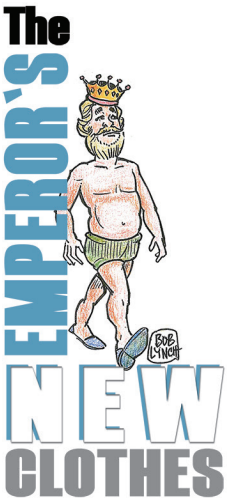
Subject: Turbines

Please show the attachment with 17-2295EL-BGN, 18-0488-EL-BGN and 18-1607-EL-BGN

Thank You
Ed Clark



BY GENERAL MANAGER MARKUS I. BRYANT — PART 75

The Myths of "Free" and "Green" Energy

There is no such thing as "free" energy. Capturing wind and solar energy and converting it to electricity requires the manufacture, transportation, installation, and maintenance of specialized equipment to capture the solar energy directly from the sun or indirectly from wind. They also need to be backed up by other generators, especially gas-fired.

The materials used to make the wind and solar equipment have to be mined, transported, refined, and then manufactured to the correct specifications. All of the steps listed above involve the expenditure of human labor and the use of machines mostly powered by fossil fuels, either directly as fuel in trucks, etc., or indirectly through electric-powered equipment.

Even the tax subsidies used to promote wind and solar equipment come from current labor or business income or debt secured by a mortgage on future human labor and business profits. Since all equipment eventually wears out, it eventually needs to be recycled or disposed of properly. Consequently, there is no such thing as completely "green" energy, since every process listed above has an environmental impact. There are only differences in environmental impact among all energy technologies. Let's take a closer look at wind and solar.

Mining and manufacturing

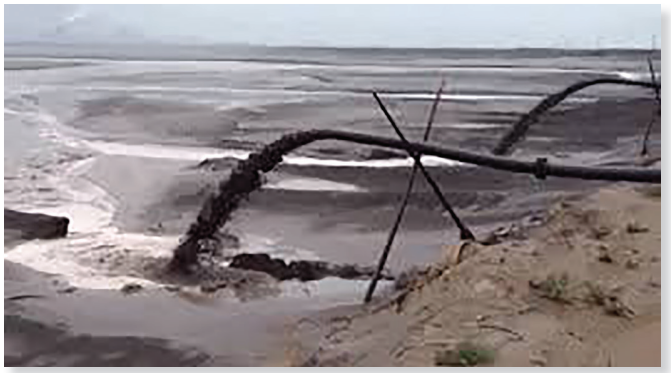
The majority of the mining and refining of materials for solar panels and the rare earth metals for magnets in wind generators and electric car motors occurs in countries without the same environmental and worker safety rules as we have in the U.S. Quartz is mined to produce the vast majority of solar panels. Unprotected miners are exposed to the lung disease hazard of silicosis. Giant furnaces consume enormous amounts of energy to convert the quartz into silicon, while releasing carbon dioxide and sulfur dioxide. Finally, hydrochloric acid is used to create a purer form of silicon called polysilicon. Three to four tons of poisonous liquid silicon tetrachloride is produced for every ton of polysilicon.

Most companies recycle this waste to make more polysilicon, but companies who can't afford the millions of dollars for the reprocessing equipment simply dump it onto neighboring fields. This makes the field unusable for agriculture and inflames the eyes and throats of people living near the fields. It was only in 2011 that China required at least 98.5 percent of silicon tetrachloride waste be recycled, which helps partly explain why their solar panels were cheaper than those made in Europe or the U.S.

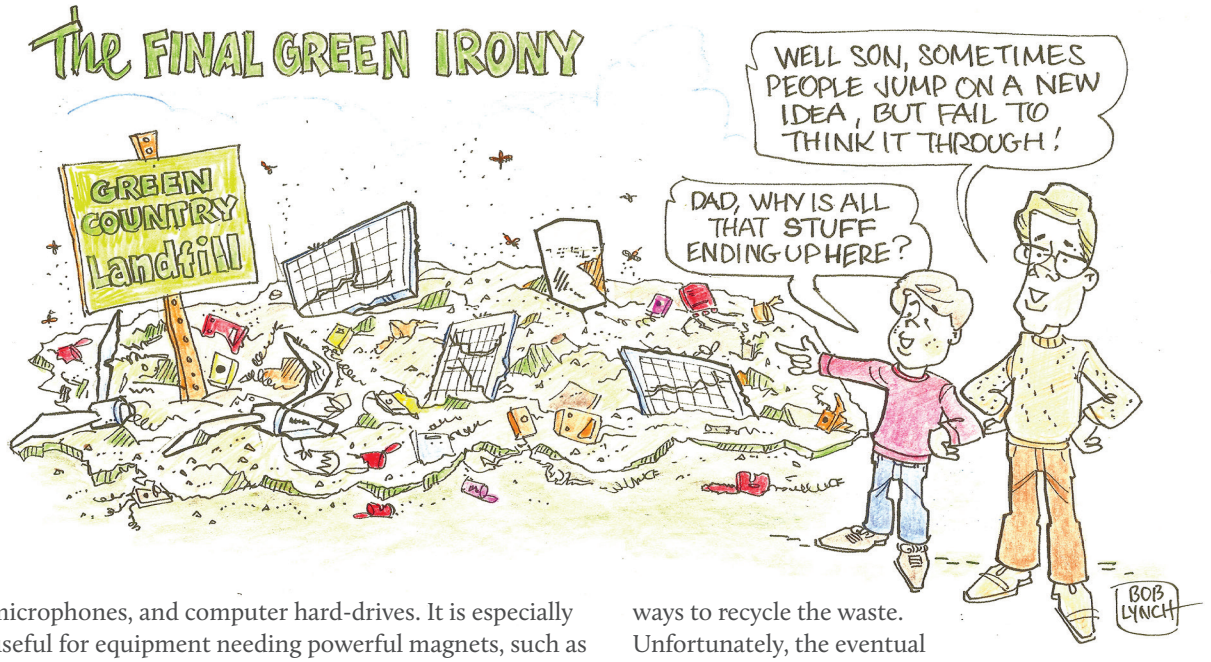
The U.S. is not immune from this waste disposal problem, as 17 companies in California from 2007 through part of 2011 produced 46.5 million pounds of sludge and contaminated water with 1.4 million tons of it sent to nine other states.

Thin-flow-solar-cell technology does not use polysilicon and will grow in market share, since it is just as efficient but uses less material and energy. These solar cells are made by depositing layers of semiconductor material directly onto panels made from glass, metal or plastic. Most semiconductor material uses cadmium telluride as the first layer and cadmium sulfide as the second layer. Sometimes copper indium gallium selenide is used as the first layer in combination with cadmium sulfide. However, cadmium is both a carcinogen and a genotoxic, which means it can cause inheritable mutations. This is why some solar panel manufacturers are switching to zinc sulfide, which is a much safer material.

China is the world's largest rare earth mineral producer, delivering 95 percent of the world supply in 2009. It is estimated that 70 percent of the world's reserves come from mines north of the industrial city of Baotou in China's Inner Mongolia region. They produce cerium, which is used to color glass, making catalytic converters. In the form of cerium oxide, it is used as a polish for touch screens on smartphones and computer tablets. Another rare earth metal produced is neodymium, which is used in magnets for in-car headphones, cellphone



City of Baotou, China industrial wastewater discharge.



microphones, and computer hard-drives. It is especially useful for equipment needing powerful magnets, such as wind turbines and electric car motors.

Estimates of the amount of rare earth minerals in a 2-megawatt (MW) wind turbine range from 755 to 930 pounds. Producing one ton of rare earth minerals generates about one ton of low-level radioactive waste. In 2012, the U.S. added 13,131 MW of wind generation. That means between 4.9 and 6.1 million pounds of rare earth minerals were used for those turbines, while creating an equivalent amount of radioactive waste. For perspective, consider that wind generated 3.5 percent of the U.S.'s electricity in 2012, while nuclear energy produced 20 percent of U.S. electricity, generating between 4.4 and 5 million pounds of spent nuclear fuel that year.

Where does Bautou rare earth waste go in China? See the previous page's photo of the Bautou industrial waste "pond" covering about 2,500 acres. It lacks the proper lining to prevent groundwater seepage and is trickling 20 to 30 meters per year toward the nearby Yellow River, which is a major source of drinking water in northern China. To appreciate what is happening, search online for: "Baotou toxic lake footage" on YouTube. You really have to see it to believe it. It's that unbelievably bad.

Waste disposal

Wind and solar generating equipment has a useful life of between 20 to 30 years. This means the first-generation wind turbine blades and solar panels are beginning to reach their end of life, while the second-generation equipment will reach that point in the 2030s. Currently, most of these solar panels and wind turbine blades are winding up in landfills. However, there is an international scramble underway to figure out the most effective ways to recycle the waste. Unfortunately, the eventual recycling of materials was not pre-engineered into the design of solar panels and wind turbine blades, although industry attention is now moving rapidly this direction.

Solar panels are considered hazardous waste and can only be disposed of in sealed landfills to prevent leakage of toxic materials into the ground water. Japan has started earlier than most to find ways to reuse its solar panel waste, which is expected to grow by 700,000 to 800,000 tons per year by 2040. Breaking down solar panels for recycling is labor-intensive and unprofitable. Europe mandates solar panel disposal guidelines. The European solar panel recycling association has announced the development of a mechanical and heat treatment process in 2016, which claims a 96-98 percent materials recovery rate. This is a step in the right direction. So there is hope for future recycling of solar panels.

However, there are no solutions yet for wind blade turbines. A recent study estimates that 330,000 tons per year by 2028 and 418,000 tons per year by 2040 of composite material from wind turbine blades will need to be disposed of worldwide. China will have 40 percent of the waste, Europe 25 percent, the U.S. 16 percent, and the rest of the world 19 percent. There is currently no established industrial recycling process for these blades, although much of the other equipment can be recycled.

Folks, wouldn't it have been wiser before our federal government and many states started subsidizing wind and solar generation, that we first had our engineers analyze and plan for these environmental issues? After all, this environmental analysis has been required for many years for coal, nuclear, and natural gas-generating plants. Why is there a double standard?

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Summary: Public Comment received via website electronically filed by Docketing Staff on behalf of Docketing.