ST.057

Geoscientists: Explorers and Architects of the New Energy Economy

Edith Newton Wilson
Rock Whisperer LLC, Tulsa, OK, USA

What a difference a year makes. Pandemic-driven changes in energy usage have accelerated demand for low-cost renewable resources as the world's appetite for fossil fuels shrinks. The percentage of global electricity generated by renewables continues to rise at rates exceeding 25% year-on-year. The old energy business model of high-risk, high-return, capital-intensive, and infrastructure-dependent production of fossil fuels is giving way to a world of abundant clean energy characterized by rapid deployment, low risk, low up-front capital investment, and distributed, lean infrastructure. Electrification of civilization carries with it the potential for long-deferred global energy equity. Renewable energy projects are delivering an order of magnitude higher return than shares of fossil fuel companies, while providing more reliable and affordable energy options for all global citizens—and with lower carbon cost. The new energy economy is here, and it rests on a foundation of economic geology.

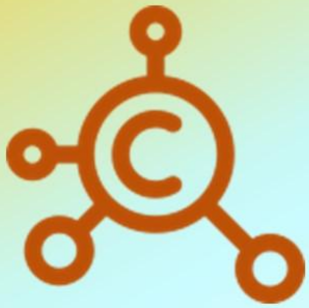
The energy transition is synonymous with a fundamental breakthrough in energy storage. Since the discovery of fire, humans have relied on storage of energy through photosynthesis, geologic processes to concentrate energy more efficiently, and the subsequent breaking of hydrogen-carbon bonds in wood, coal, oil, or natural gas to release energy. This process not only produces carbon dioxide and other greenhouse gases as a biproduct, but it also destroys the energy storage device forever, requiring that new quantities of hydrocarbons be extracted and combusted for every joule or watt hour of energy consumed. Renewable energy storage devices—batteries—require a similar amount of carbon for extraction and manufacturing but emit no carbon dioxide on use. Moreover, the extracted components used to make batteries (or solar panels or wind turbines) are not destroyed to produce energy, but can be reused, repurposed, or fully recycled. Not only is the new energy economy here, but the circular economy is just around the corner.

The talents of economic geologists will translate effectively to all aspects of the rapidly developing sustainable energy supply chain. First and foremost, we bring our geologic expertise, along with our exploration and mining experience, to the problem of filling the rising demand for metals and other conductive materials used to power the Internet of Things, electric vehicles, distributed energy resources, and utility systems. The extractive industries that produce materials for energy storage will rely on sustainable development, environmental management, and proper social license now more than ever. Mineralogy, crystallography, material science, and nanotechnology will be increasingly essential skills as we onshore industrial processing as well as electrode design and manufacturing. Optimization of battery chemistries and recycling metals from waste will also call on metallurgical and refining expertise. As we move from a society that extracts and uses up our energy resources to one that optimizes energy as a service, the most valuable talents we bring to the table may well be our creativity and thirst for discovery, as well as our willingness to embrace change.

Energy storage...

yesterday...

and tomorrow.



Hydrocarbons

Store energy from the sun in H-C bonds
Emit ~400 g CO_2 eq/kWh to make/use
Are finite on the human time-scale
Are destroyed to give up stored energy

Batteries

Store energy from the sun in electrons
Emit ~40 g CO_2 eq/kWh to make/use
Store energy from renewable resources
Preserve components through end-of-life