**Text 49 HOW GREEN ARE ELECTRIC VEHICLES?**

Around the world, governments and automakers are promoting electric vehicles as a key technology to curb oil use and fight climate change. (…) But as electric cars and trucks go mainstream, they have faced a persistent question: Are they really as green as advertised?

Broadly speaking, most electric cars sold today tend to produce significantly fewer planet-warming emissions than most cars fueled with gasoline. But a lot depends on how much coal is being burned to charge up those plug-in vehicles. And electric grids still need to get much, much cleaner before electric vehicles are truly emissions free.

(…) The good news for electric vehicles is that most countries are now pushing to clean up their electric grids. In the United States, utilities have retired hundreds of coal plants over the last decade and shifted to a mix of lower-emissions natural gas, wind and solar power. As a result, researchers have found, electric vehicles have generally gotten cleaner, too. And they are likely to get cleaner still.

“The reason electric vehicles look like an appealing climate solution is that if we can make our grids zero-carbon, then vehicle emissions drop way, way down,” said (…) an associate professor of energy studies at the M.I.T.

Like many other batteries, the lithium-ion cells that power most electric vehicles rely on raw materials — like cobalt, lithium and rare earth elements — that have been linked to grave environmental and human rights concerns. Cobalt has been especially problematic.

(…) Focusing first on cobalt, automakers and other manufacturers have committed to eliminating “artisanal” cobalt from their supply chains and have also said they will develop batteries that decrease, or do away with, cobalt altogether. But that technology is still in development, and the prevalence of these mines means these commitments “aren’t realistic,” said Mickaël Daudin of Pact, a nonprofit organization that works with mining communities in Africa.

(…) As earlier generations of electric vehicles start to reach the end of their lives, preventing a pileup of spent batteries looms as a challenge. Most of today’s electric vehicles use lithium-ion batteries, which can store more energy in the same space than older, more commonly used lead-acid battery technology.

Experts point out that spent batteries contain valuable metals and other materials that can be recovered and reused. Depending on the process used, battery recycling can also use large amounts of water, or emit air pollutants (…) A different, promising approach to tackling used electric vehicle batteries is finding them a second life in storage and other applications. (…) If done properly, though, used car batteries could continue to be used for a decade or more as backup storage for solar power, researchers at the M.I.T found in a study last year.

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