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# Terraforming Mars: How Visionaries Plan to Create a Second Earth

By Rainer Zitelmann July 27, 2026

NASA

The long-term vision of Elon Musk and other visionaries involves "terraforming" Mars. The term "terraforming" was first used in 1930 by Olaf Stapledon in his novel Last and First Men, in which he describes how, with Earth no longer habitable, humans terraform Venus. The term became more widely known thanks to the science fiction author Jack Williamson, who used it in his 1942 short story "Collision Orbit," before it was later adopted by the scientific community at large.

Terraforming refers to the use of technologies to transform hostile planets into habitable ones over several centuries. Proposed technologies include gradually warming the Martian atmosphere, essentially creating an artificial greenhouse effect, so that liquid water can flow again on Mars for the first time in three billion years. According to physicist Michio Kaku, one possible approach would be to inject methane and water vapor into the atmosphere to create such a greenhouse effect. These gases would trap sunlight, gradually warm the polar ice caps, and eventually release additional water vapor and carbon dioxide as the ice melted.

Another idea is to orbit Mars with satellites equipped with gigantic sheets, many miles across, containing a vast array of mirrors or solar panels. Sunlight could either be focused and directed toward the ice caps, or the energy could be converted using solar cells and transmitted to the surface as microwaves.

Then there are even more radical ideas, such as changing the orbits of small asteroids or comets and deliberately directing them toward Mars. According to engineer Giancarlo Genta, the enormous kinetic energy released upon impact would be converted into heat, causing localized warming while also releasing water and other materials contained within the impacting bodies. He acknowledges that the idea sounds extraordinary, but argues that it essentially mimics the natural process by which Earth itself is believed to have acquired much of its water and carbon during its formation.

This idea sounds as interesting as it does risky, because by that time humans would already be living on Mars, and the process would have to be controlled in such a way as to avoid posing a risk to them.

A completely novel idea was published by a team of scientists in August 2024 and would achieve the same goal in a more environmentally friendly way. Rather than relying on greenhouse gases, the researchers propose warming Mars with specially designed nanoparticles. They argue that such particles, manufactured from materials already available on Mars, could be thousands of times more effective than conventional greenhouse gases. Climate models suggest that continuously releasing these particles into the Martian atmosphere could raise global temperatures by more than 30 kelvin over time—enough to begin melting surface ice. If these nanoparticles can eventually be produced on Mars or transported there economically, the researchers conclude that the technological barrier to warming the planet may be much lower than previously assumed.

Terraforming is by no means an "all or nothing" undertaking. As expert Martin Beech explains in his books,

even if the ultimate goal of transforming Mars into a planet where humans can move about as freely as they do on Earth remains centuries away, intermediate achievements would still represent major progress. Making it possible for certain crops to grow outside greenhouses, for example, would already mark an important milestone.

But many questions remain unanswered. Michio Kaku notes that if the Martian ice caps were completely melted, enough water would be released to cover the entire planet with an ocean between fifteen and thirty feet deep. Whether such changes would prove permanent, however, remains uncertain. Mars might ultimately require an artificially generated magnetic field to prevent its newly created atmosphere from being stripped away into space. Undoubtedly, a whole host of completely different problems will emerge that we cannot even imagine today. At the same time, technological advances and the ingenuity of creative entrepreneurs are likely to produce solutions that seem impossible to us today.

*In June, Skyhorse Publishing will release Rainer Zitelmann's book "New Space Capitalism."*


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