potentially life-sustaining. The interiors of the Martian tubes, significantly larger than those on Earth, are protected from cosmic and solar radiation by a thick layer of rock. Scientists are testing ways to build Martian greenhouses that could produce food, shelter, and oxygen for human inhabitants.

ECOLOGISTS HAVE TESTED 14 PLANTS IN SOIL PRODUCED TO MATCH THE CHEMICAL COMPOSITION OF MARS. MARS IS ALREADY HOME TO A NUMBER OF MICRO-ORGANISMS, WHICH COULD ENSURE THE SURVIVAL OF PLANTS AND ANIMALS ON THE RED PLANET. THE ECOLOGISTS WERE ABLE TO GROW EACH OF THE 14 SPECIES IN SIMULATED MARS SOIL, WITH SUCCESS RANGING FROM 1.8% TO 30%.

IN ADDITION TO THE POTENTIAL NUTRIENTS FOR PLANTS TO GROW, INCLUDING PHOSPHORUS, NITROGEN, POTASSIUM, AND IRON, BUT FOR PLANTS ON MARS TO MAINTAIN THE KIND OF SKELETAL AND MUSCLE MASS THEY DEVELOPED FIGHTING EARTH'S GRAavity, IT ALSO BEGAN TO FEEL LIKE THEY WOULD NEED TO BE PORTABLE. MARS SITS WITHIN THE ZONE, DEFINED AS THE RANGE OF DISTANCES FROM A STAR, IN THIS CASE THE SUN, WHERE A PLANET COULD SUPPORT LIQUID WATER. MARS IS HOTTER THAN IT IS ON EARTH, NOT ONLY BECAUSE OF THE PLANET'S DISTANCE FROM THE SUN BUT ALSO BECAUSE OF MARTAN'S MASSIVE DUST STORMS. BUT HARVESTING SUNLIGHT WOULD BE MORE DIFFICULT ON MARS THAN IT IS ON EARTH. THIS MEANS THAT ASTRONAUTS THERE WOULD NEED TO DEVELOP OTHER POWER SOURCES.

POWER FROM THE SUN

FROM THE DATA ABOVE, WE CAN SEE THAT MARS IS HOTTER THAN IT IS ON EARTH. BUT WE ALSO CAN SEE THAT MARTAN'S THIN AIR AND VAST DISTANCE FROM THE SUN—ONE MARTIAN SEASON IS ABOUT 2.5 EARTH YEARS—MAKE IT HARDER TO KEEP A BODY OF WATER IN PLACE. THERE ARE THREE BIRTHS OF WATER VAPOR, 1% CARBON DIOXIDE, 1.89% NITROGEN, AND 1.93% OXYGEN FROM THE ATMOSPHERE. THROUGH CHEMISTRY, THE REACTANTS OF WATER VAPOR, CARBON DIOXIDE, OXYGEN, AND NITROGEN COULD BE FURTHER REDUCED INTO HYDROGEN AND OXYGEN. WATER MOLECULES CARRY Require SAFE, RELIABLE, LONG-LASTING POWER SYSTEMS.

PORTABLE POWER

One source that could generate the necessary juice is a nuclear battery—a radioisotope thermo electric generator—THAT CONVERTS HEAT INTO ELECTRICITY. NASA DEVELOPED A POWER-PRODUCING SYSTEM THAT COULD BE USED ON MANY PLANETS AND ASTEROIDS. A FISSION REACTION IN A NUCLEAR FISSION REACTOR COULD BE USED TO GENERATE ELECTRICITY ANYTIME OF DAY, UNDER ANY ATMOSPHERIC CONDITIONS.