Viking SNAP-19. Distinctive mission requirements for Viking included high-temperature (400 K) sterilization, storage during the long cruise to Mars, and ability to withstand the rapid, extreme temperature changes of the Martian day-night thermal cycle. Each Viking Lander used two Snap-19 RTG's modified to meet those requirements. Each RTG was to produce a minimum of 35 W(e) during a 90-day Mars surface mission following an 11 to 12-month cruise after launch. The two series-connected RTGs were the primary power sources on each Viking Lander, supplying the energy for scientific instruments and for recharging four nickel-cadmium batteries. The RTGs also supplied the Landers with thermal energy. All four RTGs more than met the 90-day requirement.

A modification from Pioneer SNAP-19 was the addition of a dome reservoir. Initial fill gas for the converter was a 90:10 helium-argon mixture; the reservoir was filled with a 95:5 argon-helium mixture. This configuration permitted a controlled interchange of gases in the two volumes to minimize heat-source operating temperatures up to launch while maximizing electrical output at the end of the mission. Although data-relay capability ended, the RTGs on the Viking Landers were still operating when last transmissions were received and those on Viking Lander-1 were capable of providing power through 1994.

In the development of the SNAP-19s, the principal contribution to power degradation was judged to come from gas effects. Changes made in SNAP-9A and Nimbus SNAP-19 designs significantly minimized the degradation effects in the SNAP-19s.

SNAP-27. The SNAP-27 RTG was developed to power the experiments of NASA's Apollo Lunar Surface Experiments Package (ALSEP). The RTG design requirement was to provide at least 63.5 W(e) at 16 V DC one year after lunar emplacement. The use of RTGs was a natural choice because of their light weight, reliability, and ability to produce full electrical power during the long lunar night-day cycle. Since the ALSEPs were to be positioned manually by the astronauts, the designers took advantage of this assembly capability: the converter and sealed-fuel-capsule were kept separate in the Lunar Module and assembled on the Moon.

SNAP-27 used 442 thermoelectric couples made of PbTe 3N/3P elements arranged in two series strings of 221 couples connected in parallel. Heat from the fuel capsule, which was loaded with Pu-238 oxide microspheres and had a nominal rating of 1,480 W(t), was transmitted to the hot frame of the RTG by radiation coupling. Design analysis and ground tests indicated that the hot-junction temperature was about 866 K and the cold-side thermoelectric temperature was maintained at about 547 K in the lunar environment. Both the cold frame and the outer case were made of beryllium. Eight cross-rolled beryllium fins were attached integrally to the outer case by brazing. The converter had a mass of 12.7 kg. The mass of the fuel-capsule assembly,