Alternatively, the solar arrays populated with high-efficiency Si cells would need to be 77% larger than arrays using triple-junction cells in order to deliver the equivalent amount of EOL power in GEO and 92% larger in LEO.

The large difference in size between solar arrays populated with Si and MJ cells is very significant in terms of stowage, deployment, and spacecraft attitudinal control. This is especially true for very high-powered GEO communication satellites in which Si solar array area can exceed 100 m^2. The comparable array with triple-junction cells, although by no means small, would have an area of $\sim$59 m^2. The array size will impact the spacecraft's weight, volume (array stowage), and system requirements on spacecraft attitude control systems (additional chemical fuel).

Three important figures of merit used in power system optimization are EOL area power density (W/m^2), specific weight (W/Kg), and cost ($/W). Representative values for the various SOA cell technologies are listed in Table 10.9.

The EOL power per unit area for a MJ cell is significantly better than a Si cell. However, the EOL specific weight for Si is almost a factor of two greater than a MJ cell. This results in a slightly smaller EOL cost per watt for a high-efficiency Si. This demonstrates the dramatic reduction in cost of MJ cells over the past few years.

If one considers the mass of the necessary array components (i.e. panel substrate, face sheet, adhesive, hinges, insulators, wiring, etc.) along with equivalent power per area for the different cell types, and also the cost involved in having the cells interconnected and covered (CIC) and laid on rigid panels, then the cost for developing an array using MJ cells is slightly less than that for HES cells. The EOL specific weight values at the CIC (with 100-μm ceria-doped microsheet cover glass) and the panel levels for these cells and the normalized cost per watt for the panels is shown in Table 10.10. A similar comparison with somewhat less expensive 100-μm high-efficiency Si cells (at the panel level) shows a slightly smaller cost advantage for the multijunction cells. The 100-μm Si

Table 10.9 EOL area power density (W/m^2), specific weight (W/Kg), and normalized (to HE Si) cost ($/W) for high-efficiency Si, dual-junction (2J), and triple-junction (3J) bare solar cells [52]

Solar cell technology	[W/m^2]	[W/Kg]	Normalized (to HE Si) cell cost [$/W]
GEO conditions (60°C) – 1-MeV, 5E14 e/cm^2			
75 μm HE Si	169	676	1.00
2J III-V	271	319	1.38
3J III-V	306	360	1.22
LEO conditions (80°C) – 1-MeV, 1E15 e/cm^2			
75 μm HE Si	143	574	1.00
2J III-V	245	288	1.29
3J III-V	275	323	1.15