Table 10.2 Comparison of technology requirements with state-of-the-art space solar cells [16]

Technology	Driving missions	Mission application	State of the art
High-power arrays for solar electric propulsion (SEP)	Comet nucleus sample return, outer planet missions, Venus surface sample return, Mars sample return	>150 W/kg specific power Operate to 5 AU	50–100 W/kg Unknown LILT effect
Electrostatically clean arrays	Sun Earth connection missions	<120% of the cost of a conventional array	∼300% of the cost of a conventional array
Mars arrays	Mars smart lander, Mars sample return, scout missions	26% efficiency >180 sols @ 90% of full power	24% 90 sols @ 80% of full power
High-temperature solar arrays	Solar probe, sentinels	≥350°C operation (higher temperatures reduce risk and enhance missions)	130°C steady state; 260°C for short periods
High-efficiency cells	All missions	30+%	27%
Low intensity low temperature (LILT), resistant arrays	Outer planet missions, SEP missions	No insidious reduction of power under LILT conditions	Uncertain behavior of MJ cells under LILT conditions
High-radiation missions	Europa and Jupiter missions	Radiation resistance with minimal weight and risk penalty	Thick cover glass

Table 10.3 Measured global AM1.5 and measured or [a]estimated AM0 efficiencies for small-area cells

Cells	Efficiency [%] Global AM1.5	Efficiency [%] AM0	Area [cm^2]	Manufacturer
c-Si	22.3	21.1	21.45	Sunpower [17]
Poly-Si	18.6	17.1[a]	1.0	Georgia Tech/HEM [18]
c-Si film	16.6	14.8[a]	0.98	Astropower [19]
GaAs	25.1	22.1[a]	3.91	Kopin [19]
InP	21.9	19.3[a]	4.02	Spire [19]
GaInP (1.88 ev)	14.7	13.5	1.0	ISE [18]
GaInP/GaAs/Ge	31.0	29.3	0.25	Spectrolab [20]
Cu(Ga,In)Se_2	18.8	16.4[a]	1.04	NREL [19]
CdTe	16.4	14.7[a]	1.131	NREL [19]
a-Si/a-Si/a-SiGe	13.5	12.0	0.27	USSC [19]
Dye-sensitized	10.6	9.8[a]	0.25	EPFL [19]

[a]Estimated AM0 efficiencies based on cells measured under standard conditions. The calculated efficiency used the ASTM E490-2000 reference spectrum and assumes that the fill factor does not change for the increased photocurrent. Quantum efficiencies corresponding to the table entries were used in the calculations

(although, low-energy protons can cause problems in the unshielded gap areas on the front of solar cells and on the unshielded back). Ionization effects can reduce the transmittance of the solar cell cover glasses through the development of color centers. Ionized electrons caused by the radiation become trapped by impurity atoms in the oxide to form