

Table 21.7 GaAs cell and module price (1994\$) [5]

Cell/wafer	Cell efficiency	\$/Module (48 cells)	\$/48 cells
SJ/GA-SC	25	741.14	459.94
	30	741.54	460.50
SJ/Ge-SC	25	447.01	156.52
	30	450.40	159.11
SJ/Ge-PC	25	404.19	111.28
	30	407.58	113.79
TJ/GA-SC	30	745.96	464.68
	35	748.56	466.99
TJ/Ge-SC	30	456.33	164.51
	35	456.31	164.90
TJ/Ge-PC	30	413.50	119.11
	35	413.49	119.51

Note: SJ = single junction; TJ = tandem junction; SC = single-crystal; wafer PC = polycrystalline wafer. © 1994 IEEE

module of the prior study [4]. The manufacturing processes for each cell were defined using three different wafers: single-crystal GaAs, single-crystal Ge, and polycrystalline Ge. Modules incorporating each of the six combinations were modeled using the same STAMPP model as for the Fresnel lens module in the prior study. Further, a range of cell efficiencies for the GaAs cells was examined because the GaAs technology was not as well developed as the Si technology. In order to compare the annual energy production from GaAs plants with Si plants, the number of modules required for a 50-MW plant was calculated and the cost of modules computed with STAMPP at the required volume, as shown in Table 21.7. The total capital requirements, as shown in Table 21.5 for the Si plant and adjusted to 1994\$, were then scaled appropriately for the number of GaAs modules.

The price of GaAs cells, whether single- and tandem-junction, shown in Table 21.7 is heavily influenced by the choice of GaAs or Ge substrate. Cells grown on Ge-PC wafers are roughly four times less expensive than cells grown on GaAs-SC wafers. However, the prices of modules incorporating these cells differ by only a little less than a factor of two due to the fact that several substantial module-cost components are the same regardless of the cell structure. The least expensive module cost of \$413.50 in Table 21.7 for TJ/Ge-PC cells compares to the \$328.42 for a module incorporating Si cells (see Table 21.4, escalated to 1994\$). Cell efficiency for the same cell structure in Table 21.7 has little effect on module price. Indeed, module price is, in some cases, just slightly higher for the higher efficiency cell than the lower one (e.g. SJ/Ge-PC at 25% versus 30%). This is a result of the modeling procedure in which the number of modules produced was just sufficient for the 50-MW power plant, being fewer at higher cell efficiency, and the allocation of elements of cost by the STAMPP model to a fewer number of modules.

The reduction in cell and module prices in Table 21.7 reflects a span of about 15:1 in wafer costs between GaAs-SC and Ge-PC wafers, as indicated in Table 21.8. When GaAs cells are grown on the GaAs wafer, the cost of the wafers is almost 60% of the module materials cost, but when a Ge-PC wafer is used, then the wafer contributes to only