Fresnel lenses are usually incorporated into modules that contain a lens, or multiple lenses in parquet, a housing to protect the backside of the lens, which is difficult to clean due to the sharp facets, and the cells. The cell may incorporate a secondary optical element (SOE) whose purpose is to further concentrate the light or to make the image more uniform. A typical Fresnel lens module is shown in Figure 11.9.

An alternative to refractive lenses is to use reflective lenses or mirrors. As is well known, a reflective surface with the shape of a parabola will focus all light parallel to the parabola's axis to a point located at the parabola's focus. Like lenses, parabolas come in a point-focus configuration (which is formed by rotating the parabola around its axis and creating a paraboloid) and line-focus configuration (which is formed by translating the parabola perpendicular to its axis). These configurations are illustrated in Figure 11.2.

Another approach is the compound parabolic concentrator (CPC) shown in Figure 11.24. Here the sides of the concentrator are parabolas; however, the focus for each side is at the opposite side of the cell and the axis of parabola a is along the direction of maximum acceptance angle, θ_{max}. The CPC is interesting in that it is a class of concentrator called "ideal," in that it provides the maximum possible concentration given the region of the sky it sees, or alternatively for a given maximum acceptance angle. It is also termed a "nonimaging" concentrator in that output bears no relation to the image of the sun. For high concentration, a CPC is rather tall and thin, and thus its use

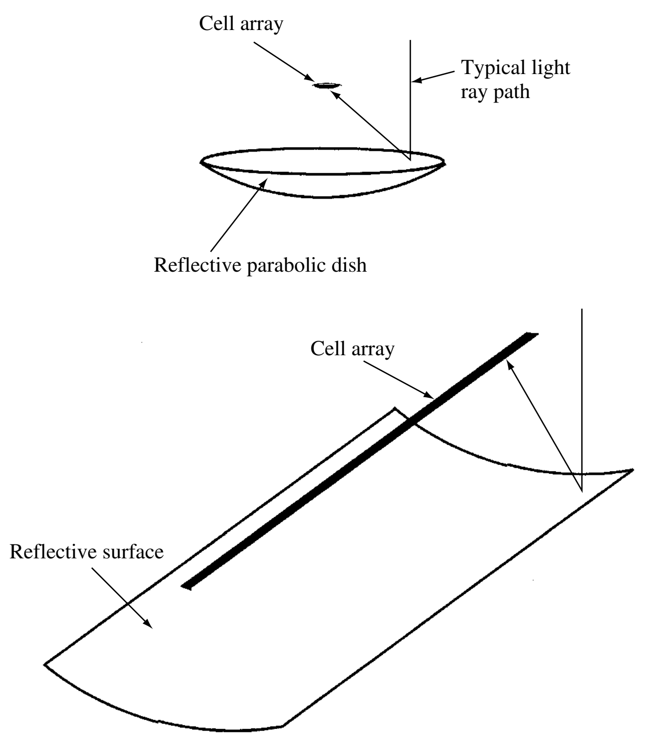

Figure 11.2 Reflective concentrator configurations. (a) Reflective paraboloid, or dish, focusing on a cell array. (b) Linear parabolic trough focusing on a line of cells