Table 21.1 Present worth of PV system cash flows shown in Figure 21.1 (discount rate = 8%)

Cash flow		Present worth		
Category	Amount [$]	n	Equation	P [$]
Year 1 investment	−100 000	2	(21.1)	$P_{investment}$ = −116 640
Year 2 investment	−100 000	1	(21.1)	$P_{investment}$ = −108 000
Annual electricity, Years 3–27	25 000	25	(21.4)	$P_{electricity}$ = 266 869
Replacement, Year 5	−5 000	5	(21.2)	$P_{replacement}$ = −3403
Replacement, Year 10	−5 000	10	(21.2)	$P_{replacement}$ = −2316
Replacement, Year 15	−5 000	15	(21.2)	$P_{replacement}$ = −1576
Replacement, Year 20	−5 000	20	(21.2)	$P_{replacement}$ = −1073
Annual maintenance, Years 3–27	−2 000	25	(21.4)	$P_{maintenance}$ = −21 350
Salvage value, Year 27	20 000	25	(21.2)	$P_{salvage}$ = 2920
Total			(21.5)	P_s = 15 431

This PV system present worth is positive, and thus the system can be said to have a net benefit of $15 431 measured at the beginning of Year 3. Whether this is an acceptable economic choice would depend on the economic criteria of the system purchaser. This subject will be discussed again later.

There are instances when the annual amounts a in equation (21.4) are not uniform (constant) over all periods, but escalate at a constant rate, e. That is, if c is defined as the amount for the first year, the amount for the second year is $c(1+e)$, and the amount for the third year is $c(1+e)^2$. An obvious instance of where such a series of cash flows might arise would be in accounting for the effect of inflation on the value of avoided electricity. In this instance, the present worth of the series of cash flows can be expressed [1], when $e > i$, as

$$P = \frac{c}{1+i}\left\{\frac{(1+x)^n - 1}{x}\right\} \tag{21.6}$$

where x is defined by

$$\frac{1+e}{1+i} = 1 + x \tag{21.6a}$$

If the escalation rate is less than the discount rate, $e < i$, then

$$P = \frac{c}{1+e}\left\{\frac{(1+x)^n - 1}{x(1+x)^n}\right\} \tag{21.7}$$

where x is defined by

$$\frac{1+e}{1+i} = \frac{1}{1+x} \tag{21.7a}$$

If the escalation rate equals the discount rate, $e = i$, then

$$P = cn/(1+e) = cn/(1+i) \tag{21.8}$$

When a financial evaluation of a PV system project is defined, such as the one in Figure 21.1, it is important to be clear about how inflation will be taken into account.