
Quick Review of Basic Economics

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Thomas E. Hoff
Clean Power Research
www.clean-power.com

Definitions

Simple Payback: extra first cost divided by 1st yr savings

Payback: years until cumulative cash flow equals investment

Net Present Value: Sum of the discounted net cash flows

$$NPV = \text{Cash Flow}_0 + \frac{\text{Cash Flow}_1}{(1+r)^1} + \frac{\text{Cash Flow}_2}{(1+r)^2} + \dots + \frac{\text{Cash Flow}_N}{(1+r)^N}$$

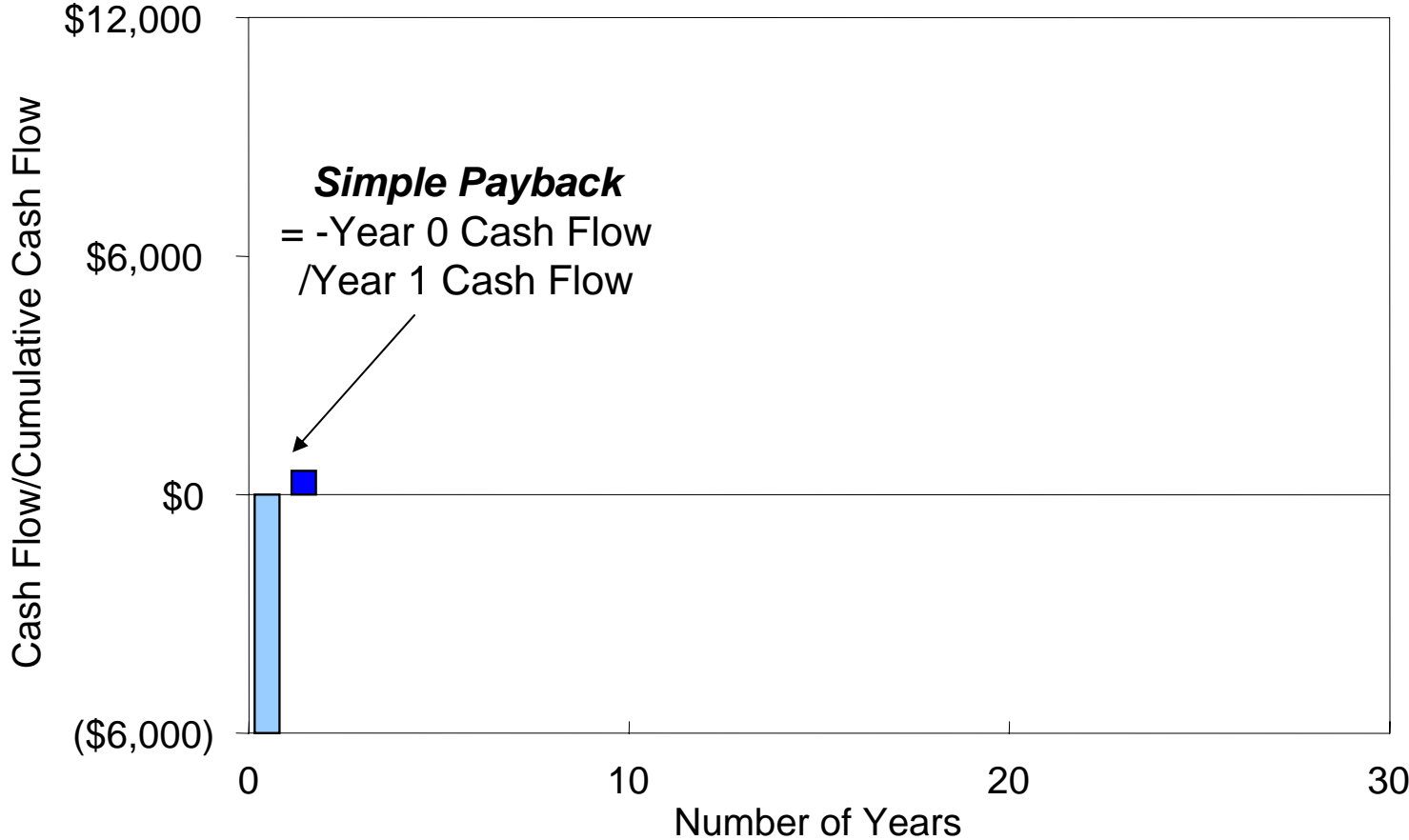
Internal Rate of Return: discount rate where NPV = \$0

$$\$0 = \text{Cash Flow}_0 + \frac{\text{Cash Flow}_1}{(1+IRR)^1} + \frac{\text{Cash Flow}_2}{(1+IRR)^2} + \dots + \frac{\text{Cash Flow}_N}{(1+IRR)^N}$$

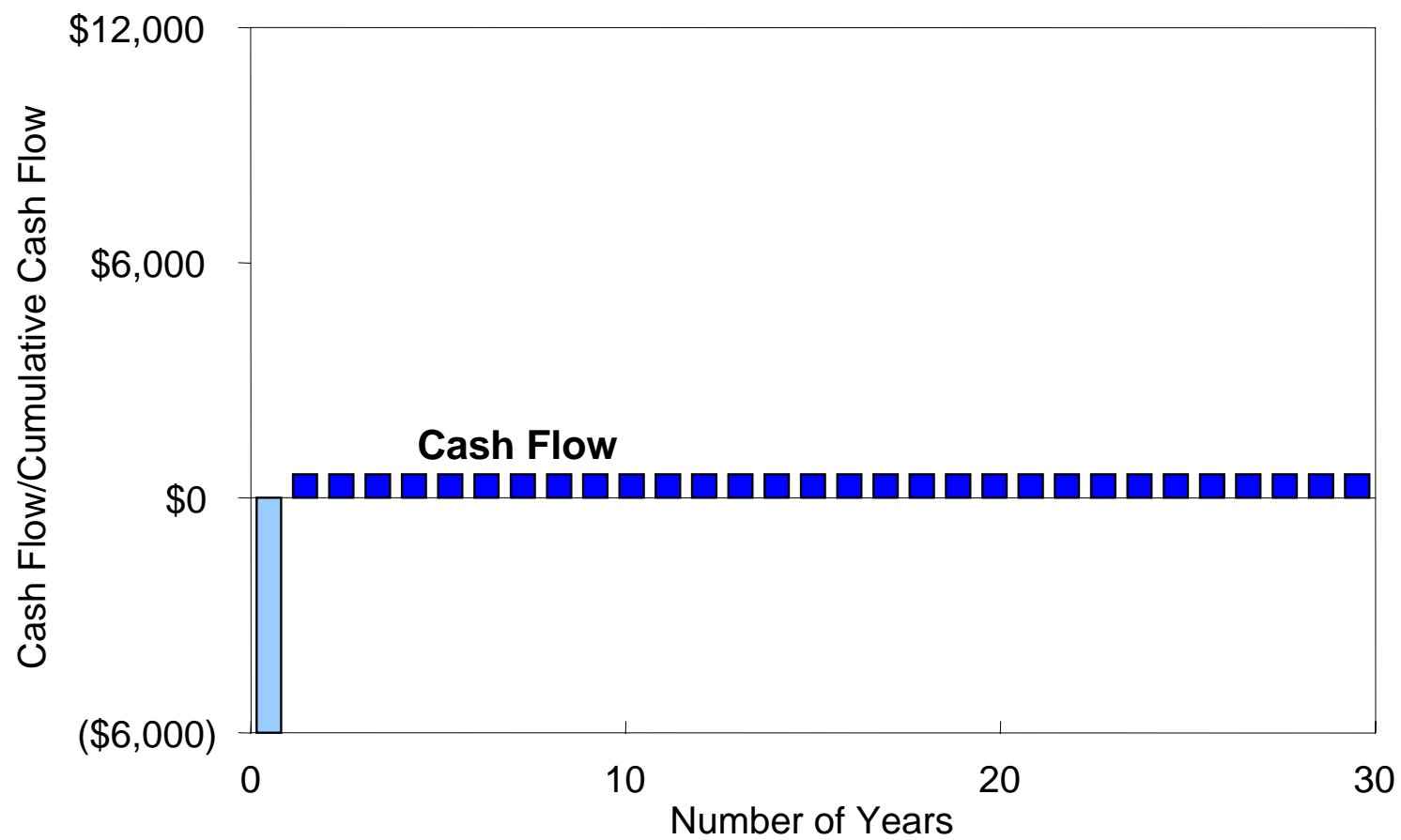
Assumptions for Example

- PV system costs \$10,000
- Consumer gets a \$4,000 incentive
- Consumer reduces utility bill by \$500/year
- System paid for with cash
- 7.5% discount rate

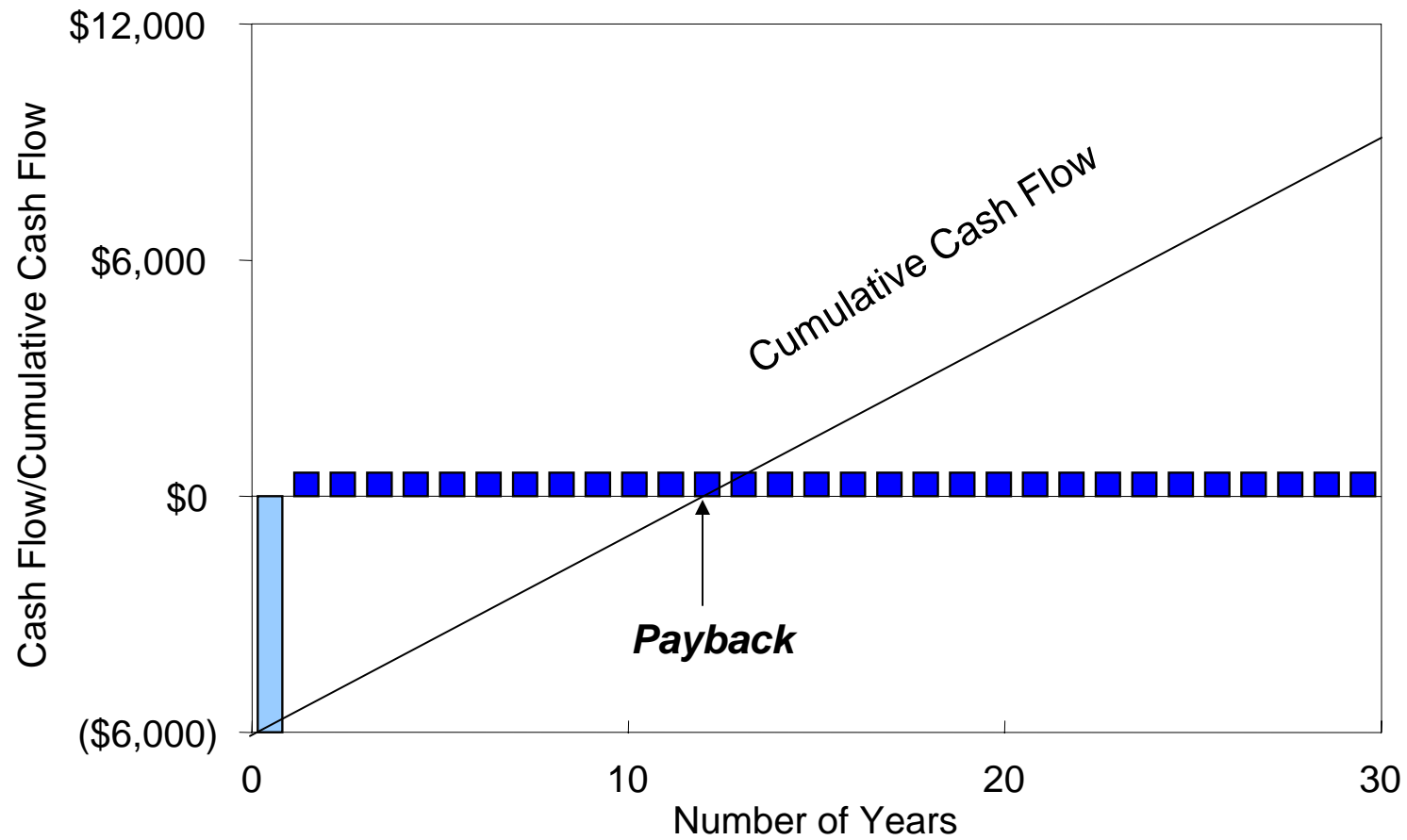
Simple Payback



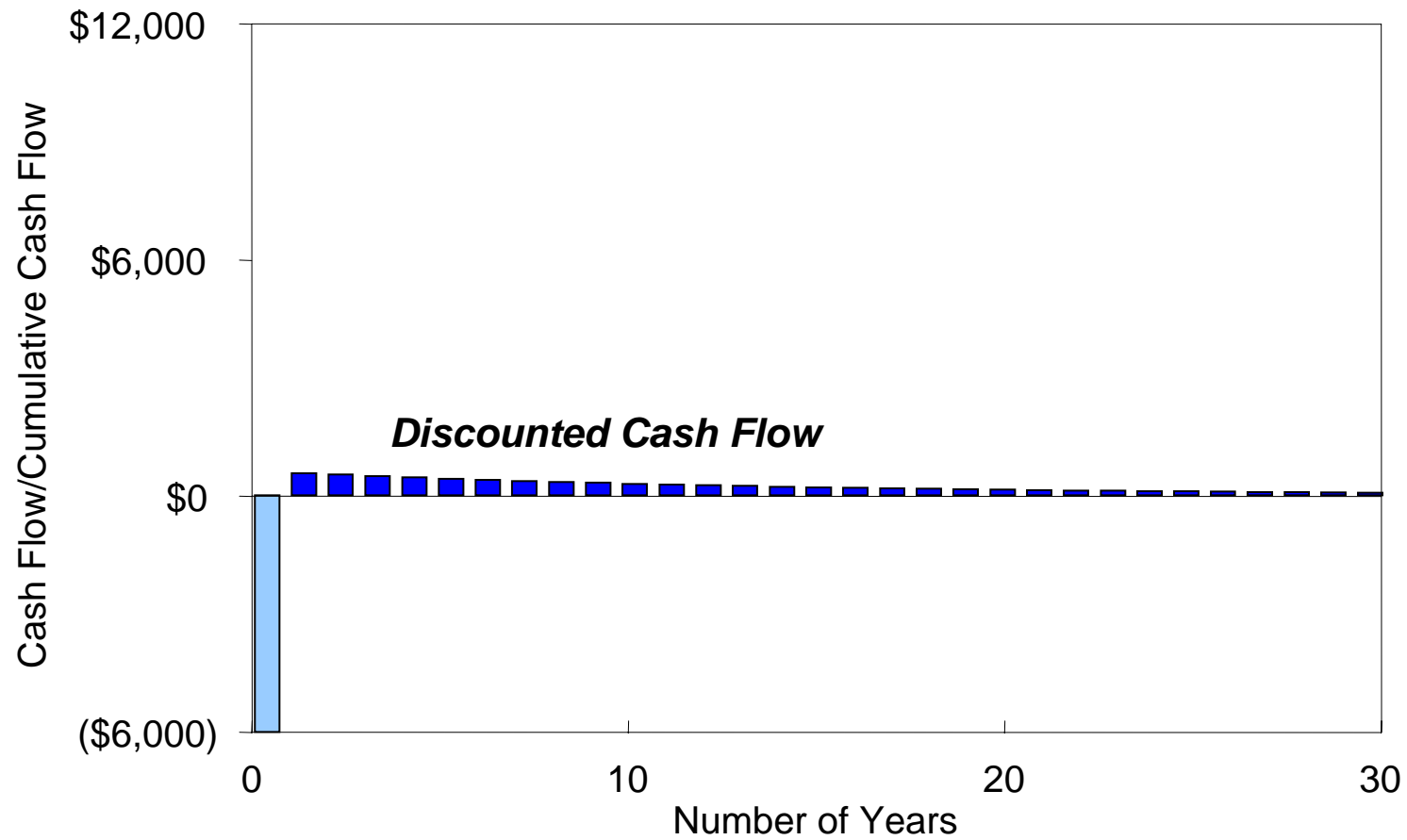
Cash Flow



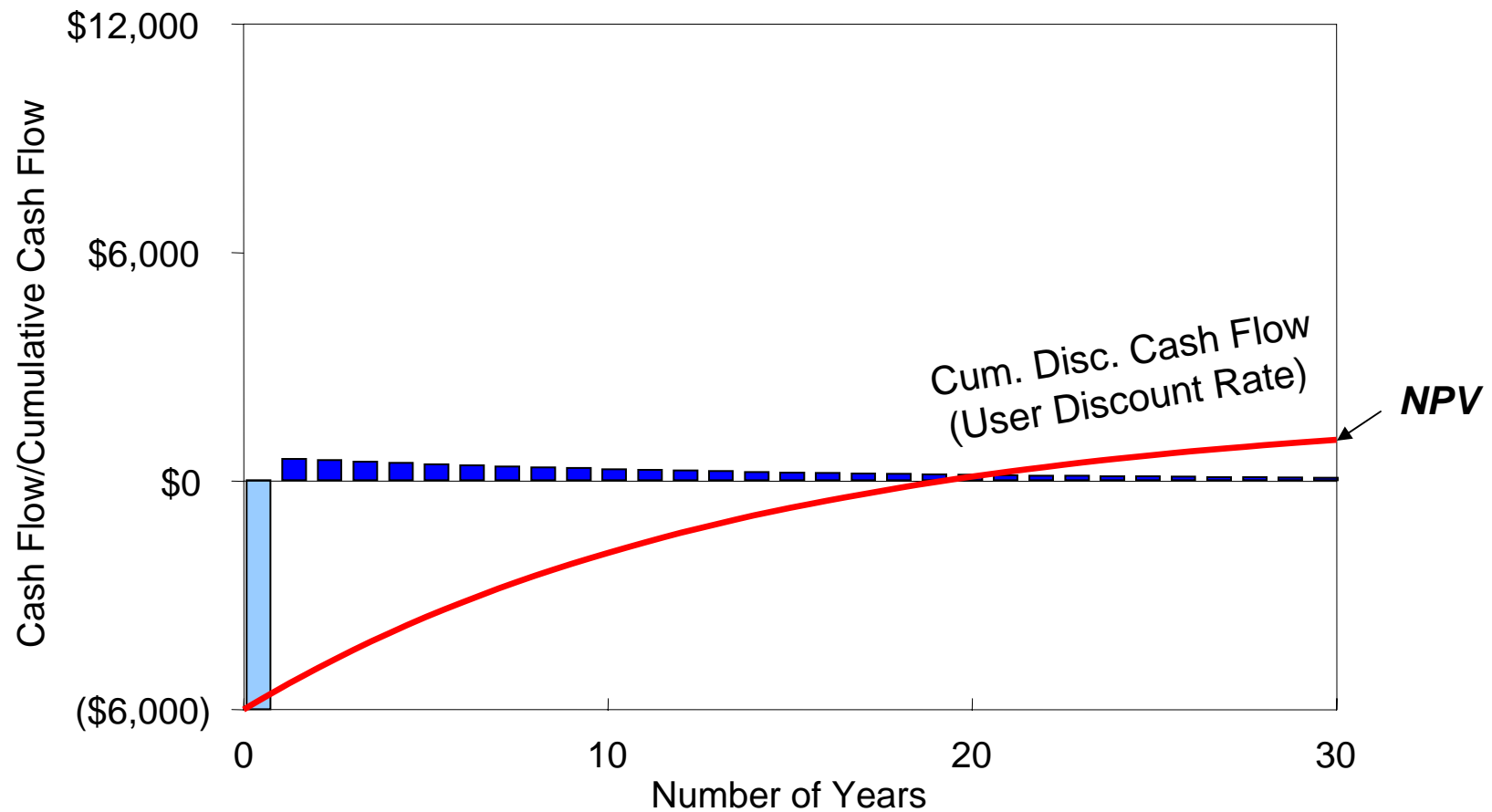
Payback



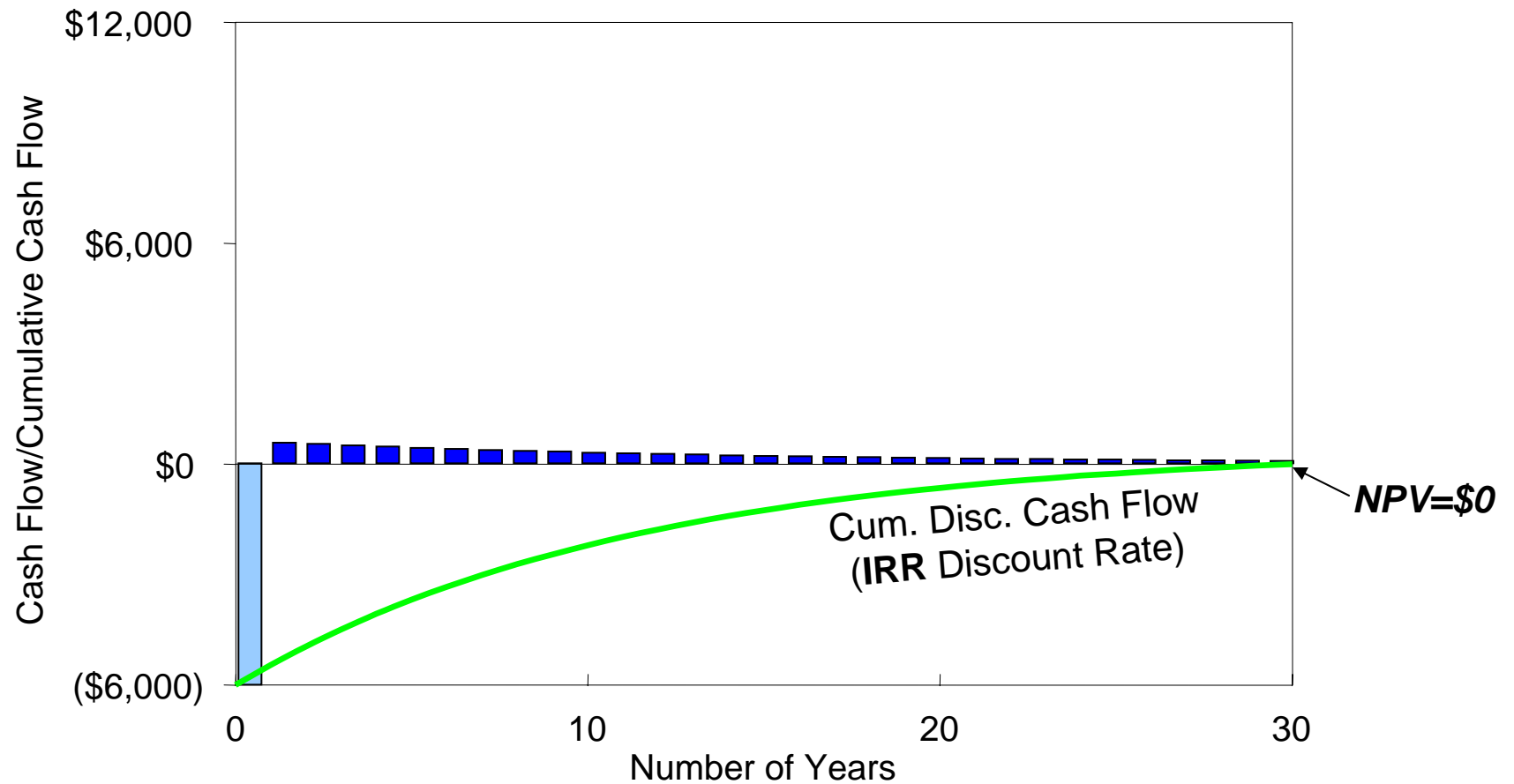
Discounted Cash Flow



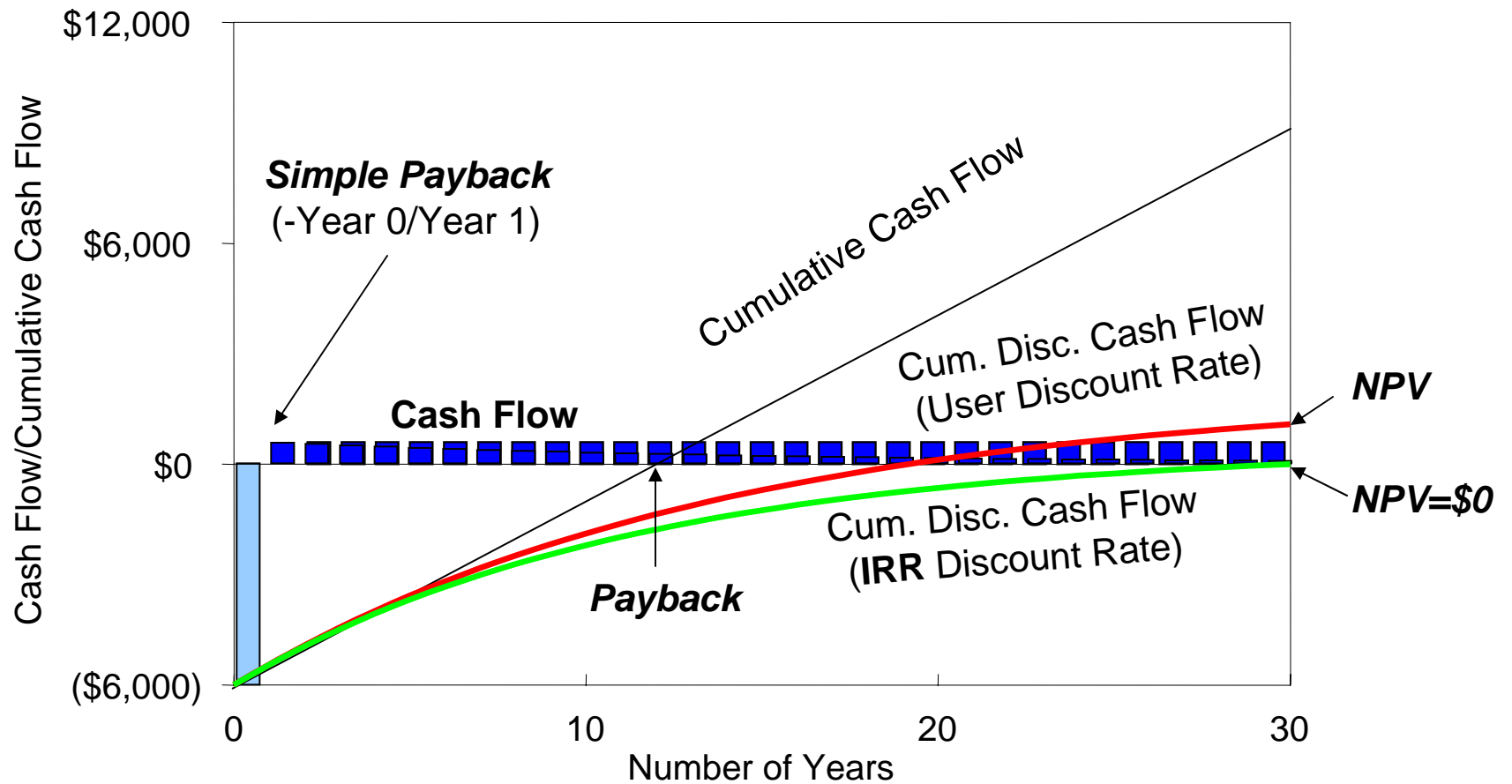
Net Present Value (\$1,086)



Internal Rate of Return (9.3%)



All Together



Simple Payback

Strengths

- People are familiar with the concept of simple payback
- Simple payback is conceptually simple

Weaknesses

- Simple payback has definition problems: what is included in cost and what is included in savings?
- People think they understand simple payback better than they do
- Simple payback discriminates against long-lived technologies such as PV
- Simple payback does not account for uncertainty
- Simple payback does not deal well with cash flows that vary substantially from year to year

Payback

Strengths

- Payback is conceptually simple

Weaknesses

- Discriminates against long-lived technologies such as PV
- Does not account for uncertainty
- Does not account for the time value of money
- Does not account for method of payment

Cash Flow Analysis

Strengths

- People want to know the real effect of a purchase on their pocketbook

Weaknesses

- One either presents all the net cash flows (which may be complicated) or picks a single point in time
- Picking one point does not deal well with cash flows that vary substantially from year to year

Net Present Value (NPV)

Strengths

- Well established, rigorous financial term

Weaknesses

- Many people do not understand what it means (e.g., a typical interpretation is that one should invest if the NPV is positive, but many people do not know why)
- Disagreement over what should be included in the net cash flows
- Disagreement over what is the correct discount rate

Internal Rate of Return (IRR)

Strengths

- Well established, rigorous financial term

Weaknesses

- While IRR is better understood than NPV, it is still not well understood
- It may not exist if the sign of the cash flows changes direction more than one time