Complex Cash Flows and Excel to the Rescue

The NPV Method: Let's try a problem together

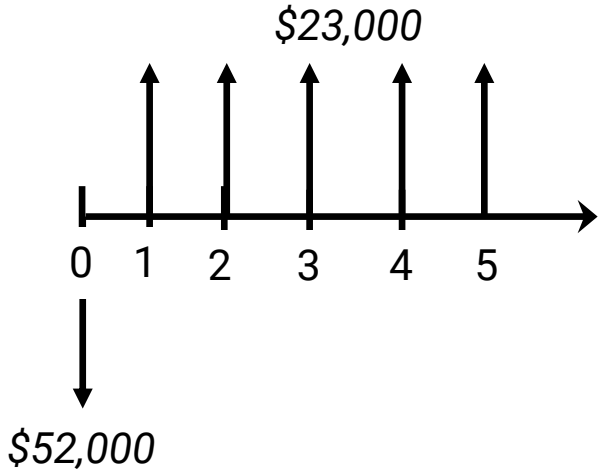
Your New Office
Rabbit Ridge Winery
Palisade, Colorado

Let's do a problem together…

Part 1: Rabbit Ridge Wineries is evaluating a grape crushing machine for use at its vineyard on the Western Slope of Colorado.

	Smart Crush
First Cost	$52,000
Annual O&M Costs	15,000
Annual Revenues	38,000
Useful Life	5 years

Net Benefits



Should Rabbit Ridge make the investment?
Rabbit Ridge has a Hurdle Rate = 12%.

Finding the Net Present Value…

Solution: determine the NPV for the machine at 12%.

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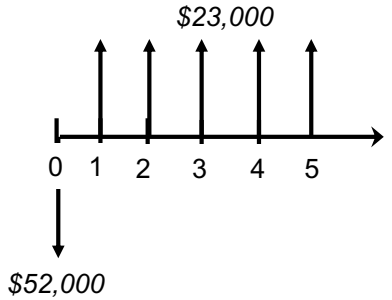


$$PV_{Inflows} = A\left[\frac{(1+i)^N - 1}{i\,(1+i)^N}\right]$$

$$PV_{Inflows} = \$23{,}000\left[\frac{(1+0.12)^5 - 1}{0.12(1+0.12)^5}\right] = \$82{,}915$$

$$PV\ (Investment) = \$52{,}000$$

NPV = $30,915

NPV > 0, so this project is economically viable.

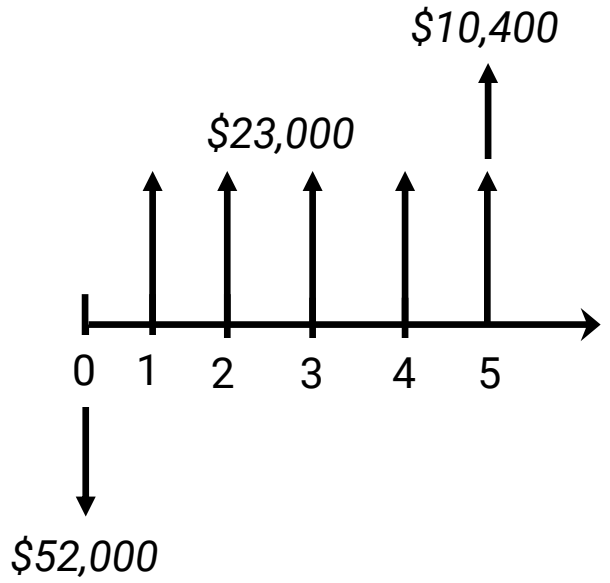
The Smart Crush Project has a positive NPV, meaning its benefits exceeds its costs (on a discounted cash flow basis at the company's discount rate).

Rabbit Ridge should purchase Smart Crush as its grape crushing machine.

Let's do a problem together…

Part 2: What if you can sell the equipment for 20% of its original value?

	Smart Crush
First Cost	$52,000
Annual O&M Costs	$15,000
Annual Revenues	$38,000
Salvage Value (20%)	$10,400
Useful Life	5 years

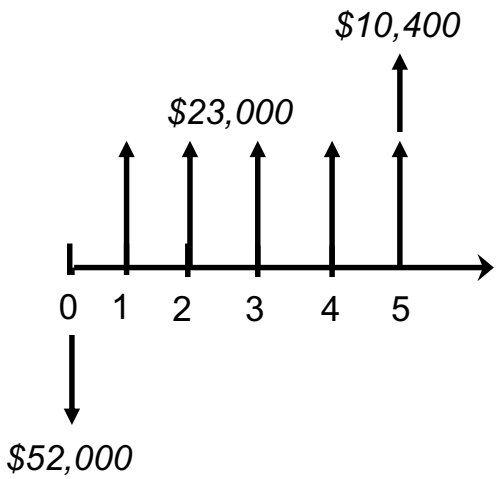


How does this change the NPV?

Finding the Net Present Value…

Solution: determine the NPV for the machine at 12%.

	Smart Crush
First Cost	$52,000
Annual O&M Costs	15,000
Annual Revenues	38,000
Salvage Value	10,400
Useful Life	5 years



$$PV_{Inflows} = A\left[\frac{(1+i)^N - 1}{i\,(1+i)^N}\right] + FV\left[\frac{1}{(1+i)^N}\right]$$

$$PV_{Inflows} = 23{,}000\left[\frac{(1+0.12)^5 - 1}{0.12\,(1+0.12)^5}\right] + \$10{,}400\left[\frac{1}{(1+0.12)^5}\right]$$

$$PV_{Inflows} = \$82{,}915 + \$5{,}901$$

$$= \$88{,}816$$

$$PV\ (Investment) = \$52{,}000$$

NPV = $36,816

NPV is even higher, although not by much.

When Cash Flows are Not So Uniform…

We have formulae when A's are all the same value.

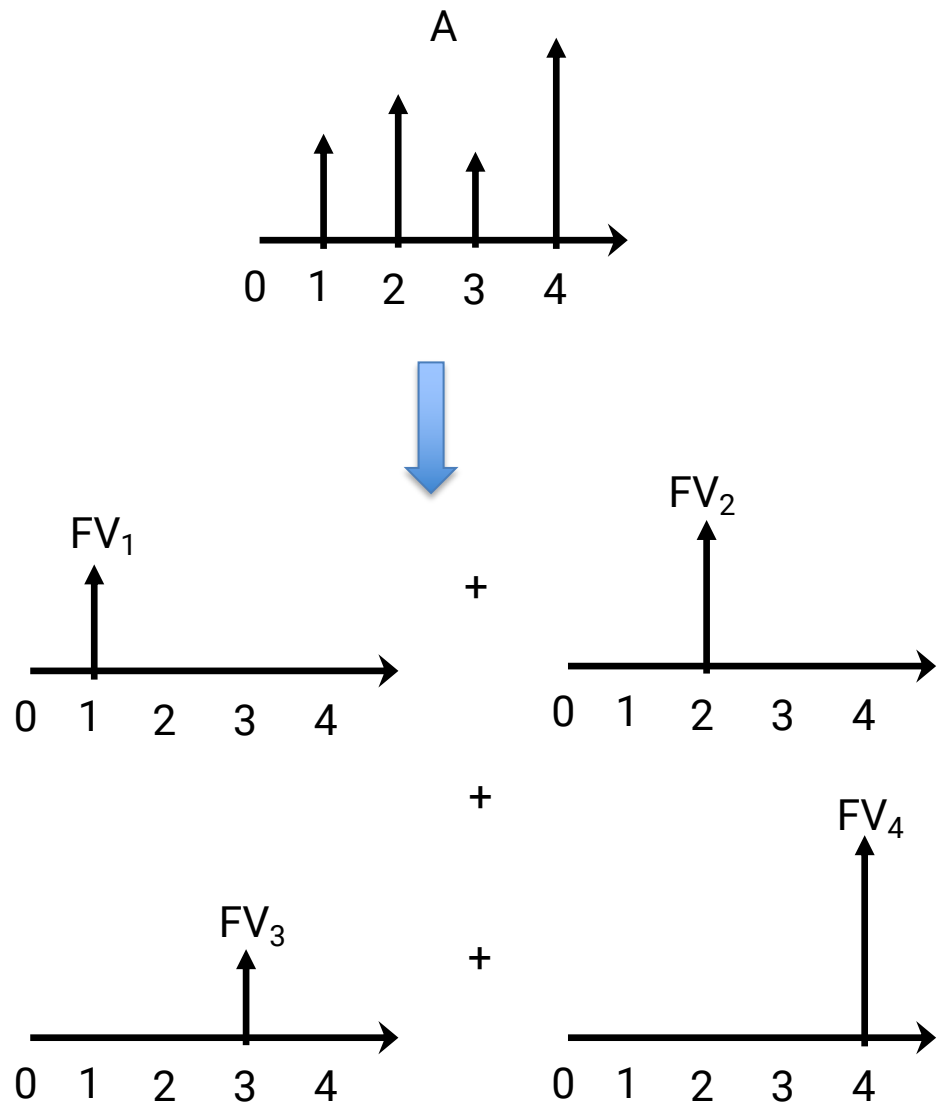
What about when they are not?

Option 1: Determine the PV for each cash inflow one at a time, treating each individual "A" as a future value, FV

$$PV_1 = FV_1 / (1+i)^1$$
$$PV_2 = FV_2 / (1+i)^2$$
$$PV_3 = FV_3 / (1+i)^3$$
$$PV_4 = FV_4 / (1+i)^4$$

$$PV_{inflow} = PV_1 + PV_2 + PV_3 + PV_4$$

Option 2: Let the NPV function in Excel do this for you…



NPV Function in Excel…

NPV: determines the net present value [sort of, as we'll see!] of an investment by discounting a series of future cash flows (positive or negative) at a discount rate.

Format: NPV(rate, values).

rate: The discount rate.

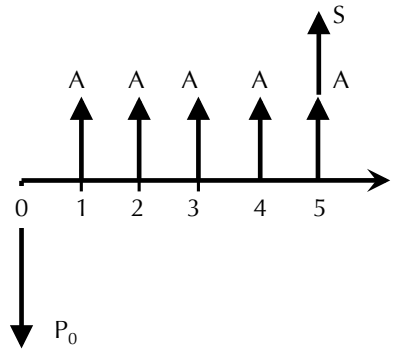
values: The cash flows starting in Year 1 (excluding the Initial Investment at Time = 0).
The cash flows must occur at the end of the periods.

While Excel calls NPV the Net Present Value, it is really the Present Value of all the future cash flows, similar to the PV function, now accounting for any value (positive or negative).

Don't confuse the NPV function with our project valuation formula, NPV = $PV_{inflows} - P_o$ as Excel's NPV function never takes the initial investment at time = 0 into account.

Our Rabbit Ridge Example now with Excel…

	A	B	C	D	E	F	G
1	**Rabbit Ridge Grape Crusher**						
2							
3	**Initial Investment:**	**$52,000**					
4	**Net Benefits:**	**$23,000**					
5	**Salvage Value:**	**$10,400**					
6	**Time (years):**	**5**					
7	**Discount Rate:**	**12%**					
8							
9		**End of Year Cash Flows**					
10	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
11	**Cash Flow**	-$52,000	$23,000	$23,000	$23,000	$23,000	$33,400
12							
13	PV (Yr 1-5):	$88,811	*=NPV(B7, C11:G11)*				
14	Initial Investment:	$52,000	*=B3*				
15	**Net Present Value, NPV:**	**$36,811**	*=B13-B14*				



NPV > 0, the project is financially justified.

Our Rabbit Ridge Example now with Excel…

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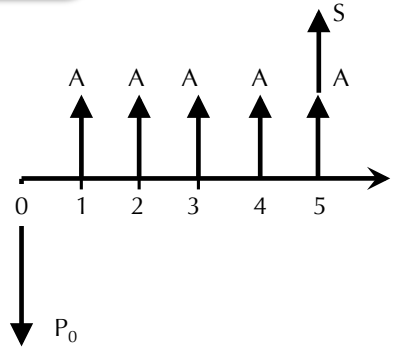
13	PV (Yr 1-5):	$88,811	*=NPV(B7, C11:G11)*				
14	Initial Investment:	$52,000	*=B3*				
15	**Net Present Value, NPV:**	**$36,811**	*=B13-B14*				

The NPV function only captures these cash flows –starting at the end of Year 1.



$NPV = PV_{Inflows} - P_0$

NPV > 0, the project is financially justified.

Our Rabbit Ridge Example now with Excel…

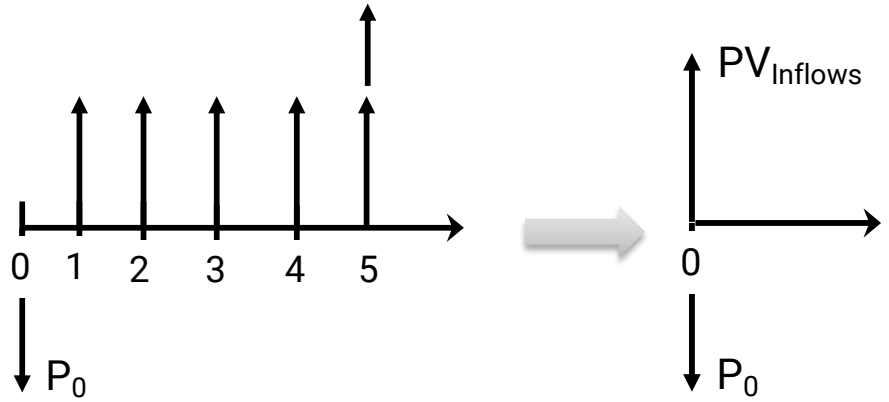
The toughest part is just keeping the signs straight…

Recall:

$$NPV = PV_{Inflows} - PV_{Outflows}$$

Or in this case:

$$NPV = PV_{Inflows} - P_o \text{ (the Initial Investment)}$$



If you consider the "Initial Investment" as a positive number (because you know you're *spending* the money)

→ $NPV = PV_{Inflows} - P_o$

If you consider the "Initial Investment" as a negative number as part of a cash flow stream:

→ $NPV = PV_{Inflows} + (-P_o)$

Main Takeaways…

The Net Present Value, or NPV, is a widely used metric to determine whether a project is financially worthwhile – do the benefits exceed the costs on a discounted cash flow basis.

The NPV can be easily determined analytically, but only if the future cash flows are the same.

In reality, future cash flows will vary considerably, calling for a spreadsheet approach.

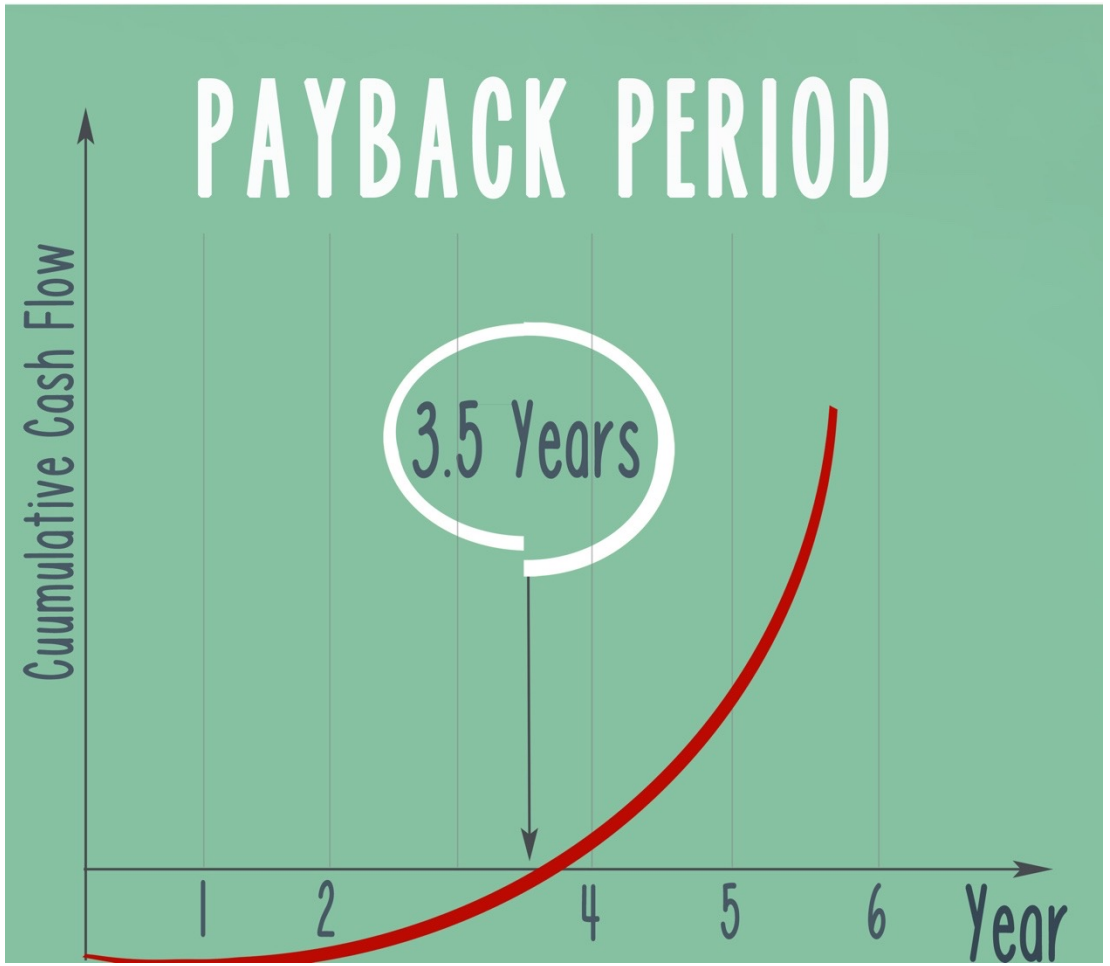
Excel's NPV Function determines the present value of all future cash flows (starting at the end of Year 1), whatever their value and whether they are positive or negative.

However, Excel's NPV function is not Net Present Value. We need to subtract the initial investment to obtain the correct value for Net Present Value.

We will see many more examples in future lessons, incorporating other important project valuation metrics.

Next Time…

Payback Period Analysis



Credits & References

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