

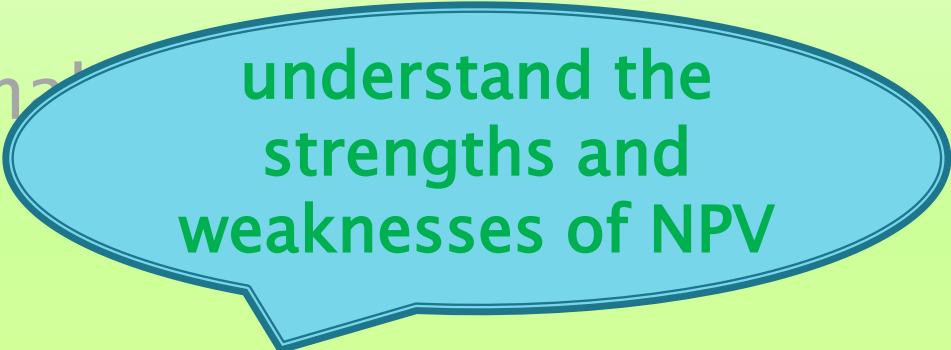
# Teach Yourself: Economic Evaluation:

Step 3 of Evaluating the Business/Project:

**2d: NPV**

# The purpose of this module is to ...

Level 3: Decision making



understand the  
strengths and  
weaknesses of NPV

Level 2: Evaluating the business/project

Level 1: Hands-on economic modelling

Spend only a few seconds on most slides.

# Level 2: Evaluating the business/project

Step 1: Find out what is required

Step 2: Create the hands-on model

**Step 3: Compute the basket of powerful economic measures: NPV, IRR, Payback, four cash streams, key drivers, break-evens, uncertainty, risk, optionality**

Step 4: Assess alternatives, flexibility, options, risks, the business, the industry

Step 5: Communicate your message

# Step 3: 'Compute Powerful Economic Metrics'

Three metrics have become pre-eminent in economic evaluation: –

- a) Net Present Value – NPV
- b) Internal rate of return – IRR
- c) Payback – real or nominal

**NPV** is pre-eminent and powerful. It is a wonderful invention (I think it was first commonly used about 40 to 50 years ago.) Some businesses and people become addicted to NPV and believe it is the 'one true and absolute' measure. The 'holy grail'

**IRR** tells you a lot about the quality of an investment. It is the second most popular metric – again for very good reason.

**Payback** is employed by some battle-hardened operators and managers as a ruthless but sensible metric – and for good reason.

I feel each of these three has its merits and its short-comings.

# Economic evaluation is much more than NPV

I am a strong believer in economic evaluation being a lot, lot more than pumping out NPV, supported by IRR and payback.

I believe each project/investment/opportunity should be understood against:

- ▶ A basket of economic measures – lots more than these three.
- ▶ Its ability to flex and adapt to a wide range of business and operating conditions.
- ▶ Its uncertainties, risks, rewards, optionality.
- ▶ Its strengths and weaknesses
- ▶ Its fit inside your company.
- ▶ Its direct and indirect competitors,  
and most importantly
- ▶ the future for that industry

# NPV is the quantity of value

## NPV is a great measure

It says you should be indifferent to receiving the NPV as cash in your hand today or taking the project/investment/business for its life.

- It is easy to calculate
- It is easy to understand and discuss
- NPV can incorporate uncertainty, risks and optionality into its computation
- It can draw everyone around you into its generation

It is by far the most revered of all the metrics.

# NPV is easy to calculate

Always remember that you are creating a model for others to readily understand, and to use if they want. (The model is not your exclusive domain and definitely not a 'trophy' of your Excel modelling abilities.)

Some of the people looking at your model will be in important positions but do not really understand how NPV is computed. If you use Excel NPV functions in your model you will alienate them and reduce your status in their eyes to a 'computer jockey' who does mathematical computations.

But if you have your NPV in easy-to-follow little steps then these important people can sneak a look and find they readily do understand the concept of NPV. Their focus can instead turn to the quality of the data in the four cash streams.

Everyone around you should see your role as the one expert who brings all the team's information together in an easy-to-follow model (that may become long and detailed) and you as being one of the key persons to improve the business. You are much more than the person with the Excel spreadsheet doing computations in the back office.

*The next two slides are reproduced from Level1: Hands on modelling*





This slide is reproduced from Level 1: Hands on modelling: –

Most important: Do not make short cuts by using Excel functions of NPV because : –

- You cannot graph NPV and cumulative NPV year-by-year.
- Hard to find your silly errors
- Less experienced people will not visually discover the simple concept that is NPV
- They are prone to take your end result at face value
- Over the years too many people have made mistakes trying to use these Excel functions.
- You would be evaluation 'arrogant'

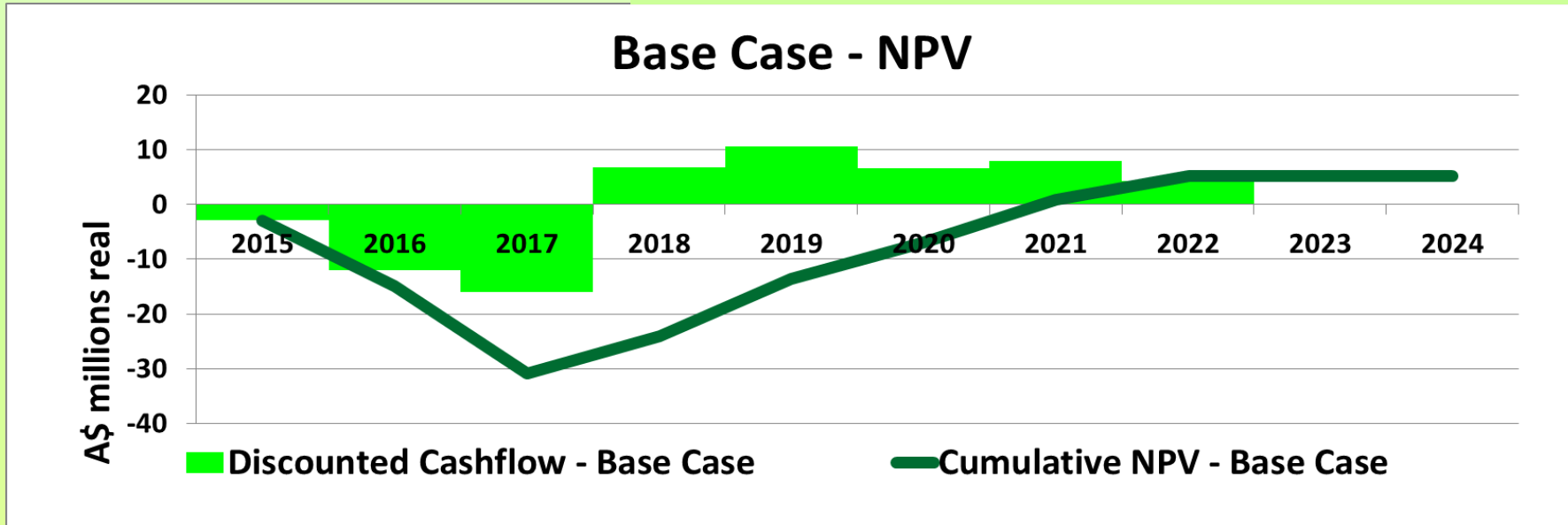
It is your duty as a team player to take a few extra minutes of modelling to show NPV step by step and generate the graph for everyone else.

Cashflow and NPV												
Life of Mine	units	Total	2015									
<b>Cashflows</b>												
Cashstream 1: Revenue	A\$ 000 Real	144,687	0									
Cashstream 2: Capital Costs	A\$ 000 Real	34,740	3,000									
Cashstream 3: Operating Costs	A\$ 000 Real	79,846	0	0	6,250	18,151	15,832	14,629	13,051	11,933	0	
Cashstream 4: Taxes	A\$ 000 Real	13,062	0	0	0	1,624	3,573	3,421	3,776	668	0	
<b>Cashflow</b>	A\$ 000 Real	<b>17,038</b>	<b>-3,000</b>	<b>-11,500</b>	<b>-19,450</b>	<b>10,869</b>	<b>10,997</b>	<b>8,451</b>	<b>9,829</b>	<b>10,843</b>	<b>0</b>	
<b>IRR</b>	Real	<b>12.7%</b>										
<b>Discounting</b>												
1Jun14 P Card: Do not use the Excel function for NPV because: 1. others cannot see and check the discount factor year by year, and 2. too many people have got its first year wrong.												
17 July 14 F Green email: Company discount rate for investment in gold is 8% Real.												
Discount Rate	% Real		8%	8%	8%	8%	8%	8%	8%	8%	8%	
Discount Factor			0.96	0.89	0.82	0.76	0.71	0.65	0.61	0.56	0.52	
Discounted Cashflow	A\$ 000	4,484	-2,887	-10,246	-16,046	8,302	7,778	5,534	5,960	6,088	0	
Cumulative NPV	A\$ 000		-2,887	-13,133	-29,179	-20,876	-13,098	-7,564	-1,604	4,484	4,484	
<b>NPV</b>	A\$ 000	<b>4,484</b>										

This slide is reproduced from Level 1: Hands on modelling: –

It is essential to take a few minutes to graph your NPV and the cumulative NPV.

1. Do not rush out your results but pause a few minutes to find your own errors before others do!
2. Understand the business
3. Perhaps suggest a change to business life strategy



### Discounting

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NPV	A\$ 000	<b>4,484</b>									

# Four home truths about NPV...

1. NPV is a wonderful and powerful concept
2. But NPV is nothing more than the mathematical treatment of a collation of best estimates, expert judgements and knowledgeable opinions
3. The process and discipline of extracting all this information from these experts is as important as the NPV itself.
4. Managers are highly naïve if they believe that NPV is a dispassionate, objective and absolute metric.

## Home Truths →

Many senior managers and decision-makers do not appreciate that NPV is nothing more than the mathematical treatment of a whole collection of opinions.

Their company's investment documents have a box for NPV which they regard as sacrosanct.

But NPV is of course derived from the aggregation of the four cash streams of production/revenue, capex, opex and taxes.

In turn each of these is derived from estimates by experts of input parameters. Within each cash stream there will be parameters that are known with confidence and others that are nothing more than best estimates of the situation many years out.

## Home Truths →

In **cost reduction exercises**, production, sales and revenue should not change and it becomes the after-tax comparison of various capex and opex configurations.

These cost reduction evaluations probably are the most reliable of NPV results because they do not extend into the vast quicksands of production, sales and prices.

Cost reduction exercises are probably the sole use of NPV as a stand-alone metric.

## Home Truths →

But in most business/project assessments the revenue stream needs to be computed. And revenue needs to be the largest of the four cash streams for the business to be economic. So in these, the forecasting of 'price' will be of utmost importance to the calculation of NPV.

The irony is that in most resource companies the nitty-gritty of forecasting the markets, sales volumes and prices of that industry for years into the future is overseen by a senior executive but in truth performed by some 'back office' expert – or perhaps relegated to an external company.

*So whilst the project manager is busy chasing down contingencies in the capital cost estimate and trying to get better head grades and processing recoveries to improve NPV, she/he probably takes the most influential opinion of price forecasting at its face value. Preventing this quite bizarre situation is covered in this website under 'Planning, Markets & Prices' that can be accessed from the home page.*

## Home Truths →

Most companies recognise the uncertainties in markets so this most influential opinion may be presented as a set of price forecasts, such as minimum, low, mid, high and maximum.

When using your model to compute NPV, these uncertainties in price can be assembled with the multitude of uncertainties, risks and options in production, capex and opex. With lots of business and operational awareness they can be carefully grouped and incorporated into the computation of NPVs.

It is most useful for a business/project team to gather and work through various combinations of uncertainty, risk and optionality together. A low scenario is not the simple combination of all the low parameters. It may comprise a reasoned combination of low, mid and even high parameters. This exercise can educate participants and share lots of hidden knowledge.

As will be covered in later modules of this 'Step 3: Evaluating the Business/Project', you may compute a series of NPV's as follows



# Compute multiple NPVs as warranted

1. Base case or mid scenario NPV
2. Minimum scenario NPV
3. Low scenario NPV
4. High scenario NPV
5. Maximum scenario NPV
6. Probability weighted NPV of min, low, mid, high, max scenarios
7. Alternative business scenarios NPVs
8. Above scenarios with risks incorporated
9. Above scenarios with optionality added
10. Probabilistic NPV



Process driven companies like to show just one NPV number so will force just one to be used.

It would be far more helpful for the decision makers and for the team to review all the NPV's to see for themselves the range and diversity. Each person can use experience and wisdom to form a balanced assessment.

## Home Truths →

- There is another home truth when using sophisticated mathematics “rubbish in = rubbish out”.

*I cannot recall ever seeing software that can properly handle the combination of multiple probabilistic distributions – for example when an iteration is with a low price does the software recompute or adopt a new optimum mine plan with new cut-off grades that leads to a new production schedule, and then recompute the capital and opex for the new mine design? Same for a high price, low grades, high grades, low recovery, high recovery, etc.*

- If you reassembled the very same experts in say two years time and had each reproduce the work it is highly likely that their expert estimates would be different; some by a substantial degree. NPV's have a currency, and are likely to change noticeably over time.
- If you changed the study team so it comprised specialists who somehow were even more expert then the NPV is likely to change.

## Home Truths →

All this leads to home truth 4: –

1. .

2. .

3. .

**4. Managers are highly naïve if they believe that NPV is a dispassionate, objective and absolute metric.**

NPV is a powerful and marvellous invention but there is a lot, lot more to economic evaluation than pumping out a number.

# NPV needs major support when:

**i. There is an upfront investment →**

*While NPV gives you a quantity measure it fails to reveal the quality of any upfront investment.*

For a new business, an acquisition, an expansion or a new project NPV does not recognise how much is to be invested and risked.

For example an NPV of \$1 million can result from investing \$2 million in a safe business or by investing \$100 million in a poor business.

This is where NPV needs augmenting with IRR and Payback.

# NPV needs major support when:

## ii. There are uncertainties, risks and options →

Uncertainties, risks and options can be incorporated into NPV in a few different ways, each of which has its pluses and minuses. These are discussed below in later modules.

As discussed above, the key is that each of these methods requires human judgement applied to mathematical computations and therefore is only as good as the people choosing the inputs.

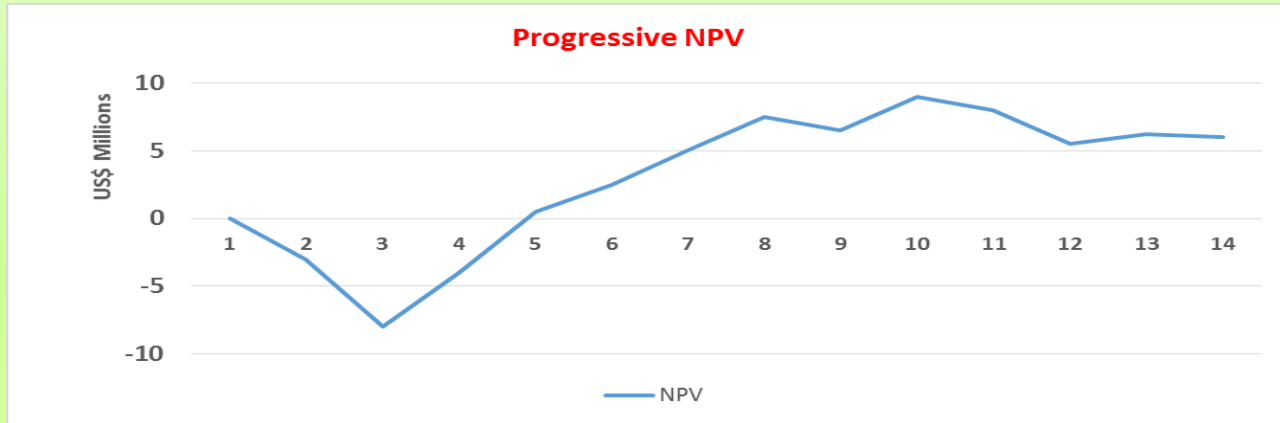
(I have witnessed self-professed experts guiding and unwittingly distorting this process.)

The biggest danger is that the managers and decision-makers get over-awed by the process and machinations, and rely on the mathematical process being true and objective. Worse if they do not participate, or even research for themselves, to see exactly how each risk is being incorporated and more importantly how the interactions of multiple parameters and multiple risks are being treated mathematically.

NPV adjusted for uncertainty, risk and optionality can be exciting but it can be highly dangerous unless it is used with full knowledge of its computation and hence used with caution.

# NPV needs major support when:

## iii. The business life needs optimising →



Here the business looks optimised in Year 10, not at the end of life in Year 14. You should explore ceasing business early – remembering closure costs would come forward.

You would not see this if you blindly use Excel NPV functions.

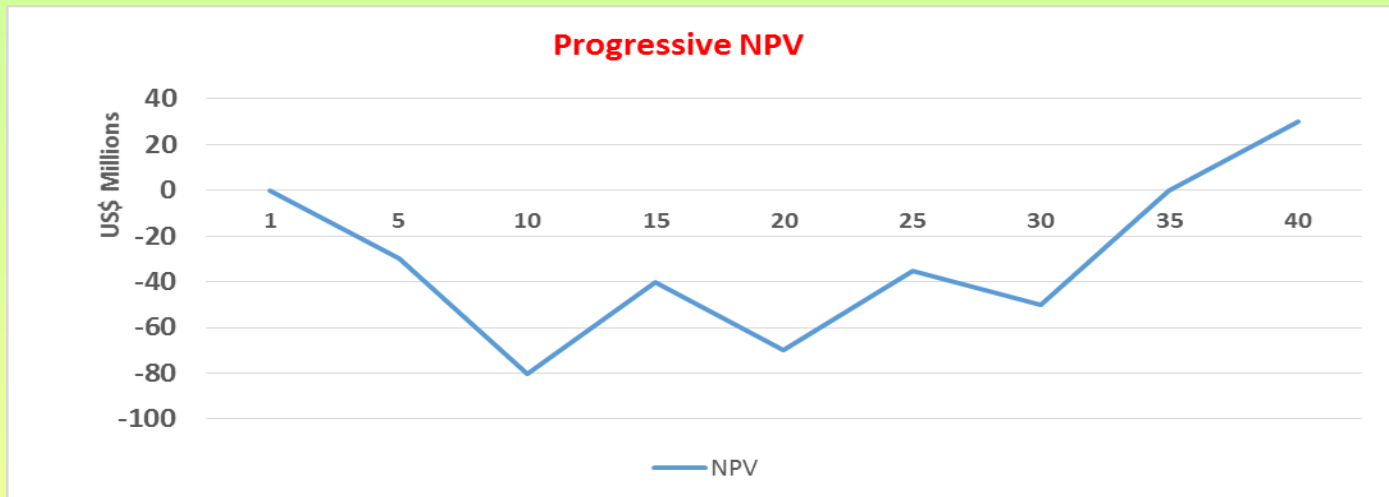
This happens in too many poorly modelled businesses and projects where optimum NPV peaks before the nominal end-of-life.

Instead, you need to take a few extra minutes so your model computes NPV for every year through its possible life and graphs progressive NPV.

# NPV needs major support when:

## iv. The journey to final NPV is terrible →

I cannot forget the world sized expansion project that was continuously reported to top management as having a satisfactory NPV and so the studies continued for years. But the NPV was forecast to be terribly negative for decades and only achieve positive NPV after everything came good in the last years after decades ...



A project manager protecting his job might say *“Do not show them the graph of progressive NPV and do not tell them the IRR!”*

# NPV needs major support when:

**v. People use it to make decisions→**

Because NPV is nothing more than the mathematical treatment of a whole collection of opinions it must be used with understanding and caution.

*Are executives and directors who rely largely on NPV, shown in a box, to make an investment decision being negligent?*



NPV is pre-eminent and powerful  
but there is a lot, lot more to evaluation!

**END**