Translating Gas and LNG into Money

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Why this model?

- Economic models used by various players for different purposes
- Importance of **Open Fiscal Models**:
  - **Fiscal models** necessary to understand the project economics and government revenues under different scenarios
  - **Open** fiscal models necessary to increase public understanding of revenue flows from transformative investment projects
- Purpose of the **Open LNG Model**:
  - Assess different LNG structures
  - Understand the project economics and government revenue flows from each component along the gas value chain
  - Assess the impact of additional upstream gas fields taking part in the project
  - Demonstrate the trade-off between different taxes

Outline for Webinar

- Background on the LNG value chain
- Understanding the structure and key features of the model (in excel)
- How to observe impacts? Tolling agreement example
- How to observe impacts? Capital cost overrun example
- Using the model

Gas is not oil

- Transport and treatment costs are higher
- Greater economies of scale required
- Smaller market
- Different segments with different ownerships
  - Upstream
  - Pipeline
  - LNG plant
- Different products
  - Gas
  - Liquefied Petroleum Gas

Segments of the gas value chain featured in this model

Upstream

- Gas producers: May be more than one block and each of those blocks will have a different set of owners/investors

Gas gathering pipeline

- Transporting the gas to be processed
- If used by 1 block, operations of the pipeline can be integrated with the upstream
- If more than 1 block, might be a separate company that charges a fee

LPG

- Depending on the "richness" of the natural gas produced, it may be more economic to extract and separately sell the liquids from the natural gas stream as Liquefied Petroleum Gas prior to the liquefaction process.
- Investment made either by the upstream or the LNG plant owner

Gas for domestic use

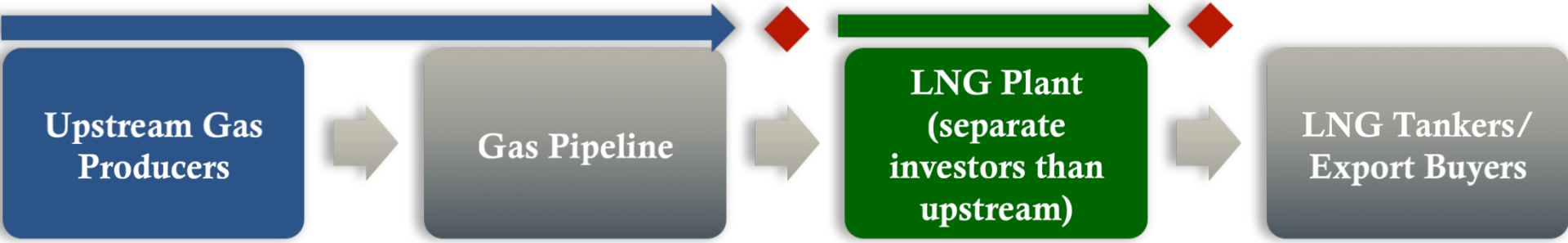
- LNG projects are an opportunity to develop the domestic use of gas since natural gas and LPG can be used relatively cheaply and easily domestically for electrical power generation or direct industrial or consumer purposes
- Most LNG projects contain some requirement for natural gas or LPG to be supplied to local markets

LNG Plant

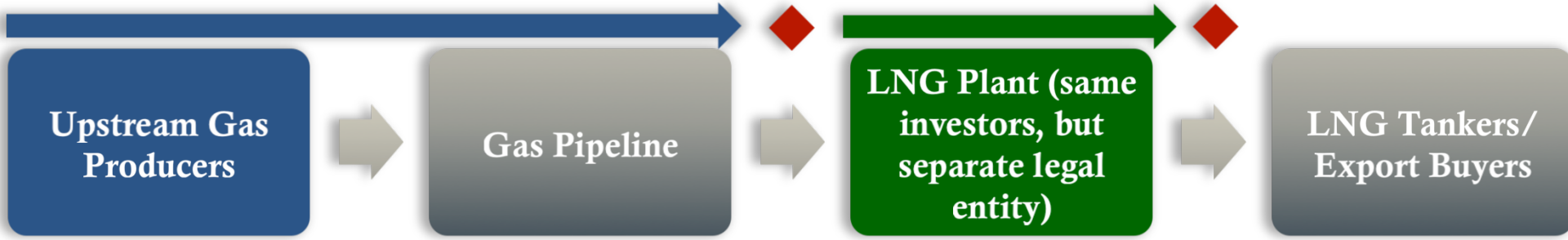
- Often requires production of several blocks
- Might be conflict of interest between the upstream and the plant
- Often LNG plant is a separate group than upstream but might have some players in common

Title to gas under different ownership structures

Independent Plant Owner/Buyer



Related Party Plant Owner/Buyer



Tolling Structure

Gas Projects - Aspects by Segment	Upstream	Gas Pipeline	LNG Plant
Ownership	Granted by License Award by Government	Can be part of Upstream, or Different	Separate from Upstream
Participation by NOC	Commonly the case	Varies	Varies
Legal Form	Typically unincorporated JV	Part of Upstream JV, or Investors purchases Shares in a separate Company	Shares Company (Investors that can be the same as in the upstream purchase shares in a separate LNG Company)
Source of Revenues	Sales of Natural Gas to LNG Plant, or Sales of LNG to Export Buyers	Tariffs from Upstream, or Part of Upstream Costs	Tolls from Upstream, or Sale of LNG to Export Buyers
Main Risks	Geologic, Market (gas prices) Successful exploration, Completion, and Operational	Completion, and Operational only (Maintaining full capacity)	Completion, Operational (Maintaining full capacity), and Market (gas prices) (if not a Tolling plant only)
Fiscal Regime	PSA, or Upstream Royalty/ Petroleum Tax Regime	Part of Upstream Fiscal Regime, or Corporate Tax	Corporate Tax, often with special incentives or taxes
Rates of Return (typical range)	15% +	7-13%	11-16%

Risk Factor:	Tolling Structure	Equity Structure – LNG Plant owners are same as upstream	Equity Structure – LNG Plant owners are separate
LNG Market Price risks	Upstream bears full risk	LNG Plant investors bear full risk	LNG Plant investors bear full risk unless transfer price from upstream is linked to market price
Gas Transfer Price to Plant	Not Applicable since gas is not sold to plant	Upstream owners want as low as possible	Upstream owners want as high as possible and Plant owners as low possible – which will get the parties to a true arm's length price
Upstream production and reserves risks	Both Upstream and LNG investors bear risk unless there is a send-or-pay clause to protect Plant investors	Both Upstream and LNG investors bear risk, but could entail a shift due to different fiscal regimes.	Both Upstream and LNG investors bear risk unless there is a take-or-pay clause to protect Plant investors
LNG Plant Operability and Downtime risks	Both Upstream and LNG investors bear risk unless there is a take-or-pay clause to protect Upstream investors	Both Upstream and LNG investors bear risk	Both Upstream and LNG investors bear risk unless there is a take-or-pay clause to protect Upstream investors
LNG Plant Capital Cost Risks	LNG Plant Investors take full risk, unless tolling tariff formula is linked to costs	LNG Plant Investors bear full risk	LNG Plant Investors bear full risk
LNG Evaporation Product Loss	Upstream bears full cost	LNG Plant Investors bear full cost	LNG Plant Investors bear full cost
Upstream Capital Cost Risks	Upstream bears full risk	Upstream bears full risk	Upstream bears full risk

Background on the LNG value chain

Understanding the structure and key features of the model (in excel)

How to observe impacts? Tolling agreement example

How to observe impacts? Capital cost overrun example

Using the model

The model is composed of 15 worksheets linked by formulas

Name of worksheet	Description of variables in worksheet
Assumptions & Results	Assumptions are inputted and key results are presented graphically
Field 1 Depr	Depreciation schedule of the capital expenditure of Field 1
Field 1 Fiscal	Computation of the fiscal terms paid by upstream gas investors of Field 1
Field 1 Investor	Calculation of the financial return of the investor and of the government take for Field 1
Field 2 Depr	Depreciation schedule of the capital expenditure of Field 2
Field 2 Fiscal	Computation of the fiscal terms paid upstream gas investor of Field 2
Field 2 Investor	Calculation of the financial return of the investor and of the government take for Field 2
Field 3 Depr	Depreciation schedule of the capital expenditure of Field 3
Field 3 Fiscal	Computation of the fiscal terms paid by upstream gas investor in Field 3
Field 3 Investor	Calculation of the financial return of the investor and of the government take for Field 3
Gas PL	Economics, financial returns and government take of the gas pipeline
LNG Equity	Computation of LNG project economics of Equity/buyer structure, whereby LNG owners take title to gas from upstream and sell to 3rd parties (irrespective of whether the LNG plant owners are the upstream operators)
LNG Tolling	Computation of LNG project economics of tolling structure, whereby the LNG plant does not take title to gas and the gas owners pay a toll (i.e: a fee) for processing purposes
Consolidated LNG Equity	Consolidation of the economics of all 3 elements of the projects (upstream, pipeline and LNG facility) under the LNG Equity model
Consolidated LNG Tolling	Consolidation of the economics of all 3 elements of the projects (upstream, pipeline and LNG facility) under the LNG-Tolling structure

The cells in the model are also color coded –

2 important points:

- Cell C156 in the 'Assumptions and Results' worksheet : 1 for the Tolling Model, 2 for the LNG equity model
- Some worksheets, charts and key results will either be marked as " VALID" or "INVALID/ NOT APPLICABLE" (in yellow)– depending on the structure choice in Cell 156.

Color	Description of color coding
Light blue	Input variables that can be changed by the user. Price, production, cost and fiscal inputs should all be edited in the 'Assumptions and Results' worksheet. The structure to be analyzed can be chosen in cell C156 of that tab.
Light green	Section dividers
Yellow	Checks that allow the user to see whether errors have occurred in the model. This color has also been used to highlight which model structure is activated and therefore which results are valid and invalid
Red	Key results
White	Fields that are linked by a formula in the model and should not be changed by inexperienced modelers, as changing them may result in the model not functioning properly
Red font	Explanatory notes within the model

Key indicators

- Net Present Value (NPV): Sum of discounted cash flows to understand today's value of
  - Government revenues
  - Investor's revenues
- Investor's Internal Rate of Return (IRR): Discount rate at which NPV = 0

	Upstream	**Gas Pipeline**	**LNG Plant**
Rates of Investor IRR (typical range)	15% +	7-13%	11-16%

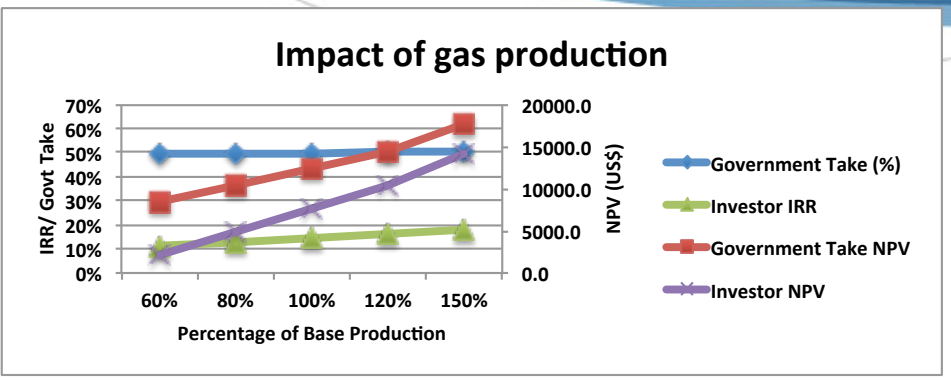
- Government Take: All government revenues/ Pre-tax profit
  - Discounted
  - Undiscounted

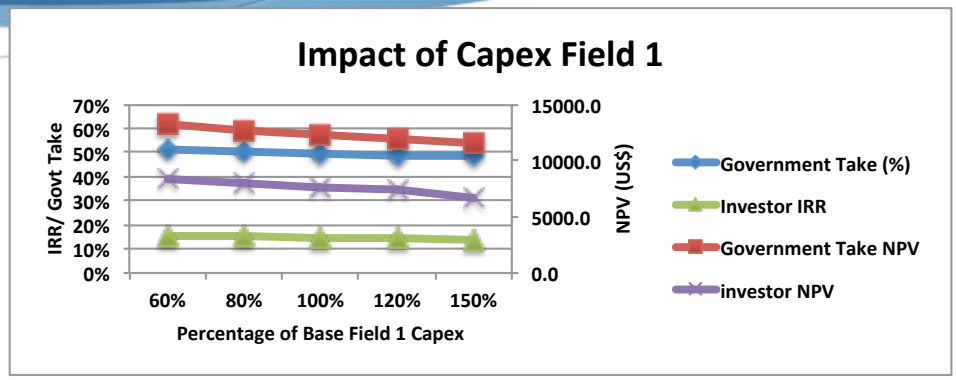
All indicators are given for all segments in 'Assumptions and Results worksheet', from line 168

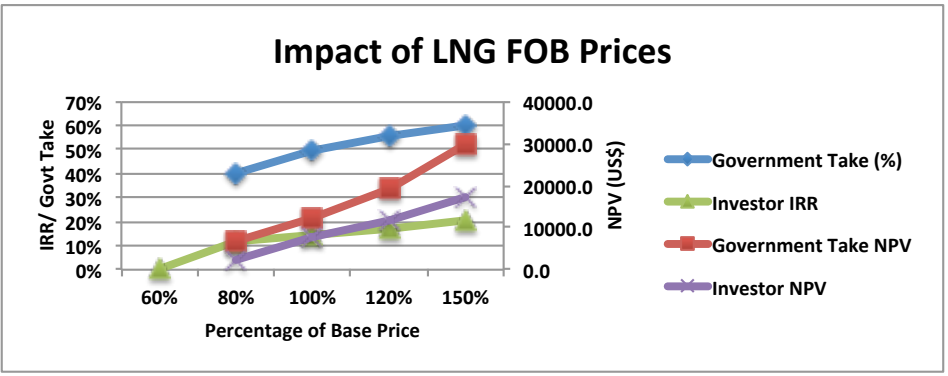
Sensitivity analyses – What for?

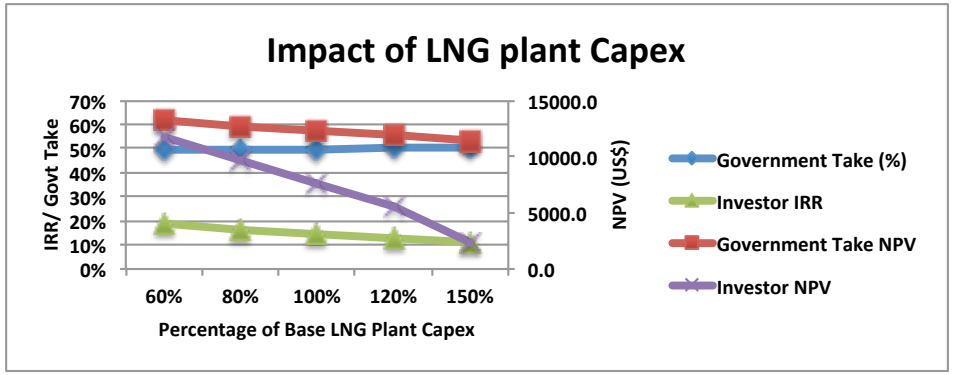
- Give a clear indication of what government and investors can expect according to market and project conditions
- Help the government better understand a fiscal regime's tolerance to changes
  - What happens if prices go up by 15%? Down 15% ?
  - What happens to Government revenues if project costs (e.g., fuel charges) unexpectedly increase?
- Help assess the trade-offs between and the interaction of fiscal elements and evaluate options

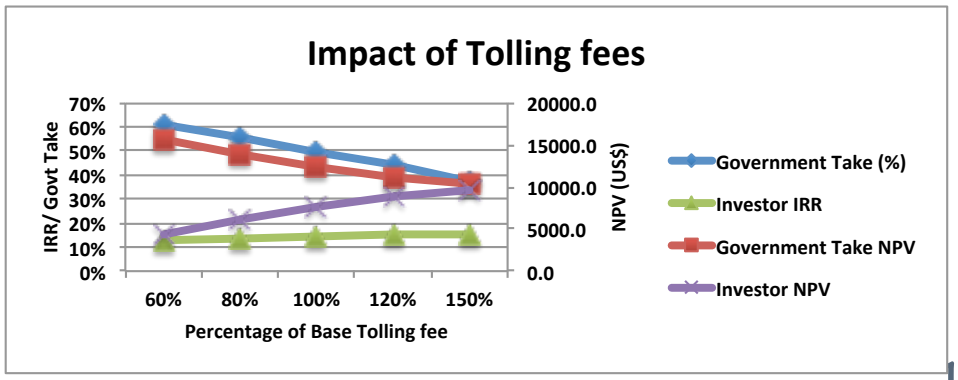
Sensitivity analysis
ex: Tolling structure

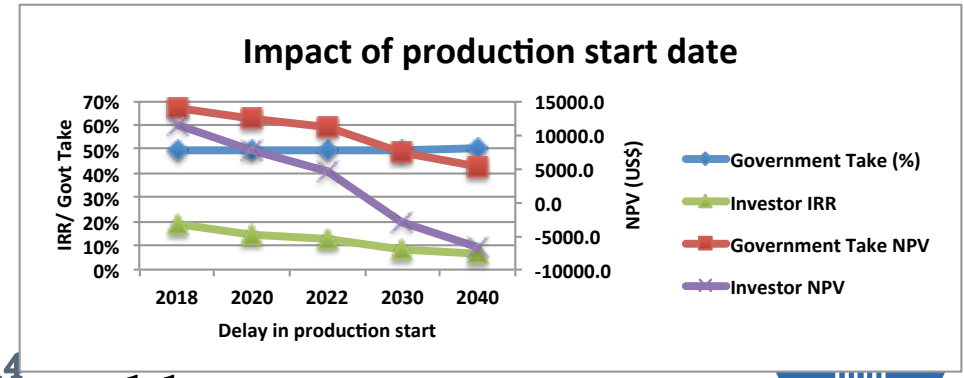












From line 237 of the Assumptions sheet in the model.

Background on the LNG value chain

Understanding the structure and key features of the model (in excel)

How to observe impacts? Tolling agreement example

How to observe impacts? Capital cost overrun example

Using the model

How to test and observe impacts

1. Observe, write-down or print key results from the existing base case with current assumptions, e.g. IRR, NPV, Government Take

   (Advanced users can also run a sensitivity analyses in other sheets – the built-in ones are only for the Consolidated project indicators)

2. Identify factors that you want to test. Factors you might want to consider include:
   a. They are an expected factor in upcoming negotiations, contract awards or legislation
   b. Market conditions may be changing
   c. A project risk exists such as insufficient reserves, project delay or cost overruns

The change in factors showcased hereafter are the :

1) Tolling fee and 2) Capital cost overrun on the upstream field

Example 1: Tolling agreement

- Assume that the project investors are negotiating a tolling agreement (C156 =1 in Assumptions worksheet).
- Observe a few key results with current assumption of a toll of $4.00.

Selected Key Results	Cell	$4.00 Toll
Consolidated Tolling, Total Net Revenues $MM	AJ4	256,818
Field 1 Investor, NPV $MM	C38	2,156
LNG Tolling Investor, NPV $MM	C33	3,275
Consolidated LNG Tolling, NPV $MM	C29	7,686
Consolidated Tolling, Government Take $MM	C32	79,646
Consolidated Tolling, Government Take %	C34	50%

- What do you think will happen if the toll is changed to $4.50 in Assumptions and Results cells D97 to AJ97? Who do you think will gain and who will lose? What indicators should you be looking at?

Example 1: Changing the tolling fee

- Is this result what you expected?
- The Total Net Revenues stayed exactly the same since tolling is a transaction occurring between two parties in the same country consolidation.

Selected Key Results	Cell	$4.00 Toll	$4.50 Toll
Consolidated Tolling, Total Net Revenues $MM	AJ4	256,818	256,818
Field 1 Investor, NPV	C38	2,156	1,451
LNG Tolling, NPV	C33	3,275	5,526
Consolidated LNG Tolling, NPV	C29	7,686	8,528
Consolidated Tolling, Government Take $MM	C32	79,646	73,690
Consolidated Tolling, Government Take %	C34	50%	46%

Example 1: Changing the tolling fee

- Field investors are worse off due to paying a higher toll.
- LNG Tolling investors are better off due to receiving a higher toll.
- But the consolidated NPV for all segments is higher. Why? Look at the main lines in the Consolidated Tolling sheet to see what has changed.

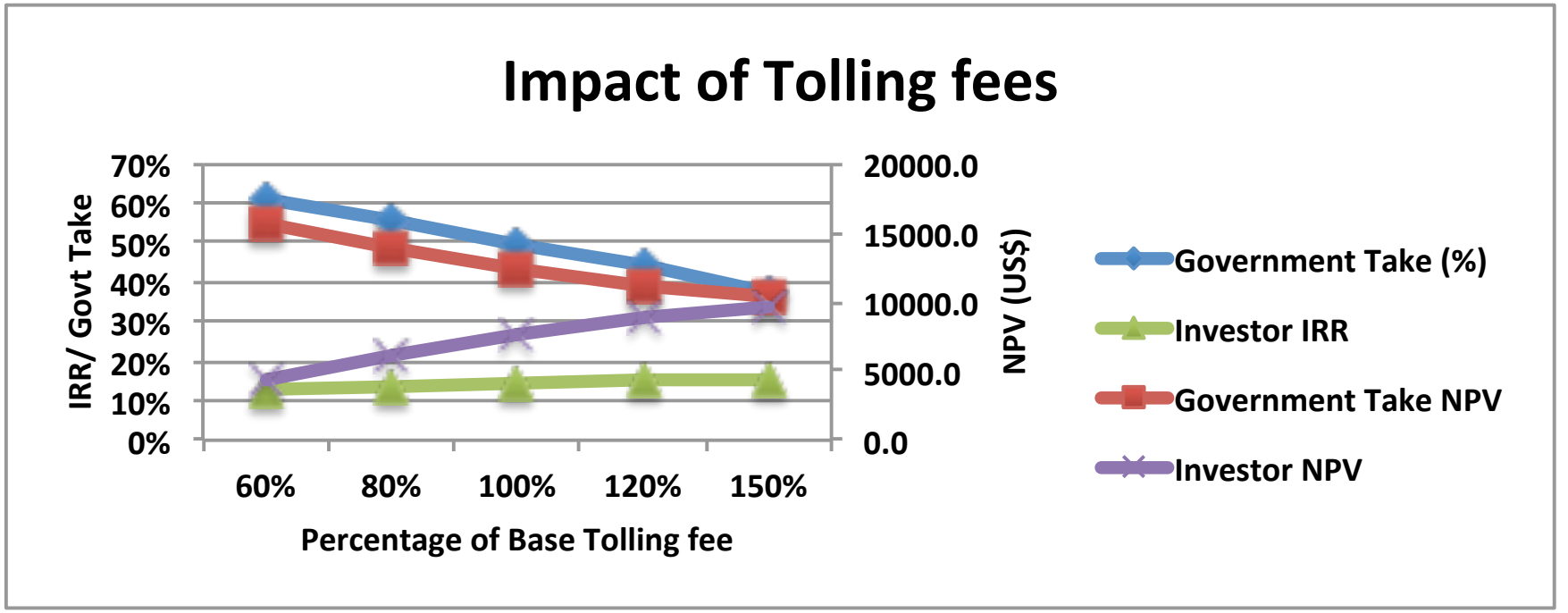
Selected Key Results	Cell	$4.00 Toll	$4.50 Toll	Change
Consolidated Tolling, Total Net Revenues $MM	AJ4	256,818	256,818	0
Field 1 and Field 2 Investor, NPV $MM	C38	2,156	1,451	*(705)*
LNG Tolling, NPV $MM	C33	3,275	5,526	*2,251*
Consolidated LNG Tolling, NPV $MM	C29	7,686	8,528	*842*
Consolidated Tolling, Government Take $MM	C32	79,646	73,690	
Consolidated Tolling, Government Take %	C34	50%	46%	

Example 1: Changing the tolling fee

- The Government Take amount and percent is lower. Why?
- Upstream is subject to production sharing and taxes so investors' profits are subject to higher percentage government take. Shifting more toll costs to the upstream means a greater reduction in profit share and income taxes going to the Government.
- How would you view this if the investors in the Upstream and in the LNG Tolling plant were the same?

Selected Key Results	Cell	$4.00 Toll	$4.50 Toll	Change
Consolidated Tolling, Total Net Revenues $MM	AJ4	256,818	256,818	0
Field 1 and Field 2 Investor, NPV $MM	C28	2,156	1,451	*(704)*
LNG Tolling, NPV $MM	C33	3,275	5,526	*2,251*
Consolidated LNG Tolling, NPV $MM	C29	7,686	8,528	*728*
Consolidated Tolling, Government Take $MM	C32	79,646	73,690	*(5,956)*
Consolidated Tolling, Government Take %	C34	50%	46%	*(4%)*

Results confirmed by the sensitivity analysis chart



With an increase in tolling fees, the consolidated NPV goes up and the government take falls

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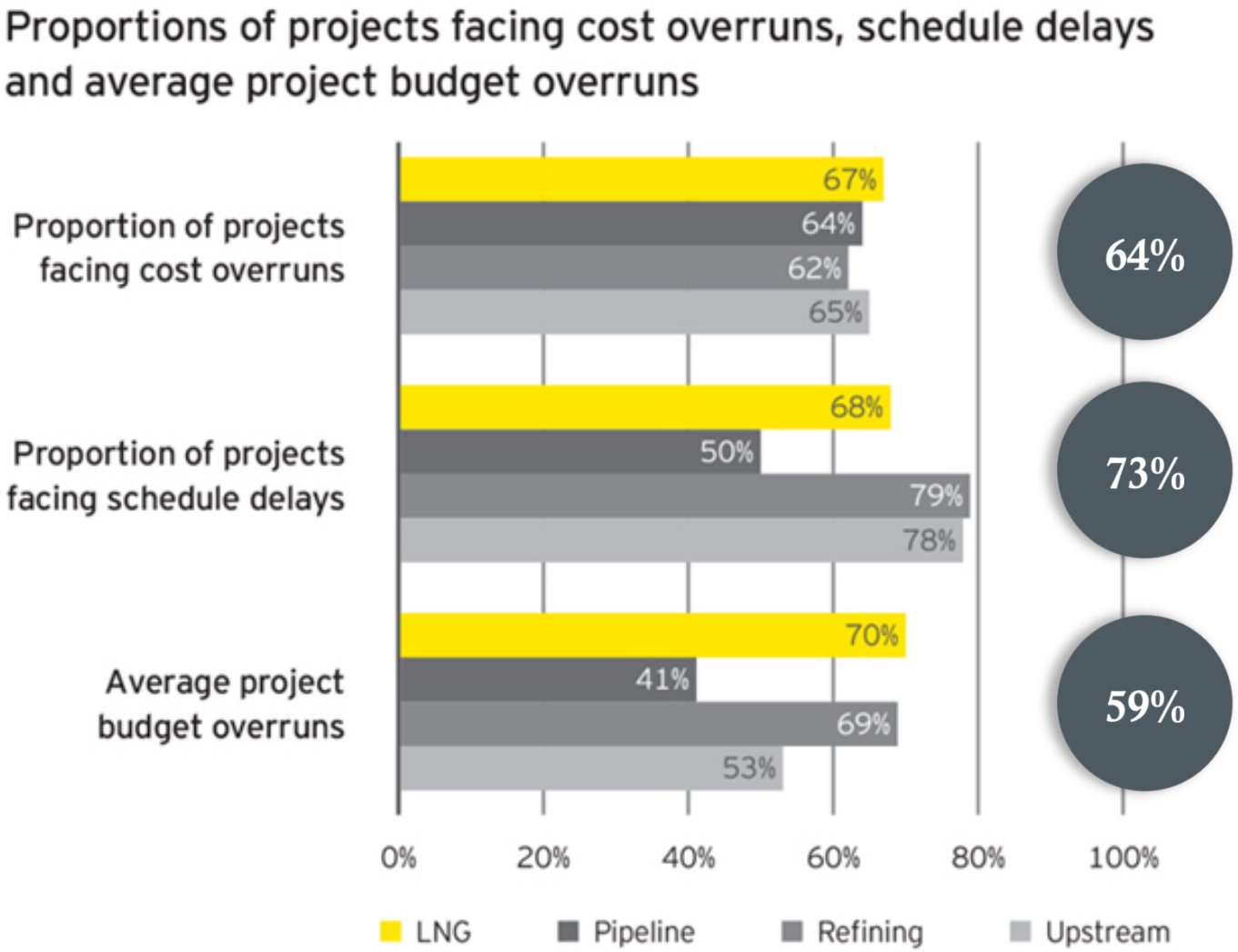
Using the model

Cost-overruns and delays are the norm, not the exception



Source: EY research and analysis

Example 2: Capital cost overrun

- The operator of one of the upstream fields determines that the capital costs of the offshore platforms are expected to double due to higher steel prices, competition in construction yards in Asia, and changes in project work scope.

- What do you think will happen if the costs of the offshore platforms for Field 1 increase two fold (cells D36 to AK36 in Assumptions & Results tab)?

Selected Key Results	Cell	Base Case
Field 1 Investor, Upstream Capital Costs, $MM	AJ3	5,290
Field 1 Investor, NPV $MM	C38	2,156
Field 1 Investor Net Cash Flow $MM	AJ37	13,605
Field 1 Investor Government Revenue, $MM	C45	27,350
Consolidated Tolling, Government Take %	C34	50%

Example 2: Capital cost overrun

- Total Capital Costs are $2,500 million higher due to the overrun.
- The Field 1 Investor NPV is impaired due to higher costs, as might be expected due to the higher capital cash flows occurring at the beginning (less discounted period) of the project.
- Look at the undiscounted Investor Net Cash Flow and the Government Take. The Investors (undiscounted) Cash Flow improved, and the Government Take went down by more than the amount of the increase in Capital Costs – WHAT CAUSED THIS?

Selected Key Results	Cell	Base Case	Cost Overrun Case	Change
Field 1 Investor, Upstream Capital Costs, $MM	AJ3	5,290	7,790	**2,500**
Field 1 Investor, NPV $MM	C38	2,155	1,269	*(886)*
Field 1 Investor, Net Cash Flow $MM	AJ37	13,605	14,896	*1,290*
Field 1 Investor, Government Revenue $MM	C45	27,350	23,559	*(3,790)*
Consolidated Tolling, Government Take %	C34	50%	48%	*(2%)*

Example 2: Capital Cost Overrun

- Examine the Field 1 Fiscal spreadsheet to search for the reasons.
- The higher capital costs caused the Investor's Cost Recovery to go up - this lowers the Profit Share available to be split between the Government and the Investor.
- But Government Profit Gas share percentages are now lower. Higher capital costs have lowered the computed R-Factor which under the PSA determines the Government Gas share percentage. In the year 2032, for example, the % Government Share went down from 50% to 30%. The R-Factor stays lower throughout the project life as per the PSA formula and more significantly in the later years (which explains why the discounted cash flows to the Investor decrease but those on an undiscounted basis increase).
- Offsetting are somewhat higher Income Taxes since the reduction in Govt Profit Gas increases the amount of Contractor's Profit Share included in the taxable income computation.

Selected Key Results	Cell	Base Case	Cost Overrun	Change
Field 1 Investor, Upstream Capital Costs, $MM	AJ3	5,290	7,790	2,500
Field 1 Fiscal, Cost Recovery $MM	AJ20	28,935	**31,435**	***2,500***
Field 1 Fiscal, Govt Profit Gas Share % in 2032	S30	50%	**30%**	***(20%)***
R-Factor in 2032	S29	3.2	**2.4**	
Field 1 Fiscal, Govt Profit Share $MM	AJ43	18,187	**13,549**	***(4,638)***
Field 1 Fiscal, Income Taxes $MM	AJ49	5,310	**6,158**	***848***

Background on the LNG value chain

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How to observe impacts? Tolling agreement example

How to observe impacts? Capital cost overrun example

Using the model

Using the model

1. First learn about the model's features in the manual.
2. Change the assumptions to better understand how the computations work and the impact of these changes.
3. Obtain and input data on the project(s) you are interested in.
4. Identify what results and indicators are important to your organization's interest.
5. To test for a wider variety and number of scenarios, the sensitivity function in the model is recommended.
6. Results of the sensitivity function may contain surprises or unexpected results. In those cases it can be informative to go back to directly input some of these tested scenarios in order to better follow the internal computations and understand what caused the result.

Using the model- cont'd

7. To understand impacts and risks, each case may require focusing on different results/indicators, and looking in more detail at intermediate computations.

8. Results can be surprising due to the impact of fiscal terms. Always double check your inputs and changes.

9. The Government often bears much of the project risks. This makes them vulnerable to market changes, cost overruns and shifts in income (and government take) between sectors due to commercial or fiscal negotiations.

Thank you for participating!

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