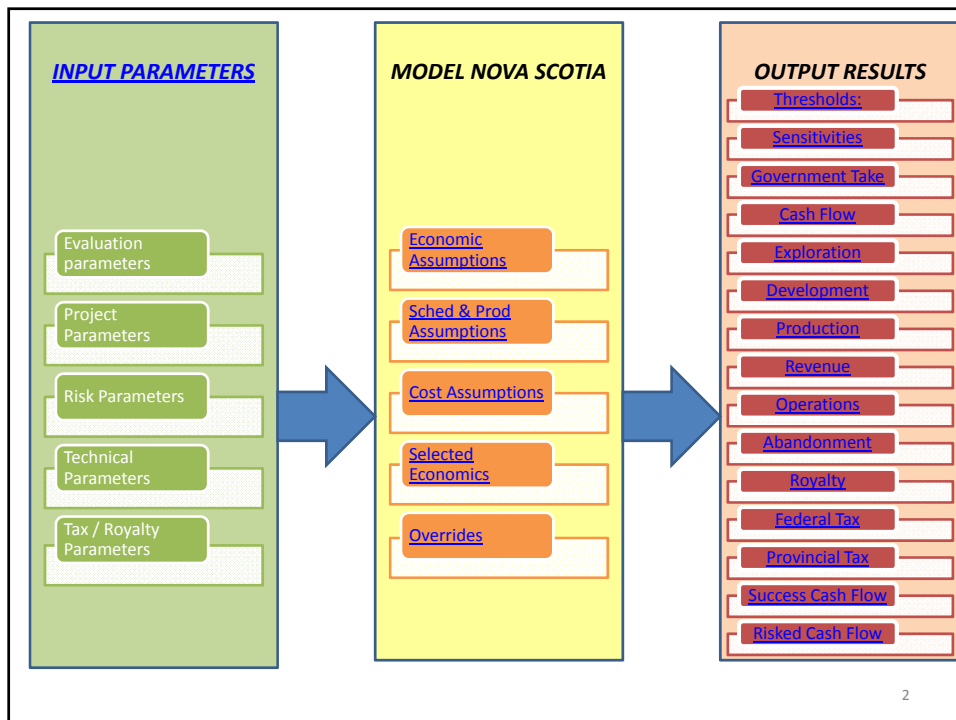
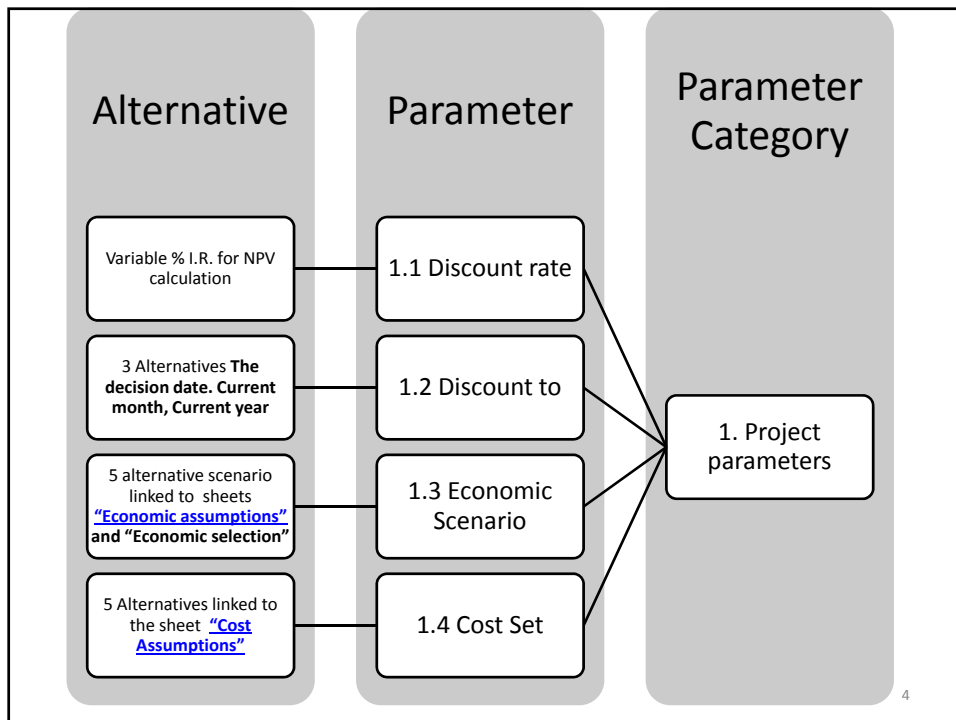
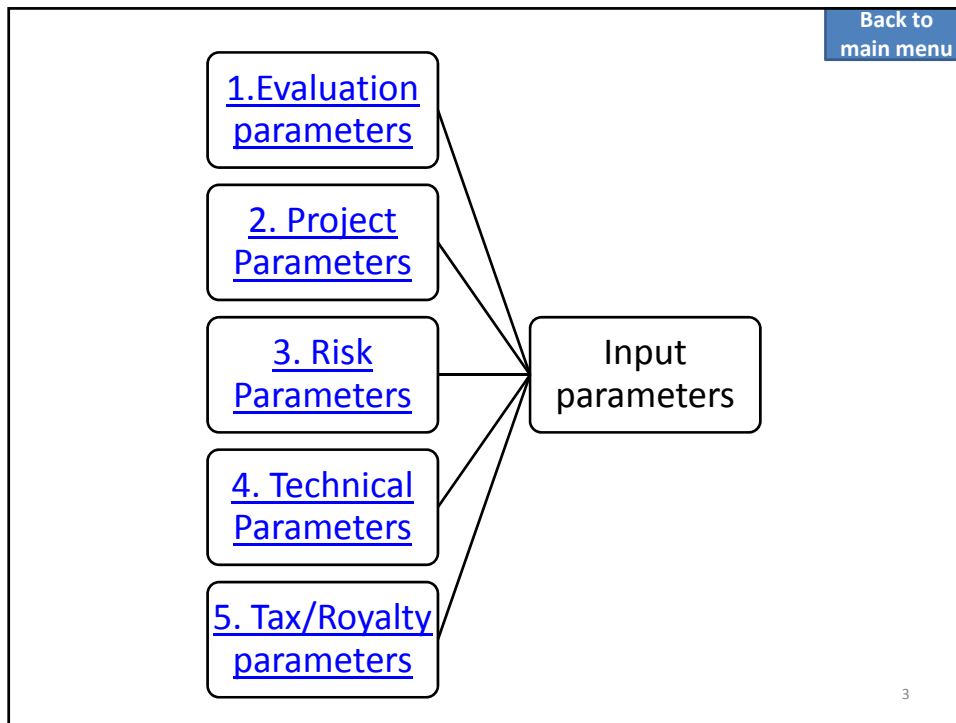


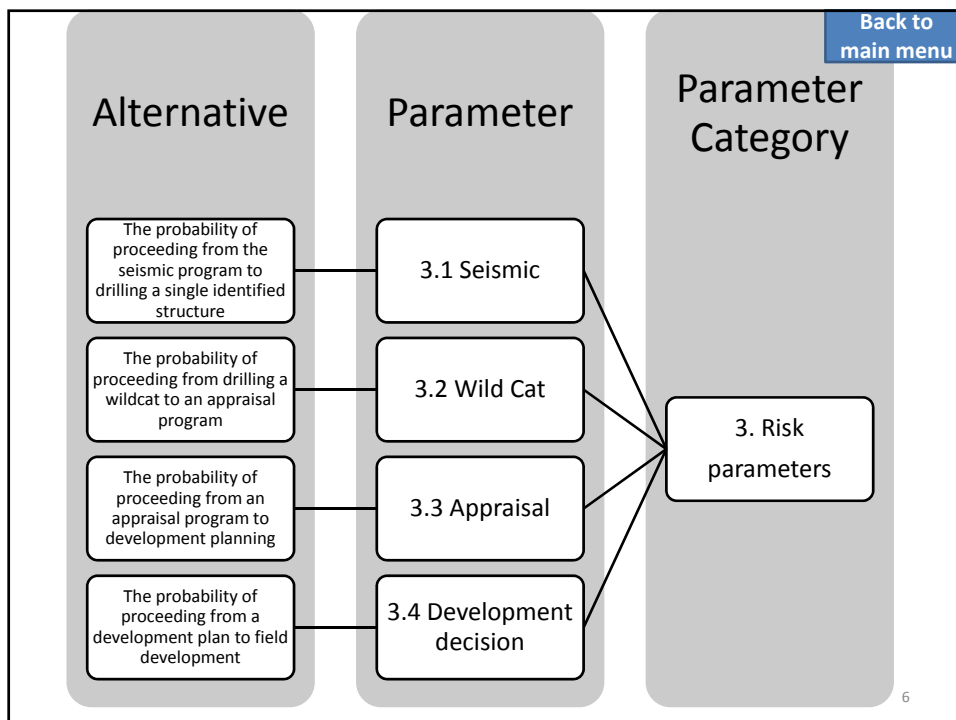
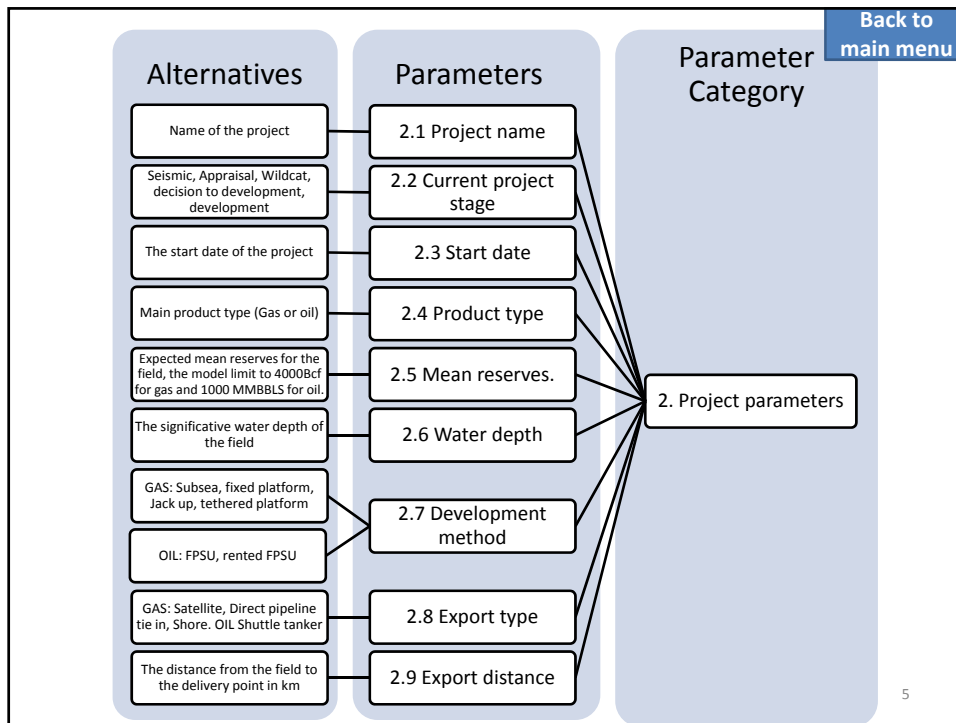
Annex F: Nova Scotia Model Description

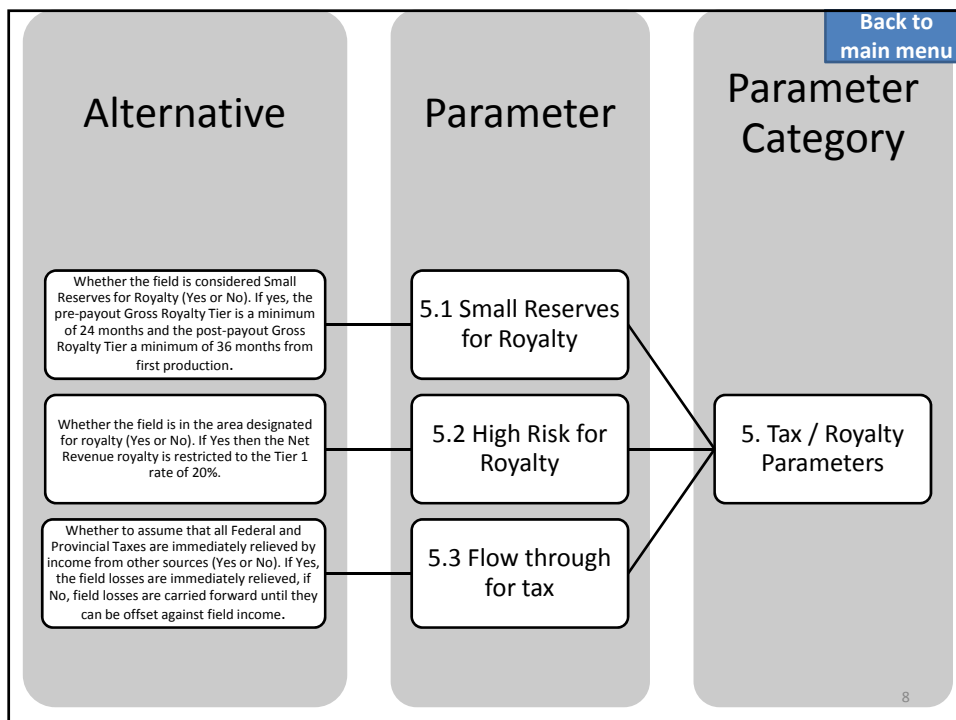
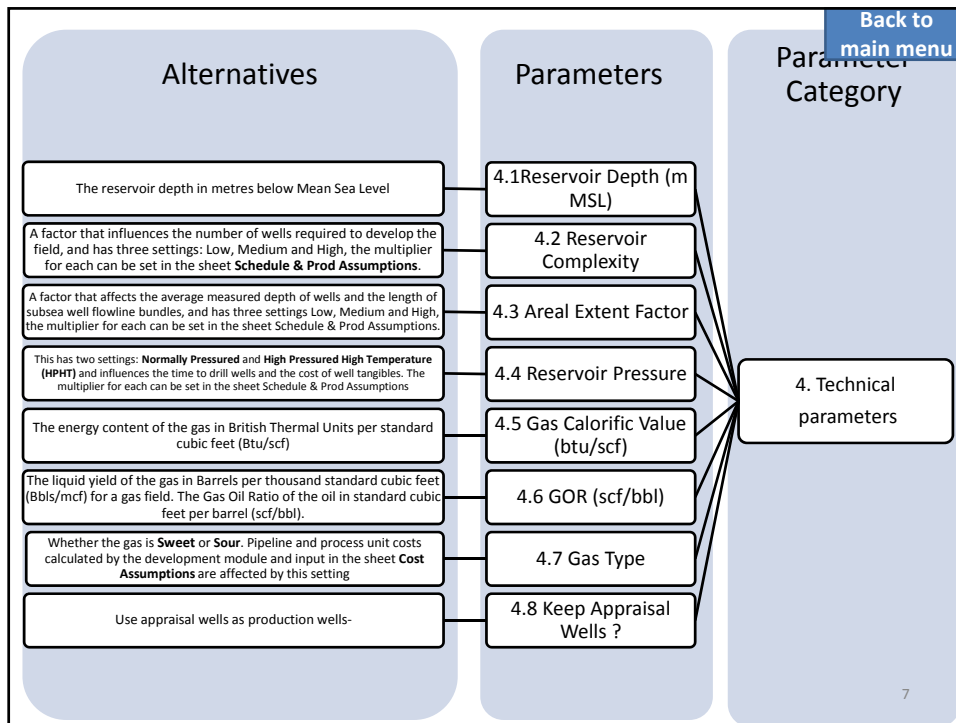
Reverse modelling of the Excel file

Reference: Nova Scotia, Department of Energy "Oil and Gas Exploration Economic Model", *Province of Nova Scotia, Canada, 2008. Available at internet*
<http://www.gov.ns.ca/energy/oil-gas/offshore/economic-scoping-tool/default.asp> Page last updated 2009-10-28.









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Economic Assumptions

This sheet shows the assumptions for prices, exchange rates, inflation and interest rates, and allows the user to set-up five Scenarios by inputting data in the cell with the blue text and white and/or blue background, which can be selected in the Sheet **Inputs**.

Economic Scenarios							
Scenario Name	Scenario 1						
Year	Market Condensate US\$/BBL	Nymex Oil Price US\$/BBL	Henry Hub Gas Price US\$/MMBTU	Exchange Rate US\$/Cdn	Cost Inflation	Long-term Bond Rate	Short-term Interest Rate
Netback Differential	3.50	3.00	0.70				
2007	83.60	76.00	8.00	1.00	3.0%	5.0%	4.0%
2008	78.38	71.25	8.05	1.00	3.0%	5.0%	2.0%
2009	50.27	45.70	4.00	1.00	3.0%	3.0%	2.0%

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Sched & Prod Assumptions 1/4

This sheet contains the assumptions relating to production, number of wells and assumptions used in the model. The user is able to override the cells with blue text and white background

General Production and Schedule Assumptions			
Profile Parameters			
GAS		OIL	
Reserves bcf	Plateau Rate %	Reserves on Plateau	Decline Factor
0	19.0%	50.0%	25.0%
200	17.0%	50.0%	25.0%
500	15.0%	50.0%	25.0%
1000	15.0%	50.0%	25.0%
2000	15.0%	50.0%	25.0%
3000	15.0%	50.0%	25.0%
1000000000	15.0%	50.0%	25.0%
BOE Factor (MSCF/BBL)	4.8		
Energy Equivalence Factor (MSCF/BBL)	5.6 for Gas @ 1000BTU/SCF		
Gas Field Shrinkage Fuel and Other	6.0%		
Oilfield Fuel Requirement	3.0%		
% wells at start up	Start-up	Plateau	
Oil	50%	70%	
Gas	70%	90%	

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Sched & Prod Assumptions 2/4

This sheet contains the assumptions relating to production, number of wells and assumptions used in the model. The user is able to override the cells with blue text and white background

Well Productivity

Parameters

GAS

Reserves	Bcf per well
0	100
250	120
500	130
1000	140
2000	140
3000	140
1000000	140

OIL (includes water injection / gas disposal)

Reserves	MMBBLs/well
0	10
100	12
200	14
500	14
700	14
900	14
1000000000	14

Number of Drilling

Centres

Wells	Number
1	1
10	2
30	3
50	4
70	5
1000000	5

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Sched & Prod Assumptions 3/4

This sheet contains the assumptions relating to production, number of wells and assumptions used in the model. The user is able to override the cells with blue text and white background

Aerial Extent Multiplier on Well

Length

Aerial Extent	Multiplier
Low	1.1
Medium	1.3
High	1.6

Reservoir Complexity Multiplier on

Number of Wells

Reservoir Complexity	Multiplier
Low	1
Medium	1.2
High	1.4

Reservoir Pressure Multiplier on Well

Time

Reservoir Pressure Type	Multiplier
Normally Pressured	1
HPHT	1.5

Reservoir Pressure Multiplier on Well

Tangibles

Reservoir Pressure Type	Multiplier
Normally Pressured	1
HPHT	1.3

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Sched & Prod Assumptions 4/4

Subsea Bundle Length (km)

Aerial Extent	Length
Low	4
Medium	6
High	8

Number of Appraisal Wells (Success Case)

Reserves	Number
0	1
200	2
500	3
1000	4
10000000000	

Reserves	Number
0	1
20	1
50	2
100	3
10000000000	

Construct & Installation times

	Onshore Fabrication			Offshore Installation		
	Fixed	Variable	per	Fixed	Variable	per
Jackup Construct	650		metre	20		
Platform Construct	250	1		30		
FPSU Construct	650			30		
Tethered Structure	650			50		
Subsea Manifold	180		MMSCFD	20		
Topsides (fixed platform)	400	0.2		60		
Topsides (mobile)	400	0.2	0			
Subsea Flowlines	150	5	well		5	well
Export Pipeline	150	0.1	km	20	0.5	km
Buffer Time	20%					

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Cost Assumptions_P 1/6

This sheet shows the unit cost and unit time assumptions used in the model. The user can set up to five costs sets and select the one to use in the sheet **Inputs**. The user is able to input data in the cells with blue text and/or white background.

Name of the variable of the set	Units	Associated value	
<i>Name:</i>		Demonstration	
<i>Estimate Date:</i>	Units	1-Jan-09	
<i>Deepwater Limit</i>	meters	200	
		Shallow Water	Deep Water
Seismic & Fixed Times			
<i>Seismic Program Time</i>	days	90.0	90.0
<i>Seismic Program Cost</i>	K\$	7,500.0	7,500.0
<i>Seismic Processing Time</i>	days	180.0	180.0
<i>Seismic Processing Cost</i>	K\$	3,500.0	3,500.0
<i>Processing to Wildcat Time</i>	days	120.0	120.0
<i>Wildcat Review Time</i>	days	90.0	90.0
<i>Wildcat Review Cost</i>	K\$	500.0	500.0
<i>Wildcat to Appraisal Time</i>	days	120.0	120.0
<i>Appraisal Review Time</i>	days	30.0	30.0
<i>Appraisal Review Cost</i>	K\$	350.0	350.0
<i>Time Between Appraisal Wells</i>	days	90.0	90.0
<i>Appraisal to Preliminary Engineering</i>	days	180.0	180.0
<i>Prelim Eng & Regulatory Prep</i>	days	300.0	300.0
<i>Regulatory Approval</i>	days	180.0	180.0
<i>Rig Rate</i>	\$/day	250,000.0	450,000.0
Exploration / Appraisal Well Drilling			
<i>Fixed Cost per well</i>	K\$	4,000.0	8,000.0
<i>Fixed Cost per metre</i>	\$/metre	2,300.0	3,400.0
<i>Variable Cost per day (non-rig)</i>	\$/day	180,000.0	230,000.0
<i>Fixed days</i>	days	4.0	10.0
<i>Average metres / day</i>	metre/day	60.0	50.0

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Cost Assumptions_P 2/6

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Name of the variable of the set	Units	Associated value	
		Shallow Water	Deep Water
Development Well Drilling			
<i>Fixed Cost per well</i>	K\$	3,000.0	6,000.0
<i>Fixed Cost per metre</i>	\$/metre	2,300.0	3,200.0
<i>Variable Cost per day (non-rig)</i>	\$/day	90,000.0	230,000.0
<i>Fixed days</i>	days	2.0	4.0
<i>Average metres / day</i>	metre/day	40.0	40.0
Well Completion			
<i>Fixed Cost per well</i>	K\$	700.0	700.0
<i>Fixed Cost per metre</i>	\$/metre	900.0	900.0
<i>Variable Cost per day (non-rig)</i>	\$/day	50,000.0	80,000.0
<i>Fixed days</i>	days	2.0	3.0
<i>Average metres / day</i>	metre/day	600.0	600.0
<i>Reenter & clean keeper</i>	days	4.0	4.0
<i>Reenterer predrill</i>	days	2.0	2.0
Preliminary Engineering			
<i>Fixed Cost</i>	K\$	5,000.0	5,000.0
<i>Variable Cost</i>	\$/mcf	3.0	3.0
Gas Facilities			
<i>Fixed Platform Fixed Cost</i>	K\$	7,000.0	
<i>Fixed Platform Cost / Metre Water</i>	K\$/metre	320.0	
<i>Fixed Platform Topside Fixed Cost</i>	K\$	25,000.0	
<i>Fixed Platform Variable Cost</i>	K\$/MMSCFD	850.0	
<i>Production Jack-up Fixed Cost</i>	K\$	190,000.0	

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Cost Assumptions_P 3/6

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Name of the variable of the set	Units	Associated value	
		Shallow Water	Deep Water
<i>Production Jack-up Topside Fixed Cost</i>	K\$	5,000.0	
<i>Jack-up Topside Variable Cost</i>	K\$/MMSCFD	600.0	
<i>Tethered Structure Fixed Cost</i>	K\$		300,000.0
<i>Tethered Structure Cost /Metre e Water</i>	K\$/metre		5.0
<i>Tethered Structure Topside Fixed Cost</i>	K\$		5,000.0
<i>Tethered Structure Variable Cost</i>	K\$/MMSCFD		1,000.0
<i>Additional Fixed Process Cost Sour Gas</i>	K\$	20,000.0	20,000.0
<i>Additional Variable Process Cost Sour Gas</i>	K\$/MMSCFD	300.0	300.0
<i>Subsea Well Surface Equipment</i>	K\$	2,000.0	5,000.0
<i>Subsea Well Flowline Bundle</i>	K\$/Km	1,500.0	3,500.0
<i>Subsea Manifold Fixed Cost</i>	K\$	9,000.0	12,000.0
<i>Subsea Manifold Cost</i>	K\$/well	300.0	600.0
Oil Facilities			
<i>FPSU Fixed Cost</i>	K\$	250,000.0	350,000.0
<i>FPSU Platform Cost /MetreWater</i>	K\$/metre	5.0	5.0
<i>FPSU Platform Topside Fixed Cost</i>	K\$	200,000.0	250,000.0
<i>FPSU Platform Variable Cost</i>	K\$/MMBBL	1,200.0	1,200.0
<i>Rented FPSU Fixed Cost</i>	K\$/day	170.0	200.0
<i>Rented FPSU Variable Cost</i>	K\$/MMBBL/day	2.5	2.5
<i>Production Jack-up Topside Fixed Cost</i>	K\$	5,000.0	
<i>Jack-up Topside Variable Cost</i>	K\$/MMSCFD	600.0	
<i>Tethered Structure Fixed Cost</i>	K\$		300,000.0
<i>Tethered Structure Cost /Metre e Water</i>	K\$/metre		5.0
<i>Tethered Structure Topside Fixed Cost</i>	K\$		5,000.0
<i>Tethered Structure Variable Cost</i>	K\$/MMSCFD		1,000.0

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Cost Assumptions_P 4/6

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Name of the variable of the set	Units	Associated value	
		Shallow Water	Deep Water
<i>Additional Fixed Process Cost Sour Gas</i>	K\$	20,000.0	20,000.0
<i>Additional Variable Process Cost Sour Gas</i>	K\$/MMSCFD	300.0	300.0
<i>Subsea Well Surface Equipment</i>	K\$	2,000.0	5,000.0
<i>Subsea Well Flowline Bundle</i>	K\$/km	1,500.0	3,500.0
<i>Subsea Manifold Fixed Cost</i>	K\$	9,000.0	12,000.0
<i>Subsea Manifold Cost</i>	K\$/well	300.0	600.0
Oil Facilities			
<i>FPSU Fixed Cost</i>	K\$	250,000.0	350,000.0
<i>FPSU Platform Cost /MetreWater</i>	K\$/metre	5.0	5.0
<i>FPSU Platform Topside Fixed Cost</i>	K\$	200,000.0	250,000.0
<i>FPSU Platform Variable Cost</i>	K\$/MMBBL	1,200.0	1,200.0
<i>Rented FPSU Fixed Cost</i>	K\$/day	170.0	200.0
<i>Rented FPSU Variable Cost</i>	K\$/MMBBL/day	2.5	2.5
Export			
<i>Export to Shore Pipeline Fixed Cost</i>	K\$	10,000.0	20,000.0
<i>Export to Shore Pipeline Variable Cost</i>	K\$/km	1,000.0	1,200.0
<i>Satellite Pipeline Fixed Cost - Sweet</i>	K\$	12,000.0	15,000.0
<i>Satellite Pipeline Variable Cost - Sweet</i>	K\$/km	1,200.0	1,500.0
<i>Satellite Pipeline Fixed Cost - Sour</i>	K\$	14,000.0	17,500.0
<i>Satellite Pipeline Variable Cost - Sour</i>	K\$/km	1,400.0	1,750.0
<i>Subsea Export Bundle Fixed Cost - Sweet</i>	K\$	7,000.0	8,750.0
<i>Subsea Export Bundle Variable Cost - Sweet</i>	K\$/km	2,500.0	3,125.0
<i>Subsea Export Bundle Fixed Cost - Sour</i>	K\$	10,000.0	12,500.0
<i>Subsea Export Bundle Variable Cost - Sour</i>	K\$/km	3,500.0	4,375.0
<i>Engineering and Project Management</i>	%	0.1	0.1
<i>Facilities Contingency</i>	%	0.2	0.2

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Cost Assumptions_P 5/6

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Name of the variable of the set	Units	Associated value	
		Shallow Water	Deep Water
Abandonment Cost			
<i>Fixed Platform Fixed</i>	K\$	3,000.0	
<i>Fixed Platform per depth</i>	K\$/metre	30.0	
<i>Jack-up Fixed Cost</i>	K\$	5,000.0	
<i>Tethered Structure Fixed Cost</i>	K\$		5,000.0
<i>FPSU Fixed Cost</i>	K\$		5,000.0
<i>Subsea Manifold</i>	K\$	2,000.0	3,000.0
<i>Cost per Surface Well</i>	K\$	2,000.0	2,000.0
<i>Cost per Subsea Well & Flowline Bundle</i>	K\$	3,500.0	3,500.0
<i>Export Pipeline variable cost</i>	K\$/km	100.0	100.0
<i>Satellite Pipeline variable cost</i>	K\$/km	150.0	250.0
Operating Costs			
Platform & Jack-up Facilities			
Fixed Cost /Year			
<i>Subsea</i>	K\$	2,000.0	2,000.0
<i>basic process, water knock out</i>	K\$	7,000.0	7,000.0
<i>full process, sweet</i>	K\$	19,000.0	19,000.0
<i>full process, sour</i>	K\$	25,000.0	25,000.0
Fixed Cost /Year / Capacity			
<i>Subsea</i>	\$/MMSCFD	200.0	200.0
<i>basic process, water knock out</i>	\$/MMSCFD	280.0	280.0
<i>full process, sweet</i>	\$/MMSCFD	370.0	370.0
<i>full process, sour</i>	\$/MMSCFD	530.0	530.0
Variable Cost			
<i>Subsea</i>	\$/MCF	0.1	0.1
<i>basic process, water knock out</i>	\$/MCF	0.1	0.1
<i>full process, sweet</i>	\$/MCF	0.2	0.2

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Cost Assumptions_P 6/6

Name of the variable of the set	Units	Associated value	
		Shallow Water	Deep Water
<i>full process, sour</i>	\$/MCF	0.2	0.2
Oil Costs			
<i>Fixed Cost/Year</i>	K\$	10,000.0	12,000.0
<i>Fixed Cost /Year / Capacity Sweet</i>	\$/MBOPD	250.0	250.0
<i>Fixed Cost /Year / Capacity Sour</i>	\$/MBOPD	300.0	300.0
<i>Variable Cost Sweet</i>	\$/BBL	2.5	2.5
<i>Variable Cost Sour</i>	\$/BBL	3.2	3.2
Transport & Process Tariff			
<i>Direct Pipeline Tie-in</i>	\$/MCF	0.4	0.4
<i>Satellite to Main Platform - Sweet</i>	\$/MCF	0.6	0.6
<i>Satellite to Main Platform - Sour</i>	\$/MCF	0.8	0.8
<i>Subsea Process & Transport - Sweet</i>	\$/MCF	1.0	1.0
<i>Subsea Process & Transport - Sour</i>	\$/MCF	1.2	1.2
<i>Shuttle Tankers</i>	\$/BBL	0.7	0.7
Pipelines			
<i>Fixed Cost /Year</i>	K\$	2,000.0	2,000.0
<i>Variable Cost</i>	K\$ / km	40.0	40.0
Wells			
<i>Subsea Intervention Cost</i>	K\$	3,500.0	10,000.0
<i>Surface Intervention Cost</i>	K\$	2,500.0	
<i>Intervention Frequency / Well</i>	Years	5	5
<i>full process, sour</i>	\$/MCF	0.2	0.2
Oil Costs			
<i>Fixed Cost/Year</i>	K\$	10,000.0	12,000.0
<i>Fixed Cost /Year / Capacity Sweet</i>	\$/MBOPD	250.0	250.0

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Selected Economics

This sheet shows the selected prices, exchange rate and interest rates for the evaluation

Prospect X Selected Economic Assumptions

Scenario	1	NYMEX							
Offset	0					Estimate Year	2009		

	1	2	3	4	5	6	7	Inflation	Index
Year	Ring Fence Condensate US\$/BBL	Ring Fence Oil US\$/BBL	Ring Fence Gas Price US\$/MMBT U	Exchange Rate US\$/SCdn	Cost Inflation	Long- term Bond Rate	Short- term Interest Rate	Index	
2010	65.07	58.97	6.50	1.000	3.00%	3.00%	2.00%	1.0300	4
2011	71.78	65.08	7.20	1.000	3.00%	4.00%	3.00%	1.0609	5
2012	75.38	68.34	7.40	1.000	3.00%	4.00%	3.00%	1.0927	6
2013	77.86	70.59	7.41	1.000	3.00%	4.00%	3.00%	1.1255	7
2014	80.16	72.68	7.45	1.000	3.00%	4.00%	3.00%	1.1593	8
2015	82.78	75.06	7.55	1.000	3.00%	4.00%	3.00%	1.1941	9
2016	84.58	76.69	7.67	1.000	3.00%	4.00%	3.00%	1.2299	10

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Overrides 1/2

This sheet allows the user to override the cost and production calculations in the standard modules. The user can elect to override for stages individually or for all stages by entering data in cells with a white background.

Prospect X		Override Cost and Production		
.		<i>All Cost in Today's Money Estimate Year:</i>		
		2009		
Seismic Costs & Schedule		Model Calculated		
<i>Exploration Times and Uninflated Costs</i>				
		Input Duration (days)	Input Lag to Next Activity (days)	Input Cost K\$
Seismic				
Seismic Processing				
Wildcat Costs & Schedule		Model Calculated		
		Input Duration (days)	Input Lag to Next Activity (days)	Input Cost K\$
Wildcat				
Wildcat Review				
Appraisal Costs & Schedule		Model Calculated		
		Input Duration (days)	Input Lag to Next Activity (days)	Input Cost K\$
Appraisal Well 1				
Appraisal Well 2				
Appraisal Well 3				
Appraisal Well 4				
Appraisal Well 5				
Development Planning				
Preliminary Engineering Cost		K\$		
Days to Development Start			days	
Development & Production				

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Overrides 2/2

Uninflated Capital Costs, Production and Operating Costs from Development Start (M\$)

	Wells	Main Structure	Topsides	Subsea & Flowlines	Export Pipeline	Engineering & Proj Man	Contingency	Total Costs	Gas Production (BCF)	Oil (MMbbls)	Condensate (MMbbls)	Operating Cost
Total	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Year from Development Start												
1								0.0				
2								0.0				
.....								0.0				
40								0.0				

Abandonment Cost [Model Calculated](#)

Abandonment Cost (M\$)

Historical Costs [Model Calculated](#)

Seismic	
Wildcat	
Appraisal	
Development Planning	
Costs for Royalty	
CDE Opening Balance	
CEE Opening Balance	

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Output Results 1/4

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Thresholds:

This sheet calculates the Threshold Reserves, Reservoir Depth and Economic Scenario at which the prospect is economic for differing Current Project Stages. The user can adjust the required ranges for each of Reserves, Reservoir Depth and Economics Scenario by inputting in cells with the blue text against a white background. Values with negative NPV (at the selected discount rate) are below the Threshold for proceeding are shown in Orange and those above the Threshold are shown in Green.

The example below shows that for the basic set of parameters and assuming a threshold discount rate of 15%, a mean reserve of 100 bcf is uneconomic at all Stages of exploration, from 150 to 250 bcf. It is economic to proceed with Development Planning and Development, but drilling a Wildcat or Appraising a discovery is uneconomic. From 300 to 700 bcf it is economic to appraise a discovery, and above 700 bcf it is economic to drill a Wildcat. Within the range of reserves specified it is not economic to run an exploratory seismic program.

Sensitivities This sheet enables the user to specify a range (up and down) for a number of critical parameters and see the effect on the resultant NPV and other evaluation parameters. The user may adjust the sensitivity ranges in the cells in the top left hand corner of the Sheet and see the affect on the results presented in the tornado charts.

Government Take This sheet displays the percentage royalty and tax takes for different economic and reserves cases.

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Output Results 2/4

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Cash Flow This sheet shows the detailed cash flow and start dates for the success case for the current prospect under evaluation and also shows the derivation of the risked evaluation.

Exploration This sheet is the exploration module. It calculates the number of wells, the timing and the costs of the exploration program.

he cell with the blue text and white and/or blue background, which can be selected in the Sheet **Inputs**.

Development This sheet is the development module. The start of development planning follows the end of exploration and the sheet calculates the number, type, timing and cost of development wells and development facilities.

Production This sheet is the production module. Production commences once the field facilities are commissioned and the initial production wells are completed. Dependent on the number of wells available at first production and the drilling program, the program calculates the number of days to plateau and the time on plateau, and thence the decline period. The parameters for plateau rate and decline rate may be adjusted in the sheet **Schedule & Prod Assumptions**.

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Output Results 3/4

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Revenue This sheet calculates the gas and liquids revenue

Operations This sheet is the operations module and calculates the operating costs for the field life

Abandonment This sheet calculates the economic limit for the field and the abandonment cost. Production and operating costs are terminated at abandonment.

Royalty This sheet calculates the royalty for the success case. For prospects commencing after the initial seismic phase, historical costs are estimated, but can be overridden in Cell C101 of sheet **Overrides**. The royalty calculation estimates the month at which the change over between each royalty tier is made.

Federal Tax This sheet calculates the federal income tax payable for the field. As with royalty, the historical costs are estimated by the model but can be overridden by the user in cells C102 and C103 of sheet **Overrides**.

Provincial Tax This sheet calculates the provincial income tax payable for the field. As with royalty, the historical costs are estimated by the model but can be overridden by the user in cells C102 and C103 of sheet **Overrides**.

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Output Results 4/4

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Success Cash Flow This sheet shows the success case cash flow for the prospect

Risked Cash Flow This sheet shows the risked cash flow for the field

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