

State of Alaska Legislative Budget &
Audit Committee Hearing

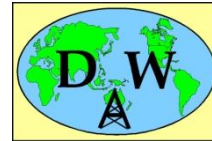


David Wood & Dan Dickinson

28th September 2009

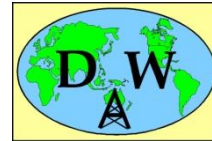
***Interim Review of Project to Build &
Evaluate an Integrated Alaska Natural
Gas Fiscal Design Model (AGFM)***

Alaska Gas Fiscal Model (AGFM)



- Review progress with this 8-month project after completion of approximately 5 months of AGFM model design, building and testing.
- Final project delivery is scheduled for later this year.
- Builds on Wood's report "*Preliminary Report on Fiscal Designs for the Development of Alaska Natural Gas*" (November 2008)
- Focus remains on gas and multi-year analysis to provide diverse scenario analyses.
- It is now much expanded and multi-dimensional to integrate many other facets including: alternative downstream value chains, analogues to real North Slope fields, comparisons with other U.S. State fiscal designs and more dynamic and graphical displays.

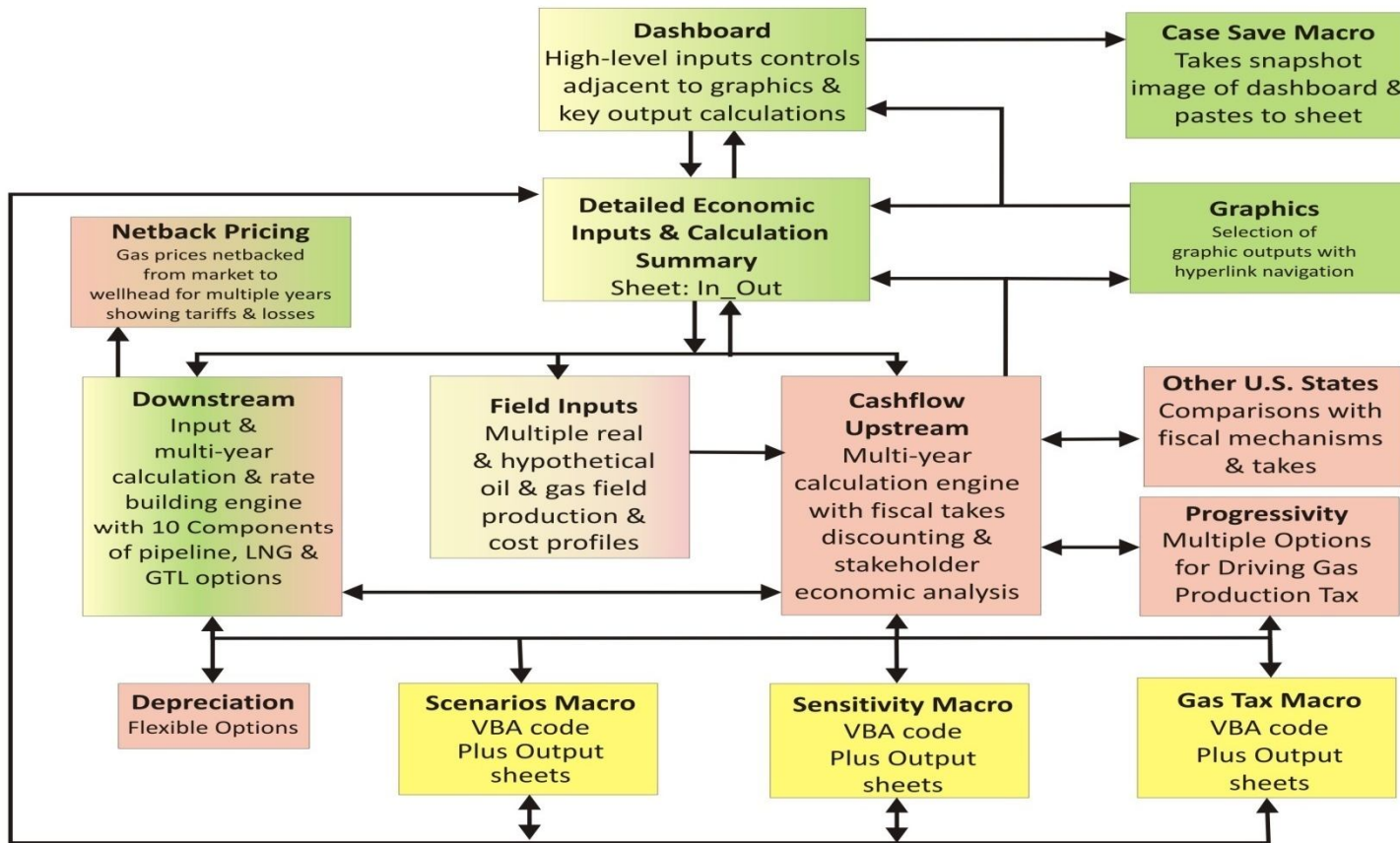
What AGFM Analyses – 5 Dimensions



- **Upstream** – (a) Analogues to existing North Slope fields, hypothetical yet-to-be discovered fields of various size and gas and oil reserves; (b) multiple field combinations and “fields” reflecting the share of a single producer in forecast North Slope production.
- **Downstream (& Midstream)** – 10 components grouped into 3 basic value chains and combinations of those chains.
- **Cases** – Different economic environments and prices for oil, gas, NGLS, including short-term spikes to test fiscal performance
- **Fiscal Regimes** – 10 mechanism’s from Wood’s 2008 work (including status quo and distinct oil and gas progressivity), other oil and gas producing U.S. States.
- **Sensitivities** – what are the critical variables determining fiscal take, and what happens when they shift?

Alaska Gas Fiscal Model (AGFM) - Excel Workbook Structure

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Dashboard Control Sheet: High-level Controls: Spinners & Graphics



Save Dashboard Image Ctrl+y

The model calculates money of day and real values

Key Assumptions
Analyse Field # (1 to 20)

Input Option 1=A, 2=B or 3=C (see Fields B6)
1=A is default for selecting individual fields

AECO
Gas Destination Price, Year 0 (\$/mmbtu)
Gas Price Nominal Escalator (%/yr)

ANSWC
Oil (C5+) Destination Price, Year 0 (\$/barrel)
Oil (C5+) Price Nominal Escalator (%/yr)

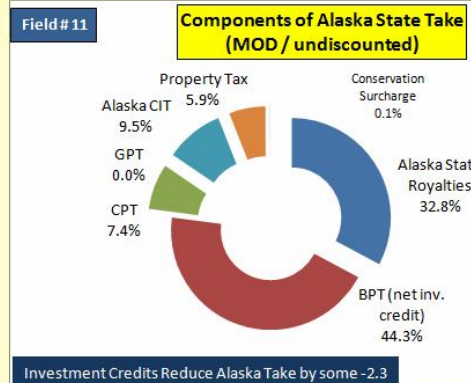
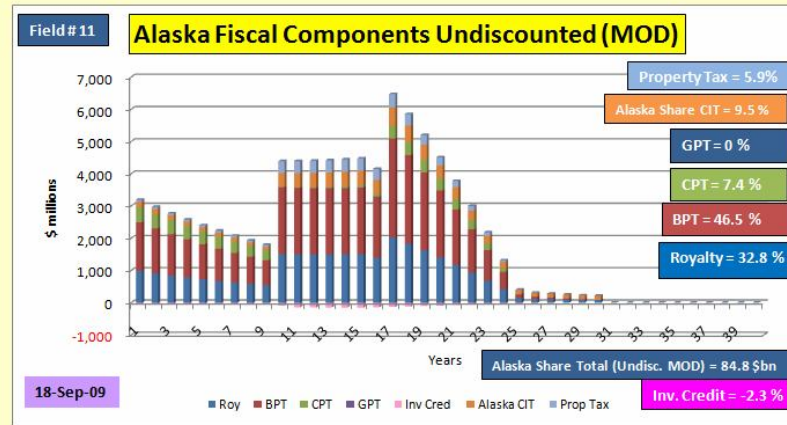
Cost Nominal Escalator (%/yr)
Buying Power Inflater / Deflator
Capital Costs Sensitivity Adjuster (%)
TT&T Costs Sensitivity Adjuster (%)
Operating Costs Sensitivity Adjuster (%)

Government Nominal Discount Rate (%)
Producer Nominal Discount Rate (%)

Royalty (%)
Base Production Tax (%)
investment credits (%)

CPT or Separate Mechanism used (0=CPT)
GPT & OPT Mechanisms (0 = CPT rates)
Alternative Progressivity Mechanism (3 to 10)

Entry Tariff to Alberta gas hub \$CAD/btu (Year 0):
AECO to Henry Hub Differential (US\$/mmbtu)
CAD per USD exchange rate
Price Premium to Rich Gas (US\$/mmbtu)
Rich gas has energy content > btu/cf
Alternative AECO Gas Pricing (1 to 4; 2=base)
ANSWC to WTI Oil Price Differential (US\$ / barrel)



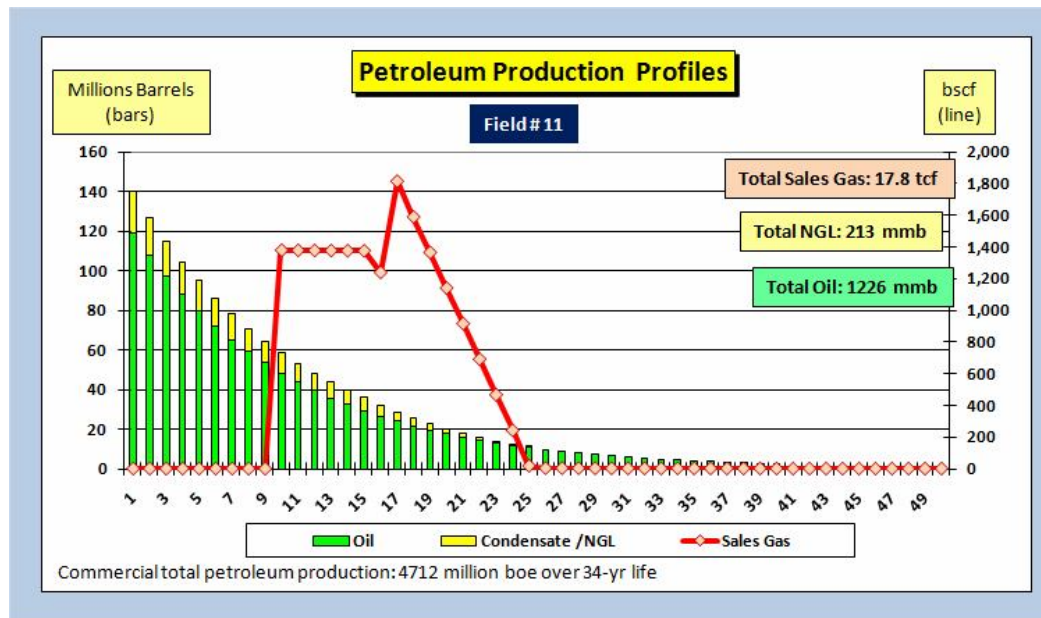
	Gov't Take	Producer
MOD Cashflow:	64.9%	35.1%
MOD NPV @ 5%:	64.8%	35.2%
MOD NPV @ 10%:	64.9%	35.1%

Fiscal Elements	\$ millions
Royalties	27,822
BPT (net inv. credit)	37,546
CPT	6,299
GPT	0
Alaska CIT	8,070
Property Tax	5,028
Conservation Surcharge	61
AlaskaTotals	84,826
Max Oil/Gas Price Ratio	10.0
Undiscounted and MOD	

Upstream: Flexibility to Define Complex Production Profiles of Liquids and Gas from a Few Inputs



Field 11 is an approximation of Prudhoe Bay Unit (PBU) and the model allows the gas production profile to be matched with infrastructure capacities over the multi-year life cycle.



Note: liquids displayed on a more expanded scale than gas.

The Fields sheet of AGFM allows the user to control forecast production rates for oil, NGL and gas independently.

Gas reinjection can also be adjusted to match quantity and timing of gas production to available supply chain capacities.

Upstream: AGFM Provides Ten In-built Hypothetical Fields to Enable Detailed Fiscal Analysis

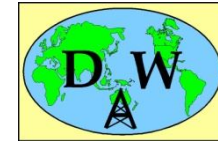


The ten fields (5 non-associated gas and 5 oil with associated gas) display a wide range of reserves and production profiles. This is ideal to review how fiscal elements might impact new field developments. The fields are:

1. Gas Field (~0.5 tcf + ~10 mmb NGL)
2. Gas field (~0.75 tcf + ~15 mmb NGL)
3. Gas field (~1 tcf + ~20 mmb NGL)
4. Gas field (~5 tcf + ~100 mmb NGL)
5. Gas field (~10 tcf + ~200 mmb NGL)
6. Oil field (~25 mmb Liquids + ~20 bcf gas)
7. Oil field (~75 mmb Liquids + ~50 bcf gas)
8. Oil field (~100 mmb Liquids + ~60 bcf gas)
9. Oil field (~150 mmb Liquids + ~150 bcf gas)
10. Oil field (~500 mmb Liquids + ~750 bcf gas)

In reviewing gas fiscal design Alaska is in the situation where it needs to consider fiscal impacts partly on the existing proved reserves. But also on new field developments to encourage exploration to discover the yet-to-find resources. These fields were used by Wood in his Dec 2008 report.

Upstream: Alaska North Slope Production & Reserves are Dominated by Three Corporations



For fiscal analysis it is important to be able to model the expected fiscal returns from specific corporations. AGFM facilitates this by enabling percentage fractions of individual fields to be combined in a user definition area on sheet Fields.

Company Holdings of Major North Slope Fields				
1	2	3	Field	
36.40%	26.36%	36.08%	Prudhoe Bay	Field#11
52.88%	29.19%	2.82%	Point Thomson	Field#12
0.98%	39.03%	55.04%	Kuparuk	Field#13
Exxon Mobil	BP	ConocoPhillips		

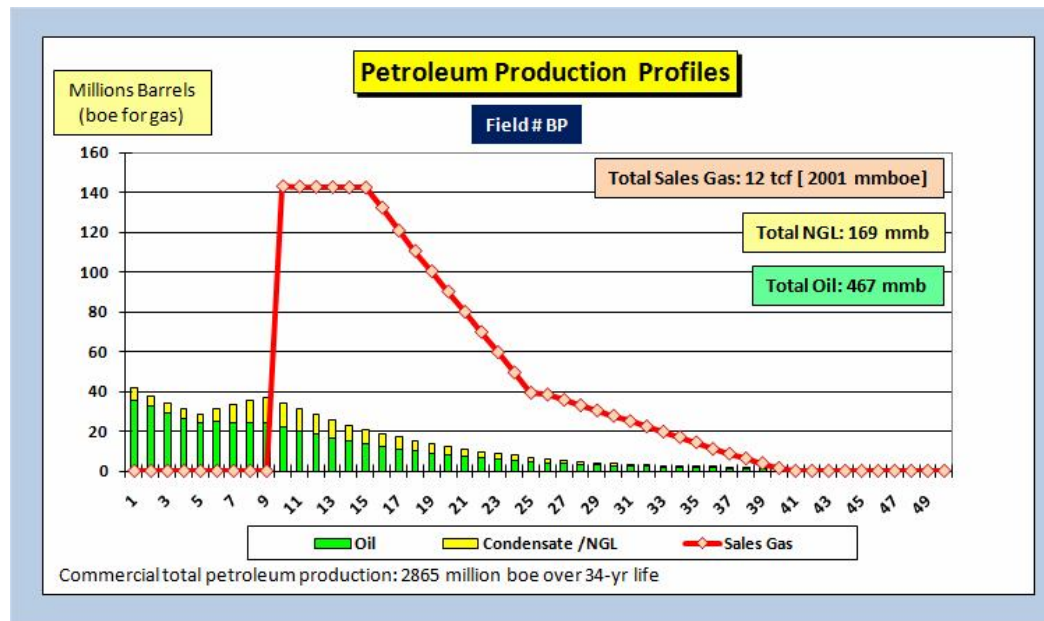
Three North Slope fields contain most of North Slope proved gas reserves.

By applying the corporate working interests to those fields a profile for each company can be approximated.

Upstream: Alaska North Slope Production Profiles Forecast by AGFM for BP



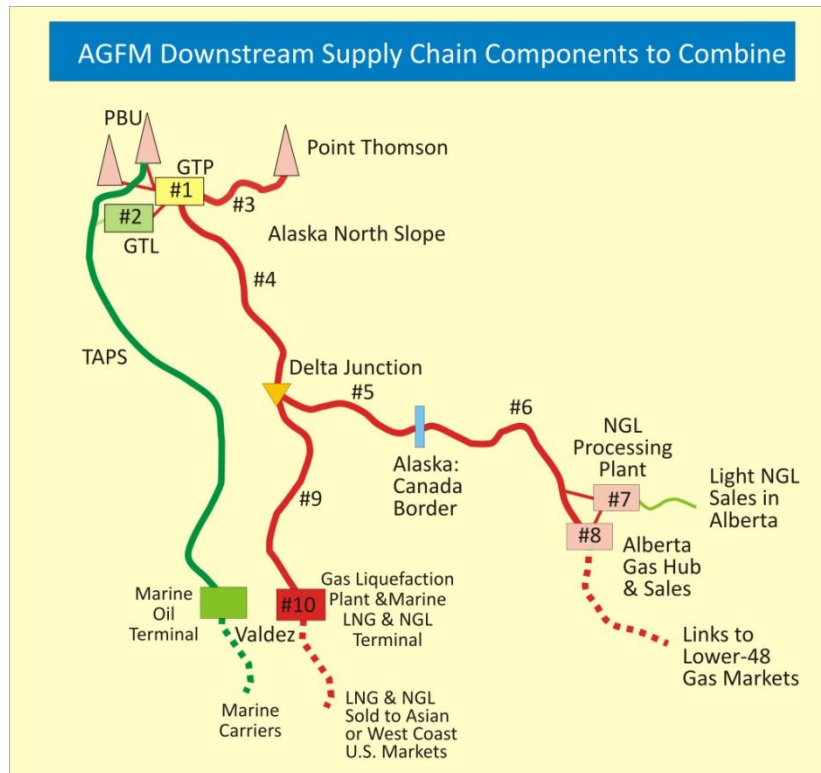
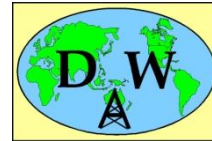
AGFM can be set up to apply corporate interests to the field data to approximate the position of a specific corporation. In this case combining BP's interests in Fields #11, #12 and #13 the major North Slope Analogues.



These corporate profiles can be analysed in a similar way by AGFM to individual fields.

These forecasts are dependent on the assumptions and input made for the individual fields and supply chains.

Downstream (Midstream): Ten Components Combined to Build Simple & Complex Supply Chains

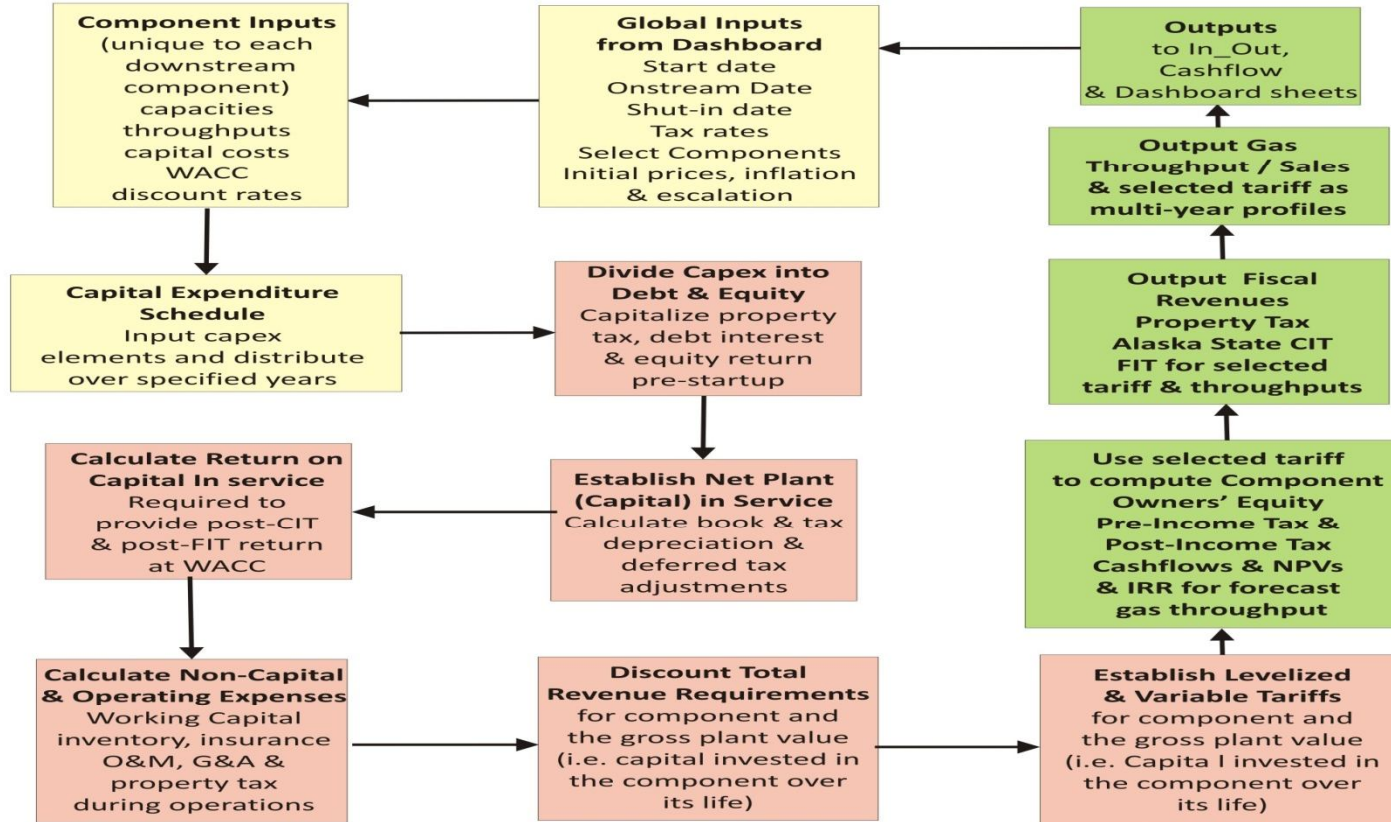


The components are selected by entering “1” and de-selected by entering “0” on AGFMs dashboard.

Alaska Gas Fiscal Model (AGFM) - Generic Flow Diagram for Downstream Components

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The "Downstream" sheet of the Excel model is used to evaluate infrastructure cash flows and tariffs and downstream operator returns and feeds this to the upstream "Cashflow" sheet



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Downstream: Dashboard Control Sheet - Easy to Setup and to Define Value Chain Scenarios

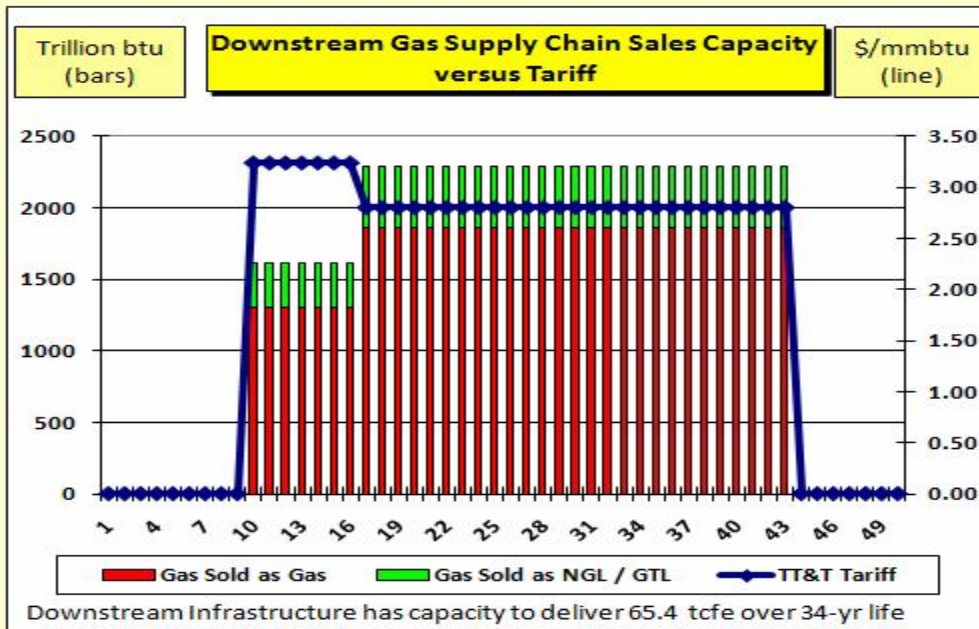


Upstream (1) or Downstream (2) Revenue Calcs?	2	Downstream Revenue Calculations Applied									
Upstream (1) or Downstream (2) TT&T Calcs?	2	Downstream TT&T Calculations Applied						Supply Chain Throughputs			
Key Controls for Downstream Model	1= select	Initial	Expansion		% Gas	Sales as	Input	initial	Expanded		
Components:		Onstream	Expand	Expand	Onstream	Consumed	% GTP	Capacity	Output	Output	
		Year	1= Yes	Year	Year	in Process	Input	bcf/day	bcf/day	bcf/day	
#1: Prudhoe Bay Gas Treatment Plant (GTP)	1	10	1	11	17	6.23%	93.77%	6.60	4.50	6.50	
#2: North Slope Gas To Liquids (GTL) Plant	0	10	1	11	17	0.00%	93.77%	0.00	0.00	0.00	
#3: Point Thomson to GTP Pipeline	0	12	1	11	17	0.00%	93.77%	0.00	0.00	0.00	
#4: Prudhoe Bay to Delta Junction Gas Pipeline	1	10	1	11	17	1.34%	92.51%	4.50	4.44	6.41	
#5: Delta Junction to Canada Border Gas Pipeline	1	10	1	11	17	0.30%	92.23%	4.50	4.43	6.39	
#6: Canada Border to BC -Alb Border Gas Pipeline	1	10	1	11	17	2.86%	89.59%	4.50	4.30	6.21	
#7: Natural Gas Liquid (NGL) Extraction Plant	1	10	1	11	17	3.87%	86.12%	4.50	4.13	5.97	
#8: Alberta Gas Pipeline -Delivery to Alberta Hub	1										
#9: Delta Junction to Valdez Gas Pipeline	0	12	1	11	17	0.00%	86.12%	0.00	0.00	0.00	
#10: Valdez Gas Liquefaction (LNG) Plant	0	12	1	11	17	0.00%	86.12%	0.00	0.00	0.00	
Year Supply Chain Shuts Down:		43				Total Input Gas Consumed:	13.54%	13.88%			
Gas Pipeline to Canada requires selection of components #1 (#3) #4 #5 #6 (#7) #8 (brackets mean selection is optional)								Gas Sold % of Revenue:		70.5%	
Gas Pipeline to Valdez for LNG requires selection of components #1 (#3) #4 #9 #10 (brackets mean selection is optional)								NGL Sold % of Revenue:		29.5%	
Y-line Option requires selection of components #1 (#3) #4 #5 #6 (#7) #8 #9 #10 (brackets mean selection is optional)								GTL Sold % of Revenue:		0.0%	
GTL Plant requires selection of components #1 #2 (#3) (brackets mean selection is optional)											
		Facilities Debt				Initial Expansion					
Energy Content of Gas Exiting GTP (btu/cf)	1118	Debt/(Debt + Equity)		70.0%	60.0%	NGL Plant Pricing Options (1 to 4):		4			
Days / year downstream facilities online	344	AFUDC Debt Interest Rate		4.700%	5.000%	GTL Pricing Options (1 to 4):		4			
Book Depreciation Period for Facilities (years)	25	Repayment Period (years)		25	10	NGL from LNG Pricing (1 to 4):		4			
Facilities online (years)	34	Return on Equity		14.000%	0	Tax GTL as Gas (=0) or Oil (=1):		0			
						LNG Sales Pricing Options (1 to 4):		2			

Dashboard Control Sheet: Dynamic Graphics & Summary Results



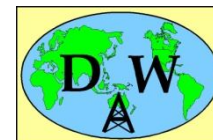
Avg. MOD Revenue / unit gas & NGL (\$/millions btu sold)	12.08
Avg. Tariff for T & T / unit gas & NGL (\$/millions btu sold)	2.87
Alaska Downstream Property Tax (\$/btu sold at capacity)	0.14
Alaska Income Tax Downstream (\$/btu sold at capacity)	0.07
Federal Income Tax Downstream(\$/btu sold at capacity)	0.25



This graphic sits adjacent to the supply chain selection and definition table and responds immediately to changes.

Note the graph shown highlights the start of supply chain, its expansion, gas plus NGL capacities and the multi-year tariff calculated.

Cases: Alternative Price Combinations For Gas and Oil Selected to Test Fiscal Performance

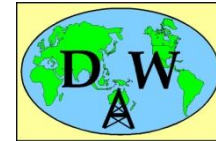


A large number of cases for different field(s), supply chains and capacities can be evaluated rapidly for several price scenarios. Seven price scenarios, in particular, are used to highlight fiscal performance.

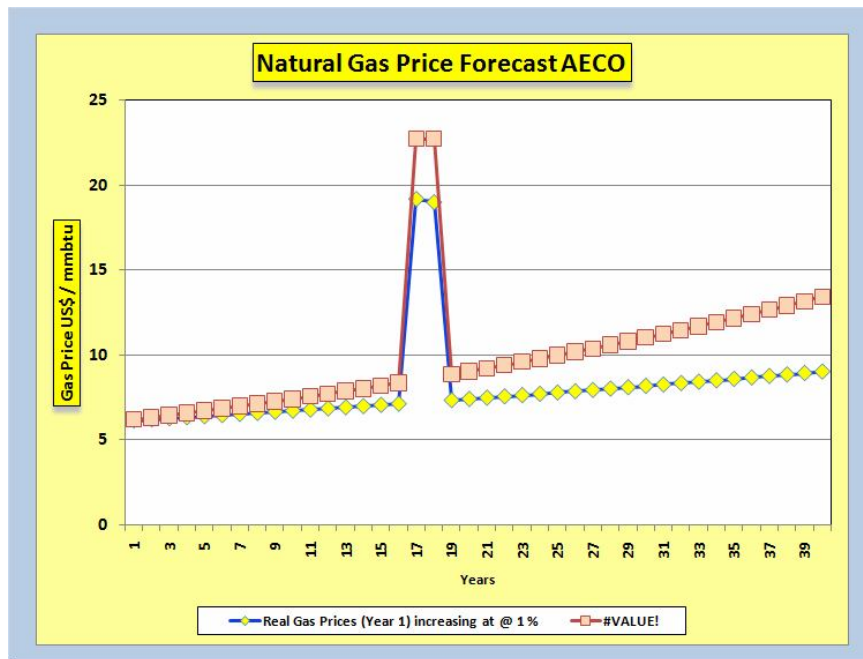
Used for Analysis	Gas Price \$/mmbtu				Oil Price US\$/bbl			
	AECO	Yr 1	Yr15	Yr 17	ANSWC	Yr 1	Yr15	Yr 17
Price Scenario 1	moderate	6	8	9	moderate	60	81	84
Price Scenario 2	high	6	11	12	low	30	40	42
Price Scenario 3	low	6	6	7	high	100	135	140
Price Scenario 4	high	6	11	12	high	100	135	140
Price Scenario 5	mod w/ spike	6	9	25	moderate	60	81	84
Price Scenario 6	Mod / No NGL	6	8	9	moderate	60	81	84
Price Scenario 7	Low	6	6	7	low	30	40	42

Note the AGFM user has the option to define four separate gas price scenarios independently for pipeline gas (to Canada and Lower-48 Mid-West markets), LNG from southern seaboard (Asia or West Coast U.S. markets), GTL products and NGL products (Asia or West Coast U.S. markets).

Cases: Gas Price Forecasts Can Grow (or Deflate) Irregularly as Decided by the User



In this case the price is escalated in nominal terms at 2% / year which includes real growth of 1% / year, but a price spike is introduced in years 17 and 18.



Price spikes are very informative in fiscal performance analysis.

This is particularly the case in terms of Alaska's progressivity tax.

Cases: Gas Price to Oil Price Ratio Can Vary Substantially - Requiring Consideration of a Wide Range of Cases



“In the roughly 14 years from 1995 through part of 2008...the oil gas Price ratio was only as high as 13 for at most 6 months, or less than 4% of the time” – Gaffney Cline February 2, 2009.

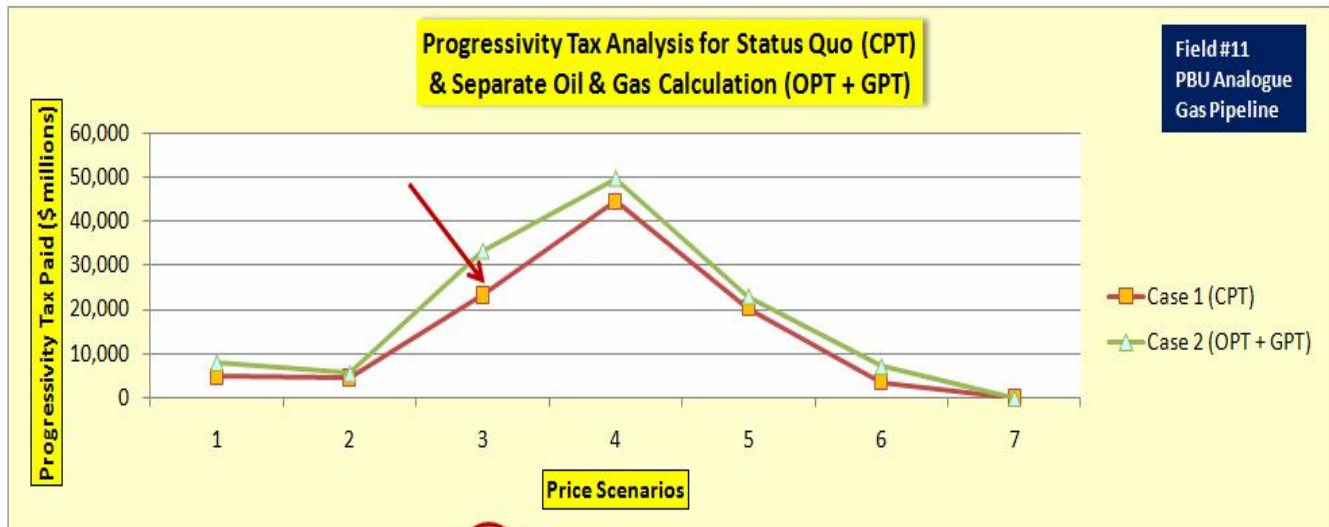
Figure 7-38: Historical Oil to Gas Price Ratio



Gas price to oil price ratio has been 13 for 7 of past 13 months....
...for August 2009 the price ratio was 1 to 22.5.

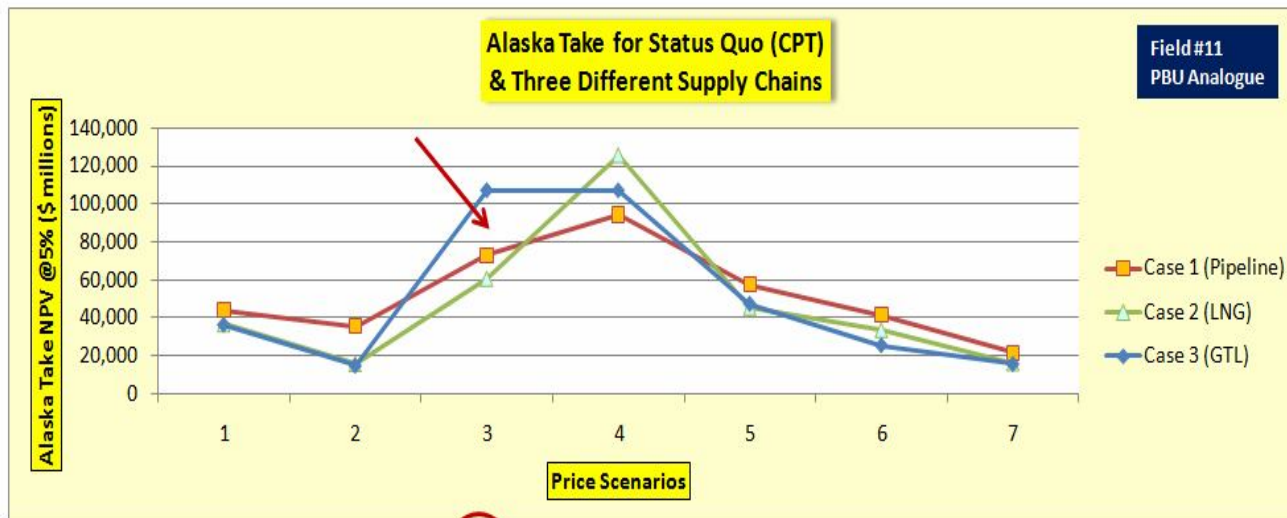
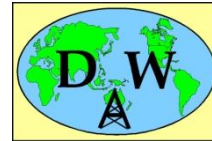
These price combinations need to be considered in fiscal performance analyses, which AGFM facilitates.

Fiscal: AGFM Evaluates Effect of Separating Oil & Gas Progressivity Calculations



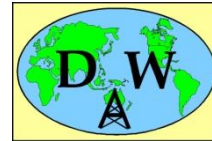
Price Scenario	1	2	3	4	5	6	7	
CASE 1(\$ millions)	4,865	4,495	23,267	44,523	20,293	3,473	0	Status Quo Progressivity Paid as CPT
CASE 2 (\$ millions)	8,000	5,568	33,327	49,717	23,047	7,138	0	Progressivity Paid as OPT & GPT Total
OPT included in case 2	6,703	0	32,295	32,291	6,703	6,809	0	Progressivity Paid as OPT
GPT included in case 2	1,297	5,568	1,032	17,426	16,345	329	0	Progressivity Paid as GPT
Gas Price:	moderate	high	low	high	mod./spike	mod. /No NGL	low	
Oil Price:	moderate	low	high	high	moderate	moderate	low	

Fiscal: AGFM Has Power to Compare Fiscal Take for Different Fields, Prices and Supply Chains



Price Scenario	1	2	3	4	5	6	7	Total Alaska Take NPV @5%
CASE 1 (\$ millions)	44,075	35,539	72,888	94,317	57,391	41,516	21,571	Pipeline Supply Chain
CASE 2 (\$ millions)	36,633	15,761	60,602	125,620	45,444	33,679	16,273	LNG Supply Chain
CASE 3 (\$ millions)	36,328	14,708	107,261	107,261	47,386	25,500	15,562	GTL Supply Chain
Highest Case:	1	1	3	2	1	1	1	
Gas Price:	moderate	high	low	high	mod./spike	flat/ -NGL	Low	Status Quo Progressivity as CPT
Oil Price:	moderate	low	high	high	moderate	flat/ -NGL	Low	

Fiscal: AGFM Evaluates Other Alternative Gas Progressivity Tax Mechanisms



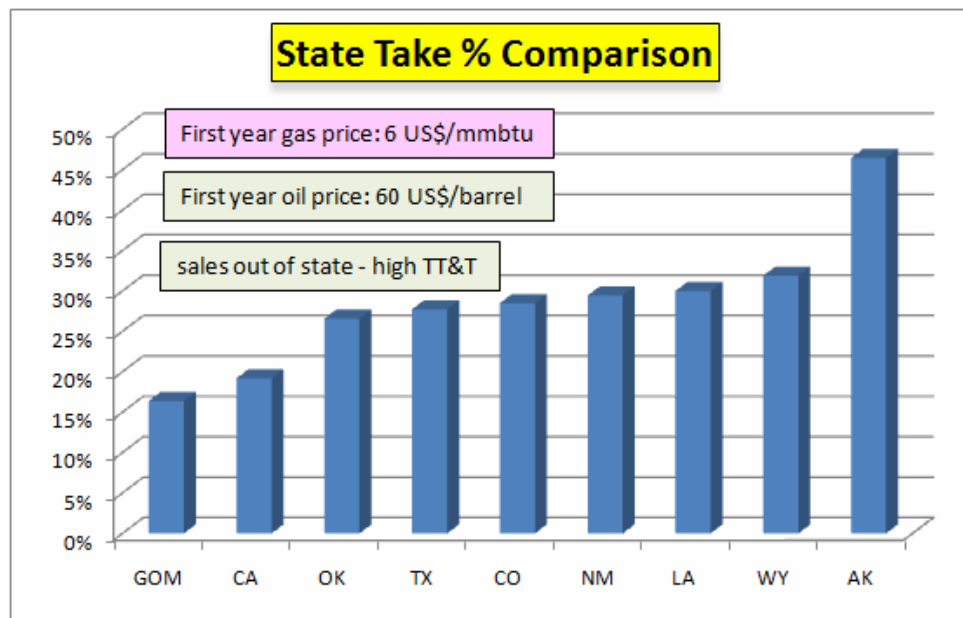
Ten GPT mechanisms are built into AGFM with potential to add more. Mechanisms used to vary rates of fiscal elements in international contracts have influenced the choice of some of the alternative mechanisms built-in.

- ***Rates of Return:*** e.g. Angola, Azerbaijan, Canada, Papua New Guinea, Russia (Sakhalin).
- ***R-factor (cumulative revenues / cumulative costs):*** e.g. Azerbaijan, Libya, Malaysia, Nigeria, Peru, Qatar, Tunisia.
- ***Cumulative Reserves:*** e.g. Nigeria.
- ***Production Volumes:*** e.g. Azerbaijan, Angola, Egypt, Malaysia, Peru, Qatar, Trinidad, Tunisia (and the majority of countries operating production sharing contracts).
- ***Uplift Allowances for Capital Costs:*** e.g. Australia, Norway, U.K.

Fiscal: Comparing Percentage State Take



This graph compares the percentage of total value the state government would collect in royalties and taxes (excluding FIT) over the remaining life of an Prudhoe Bay Analogue field, found on state land in the main oil and gas producing U.S. States.



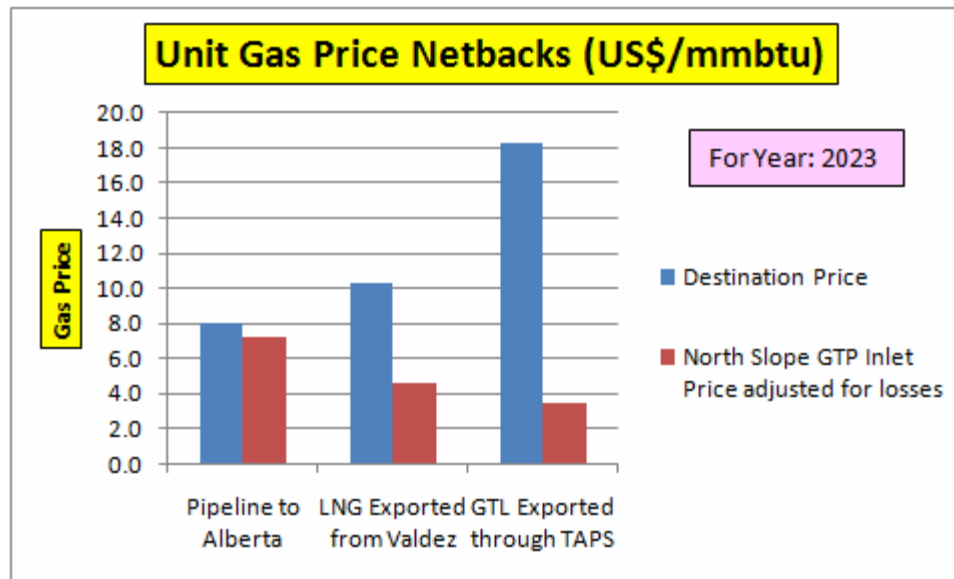
This analysis is based upon price scenario 1.

AGFM also enables the user to compare the impact of varying TT&T costs (much lower in the Lower-48 than Alaska).

Netback Price Analysis: The Model Facilitates Netback Comparisons



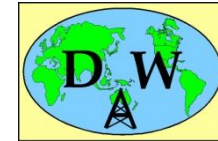
This graphic compares, for specific cost and price assumptions, the netback gas prices to North Slope point of production from Pipeline, LNG and GTL supply chain configurations evaluated.



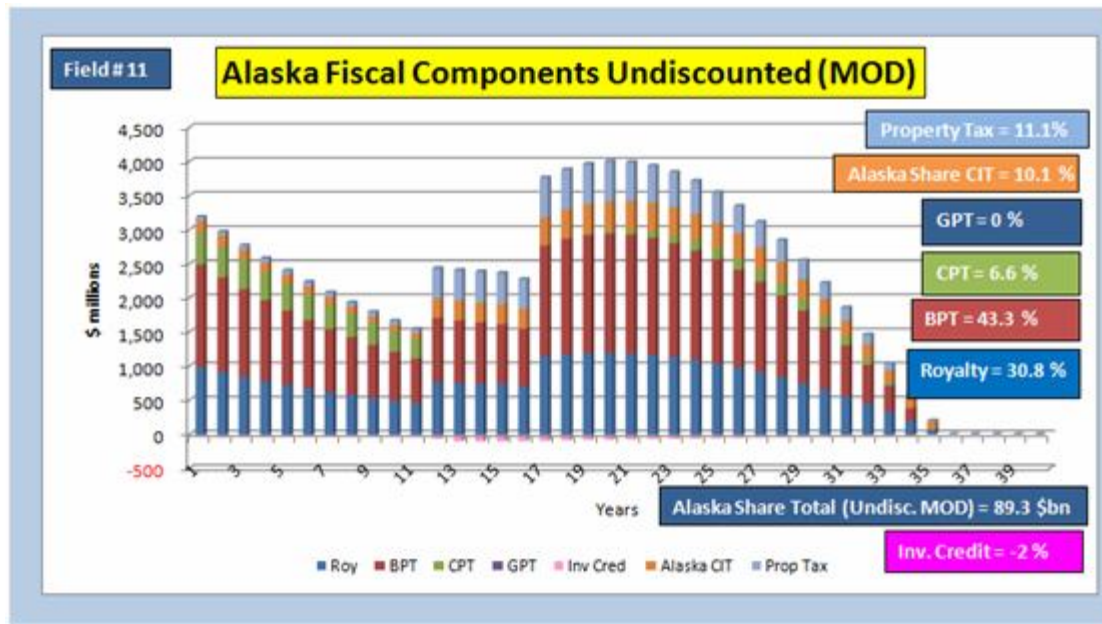
At this stage of the project we are showing this comparison purely to illustrate the model's capabilities, not to promote one supply chain or another.

However, with detailed cost analysis the model should be able to do that for a range of price scenarios.

Contribution of Each Fiscal Element to Alaska's Take Varies Depending upon Supply Chain



The relative contributions to Alaska's fiscal take for price scenario 1 and an **LNG** supply chain for the Prudhoe Bay analogue field shows a longer life because capacities in each year are lower than the pipeline alternative.



Annual contributions are constrained by supply chain capacities and field production capabilities.

User Interfaces: AGFM Offers Several Fit-for-Purpose Ways in Which Users Can Operate the Model



AGFM is designed with a range of user types in mind.

- Dashboard – for dynamic quick-look analysis
- In_Out – for more detailed control
- Graphics
- Fields
- Downstream
- Progressivity
- Sensitivities
- Scenarios

Work Left to Complete AGFM Project



- Continue to run cases and sensitivities
- Analyze and interpret results
- Understand and explain fiscal design significance of the results
- Present fiscal design recommendations based on results
- Complete a three-part report of the project:
 - Part 1: AGFM Model Description
 - Part 2: Cases and Sensitivities
 - Part 3: Conclusions and Recommendations
- Continue to troubleshoot and refine the model in line with case results