PLAYS AND CONCESSIONS – A STRAIGHTFORWARD METHOD FOR ASSESSING VOLUMES, VALUE, AND CHANCE

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ABSTRACT

It is an exploration "fact of life" that, while the Prospect is the *economic* unit of exploration, the Play is the *operational* unit. Due to the magnitude of expenditures (both money and manpower) and time framework involved, the most difficult and critical task in Exploration is selecting which **plays** in which to explore, not which **prospects** to drill.

We present a simple but powerful method for evaluating the geologic (and economic) chance, volume and value of geologic plays. The methodology is applicable for a spectrum of opportunities, from a medium-sized concession to a full geologic play. This monetization approach fills an 'analytical gap' between traditional methods for assessing volumes and geologic chance for plays (e.g., Baker et al., 1984,) and assessing the value of individual prospects (e.g., Rose, 1992, White 1994).

Required inputs (only seven variables) are tied to company strategy (e.g., activity level, risk tolerance), and to units of natural measure (forecast geologic discoveries, their size distribution, and historic success rates) that can be validated against historical (or analog) results. The small number of requisite input variables encourages making multiple sensitivity cases for an exploration program.

Calculated outputs provide powerful information that can be used to prioritize a company's exposure to various trends, leading to a portfolio of Plays. The process flow can be created quickly using Microsoft Excel and its embedded functions, as demonstrated in our poster session. Spreadsheets can be customized to model optimal activity levels and working interest, based upon a company's risk tolerance.

KEY MESSAGE:

Plays and Large Concessions can be Systematically And Objectively Evaluated for Undiscovered Potential –

Volumes, Value, and Chance of Success

Just Like Prospects

THE GOAL: *EXPECTED VALUE*

PROSPECT **VS** **PLAY**

PROSPECT EXPECTED VALUE

CHANCE OF SUCCESS X SUCCESS CASE VALUE

LESS

CHANCE OF FAILURE X DRY HOLE COST

CONCESSION / PLAY EXPECTED VALUE

CHANCE OF PROGRAM ECONOMIC SUCCESS X SUCCESS CASE VALUE

LESS

CHANCE PROGRAM FAILURE X DRY HOLE PROGRAM COST (FAILURE COST)

INPUTS:

PROSPECT (7) **VS** **PLAY (7)**

1--GEOLOGIC CHANCE FACTORS
2--AREA
3--AVERAGE NET PAY
4--RECOVERY PER UNIT VOLUME
5--DRY HOLE COST
6--NET PRESENT VALUE PER BARREL FOUND ($/BOE)
7--MINIMUM *COMMERCIAL* FIELD SIZE

1--GEOLOGIC CHANCE FACTORS (Shared and Local)
2--PROJECTED FIELD NUMBER DISTRIBUTION
3--PROJECTED FIELD SIZE DISTRIBUTION
4—PROJECTED DRY HOLE TOLERANCE (# Consecutive Dry Holes Drilled Before Exiting Play)
5--TOTAL DOLLARS EXPOSED (Failure costs)
6--NET PRESENT VALUE PER BARREL FOUND ($/BOE)
7--MINIMUM ECONOMIC FIELD SIZE

Many terms are common to both analyses. Due to uncertainties associated with prediction, input variables should be entered as probabilistic ranges (e.g., P10/P90).

Expected Value (EV) is calculated by subtracting the chance-weighted capital exposure (funds at total risk) from the chance-weighted value, given success. Investing in a large number of projects with a positive Expected Value improves chance of profit.

For a prospect, generally one test is tolerated, with an associated 'dry hole' cost (cost to generate and drill the prospect). Success case value is estimated from a full-cycle cash flow analysis of field development, given a discovery.

For a family of prospects, a minimum program is modeled, reflecting the number of consecutive dry holes that would be tolerated before abandoning the play. The chance reflects the probability of making at least one economic discovery, and the 'dry hole' costs, are those associated with that minimum program.

Success case value is based upon the economic volumes found, given that the play proves economically viable and the modeled success-case exploration program is executed.

THE PLAY EVALUATION PROCESS

1 -- DELINEATE 'PLAY'

2 -- ASSESS GEOLOGIC CHANCE

3 -- DRY HOLE TOLERANCE, COST

4 -- ESTIMATE SUCCESS CASE ACTIVITY

5 -- ECONOMIC THRESHOLD, VALUE / BOE

6 -- APPROPRIATE FIELD SIZE DISTRIBUTION

1 - PLAY DELINEATION

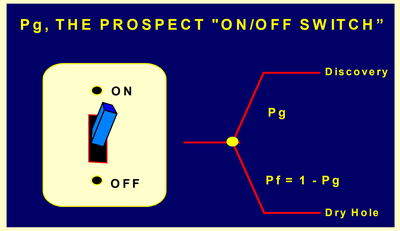
-- The play should consist of prospects with similar geologic character and history

-- Assessors should agree on the time period being analyzed (typically 5 years, 10 years, or total play life)

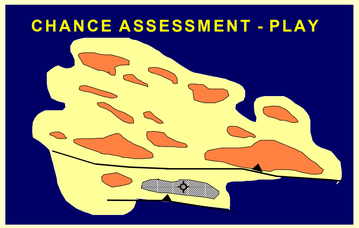
-- Decide if the assessment is for total industry, or just the prospects in which your company will participate

-- To 'value' a play for a company (recommended), inputs should reflect company dry hole tolerance and success case activity levels

2 - ASSESS CHANCE



For an individual prospect, detectable oil or gas is either present or not – much like an on / off switch



Now consider this family of prospects, as yet untested. There are elements of geologic chance that could condemn them all – Shared chance factors.

Also, there are variables that can result in some being successful while others fail – Local chance factors.

The product of the Shared chance factors is called Play Chance -- the chance that the play is viable. In proven plays this value is often set to certainty (1.0). Statistically, these factors are treated dependently.

The product of the Local chance factors is called Prospect Success Ratio -- the percentage of prospects that will be viable, if the overall play works. Statistically, these factors are treated independently.

This subdivision of chance is crucial to assessing the chance of program success, as explained on the next panel…

3 - ASSESS DRY HOLE TOLERANCE AND MINIMUM PROGRAM COSTS

"HOW MANY TOTALLY DRY HOLES WOULD MY COMPANY TOLERATE DRILLING PRIOR TO ABANDONING THIS PLAY?"

This estimate is based upon
-- Company's track record in similar plays
-- Variability of prospects
-- In some cases, minimum well commitment(s)

All costs associated with this minimum program must also be estimated (wells / seismic / land / manpower)

4 - ESTIMATE SUCCESS CASE ACTIVITY LEVELS

Estimate the level of exploration activity for the time period being analyzed, given that there will be at least one economic discovery made in the play.

To calculate overall play volumetric potential, enter a range for number of undrilled prospects, or predicted number of discoveries.

To model volumes captured by your company, enter a range for the number of prospects in which your company will participate, based upon:

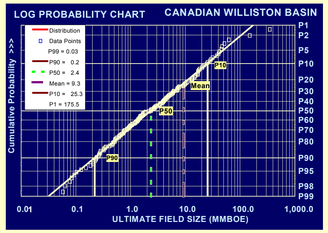
-- Company budget size
-- Number of prospects in inventory, or that is reasonable to assume could be acquired
-- Time period being analyzed

5 - ESTIMATE THRESHOLD SIZE AND VALUE PER BOE / MCFE

"HOW LARGE A FIELD MUST WE FIND TO RECOVER ALL FULL-CYCLE COSTS?"
and
"WHAT IS A REASONABLE ESTIMATE FOR NPV PER BARREL / MCF FOR FIELDS THAT WILL BE FOUND IN THIS PLAY?"

CONSIDERATIONS:
1 - TIME VALUE OF MONEY
2 - TIME PERIOD BEING EVALUATED
3 - CURRENT INFRASTRUCTURE

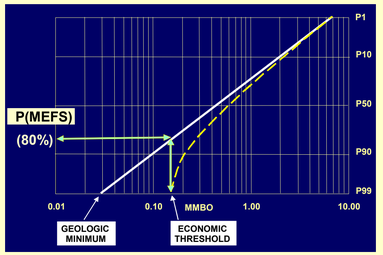
6 - FUTURE FIELD SIZE DISTRIBUTION



CHOOSING THE APPROPRIATE SIZE DISTRIBUTION FOR *FUTURE* DISCOVERIES IS CRUCIAL TO REALISTICALLY ASSESS UNDISCOVERED VOLUMES AND VALUE.

The distribution must reflect that the largest fields are often (but not always) found early in the 'life' of a play.

Fields tend to distribute themselves lognormally. That is, field sizes form a straight line on log – probability plots



The future field size distribution should reflect the size range from smallest detectable ('geologic') discovery up to the largest future discovery remaining to be found in the play.

The threshold size is then used to estimate P(MEFS), the probability that any given discovery will exceed threshold (80% in the example, above). The size characteristics of just those fields exceeding the economic minimum (dashed yellow line, above) are used to calculate the economic volumes found, given success in the play.

CALCULATIONS AND OUTPUT

PLAY / CONCESSION *EXPECTED VALUE* =

(**CHANCE OF SUCCESS** X **VALUE GENERATED**) MINUS (**1 - CHANCE OF SUCCESS** X **FAILURE COST**)

This term represents the chance that at least one economic discovery will be made with the minimum program specified in Step 3 = Program Pe

This term represents value generated, given some success in the play, and that the success-case exploration program defined in Step 4 is executed.

This term reflects funds exposed to total loss in executing the minimum program defined in Step 3 – the equivalent of 'dry hole cost' in prospect analysis.

SHARED CHANCE

DEPENDENT CHANCE

X

(1 –[1 –(LOCAL CHANCE X P(MEFS))] $^{\#TESTS}$)

INDEPENDENT CHANCE

PROGRAM Pe

WHY DOES THE FORMULA LOOK LIKE THAT?

Two Prospects, Both Pe = 0.2
Total Geologic *Independence*

Possible Successful Outcomes:		
A HITS, B DRY	= 0.2 x (1 - 0.2)	= 0.16
A DRY, B HITS	= (1 - 0.2) x 0.2	= 0.16
BOTH HIT	= 0.2 x 0.2	= 0.04
		0.36
Chance of TOTAL FAILURE:		
A DRY, B DRY	= (1- 0.2) x (1 - 0.2)	= 0.64

= (1 - Pe) NUMBER OF TESTS

Since Local chance factors are treated independently, the chance of program success is simply one minus the product of all chances of total failure, as shown in the example above.

Shared / play chance factors are shared by all prospects and are therefore kept as a constant in the calculation.

The number of dry holes tolerated has a pronounced effect on calculated chance of program success, particularly on the low end (e.g., 1 vs. 2, 2 vs. 3 dry holes tolerated).

 # PROSPECTS x PROSPECT SUCCESS RATIO

⇓

 # *GEOLOGIC* DISCOVERIES

X P(MEFS)

⇓

 # ECONOMIC DISCOVERIES

x ECONOMIC FSD

⇓

SUCCESS ECONOMIC VOLUME

X $NPV / BOE

⇓

SUCCESS CASE VALUE

EXAMPLE CALCULATION

INPUT (MEAN VALUES):

SUCCESS ACTIVITY = 10 Prospects
DRY HOLE TOLERANCE = 3 WELLS
CHANCE = 1.0 / .25 (SH / LOCAL)
MEAN FLD SIZE = 100 MMBOE
THRESHOLD SZ = 50 MMBOE

MEAN ECON FLD SZ = 200 MMBOE
P(MEFS) = .40
NPV / BOE = $1.00
GWI / NWI = 50%
DRY HOLE COST = $4 MM (100%)
'DRY HOLE' EXPOSURE = $20MM

OUTPUT (MEAN VALUES):

-- 2.5 GEOLOGIC DISCOVERIES = (10 x .25)
-- 1 ECONOMIC DISCOVERY = (10 x .25 x .4)
-- 100 MMBOE (Co SHARE) FOUND = (1 x 200 x .5)
-- $82MM SUCCESS NPV = (100 - {(10 - 1) x ($4 x .5)}
-- 10% Pe (Individual Prospect) = (1.0 x .25 x .40)
-- 27% Pe (Program) = 1 x (1 - {1- (.25 x .40)} ^{3})
-- $7.5MM EV = (.27 x $82) - {(1 - .27) x $20}

Example calculation based upon single-point input (we favor using probabilistic ranges). Dry hole exposure is the sum of all costs to execute the minimum program of 3 wells (company share). Play is assumed to be proven in this example (Play Chance = 1.0).

Note that the success-case NPV is burdened with the costs of dry holes associated with the successful program.

COMPARATIVE MEASURES

PROSPECT SCALE

--Pe
--DISCOVERY SIZE RANGES (incl non-economic)
--ECONOMIC SIZE RANGES (above company threshold)

PROGRAM / PLAY SCALE

--Pe
--DOLLARS EXPOSED (pre / post tax)
--SUCCESS CASE PRESENT VALUE, VOLUMES
--NUMBER OF ECONOMIC FIELDS FOUND
--RISKED PRESENT VALUE, VOLUMES
--COST OF FINDING, RISKED COST OF FINDING
-- RISKED EXPLORATION EFFICIENCY
-- E & P EFFICIENCY

These are the key output variables from the analysis that can be incorporated into a business model for ranking a global portfolio of plays.

This methodology has been coded into a user-friendly, Excel®-based software package that facilitates the analysis.