The right way to hedge
Today’s discussion

- Importance of cash flow risk management and core beliefs
- Case study on hedging and capital structure optimization in oil & gas
- Implications for organizations
## Our beliefs and insights on hedging and capital structure optimization

1. **There is no such thing as “hedging”; management teams must define a strategic position regarding hedging and risk management**
   - There are either: (1) risk mitigation or (2) margin optimization actions; management teams should disaggregate and measure these activities independently.

2. **A “Risk Compass” provides an effective guide to understand true risk capacity and optimize hedging and capital structure decisions**
   - Account for indirect and second order effects.
   - Take advantage of natural hedges/optionality in portfolio (e.g., flexibility of capital program).

3. **Risk mitigation actions should be linked to both capital structure and optimized to protect priority business cash requirements**
   - Optimal liquidity based on trade-off between marginal returns from capex vs. incremental liquidity cost.

4. **Incorporate impact of natural floors/ceilings and commodity relationships on risk capacity**
   - Requires deep understanding and alignment of commodity pricing mechanisms.

5. **Take a “TCO” approach to hedging and optimizing capital structure; the direct costs are only a fraction of total hedging cost**
   - Indirect costs (e.g., liquidity capital posting and lost upside) typically represent greatest costs.

6. **Alternatives to financial hedging could be more attractive**
   - Options include: contracting, substitution/product specs, strategic moves (e.g., vertical integration).
2. UNDERSTAND TRUE RISK CAPACITY

A “Risk Compass” allows a company to understand true risk capacity…

[Diagram showing cash flow distribution and probability levels for different cash needs categories: Interest and principal, Dividends, Sustaining capex, On-going project capex, Growth capex, Strategic capex.]

- Operating cash flow distribution
- Where liquidity trade-off is faced for most companies

Capex requirement usually correlated to commodity prices through flexibility in activity levels and pricing.

Avoid distress  Reliability  Protect investments/growth  Keep strategic flexibility

SOURCE: McKinsey Risk Management Practice
2. UNDERSTAND TRUE RISK CAPACITY – Cont.

... and hedge only the material exposures

Overextended company

Ways to reshape
- Hedging
- Contracting
- Portfolio changes
- Capital structure

When it typically applies
- Recent distress
- Substantial growth/capital program

Over-insured company

Ways to reshape
- Increase debt
- Share repurchases

When it typically applies
- High free cash flow ("pecking order theory")

SOURCE: McKinsey Risk Management Practice
2. UNDERSTAND TRUE RISK CAPACITY

Need to understand “second-order” exposures embedded in commodity exposure

**BHKP delivered cost of supply (cash cost)**
US$/ADMT

- **Marginal producer fluctuates between Canada, Scandinavia**
- **Operating Capacity = 93%**

**Industry weighted average cash cost**
Percent of total

- **Fuel**
  - 10%
- **Chemical**
  - 15%
- **Material**
  - 10%
- **Labor**
  - 15%
- **Power**
  - 5%
- **Fiber**
  - 45%

- **Partial local currency exposure**
- **Primarily USD exposure**

**Cumulative Capacity**
Millions of ADMT Per Year

- **Significant FX exposure embedded in pulp prices**
- **FX exposure in Pulp shifts between Canada, Scandinavia**

1 Sorted by cash costs, delivered to Shanghai, China

SOURCE: Hawkins Wright, Paperloop, RISI Analytical Cornerstone; McKinsey analysis
Risk mitigation actions must be linked to capital structure and optimized to protect priority business cash requirements.

Where the tradeoffs occur

- **Capex projects**
- **Liquidity raised**

<table>
<thead>
<tr>
<th>Cash raised or capex invested</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCO</td>
</tr>
<tr>
<td>Optimal liquidity</td>
</tr>
<tr>
<td>Hedge strategy #1</td>
</tr>
<tr>
<td>Hedge strategy #2</td>
</tr>
</tbody>
</table>

For the optimal liquidity point, the marginal cost equals the return of protected capex projects.

Risk analysis prioritizes which projects are worth “protecting” to the desired confidence level.

**Comparing project returns to cost of “protecting” funds**

- **NPV**
- **% total**

SOURCE: McKinsey Risk Management Practice
Commodity price risk can be forecasted with a “price envelope” based on distribution of market expectations and industry expertise.

**Methodology**

- Future prices simulated based on aggregate market expectations
- Mean price based on 30 day average forward curve
- Volatility is implied volatility from traded options
- Mean reversion estimated using the mOU process

**Simulated future HH prices**

$$/MMBtu

- Simulated HH prices in 2014 fluctuate between $4 and $13.5/MMBtu

**Simulated future WTI prices**

$$/Bbl

- Simulated WTI prices in 2014 fluctuate between $49 and $160/Bbl

---

1 5,000 Monte Carlo simulations; model uses market forwards, implied volatilities and mOU process calibrated with historical prices from 1999-current. A correlation of 23% is assumed between WTI and HH.

SOURCE: Forward curve and implied volatility from Bloomberg. Used 30 day averages with prices through May 25.
5. TOTAL COST OF HEDGING

Direct costs are only a fraction of total cost of hedging

<table>
<thead>
<tr>
<th>Description</th>
<th>Percent of revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct costs</strong></td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>• Bid/ask spread</td>
<td></td>
</tr>
<tr>
<td>• Banking/origination fees</td>
<td></td>
</tr>
<tr>
<td><strong>Margin capital opportunity costs</strong></td>
<td>7.0-11.0</td>
</tr>
<tr>
<td>• Opportunity cost of margin capital required to withstand significant price</td>
<td></td>
</tr>
<tr>
<td>moves (two sigma event)</td>
<td></td>
</tr>
<tr>
<td><strong>Net asymmetric upside lost</strong></td>
<td>2.5-4.0</td>
</tr>
<tr>
<td>• Overall decline in expected cash flow</td>
<td></td>
</tr>
<tr>
<td>• Log normal distribution of commodity prices makes protected downside less</td>
<td></td>
</tr>
<tr>
<td>than lost upside</td>
<td></td>
</tr>
<tr>
<td>• Higher natural floors lead to greater asymmetric upside</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: McKinsey Energy Hedging Model
A variety of levers beyond traditional financial instruments are available to address risk-return decisions

**6. ALTERNATIVES TO FINANCIAL HEDGING**

**Operational/merchandising**
- Develop alternate product formulations/wider specifications
- Leverage inventory
- Optimize pack size/price/quality across channels/geographies
- Optimize trade spend/marketing dollars

**Strategic**
- Integrate vertically to balance buy-side/sell-side
- Develop partnerships
- Invest in pure plays or counter-cyclical businesses

**Contracting (sales and purchasing)**
- Align purchasing and sales contracts in timing/terms
- Use escalator clauses and/or formula pricing
- Leverage traditional financial instruments
- Integrate vertically to balance buy-side/sell-side
- Develop partnerships
- Invest in pure plays or counter-cyclical businesses

**Examples**
Today’s discussion

• Importance of cash flow risk management and core beliefs

• Case study on hedging and capital structure optimization in oil & gas

• Implications for organizations
Commodity hedging review

Hedging strategy
- Reduce Price Uncertainty – Ensure Predictability of Cash Flows
- “Lock in” Acquisition Economics

Peer group evaluation
- “There’s No One Best Way” as Peer Group Employs a Wide Range of Hedging Strategies

Conclusions from review
- Hedging Program Has Been Effective But Has Entailed Opportunity Cost
- Company Valuation Impact – Inconclusive
- MTM Accounting Well Understood and Endorsed by Investors
- NBL’s Governance and Control Framework is Robust
- Enhancing Current Program by Employing Best Practices
  - Use of a Range of Hedging Instruments Including Costless Collars, Purchased Puts
  - Employing “Proactive” Management to Commodity Risk Management
  - Application of Cash Flow at Risk
Recent post mortem on hedge program results led to new thinking around hedge execution.

1 Settlements Represent the Close Out of the Hedge Position with the Counterparty For Cash: (Noble Cash Payment to Counterparty) / Noble Cash Receipt From Counterparty
Noble Energy (NYSE: NBL)
Leading independent energy company

- **Oil and Gas Exploration and Production**
  - Member of S&P 500

- **Diversified and Balanced Asset Portfolio**
  - Leverage to U.S. and international markets
  - Exposure to crude oil and natural gas

- **Key Operating Areas**
  - Onshore U.S.
  - Deepwater Gulf of Mexico
  - Eastern Mediterranean (Israel and Cyprus)
  - West Africa (Equatorial Guinea and Cameroon)

- **1,600+ Worldwide Employees**

- **Market Value: $14 Bn**

**Reserves YE 2009**
820 MMBoe

- **Volumes 2010E**
214 to 217 MBoe/d

**United States**

**International**

**U.S. Natural Gas**

**International Natural Gas**

**Liquids**
Acquisition case: Patina look-back
Oil and gas put vs. swap strategy
Alternative instruments can create value

The Patina Swap Strategy, While Initially Costless, Incurred Large “Indirect Costs” Due to Lost Upside Opportunity

For Future Large Acquisitions, Consider:
• Purchasing Puts as Insurance to Protect the Downside and Retain the Upside rather than use swaps (Include Put Premium Cost in Acquisition Economics)

AND / OR

• Proactively Monitor / Manage Hedge Positions—If Market Dynamics and NBL’s Commodity Price View Changes Significantly From the Time Hedges Were Originally Put in Place, Consider Early Settlement and Reset of Hedges

NOTE: Put Strike Prices Set Equal to Actual Swap Hedge Rates
A new hedging approach linked to capital structure planning

Illustrative Example

Cash Flow Probability Distribution (Monte Carlo)
- Commodity Price Scenarios
- Business Outcomes

Potential Stress

Revised Operating Cash Flow Distribution, Levers Include (e.g.):
- Commodity Hedging
- Capital Structure Changes
- Portfolio Changes
- Others (e.g. Contracting, etc.)

Higher Probability of Funding Strategic capex

Pre-CFAR Operating Cash Flow Distribution
Lower Probability of Funding Strategic capex

Prioritization of Cash Needs
- Interest & principal payments
- Dividends
- Ongoing Maintenance capex
- Sustaining capex
- Growth capex
- Strategic capex

Operating Cash Flow
Cash flow at risk – highly confident of meeting objectives

Monte Carlo Simulation
- 5,000 Scenarios

Commodity Price Range
- Oil: $49 - $160 / Bbl.
- Gas: $4 - $13.5 / MMBtu

Implied Commodity Price Volatilities

Business Scenarios
- Production Uncertainty
- Capex Overruns
- Project Delays
Prioritizing capex based on incremental NPV returns reduces cash requirements for protecting marginal projects

**Cumulative NPV from capex Investments**

**Cost-benefit analysis of capex funding**

<table>
<thead>
<tr>
<th>Tiers covered @ 95% level</th>
<th>External liquidity required</th>
<th>NPV benefit less liquidity cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>II</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>III</td>
<td>1,000</td>
<td>(73)</td>
</tr>
</tbody>
</table>

- Capex Tiers I & II represent attractive projects to “protect” (protect 70% of total capex program with 95% confidence interval)
- However, Tier III capex does not provide a sufficient return to hedge cash flows to ensure delivery

**SOURCE:** McKinsey Risk Management Practice
Today’s discussion

• Importance of cash flow risk management and core beliefs

• Case study on hedging and capital structure optimization in oil & gas

• Implications for organizations
“Discovery” To Application Conclusions

• Risk Management Programs Should be Strategically Focused
  – Integrated Into Business Plan to Sustain Competitive Advantage
  – Potential Exists for Shifting Emphasis From Pure Risk Reduction to the
    Management of Competitive Risk/Opportunity
  – Recognizes that Management Has a View on Future Commodity Price Moves

• Evaluate Risk Management Program in Terms of Assessing Likelihood of Achieving
  Targeted Objectives
  – Knowing Cash Flow at Risk (CFAR) Profile Assigns Probability of Achieving
    Business Plan
    • Operating Gains -- Fewer Forced Modifications to Business Plan and Lower
      Plan Execution Costs
    • Financing Gains – Using Hedges to Create Good Match Between Cash Flow
      Generated and Cash Flow Requirements Reduces the Need to Maintain Excess
      Liquidity (Capital Structure Linkage)

• Matching Cash Inflow to Outflows Coupled with Internal View on Commodity Price
  Movements Implies Use of Multiple Types of Hedging Instruments
  – Swaps for anticipated down markets; Purchased Puts for up markets
## Risk optimization approach and principles

### Key objectives

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Construct risk compass based on cash flow-at-risk (CFAR) model</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Evaluate risk/return optimization strategies including hedging and optimal capital structure</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Define governance model and required implementation plan</td>
</tr>
</tbody>
</table>

### Key principles

**Develop practical tool for that can be integrated into decision making process**
- Risk compass should be robust enough to “test” various business scenarios but also user-friendly to incorporate in on-going decision making.

**Ensure Risk Compass addresses key business uncertainties and risks**
- Focus on both market risks (e.g., commodity prices) and business risks (e.g., capex and opex overruns for new mega-projects).

**Collaborative and iterative team approach**
- Interact and problem solve with working team on ongoing basis to develop relevant solutions.

SOURCE: McKinsey Risk Management Practice
Risk Compass compares business cash requirements with dynamic forecasts of operating cash flow availability.

**Business cash requirements**
- Interest and principal
- Dividend
- Capex

**Segmentation of capex**
- Segment I: Top priority
  - Strategic importance
- Segment II: Medium priority
- Segment III: Lowest priority

**Operation cash flow distribution**
- Commodity price forecasts
  - 5 year average prices based on forward curve
  - Volatilities based on implied volatility from traded options
- Operational risks
  - Project delays
  - Capex overruns
  - Production changes

SOURCE: McKinsey Risk Management Practice