# Oil, Gas & Mining Questions & Answers

I created this section of the interview guide because I kept getting questions on what to expect when interviewing for **specific industry groups**.

This chapter deals with oil & gas companies and the associated energy groups at banks. Mining is very similar (95% overlap) so we address that here as well.

Within oil & gas, we focus on the upstream, or Exploration & Production (E&P), segment because it's the most common one to receive questions on in interviews.

A couple points:

1. This is **advanced material**. You should not expect to receive all these questions in entry-level interviews unless you have worked at a bank before.
2. You will **still get normal accounting, valuation, and modeling questions** even if you interview with specific industry groups – so don't forget about those.
3. I've divided this into "High-Level Questions" – good to know even for entry-level interviews – and then advanced questions on specific topics like accounting, valuation, and modeling that are more appropriate for lateral interviews.

Finally, keep in mind that this guide is only questions and answers – if you want to learn the concepts *behind* the questions in-depth, you should check out the Oil & Gas Modeling Program at a special, members-only discounted rate right here:

http://breakingintowallstreet.com/biws/oil-gas-modeling-members-only-discount/

You must be logged into the site to view that page.

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## *High-Level Questions & Answers*

These are the most important questions to know for **entry-level interviews** with energy and natural resource groups.

Even if you know more than the questions and answers here, you should downplay your knowledge in interviews and set expectations low – otherwise you open yourself up to obscure technical questions.

**1. How are energy and natural resource companies different from normal companies?**

- **They Can't Control Revenue:** More accurately, they can't control the prices they receive for their "products" (oil, gas, gold, etc.) and can therefore only control the production side of revenue.
- **Asset-Centric:** All value for natural resource companies flows directly from their assets – how much in **reserves** they have in the ground, how much they can **produce**, and how much they can find to replace what they've produced.
- **Different Accounting:** There are different accounting standards, more so for oil & gas companies, and so you have to do extra work when modeling companies and when using them in a valuation.
- **Depleting Assets:** When natural resource companies produce energy or minerals, they also deplete the PP&E on their balance sheets – so they have to spend a small fortune on finding or acquiring replacement assets.
- **Cyclical:** Prices for commodities such as oil and gold are cyclical and therefore difficult to project – to get around this, you have to look at longer time horizons and use price scenarios in models.

**2. What are the different segments of the oil & gas and mining industries?**

The major segments for oil & gas are **upstream** (also known as Exploration & Production (E&P)), **midstream**, **downstream** (also known as Refining & Marketing (R&M)), oil field services, and integrated majors.

Most M&A activity takes place in the upstream segment because those companies focus on finding and producing energy in the first place, which is the biggest value driver in the industry.

Midstream companies store and transport energy via pipelines and land, sea, and air transportation, and downstream companies turn energy into products that are usable by the consumer, such as jet fuel or automobile gasoline.


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Oil field service companies provide drilling, management, construction, maintenance, and other services to energy producers.

Integrated majors (Exxon Mobil, BP, etc.) operate across multiple segments – so they might have both upstream and downstream segments, for example.

On the mining side, companies are divided according to the minerals they extract – gold, silver, iron, coal, and so on, or larger companies that produce many different minerals.

**3. Do these other segments outside of upstream still share the same differences compared to normal companies?**

No, not to the same extent. Everything is sensitive to commodity prices, but other areas such as downstream, midstream, and oil field services are much closer to "normal" companies because they are not as asset-dependent as upstream companies.

For the integrated majors, normally you analyze each business segment separately – so an upstream division would still have the same differences, but the downstream and midstream divisions would not.

**4. What are Production and Reserves and why are they so important for these companies?**

**Reserves** are how much a natural resource company has in the ground that could potentially be extracted in the future. It's important because everything in models flows from how much they have in the ground, and it's one of the key inputs for the Net Asset Value (NAV) model.

**Production** is how much the company is extracting and turning into energy or minerals – usually it's listed on a daily basis for energy companies and on an annual basis for mining companies, though you see both methods used in filings.

Production is important because it's the key driver for revenue and expenses in a model: for normal companies you might make revenue growth or profit margin assumptions, but for natural resource companies you make production growth, commodity price, and per-unit expense projections instead.

**5. How are the 3 financial statements different for a natural resource company?**


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- **Income Statement:** Revenue is split into categories such as gas, oil, and downstream; COGS does not exist and all expenses are listed together; common expenses are Production (similar to COGS for normal companies), Taxes & Transportation, DD&A (Depletion, Depreciation & Amortization), Accretion of Asset Retirement Obligation, G&A, Leases, and Midstream / Downstream expenses.
- **Balance Sheet:** It's almost exactly the same, but PP&E may be split into Proved Properties and Unproved Properties; on the liabilities side, the Asset Retirement Obligation is an industry-specific item that reflects the cost of shutting down wells and mines in the future.
- **Cash Flow Statement:** Very similar, but you add back new and slightly different non-cash expenses such as the Accretion of Asset Retirement Obligation and the Non-Cash Derivative Losses; under Cash Flow from Investing, you may project Asset Sales and Purchases since they're recurring items.

**6. How would you value a natural resource company?**

You still use public comps and precedent transactions, but:

- You screen based on Proved Reserves or Production rather than the usual Revenue and EBITDA criteria.
- You look at metrics like Proved Reserves, Production, EBITDAX, and the Reserve Life Ratio instead of Revenue and EBITDA.
- You use valuation multiples such as EV / EBITDAX, EV / Proved Reserves, and EV / Production instead.

You could still use a DCF, and for segments outside of E&P it's quite common because you can still project growth and cash flows.

For E&P, though, the **Net Asset Value (NAV) model** takes the place of the DCF.

You assume that a company produces resources until it literally runs out, and then make assumptions for the realized prices, expenses, and taxes to calculate after-tax cash flows; take the net present value of those and then add in the value of other business segments and undeveloped acreage to calculate Enterprise Value.

You use this methodology because a natural resource company's value lies in its assets rather than the company as a whole, and because "Free Cash Flow" as defined in a DCF may be very low due to high CapEx.


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**7. What are common metrics and valuation multiples for energy and natural resource companies?**

- **Proved Reserves:** How much in minerals/energy the company can extract with 90% certainty.
- **Daily Production:** How much in minerals/energy the company is producing each day.
- **Oil Mix %:** The percentage of Production or Proved Reserves that are oil rather than natural gas (you could make a similar calculation for mining companies).
- **R / P Ratio or Reserve Life Ratio:** Proved Reserves / Annual Production, in other words how many years until the company depletes its resources.
- **EBITDAX:** EBITDA + Exploration Expense, needed to normalize different accounting standards.
- **EV / EBITDAX:** How valuable is a company in relation to its approximate normalized cash flow?
- **EV / Proved Reserves:** How valuable is each unit of a company's Proved Reserves?
- **EV / Daily Production:** How valuable is each unit of a company's Production?

You could also use Annual Production rather than Daily Production, but daily metrics are more common for oil & gas companies.

Note that the last 2 multiples – EV / Proved Reserves and EV / Daily Production – are in **dollars per unit** (or Euros, yen, RMB, or whatever the currency is) and are **not** actual numbers. A "multiple" there does not mean 2.0 x, but rather $2.50 or $10.15 (for example).


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## *Production and Reserves Questions & Answers*

These concepts are crucial if you want to build an in-depth model of an energy or natural resource company, but they're not likely to come up in interviews unless you've had previous experience.

It may be a good idea to learn the basic types of reserves and the most common metrics, but you don't need to go crazy memorizing everything here unless you find it fun.

**1. How do we measure Production and Reserves?**

For oil & gas it's easy: everything is measured in **barrels** (1 barrel = 42 gallons) on the oil, natural gas liquids, synthetic oil, and bitumen side and everything is measured in **thousand cubic feet** for natural gas.

Yes, even in countries that use the metric system these units are still common though you may see slight variations elsewhere.

For mining, the situation is more complicated because there are so many different types of minerals – but common units are **tons** or **tonnes** (1 metric ton = 1,000 kg), **ounces**, and **carats**. Here's a chart that summarizes the key units:

| Resource Type | Daily Production | Annual Production & Reserves |
|---|---|---|
| Oil, Natural Gas Liquids, Synthetic Oil and Bitumen | Thousands of Barrels (MBbls) | Millions of Barrels (MMBbls) or Billions of Barrels (BBbls) |
| Natural Gas | Millions of Cubic Feet (MMcf) | Billions of Cubic Feet (Bcf) or Trillions of Cubic Feet (Tcf) |
| Iron Ore and Coal | Thousand Tonnes (kt) | Million Tonnes (Mt) |
| Aluminum, Copper, Lead, Zinc, Nickel, and Manganese | Tonnes (t) | Thousand Tonnes (kt) |
| Uranium | Tonnes (t) | Tonnes (t) |
| Diamond | Carats | Thousand Carats |
| Gold and Silver | Ounces (oz) | Thousand Ounces (koz) or Million Ounces (moz) |

Do not worry about the specifics for every single item – just understand the basic units and how mining is different from energy.


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**2. How do you convert between different types of energy, such as oil, gas, and natural gas liquids? Why do we need to convert units in the first place?**

You convert based on how much energy a barrel of oil (or natural gas liquids, or synthetic oil, and so on) produces and how much energy 1,000 cubic feet of natural gas produces.

Since 1 barrel of oil produces 5.8 million British Thermal Units of energy (5.8MMBtu) and 1,000 cubic feet of gas produces 1 MMBtu, you round the 5.8 to 6 and assume that:

- 1 Bbl of Oil = 6 Mcf of Natural Gas
- 1 MBbl of Oil = 6 MMcf of Natural Gas
- 1 MMBbl of Oil = 6 Bcf of Natural Gas
- 1 BBbl of Oil = 6 Tcf of Natural Gas

If you convert to oil units, you get **Barrels of Oil Equivalent (BOE)** and if you convert to gas units, you get **Thousand Cubic Feet Equivalent (Mcfe)**.

It's super-important to get this conversion right because you pick comps based on Proved Reserves and Daily Production – if one company's reserves are in BOE and another's are in Mcfe, they are not comparable and you need to convert everything to either BOE or Mcfe.

You can't "convert" units for mining companies in the same way – if you could convert iron into diamonds, you should go into business as an alchemist and forget investment banking.

Sometimes you do see "gold-equivalents" or similar units in a company's filings; all they're doing is multiplying each mineral volume by the average realized price, summing them up, and then dividing by the price per ounce of gold.

**3. What are the different types of Reserves, and why do we care about them in a model?**

The 3 main types of reserves are **Proved**, **Probable**, and **Possible**.

Proved Reserves have at least a 90% chance of being extracted, Probable is at least a 50% chance, and Possible is less than 50%.

In natural resource-lingo, **1P** refers to the **Proved Reserves**, **2P** is **Proved + Probable**, and **3P** is **Proved + Probable + Possible**.


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You can further divide Proved Reserves into Proved Developed and Proved Undeveloped, and then Proved Developed Producing and Proved Developed Non-Producing.

In finance you care mostly about the **Proved Reserves** because you use it as a valuation multiple (EV / Proved Reserves) and because you select comps based on Proved Reserves.

Proved Reserves are also one of the key inputs for the Net Asset Value (NAV) model and the operating model.

The other reserve types are less important, but if you wanted to be more aggressive you could use them as inputs to a NAV model and get a higher valuation since the 2P and 3P numbers are always higher than 1P.

**4. Why can't we just use Revenue and EBITDA to select comps? Is there a reason that metrics like Proved Reserves or Production are fundamentally better?**

If you used revenue or EBITDA, the numbers would shift around too much because of changes in commodity prices. For example, if the price of oil suddenly fell by 50% then oil companies' revenue would also fall by 50%.

So you'd have to constantly re-adjust the selection criteria based on commodity prices. That's not practical, so you use Proved Reserves or Production to measure the "size" of companies instead.

**5. What are the key metrics you can use to analyze Production and Reserves?**

We listed a few of these key metrics in the previous section: the Oil Mix % (for O&G companies), the R / P Ratio or Reserve Life Ratio, and EBITDAX.

Several additional metrics you use:

- **Production Costs per Unit:** Annual Production Expense / Annual Production Volume
- **Finding & Development (F&D) Costs – All Sources (per Unit):** Net Reserve Additions / (Acquisition + Development + Exploration Expenses)
- **Finding & Development (F&D) Costs – Excluding Purchases and Sales (per Unit):** Net Reserve Additions Excluding Purchases and Sales / (Development + Exploration Expenses)


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- **Production Replacement Ratio – All Sources:** Net Reserve Additions / Annual Production
- **Production Replacement Ratio – Excluding Purchases and Sales:** Net Reserve Additions Excluding Purchases and Sales / Annual Production

Most of these are straightforward – Production Expenses per Unit gives you a rough idea of the "cost of goods sold" on each unit of energy/minerals produced.

Finding & Development Costs indicate how expensive it is to acquire, find, and develop additional reserves. The one excluding purchases and sales tells you how expensive it is organically. Lower is better here – if the number exceeds the average realized price per unit of resources, the company's profit won't look so good.

The Production Replacement Ratio tells you how much of the company's depleted reserves are replaced each year. If this falls below 100%, the company is in trouble.

This ratio is more of a concern for huge companies like Exxon Mobil that have genuine difficulty replacing more than 100% each year.

**6. How do you move from Production and Reserves to a full 3-statement model for a company?**

Most revenue and expense items are directly linked to Production, or to Revenue, which is in turn linked to Production.

For Total Revenue you just multiply the Annual Production of each commodity by the Average Realized Price for each commodity and sum up everything.

On the expense side, normally you link Production, Sales Taxes, Transportation, DD&A, and Accretion of Asset Retirement Obligation to Annual Production; other expenses such as G&A, CapEx, and Exploration also generally follow Annual Production even if they're not directly linked.

Once you have the revenue and expenses in place, it's just a standard 3-statement model that links together as you would expect.


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## *Accounting & 3-Statement Model Questions & Answers*

These questions are all more advanced than anything in the "High-Level" section.

It's difficult to generalize 3-statement modeling for energy companies because it depends on the company type, the region, and how big it is – but there are some commonalities, especially when we focus on the E&P segment.

If you're interviewing in the US, the successful efforts vs. full cost questions are the most likely ones here because US-based companies use different accounting standards; outside the US these questions are less likely because IFRS ensures that most companies use successful efforts.

**1. Explain the differences between successful efforts and full cost accounting.**

The only difference is that **unsuccessful exploration** is **expensed** for a **successful efforts** company but it's **capitalized** and added to PP&E for a **full cost** company.

The **successful exploration** expense is always capitalized under both standards.

That seems simple, but it leads to many consequences on the financial statements:

- Operating income, net income, and PP&E are usually lower for successful efforts companies and higher for full cost companies.
- However, full cost companies have higher DD&A expenses and more frequent write-downs and impairment charges because they always need to "reset" the value of their PP&E to fair market value (the so-called "ceiling test").

Outside the US, successful efforts vs. full cost is less of a concern because IFRS limits the application of full cost – so most companies use successful efforts and you don't have to worry about normalizing anything.

**2. So why would a company ever want to use successful efforts accounting? It seems like full cost accounting is much better in terms of net income and therefore EPS.**

This statement is not necessarily true. Yes, full cost companies often have higher operating incomes and net incomes, but high impairment charges may reduce both of those and actually make them lower.


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For example, if commodity prices suddenly dropped a full cost company would have to record an impairment charge to reflect that – and so its operating income and net income might fall by quite a bit.

In general, small and startup companies prefer the full cost method and larger and more diversified companies use successful efforts because it's easier for the larger companies to absorb the unsuccessful exploration expense.

But again, it's a trade-off: a full cost company could easily end up with massive impairment charges that result in lower net income, EPS, and PP&E.

**3. Let's say a successful efforts company has a successful exploration expense of $100 and a dry hole, or unsuccessful exploration, expense of $100. Walk me through how the 3 statements change when we record these expenses.**

On the income statement, operating income falls by $100 because of the unsuccessful exploration expense. Assuming a tax rate of 40%, net income is down by $60.

On the cash flow statement, net income is down by $60 so cash flow from operations is down by $60; the successful exploration expense of $100 is recorded under cash flow from investing, so that is down by $100 and the net change in cash at the bottom is down by $160.

On the balance sheet, cash is down by $160 but PP&E is up by $100 because of the $100 in additional successful exploration expense, so assets are down by $60. On the other side, shareholders' equity is down by $60 because of the $60 decrease in net income, so both sides balance.

**4. Now let's say they become a full cost company with the same expenses. Walk me through the 3 statements once again.**

There are no changes to the income statement for a full cost company. On the cash flow statement, cash flow from investing falls by $200 because both the successful and unsuccessful exploration expenses are capitalized, and so cash is down by $200 at the bottom.

On the balance sheet, cash is down by $200 but PP&E is up by $200 because of the capitalized exploration expenses, so neither side of the balance sheet changes and it remains in balance.


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**5. I'm looking at a successful efforts company's cash flow statement right now, and they're adding back the dry hole expense in cash flow from operations and then counting it as part of their CapEx under cash flow from investing. Why are they doing that?**

There is inconsistent treatment of the dry hole expense among successful efforts companies – according to the accounting rules, you should **not** show the expense on the cash flow statement at all.

But in real life, some companies actually add back the expense under cash flow from operations and then subtract it out again under cash flow from investing, therefore capitalizing it and adding it to their PP&E number.

Unfortunately there's no rhyme or reason to this – it's just an inconsistency and something you have to be aware of when analyzing the financial statements. There's a good article on the subject right here:

http://findarticles.com/p/articles/mi_qa5447/is_199907/ai_n21443806/

**6. How do successful efforts and full cost accounting apply to mining companies?**

Similar to the question above, many mining companies use a method that's in between successful efforts and full cost.

The exact rules are company-dependent, so you have to go by what they say in the financial statements and follow whatever standard they've been using.

**7. Let's say we're comparing 2 companies, 1 that uses successful efforts and 1 that uses full cost. How can we normalize EBITDA to make the numbers truly comparable?**

Similar to the EBITDAR metric for airlines and retail companies, you can calculate EBITDAX – Earnings Before Interest, Taxes, Depreciation/Depletion, Amortization, and Exploration – by adding the Exploration expense on the income statement to EBITDA.

For full cost companies, EBITDAX is the same as EBITDA because they don't record an Exploration expense on their income statements at all – but for successful efforts companies EBITDAX will always be higher.

If you did not do this, EBITDA would seem higher for full cost companies – but that reflects different accounting standards rather than actual cash flow.


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**8. Walk me through what happens on the 3 statements when the asset retirement accretion expense goes up by $100.**

The asset retirement accretion expense relates to the asset retirement obligation, a liability on a natural resource company's balance sheet – it reflects how much it will cost to shut down the mines or oil/gas fields of that company in the future.

If the expense goes up by $100, operating income on the income statement falls by $100 and net income falls by $60 assuming a 40% tax rate.

On the cash flow statement, net income is down by $60 but the asset retirement accretion is a non-cash expense, so you add it back and cash at the bottom is up by $40.

On the balance sheet, cash is up by $40 so total assets are up by $40; on the other side, the asset retirement obligation is up by $100 but shareholders' equity is down by $60 due to the reduced net income, so both sides are down by $40 and the balance sheet balances.

**9. Let's say we're looking at an energy company that uses derivatives for hedging purposes. They record a realized gain of $60 and an unrealized gain of $40. Walk me through the 3 financial statements.**

On the income statement, you record both the realized gain and the unrealized gain, so operating income is up by $100 (normal companies may list these under pre-tax income, but for energy companies they are usually part of operating income). Net income is up by $60 assuming a 40% tax rate.

On the cash flow statement, net income is up by $60 but you **subtract** the unrealized gain because it's non-cash, so cash is up by $20 at the bottom.

On the balance sheet, cash is up by $20 and the derivatives line item on the assets side is up by $40 due to the unrealized gain, so total assets are up by $60. On the other side, shareholders' equity is up by $60 because of the net income increase, so both sides balance.

**10. Why do energy and natural resource companies have high deferred tax expenses? How can we estimate them in a model?**

They have high deferred income tax expenses because they have high PP&E balances and they depreciate PP&E differently for book and tax purposes – that difference creates deferred tax liabilities (DTLs) or deferred tax assets (DTAs).


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You could attempt to estimate these differences, but it's almost impossible unless they give you detailed numbers for everything – so you usually just assume a percentage for current income taxes and a percentage for deferred income taxes, based on historical averages.

**11. What are common non-recurring charges and add-backs for energy and natural resource companies?**

When you're calculating EBITDA and EBITDAX, there are the usual DD&A, Stock-Based Compensation, and Restructuring-type items to add back.

But there are also a couple of industry-specific items:

- Asset Retirement Accretion (a form of amortization)
- Non-Cash or Unrealized Derivative (Gains) / Losses (appears on the cash flow statement)
- Impairment Charges and PP&E Write-Downs (more common with full cost companies)
- (Gain) / Loss on Sale of Assets (appears on the cash flow statement)
- Environmental Remediation

You have to be really careful when adding back these charges because sometimes companies embed these items in DD&A and sometimes they list the expenses separately – **read the footnotes**.

**12. How do you take into account the uncertainty of commodity prices when projecting revenue for a natural resource company?**

You create scenarios for different prices – for example, you might have a low, base, and high case and assume $40 per barrel of oil in the low case, $70 in the base case, and $100 in the high case.

Generally you assume that the prices stay the same each year, i.e. that it's $40 per barrel in years 1 through 5 of the low case. Otherwise it gets confusing to assess the impact of different prices on the model.

**13. Why might a natural resource company use hedging, and how do you incorporate it into a 3-statement model for the company?**


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With hedging, a company uses derivatives to provide "insurance" against a sudden drop in commodity prices.

For example, if oil is currently at $70 per barrel the company might buy contracts that guarantee it the ability to sell oil at $50 per barrel as downside protection. Then, if the price drops to $40, they can still sell their oil at $50 and their revenue won't drop quite as much.

The downside is that if oil prices jump to $100 per barrel the company won't realize the full benefit because they paid many for those contracts that are now worthless – so their average realized price (which includes the cost of the contracts) might be $90 instead of $100.

You could try to use the actual numbers for derivatives, but in an operating model it's more common to use simpler percentages and to assume a certain increase over market prices in the downside case, and a certain decrease below market prices in the upside case.

In addition to hedging, you also have to take into account the differential between market prices and realized prices – so the complete formula for revenue would be Annual Production * Average Market Price * Price Differential * Hedging Percentage.

**14. Hedging seems like a good idea to smooth out a company's revenue – why do many natural resource companies, especially large ones, choose *not* to use it?**

Because of the downside pointed out above: that if commodity prices rise, the company would not realize the full benefits.

Large, multi-national companies like Exxon Mobil tend not to use hedging at all because they produce so much energy that hedging wouldn't even be effective: there are not enough derivatives available to cover all their production.

**15. How do you determine which expenses on the 3 statements are linked to Production and which are not?**

Usually companies point this out explicitly in their filings by saying that certain expenses "trend with production." If they don't list that, just think through which expenses would depend on energy/mineral production:

- Production Expense
- Sales Taxes


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- Transportation
- Depreciation, Depletion & Amortization (DD&A)
- Accretion of Asset Retirement Obligation

The first 3 are dependent on how much is extracted, transported, and sold, so they are linked to production; DD&A is also linked to production because each unit produced **depletes** the company's reserves. Each unit produced also makes it more expensive to shut down the operation in the future, which explains the asset retirement accretion.

G&A, Capital Expenditures, and the Exploration expense could go either way but generally they will be linked to Production as well: the more a company produces, the more employees it needs and the more it needs to spend to replace its depleted reserves.

Stock-Based Compensation, the Derivative Fair Value Gain or Loss, Impairment and Restructuring Charges, and Interest Expenses should **not** be linked to production because they are not directly correlated. They will be linked to revenue, based on historical averages, set to 0, or dependent on other schedules (interest and debt).

**16. How are revenue and expense projections different for mining companies?**

The expense side is very similar: you just decide which expenses are Production-linked and which trend with revenue or move independently.

The revenue side is more complicated because for mining companies, you assume that a certain number of tons or tonnes are mined but that each ton/tonne only contains a small amount of the mineral you're looking for. So you need to make a few more calculations to get to the annual Production numbers.


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## *Valuation Questions & Answers*

The most likely questions here are the ones on Net Asset Value (NAV) models, since those are specific to energy and natural resource companies.

The differences with public comps, precedent transactions, and the DCF are good to know but those methodologies are not dramatically different – so focus on the NAV-related questions.

**1. How do you calculate Equity Value and Enterprise Value differently for a natural resource company?**

Equity Value is the same: take the common shares outstanding, add in dilution from options, warrants, convertibles, RSUs, performance shares, and any other dilutive securities, and multiply by the current stock price.

Enterprise Value is similar: start with Equity Value, subtract cash and cash-like items, and add debt, preferred stock, non-controlling interests, unfunded pension obligations, and similar liabilities.

But there are 2 new potential additions:

- **Net Value of Derivatives:** For companies that use hedging and therefore carry derivatives on their balance sheet, the net value of the derivatives might count as a cash-like item to be subtracted.
- **Asset Retirement Obligation:** This is a new type of liability that's specific to natural resource companies – it reflects the cost required to shut down mines, oil fields, and wells in the future, discounted to its present value. You might add this as a debt-like item.

Please note that these two items **are not universally added to calculate Enterprise Value** – some banks count them and some do not.

**2. How is an oil & gas company's capital structure different from a normal company's capital structure? What impact does that have on the valuation?**

Generally, oil & gas companies carry significantly more debt than "standard" companies in other industries like technology. They may have over a dozen different tranches of debt, often in the form of high-yield debt with bullet maturity.


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They do this because they constantly need to find and acquire new reserves, and they may not always have sufficient organic cash flow to do so.

This difference doesn't *directly* impact the valuation, but it's one of the reasons why P / E multiples are not as meaningful for natural resource companies: a higher-than-normal interest expense can distort what P / E tells you.

**3. How are comparable public companies (public comps) and precedent transactions (M&A comps) different for natural resource companies?**

The mechanics of picking similar companies and transactions and then using the median (or 25th percentile, or 75th percentile, or whatever you want) multiples to estimate value for the company you're analyzing are the same.

The differences:

- You might screen based on **Proved Reserves** or **Daily Production** rather than traditional metrics such as revenue or EBITDA.
- You would list metrics such as Proved Reserves, Daily Production, the Reserve Life Ratio, and EBITDAX rather than traditional ones like revenue, EBIT, or EBITDA.
- You use multiples such as EV / EBITDAX, EV / Proved Reserves, and EV / Daily Production instead.

Note that once again, EBITDAX is not a universal standard – outside the US it isn't necessary most of the time, and even in the US many banks still just use EBITDA.

**4. Let's say that one of my public comps has a Reserve Life Ratio of 15 and another has a Reserve Life Ratio of 10. Which one will have higher EBITDA and EBITDAX multiples, and why?**

All else being equal, the one with the Reserve Life Ratio of 15 will have higher EBITDA and EBITDAX multiples. Remember that the Reserve Life Ratio is Proved Reserves / Annual Production – a company with 15 rather than 10 can generate profits for a longer time period and may not need to explore and acquire as frequently.

Investors would reward that by valuing the company with the higher Reserve Life Ratio more highly.

**5. What are the flaws with looking at revenue and P / E multiples for natural resource companies?**


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Revenue multiples make little sense because revenue is almost completely dependent on commodity prices: rather than reflecting how much the company is producing or expanding, revenue multiples usually just reflect prices for oil, gold, gas, etc.

P / E multiples are not accurate because natural resource companies because often have high interest expenses, high deferred tax numbers, and high non-cash charges such as DD&A and Impairment.

It's not necessarily "wrong" to use these multiples, but usually EBITDA, EBITDAX, Proved Reserves, and Daily Production are preferred.

**6. What's the normal range for EBITDAX, Proved Reserves, and Daily Production multiples?**

This one is dangerous to answer directly because the range depends on the geography, the sub-industry, and the type of company you're looking at. In the case of Proved Reserves and Daily Production, it also depends on the measurement units – MBOE? MMBOE? Bcfe? And it gets even more fun on the mining side.

If they really press you for an answer, just say that EBITDAX multiples are usually in the same range as EBITDA multiples for normal companies, around 5-15x and more like 5-10x for natural resource companies.

The production and reserves-based multiples vary so much that you're better off saying that it depends and avoiding a direct answer.

**7. Could you create a standard DCF for natural resource companies? How is it different?**

You could still create a standard DCF, and it works almost exactly the same way. There are 5 potential differences to note:

1. You will have additional non-cash expenses (e.g. Asset Retirement Accretion) in addition to the standard ones like DD&A and Stock-Based Compensation.
2. You would use Daily Production, EBITDA, or EBITDAX for the terminal exit multiples rather than Free Cash Flow-based multiples.
3. For the Gordon Growth method usually you assume 0% long-term growth because oil & gas assets get depleted over time and there's only a finite amount in the ground.


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4. You could use the oil & gas industry standard 10% discount rate rather than calculating WACC.
5. For the sensitivity tables you would look at commodity prices as one of the variables rather than revenue growth or EBITDA margins; other variables might be the discount rate and terminal growth rate or terminal multiple.

**8. Walk me through a Net Asset Value (NAV) model.**

In a Net Asset Value model, you assume that the company **never increases its existing reserves** – so there's no additional CapEx over time and the company literally runs out of energy or minerals at some point in the future.

You create a NAV model with the following steps:

1. Pick a starting number for the Reserves – usually this will be Proved Reserves (1P), but you could also go with 2P or 3P in more aggressive models.
2. Project Production and Realized Prices. Usually you assume that Production grows for a few years and then declines as the Reserves go to 0; Realized Prices are usually held constant in future years and are tied to historical averages.
3. Project the Production and Development expenses and Taxes to calculate After-Tax Cash Flows. Tie the Production expenses to historical averages on a per unit basis; you can find estimates for future Development expenses in the company's filings. After-Tax Cash Flows = Revenue – Production – Development – Taxes.
4. Calculate the Net Present Value of the After-Tax Cash Flows. Use the NPV function in Excel and your discount rate, normally 10% for oil & gas.
5. Add the value of undeveloped land and the value of the other business segments such as chemicals, midstream, and downstream. You can estimate these with simple EBITDA multiples based on comps for each segment.
6. Work backwards to calculate Equity Value (i.e. add cash, subtract debt, and so on) and calculate the per share price.

It's similar to a DCF but there's no Terminal Value, which is arguably a good thing, and there's a much smaller CapEx expense since you assume no future expansion.

**9. What's the advantage of a NAV model over a traditional DCF?**

There are 2 big problems with a DCF for an E&P-focused company:

- A DCF values a company at the **corporate-level**, but natural resource companies are balance sheet-centric and should be valued based on their **assets** instead.


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- Natural resource companies often have extremely **high capital expenditures** that reduce their Free Cash Flow and may even make it negative; this distorts a traditional DCF and sometimes turns it into nothing more than a simple Terminal Value calculation.

A NAV model gets around those problems by valuing the company on an asset-by-asset basis (the producing assets are valued first, followed by undeveloped land and then other segments such as chemicals and midstream) and by eliminating growth CapEx.

Arguably the NAV is more conservative than the DCF as well, since you assume that the company stops producing after a certain point in time rather than the constant growth implied by a DCF.

**10. Let's say that my NAV model is producing values that are far too low – which variables and assumptions should I tweak to boost the valuation?**

1. Use Proved + Probable Reserves (2P) or Proved + Probable + Possible (3P) rather than just Proved Reserves.
2. Assume higher Production numbers in the earlier years.
3. Make more aggressive assumptions for Realized Prices – but be careful that they're still in line with historical numbers.

Of these, #3 is the most problematic because companies have no control over commodity prices – so it's better to start with the first two.

**11. Normally we prefer a NAV to a DCF, at least for E&P-focused companies. But what are some of the flaws with the NAV model? Are there certain types of natural resource companies where it doesn't apply?**

You could argue that a NAV model has similar problems to a DCF because you're still projecting numbers far into the future, which is inherently unreliable – and variables like commodity prices are almost impossible to get right.

You're often projecting even further into the future than with a DCF because a company's reserves might last for 10-20 years – so it might be even more dependent on far-in-the-future assumptions.

Also, a NAV model would not work as well for non-E&P-focused companies such as oil and gas transportation or refining firms, or oil field services companies.


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They are not asset-centric and operate more like normal companies, so a traditional DCF is better there.

**12. How is a NAV model different for mining companies?**

It's the same idea, but you might have to go through a few more steps to project revenue – remember that mining companies extract tons and tons of minerals from the ground but are only able to use a small fraction. So you would have to make extra assumptions for the usable percentage.

**13. Why do we only subtract out Production and Development expenses in a NAV model – isn't it inaccurate to skip over G&A and other expenses like DD&A?**

You leave out expenses such as G&A because those are considered corporate overhead, and you are valuing the company strictly on an asset-by-asset level.

Some expenses are ambiguous – for example, sometimes you'll see Taxes and Transportation subtracted out on the argument that they're linked to production from individual assets.

But that's the reasoning behind it – when in doubt, look at the "mini-NAV" that companies have in the PV-10 section of their filings and see which expenses they have subtracted.

Other expenses like Depreciation, Depletion & Amortization are not included because they're non-cash in the first place and would therefore be added back even in a traditional DCF. You're also not assuming any growth CapEx so you don't want to include matching DD&A.


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## *Merger Model and LBO Model Questions & Answers*

I would be **shocked** if you got anything on merger models and LBO models for natural resource companies in interviews, simply because there's not much to say – neither one is dramatically different from the "standard company" models.

Still, there are a few points to keep in mind if you have super-advanced interviews.

**1. How is a merger model for a natural resource company different?**

It's not much different at all – the few differences that do exist:

- **Commodity prices** may be an important assumption in the model and in your sensitivity tables.
- The **PP&E write-up** may not be a simple percentage estimate (see next question).
- **Synergies** are calculated differently (see questions #4 and #5).
- You may have to **adjust accounting standards** if you have a successful efforts company buying a full cost company or vice versa.
- In a **contribution analysis** you will look at metrics such as NAV, Daily Production, and Proved Reserves.
- You can calculate **natural resource-specific accretion / dilution** metrics, such as NAV per Share, Production per Share, Proved Reserves per Share, and so on.

Overall, merger models are far less different for energy and mining companies than accounting, operating models, or valuation.

**2. Normally for the PP&E write-up in a merger or acquisition, we make a simple assumption such as 5% or 10% of the current PP&E book value. How might this be different for a natural resource company?**

For natural resource companies you might look at the PV-10 value in their filings and use that as the fair market value instead.

**Example:** A company has done an internal NAV analysis and pegged the fair market value of their PP&E at $100 in the oil & gas supplemental section of their filings. On the balance sheet it's currently listed at $50.

Rather than assuming a 5% or 10% write-up, we might just use that $100 value and therefore record a $50 write-up for this company in an M&A deal.


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**3. What's the flaw with making an assumption for revenue synergies in a merger model between 2 natural resource companies?**

There are only 2 ways to boost revenue as a natural resource company: hope for higher prices or boost production.

Commodity prices are beyond the control of any single company, even giants like Exxon Mobil and BHP Billiton. So in a merger model you can't say, "As a result of this acquisition, oil prices will magically rise to $100 per barrel!"

Production increases are more plausible, but you run into another problem: mines and oil/gas fields take years to develop and it's impossible to flip on additional production instantly.

As a result, revenue synergies are rarely taken seriously for natural resource companies.

**4. Revenue synergies might be unrealistic, but what about expense synergies? Could you make assumptions for those?**

Sure. You could look at all the standard ways to reduce expenses, from CapEx synergies to operating lease consolidation to headcount reduction.

Just remember that most expenses for natural resource companies are on a unit-of-production basis, so your assumptions need to reflect that. Rather than absolute dollar amounts, you should frame expense synergies in terms of $ per Mcfe, $ per BOE, or $ per ton.

**5. Can you explain what natural resource-specific accretion / dilution metrics are and why we might look at them in addition to the standard EPS accretion / dilution?**

The 3 most common ones are **NAV per Share**, **Daily Production per Share**, and **Proved Reserves per Share**.

You calculate them as you would expect: take the buyer and seller's Net Asset Values from the NAV models and add them together, make balance sheet adjustments (reflecting cash used and debt issued) and then divide by the new share count to get the new NAV per Share.

The others are even easier: just add the Daily Production and Proved Reserves from the buyer and seller and divide by the new share count post-transaction.


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You look at them because EPS is not always a meaningful metric for natural resource companies due to non-cash charges, odd tax treatment, and so on – a deal that looks bad on an EPS basis might look much better if you think about it in terms of NAV per Share or other industry-specific metrics.

**6. What's the downside of these natural resource-specific metrics? Are there cases where they would not be meaningful?**

The downside is that these metrics may not always be meaningful: for 100% cash or 100% debt deals, for example, Daily Production per Share and Proved Reserves per Share will **always** be accretive because there are no new shares issued in the transaction.

NAV per Share is meaningful no matter the form of payment, but there you run into problems with companies calculating NAV slightly differently, using different commodity price assumptions, and so on.

**7. Do you think natural resource companies are good targets for leveraged buyouts? What are the advantages and disadvantages?**

Generally oil & gas and mining companies are poor targets for LBOs, which explains why they're rare in these industries.

They don't have stable or predictable cash flows due to their dependency on commodity prices, they have a huge need for ongoing investment in the form of CapEx, and usually they have high debt loads already.

The other characteristics that PE firms look for such as a low-risk business profile, market conditions that depress stock prices, strong management teams, and opportunities for cost reduction are company-dependent but are often untrue.

Their only real advantage is that they do have hard asset bases that can be used as collateral, but even there you run into a problem: PP&E values on the balance sheet are linked to commodity prices, so the value of their assets could shift around significantly.

**8. When you're creating an LBO model for a natural resource company do you use EBITDAX for the leverage ratios and other metrics?**

No – remember that EBITDAX exists only to normalize accounting standards between successful efforts and full cost companies.


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EBITDA is the standard used in leveraged finance and by anyone looking at the debt profile of a company, so it's far more common in LBO models no matter what type of company you're analyzing.

**9. How are the sensitivity tables for an LBO of a natural resource company different from those of a normal company?**

Rather than looking at variables like revenue growth and EBITDA, you would look at commodity prices and how they impact the IRR.

You would also select a wider range for the exit multiples since the industry is extremely cyclical: 2x to 8x EBITDA might be too wide a range for a normal company, but it's not unreasonable for natural resource companies since you have no idea where the cycle will be when the PE firm exits.


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