Executive Summary:

Midland Energy Resources, Inc. is a global energy company with a broad array of products and services. The company operates within three different operations including oil and gas exploration and production (E&P), refining and marketing (R&M), and petrochemicals. Midland has proven to be a very profitable company, with reported operating revenue of $248.5 billion and operating income of $42.2 billion. The company has been in business for over 120 years and employed more than 80,000 individuals. Janet Mortensen, the senior vice president of project finance for Midland Energy Resources, has been asked to calculate the weighted average cost of capital (WACC) for the company as a whole, as well as each of its three divisions as part of an annual budgeting process.

Midland’s Three Divisions:

Exploration & Production

Oil exploration and production (E&P) is Midland’s most profitable business, and its net margin over the previous five years was among the highest in the industry. With oil prices at historic highs in early 2007, Midland anticipated heavy investment in acquisitions of promising properties, in development of its proved undeveloped reserves, and in expanding production. They also needed to account for competition from areas such as the Middle East, Central Asia, Russia, and West Africa.

Refining and Marketing

Midland had ownership interests in forty refineries around the world with distillation capacity of five million barrels a day. Measured by revenue, this side of the business was Midland’s largest. The relatively small margin was consistent with a long-term trend in the industry. Margins had declined steadily over the previous twenty years.

Petrochemicals

Petrochemicals is Midland’s smallest but most promising and undervalued division. Midland owned twenty-five manufacturing facilities and five research centers in eight countries around the world. Capital spending in petrochemicals was expected to grow in the near term.
In order to find the cost of capital for Midland Energy Resources and each of the three divisions within the company, we will need to use the formula for weighted average cost of capital (WACC) which is:

\[
WACC = rd \left( \frac{D}{V} \right) (1 - t) + re \left( \frac{E}{V} \right)
\]

rd= Cost of debt
re= Cost of equity
D= Market value of debt
E= Market value of equity
V= D+E= Value of the company (or division)
T= Tax rate

First, we can calculate “rd” for each division as it is outlined in the case by adding a premium/spread over US Treasury securities of a similar maturity. In other words:

\[
rd = rf (risk – free rate) + Spread to Treasury
\]

The two tables in the case are as follows:

**Table 1**

<table>
<thead>
<tr>
<th>Business Segment</th>
<th>Credit Rating</th>
<th>Debt/Value</th>
<th>Spread to Treasury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated</td>
<td>A+</td>
<td>42.2%</td>
<td>1.62%</td>
</tr>
<tr>
<td>E&amp;P</td>
<td>A+</td>
<td>46.0%</td>
<td>1.60%</td>
</tr>
<tr>
<td>R&amp;M</td>
<td>BBB</td>
<td>31.0%</td>
<td>1.80%</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>AA-</td>
<td>40.0%</td>
<td>1.35%</td>
</tr>
</tbody>
</table>

**Table 2**

<table>
<thead>
<tr>
<th>Maturity</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Year</td>
<td>4.54%</td>
</tr>
<tr>
<td>10-Year</td>
<td>4.66%</td>
</tr>
<tr>
<td>30-Year</td>
<td>4.98%</td>
</tr>
</tbody>
</table>

*For my calculation, I used the 30-year maturity for E&P, R&M, and Midland as a whole as they take on longer term projects. I used the 1-year for petrochemicals as they tend to take on short term projects.*
Calculations are as follows:

rd for Exploration & Production:

$$4.98\% + 1.60\% = 6.58\%$$

rd for Refining & Marketing:

$$4.98\% + 1.80\% = 6.78\%$$

rd for Petrochemicals:

$$4.54\% + 1.35\% = 5.89\%$$

rd for Midland:

$$4.98\% + 1.62\% = 6.60\%$$

Second, we need to calculate “re” for the three divisions as well as Midland as a whole. To find “re”, we will use the CAPM model outlined in the case:

$$re = rf + \beta (EMRP)$$

In order to solve this equation, we need to find beta for the three divisions. The case already outlines Midland’s overall beta at 1.25. However, the case does not state the beta for the three divisions. We can calculate this using beta for publicly traded companies outlined in the case.

Using the following formula, as well as exhibit 5 in the case, we can calculate beta for the three divisions:

$$Asset_\beta = \frac{Equity_\beta}{[1 + (1 - t) \times \left(\frac{D}{E}\right)]}$$


Exhibit 5 (from case)

<table>
<thead>
<tr>
<th>Exploration &amp; Production:</th>
<th>Equity Market</th>
<th>Net</th>
<th>D/E</th>
<th>Equity</th>
<th>Beta</th>
<th>LTM Revenue</th>
<th>LTM Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackson Energy, Inc.</td>
<td>57,931</td>
<td>6,480</td>
<td>11.20%</td>
<td>0.89</td>
<td>18,512</td>
<td>4,981</td>
<td></td>
</tr>
<tr>
<td>Wide Plain Petroleum</td>
<td>46,089</td>
<td>39,375</td>
<td>85.40%</td>
<td>1.21</td>
<td>17,827</td>
<td>8,495</td>
<td></td>
</tr>
<tr>
<td>Corsicana Energy Corp</td>
<td>42,263</td>
<td>6,442</td>
<td>15.20%</td>
<td>1.11</td>
<td>14,505</td>
<td>4,467</td>
<td></td>
</tr>
<tr>
<td>Worthington Petroleum</td>
<td>27,591</td>
<td>13,098</td>
<td>47.50%</td>
<td>1.39</td>
<td>12,820</td>
<td>3,506</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>39.80%</strong></td>
<td></td>
<td><strong>1.15</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refining &amp; Marketing:</th>
<th>Equity Market</th>
<th>Net</th>
<th>D/E</th>
<th>Equity</th>
<th>Beta</th>
<th>LTM Revenue</th>
<th>LTM Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bexar Energy, Inc.</td>
<td>60,356</td>
<td>6,200</td>
<td>10.30%</td>
<td>1.7</td>
<td>160,708</td>
<td>9,560</td>
<td></td>
</tr>
<tr>
<td>Kirk Corp.</td>
<td>15,567</td>
<td>3,017</td>
<td>19.40%</td>
<td>0.94</td>
<td>67,751</td>
<td>1,713</td>
<td></td>
</tr>
<tr>
<td>White Point Energy</td>
<td>9,204</td>
<td>1,925</td>
<td>20.90%</td>
<td>1.78</td>
<td>31,682</td>
<td>1,402</td>
<td></td>
</tr>
<tr>
<td>Petarch Fuel Services</td>
<td>2,460</td>
<td>-296</td>
<td>12.00%</td>
<td>0.24</td>
<td>18,874</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>Arkana Petroleum Corp.</td>
<td>18,363</td>
<td>5,931</td>
<td>32.30%</td>
<td>1.25</td>
<td>49,117</td>
<td>3,353</td>
<td></td>
</tr>
<tr>
<td>Beaumont Energy, Inc.</td>
<td>32,662</td>
<td>6,743</td>
<td>20.60%</td>
<td>1.04</td>
<td>59,989</td>
<td>1,467</td>
<td></td>
</tr>
<tr>
<td>Dameron Fuel Services</td>
<td>48,796</td>
<td>24,525</td>
<td>50.30%</td>
<td>1.42</td>
<td>58,750</td>
<td>4,646</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>20.30%</strong></td>
<td></td>
<td><strong>1.2</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Midland Energy Resources  | 134,114       | 79,508 | 59.30% | 1.25  | 251,003 | 18,888     |

Again the calculation to find Asset $^\beta$ is:

$$Asset^\beta = \frac{Equity^\beta}{[1 + (1 - t) \times (\frac{D}{E})]}$$

Equity $^\beta$ for Midland = **1.25**

Equity $^\beta$ for E&P = 0.93*[(1 + (1-39.73%)*85.19%)] = **1.41**

Equity $^\beta$ for R&M = 1.05*[(1 + (1-39.73%)*44.93%)] = **1.33**

*85.19% and 44.93% come from Exhibit 1 in the case

In order to get Equity $^\beta$ for Petrochemicals, we will need to take a weighted average of the three divisions. The equation would be as follows:

$$^\beta$$ for Midland = w1 * $^\beta$ for E&P + w2 * $^\beta$ for R&M + w3 * $^\beta$ for Petrochemicals

(w1, w2, w3 are based on the total assets of a division divided by Midland’s total assets).

To find this, we will use the numbers from Exhibit 3 in the case:
### Calculation for w1-3:

- \( W1 = \frac{114,002.67}{221,515.33} = 0.51 \)
- \( W2 = \frac{82,048.67}{221,515.33} = 0.37 \)
- \( W3 = \frac{25,464.33}{221,515.33} = 0.12 \)

Now we can use the formula from before to find the \( \beta \) for Petrochemicals:

\[
\beta_{\text{for Petrochemicals}} = W1 \times \beta_{\text{for E&P}} + W2 \times \beta_{\text{for R&M}} + W3 \times \beta_{\text{for Petrochemicals}}
\]

\[
1.25 = 0.51 \times 1.41 + 0.37 \times 1.33 + 0.12 \times \beta_{\text{for Petrochemicals}}
\]

\[
\beta_{\text{for Petrochemicals}} = 0.32
\]

Lastly, we need to find EMRP to find “re” for Midland and the three divisions. We can find our EMRP number by looking at exhibit 6 in the case:

<table>
<thead>
<tr>
<th>Period</th>
<th>Average excess return</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US Equities – T-Bonds</td>
<td></td>
</tr>
<tr>
<td>1987-2006</td>
<td>6.4%</td>
<td>3.7%</td>
</tr>
<tr>
<td>1967-2006</td>
<td>4.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>1926-2006</td>
<td>7.1%</td>
<td>2.2%</td>
</tr>
<tr>
<td>1900-2006</td>
<td>6.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>1872-2006</td>
<td>5.9%</td>
<td>1.6%</td>
</tr>
<tr>
<td>1798-2006</td>
<td>5.1%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

I will choose to use the average return from the time period of 1798-2006. That is the longest sample size in regards to time, as well as having the lowest standard of error. I will round down to 5% for ease of calculation:


\[ re = rf + \beta(EMRP) \]

“re” for Midland= 4.98%+5%*1.25= 11.23%

“re” for E&P= 4.98%+5%*1.41= 12.03%

“re” for R&M= 4.98%+5%*1.33= 11.63%

“re” for Petrochemicals= 4.54%+5%*0.32= 6.14%

With this information, we are able to finally calculate the weighted average cost of capital (WACC) for Midland and the 3 divisions of the company. The formula and calculations are as follows:

\[
WACC = rd \left( \frac{D}{V} \right) (1 - t) + re \left( \frac{E}{V} \right)
\]

* D/V are provided in Table 1 for Midland, E&P, R&M, and Petrochemicals. They are 42.2%, 46.0%, 31.0%, 40.0% respectively.

WACC-cost of capital we need:

\[
1 - t = 39.73% = 60.27%
\]

WACC for E&P:

\[
6.58\% \times 0.46 \times 60.27\% + 12.03\% \times (1 - 0.46)
\]

= 8.32%

WACC for R&M:

\[
6.78\% \times 0.31 \times 60.27\% + 11.63\% \times (1 - 0.31)
\]

= 9.29%

WACC for Petrochemicals:

\[
5.89\% \times 0.4\times 60.27\% + 6.14\% \times (1 - 0.4)
\]

= 5.10%

WACC for Midland:

\[
6.60\% \times 0.422 \times 60.27\% + 11.23\% \times (1 - 0.422)
\]

= 9.17%
The cost of capital (as shown above) will differ for the three divisions because the business operates in different industries. By being in different industries, the companies have different risk exposure and betas, while also having different credit ratings. All of these components will affect a company’s cost of capital differently.

**Further Analysis:**

Mortensen’s estimates were used for many things including performance assessments, mergers and acquisition proposals, stock repurchases, asset appraisals, and financial accounting. As stated in the case, cost of capital is a very important component in WACC calculations. These calculations were being used to evaluate at a divisional level as well as at a corporate level as a whole. In my calculations for the case, I solved for both levels.

In regards to Midland’s corporate WACC, Mortensen computed the cost of debt for each division by adding a premium (or “spread”) over U.S. Treasury securities with an appropriate maturity depending on the division. For Exploration and Production (E&P), Refining and Marketing (R&M), as well as Midland as a corporation, Mortensen used a 30 year maturity T-Bond assumption as those divisions tended to focus on longer term projects. She decided on a 1 year T-Bond maturity assumption for Petrochemicals as they tended to focus on shorter term projects.

Another assumption was that the tax rate (39.73%) remained constant throughout the case as well as an EMRP of 5%. The EMRP was based on exhibit 6 of the case which examined T-Bonds during a certain period of time and with a certain standard of error. With a very low standard of error (based on the chart) and advisors, bankers, and investors covering the industry agreeing with 5% as an estimate, I believe the estimate to be appropriate. Analysts on the industry, bankers, and investors tend to have a broader look on companies within an industry as a whole.

Lastly, Midland should not use a single corporate hurdle rate for evaluating investment opportunities in all of its divisions because each division is different. Midland is too large of a corporation, with different divisions, each containing its own unique set of risks. Due to the fact that the risk for each division will be different, I believe the corporate hurdle rates for those divisions should also be different to reflect a more accurate corporate assessment. I believe Mortensen did a great job with the information she was presented with in the case and I believe Midland Energy will continue to be a prominent company within the industry.