Oil Panic and the Global Crisis
Predictions and Myths

Steven M. Gorelick
Stanford University
## Contents

*Preface*  ix

*Acknowledgments*  x

*About Units*  xi

*Getting Started: What Do You Think?*  xiii

### 1 End of the Oil Era  1

- Cause for Concern  1
- Hubbert's Curve  4
- The Appeal of Hubbert’s Curve  10
- Hubbert’s Success  11
- US Oil Dependence Since Peak Production  12
- Chapters Ahead  13
- Notes and References  13

### 2 The Global Oil Landscape  16

- Introduction  16
- Definitions  17
- Petroleum Composition and Energy Density  18
- Why a Barrel Is a bbl  20
- The Oil Business  20
- OPEC  23
- How Much Oil Is There? The USGS Assessment  26
- From the USGS Assessment to 2009  29
  - Reserves  31
- Where Is Oil Produced?  32
- Where Is Oil Consumed?  33
- Oil Imports  35
- After Oil Is Produced  37
- Oil Production Versus Consumption  38
- Oil Quality  40
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back to Oil</td>
<td>110</td>
</tr>
<tr>
<td>Scarcity Rent</td>
<td>116</td>
</tr>
<tr>
<td>Myth III: Resource Assessments Provide Useful Endowment Estimates</td>
<td>118</td>
</tr>
<tr>
<td>The Missing Mass Balance</td>
<td>123</td>
</tr>
<tr>
<td>Counter-Argument to OPEC and Industry Exaggeration of Reserves</td>
<td>124</td>
</tr>
<tr>
<td>Myth IV: After So Much Exploration, There Is Little Oil Left To Be Found</td>
<td>126</td>
</tr>
<tr>
<td>US Oil: Reserves</td>
<td>126</td>
</tr>
<tr>
<td>US Oil: Discoveries</td>
<td>128</td>
</tr>
<tr>
<td>Global Oil: Reserves</td>
<td>132</td>
</tr>
<tr>
<td>Global Oil: Discoveries</td>
<td>138</td>
</tr>
<tr>
<td>Russian and Global Arctic Oil</td>
<td>144</td>
</tr>
<tr>
<td>Myth V: The World Cannot Afford Increases in Oil Use as Developing Nations Demand More Oil</td>
<td>146</td>
</tr>
<tr>
<td>Future Demand of Developing Nations</td>
<td>146</td>
</tr>
<tr>
<td>Oil Expenditures in the World Economy</td>
<td>153</td>
</tr>
<tr>
<td>Myth VI: There Are No Substitutes for Oil</td>
<td>156</td>
</tr>
<tr>
<td>The Gold Resource Pyramid</td>
<td>156</td>
</tr>
<tr>
<td>The Oil Resource Pyramid</td>
<td>160</td>
</tr>
<tr>
<td>The US and Global Oil Resource Pyramids</td>
<td>161</td>
</tr>
<tr>
<td>Three Unconventional Oil Substitutes</td>
<td>165</td>
</tr>
<tr>
<td>US heavy oil</td>
<td>165</td>
</tr>
<tr>
<td>Global heavy oil</td>
<td>166</td>
</tr>
<tr>
<td>US oil sands</td>
<td>168</td>
</tr>
<tr>
<td>Global oil sands</td>
<td>168</td>
</tr>
<tr>
<td>US oil shale</td>
<td>170</td>
</tr>
<tr>
<td>Global oil shale</td>
<td>172</td>
</tr>
<tr>
<td>Fossil Fuel Conversion: The Role of Gas and Coal</td>
<td>173</td>
</tr>
<tr>
<td>The Importance of Diesel</td>
<td>175</td>
</tr>
<tr>
<td>Synthetic Fuel from Coal and Natural Gas</td>
<td>175</td>
</tr>
<tr>
<td>Natural Gas Resources</td>
<td>177</td>
</tr>
<tr>
<td>Coal Resources</td>
<td>180</td>
</tr>
<tr>
<td>Chapter Summary</td>
<td>181</td>
</tr>
<tr>
<td>Notes and References</td>
<td>183</td>
</tr>
</tbody>
</table>

5 Beyond Panic

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Non-Renewable Resource Model</td>
<td>195</td>
</tr>
<tr>
<td>Where Is an Efficiency Gain Possible?</td>
<td>196</td>
</tr>
<tr>
<td>Will Increases in Efficiency Indeed Reduce Demand?</td>
<td>199</td>
</tr>
</tbody>
</table>


| Contents |
|---------------------|-------|
| Two scenarios for developing nations | 204  |
| What Might Ultimately Substitute for Oil? | 207  |
| Consideration 1: Cost of dependence on imported oil | 208  |
| Consideration 2: Gasoline and atmospheric carbon dioxide emissions | 209  |
| Consideration 3: Alternatives | 210  |
| Ethanol | 211  |
| Biodiesel | 212  |
| Leapfrogging to an ultimate substitute | 213  |
| Effects of a US move to oil alternatives | 215  |
| The State of Oil Resources | 219  |
| Ending Thoughts | 221  |
| Notes and References | 225  |

Index 231