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National Assessment of Oil and Gas Fact Sheet

Natural Bitumen Resources of the United States

Major natural bitumen accumulations in the United States are estimated to contain about 36 billion barrels of measured in-place resource and about 18 billion barrels of speculative in-place resource. Major natural bitumen resources are in Alabama, Alaska, California, Kentucky, New Mexico, Oklahoma, Texas, Utah, and Wyoming.

Introduction

Natural bitumen accumulations in the United States are generally known as "tar sands," a generic term that has been used for several decades to describe petroleum-bearing rocks exposed on the Earth's surface (fig. 1). Other terms for such accumulations include oil sand, oil-impregnated sand, asphaltic sand, rock asphalt, bituminous rock, and bitumen-bearing rock. Natural bitumen is defined as petroleum with a gas-free viscosity greater than 10,000 centipoises (cp) at original reservoir temperature (fig. 2). Petroleum with a gas-free viscosity between 10,000 and 100 cp is generally termed heavy crude oil. In the absence of viscosity data, oil with API gravity less than 10 degrees is generally considered a natural bitumen (Danyluk and others, 1984), whereas oil with API gravity ranging from 10 degrees API to about 20 degrees API is considered heavy crude oil. The term "extra-heavy crude oil" is used for oil with a viscosity less than 10,000 cp but with API gravity less than 10 degrees.

The locations of more than 500 accumulations of natural bitumen in the United States were compiled by Ball Associates Ltd. (1965), but resource estimates were provided for only a limited number of the accumulations. The most recent study providing estimates of both measured and speculative in-place resources for the Nation's major natural bitumen accumulations (those containing more than 100 million barrels of oil [MMBO] in-place) was by Lewin and Associates, Inc. (1984). The estimates given in table 1 are from Lewin and Associates, Inc. (1984) for the conterminous United States and from Kamath and others (1995) for northern Alaska. These estimates represent in-place resources but do not represent either technically recoverable resources or economically recoverable resources. Recovery factors to determine technically or economically recoverable resources are difficult to predict, given that recovery procedures might range from surface mining to subsurface technology such as that involving steam-assisted gravity drainage from paired well bores. Measured resources are generally those estimated from areal dimensions and bitumen saturations of deposits at the surface. Speculative resources, on the other hand, are generally those representing the subsurface extension of a surface accumulation, so considerable uncertainty exists in estimating their volumes. For example, estimates of the speculative in-place bitumen resource for the Tar Sand Triangle accumulation in Wayne and Garfield Counties, Utah, range from 420 million barrels of bitumen (Lewin and Associates, Inc., 1984) to 16 billion barrels of bitumen (Campbell and Ritzma, 1979).

Figure 1. *Photograph of an outcrop of cross-stratified fluvial sandstone with natural bitumen (black), Sunnyside accumulation, Carbon County, Utah. Hammer for scale.*

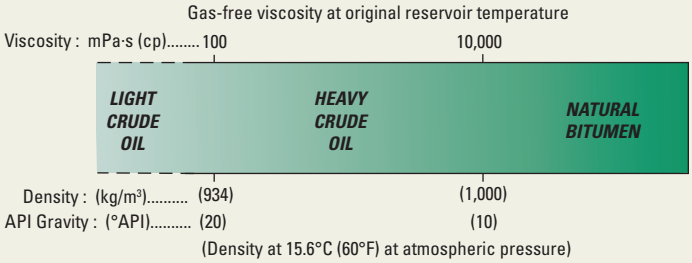

Figure 2. *Definition of natural bitumen and heavy oil based on viscosity, density, and API gravity (modified from Danyluk and others, 1984). mPa-s, millipascal-second; kg/m³, kilogram per cubic meter; cp, centipoises; °API, degrees API; °C, degrees Celsius; °F, degrees Fahrenheit.*

Tar-Sand Resource Summary

For 29 major tar-sand accumulations in the United States, the total measured in-place resource is estimated to be about 36,000 MMBO, and the total speculative in-place resource is estimated to be about 18,000 MMBO (table 1). Major natural bitumen resources are in Alabama, Alaska, California, Kentucky, New Mexico, Oklahoma, Texas, Utah, and Wyoming (table 1). Utah is estimated to contain about 18,680 MMBO in 10 major accumulations. If the higher published numbers for the speculative resource in the Tar Sand Triangle deposit are used (Campbell and Ritzma, 1979), the total in-place resource for Utah could possibly include another 16,000 MMBO. The Ugnu Sand accumulation on the North Slope of Alaska is estimated to contain a measured

Table 1. *Summary of estimates of measured in-place and speculative in-place natural bitumen resources for the major accumulations in the United States.*

[MMBO, million barrels of oil; NA, reservoir temperature not available; cp, centipoises; °API, degrees API; >, greater than; °F, degrees Fahrenheit]

Deposit name	State	Viscosity (cp @ reservoir temperature [°F])	API gravity range (°API)	API gravity average (°API)	Measured in-place resources (MMBO)	Speculative in-place resources (MMBO)	Total in-place resources (MMBO)
Hartselle	Alabama				1,760	4,500	6,260
Pride Mountain	Alabama					100	100
Ugnu Sands	Alaska	60,000–10,000,000@NA	7.1–11.5	10	15,000		15,000
Arroyo Grande	California	15,000@100°F		8	310		310
Basal Foxen	California	47,000@80°F	9.0–17.0	9.5		1,900	1,900
Cat Canyon	California	12,000–1,000,000@NA	0.0–12.0	6	830	280	1,110
Casmalia Diatomite	California				90	170	260
Zaca-Sisquoc	California		4.0–6.0		180	50	230
Oxnard	California	500,000@100°F	5.0–8.0	5	500	160	660
Big Clifty	Kentucky	15,000–150,000@NA		10	1,190	910	2,100
Hardinsburg	Kentucky			10	230	190	420
Tar Springs	Kentucky					340	340
Caseyville	Kentucky				300	250	550
Santa Rosa	New Mexico	30,000@60°F		12	130	220	350
S. Central Oklahoma	Oklahoma			4		800	800
San Miguel	Texas	20,000–20,000,000@95°F	−0.5– −2	−2	3,200	610	3,810
Anacacho	Texas	235,000@70°F			550	400	950
Hensel	Texas			7	120		120
Circle Cliffs	Utah		−11.1–6.8	–2.9	560	1,140	1,700
Tar Sand Triangle	Utah	100,000@NA	−3.6–9.6	4.3	2,500	420	2,920
Nequoia Arch	Utah				730	160	890
San Rafael Swell	Utah				300	250	550
P.R. Spring	Utah	1,000,000@77°F	5.8–15.3	9.5	2,100	2,200	4,300
Hill Creek	Utah		5.5–17.3	9.1	300	600	900
Sunnyside	Utah	100,000@NA	7.6–9.2	8.6	4,400	1,700	6,100
Whiterocks	Utah	100,000@NA	4.0–12.0		60	60	120
Asphalt Ridge	Utah	>1,000,000@NA	8.2–12.9	10.4	800	300	1,100
Raven Ridge	Utah	1,000,000@NA	4.4–9.9	7.4	100		100
Burnt Hollow	Wyoming	1,000,000@53°F	5.0–9.0		120	25	145
TOTALS					36,360	17,735	54,095

in-place resource of about 15,000 MMBO (Kamath and others, 1995) and is gradational with the heavy oil accumulation in the giant Kuparuk oil field. Estimates of in-place natural bitumen resources in other States are: (1) Alabama, two accumulations with about 6,360 MMBO in-place resource; (2) Texas, three accumulations with about 4,880 MMBO; (3) California, six accumulations with about 4,470 MMBO; (4) Kentucky, four accumulations with about 3,410 MMBO; (5) Oklahoma, one accumulation with about 800 MMBO; (6) New Mexico, one accumulation with about 350 MMBO; and (7) Wyoming, one accumulation with about 145 MMBO.

For Additional Information

Additional information for U.S. onshore oil and gas resources are available on the U.S. Geological Survey Energy Program Web site, *http://energy.cr.usgs.gov/oilgas/noga/*.

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