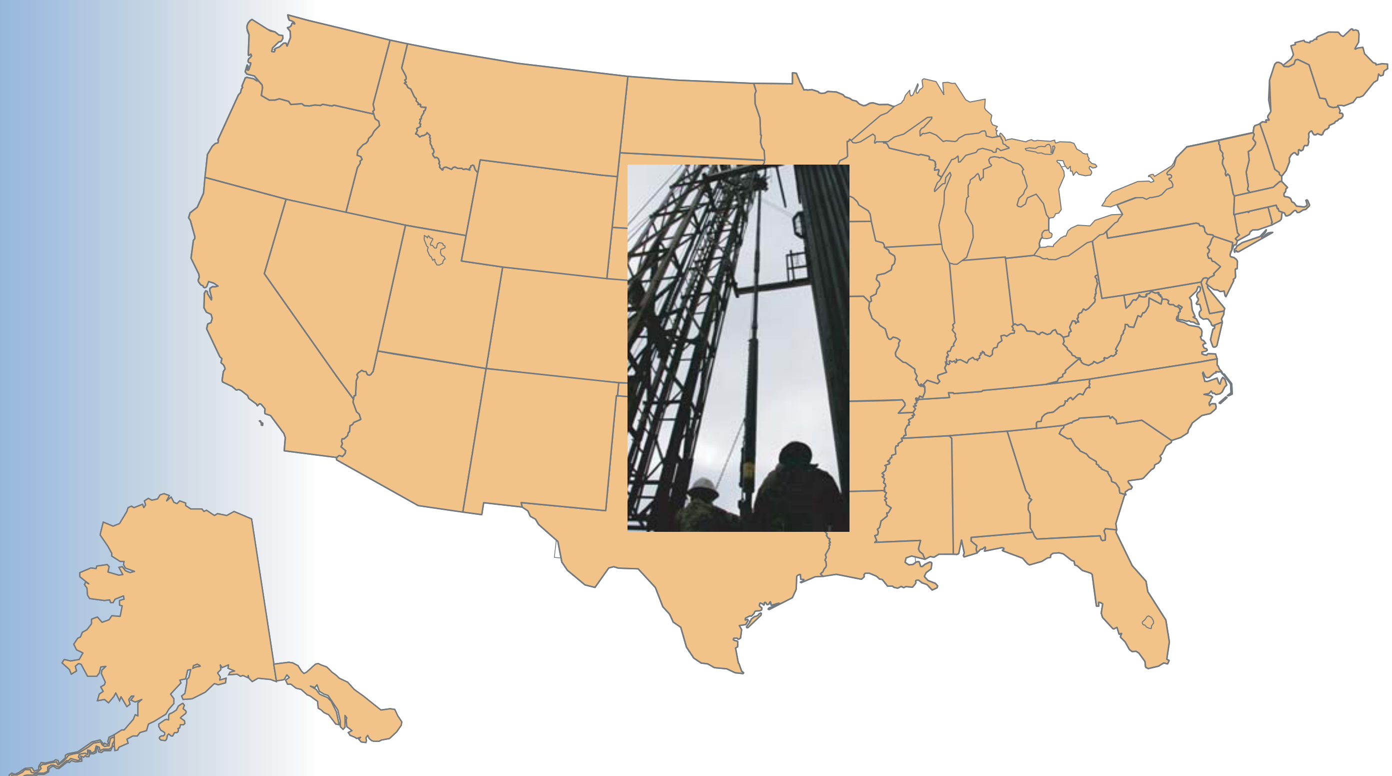
UNDEVELOPED DOMESTIC OIL RESOURCES:

THE FOUNDATION FOR INCREASING OIL PRODUCTION AND A VIABLE DOMESTIC OIL INDUSTRY



Prepared for

U.S. Department of Energy

Office of Fossil Energy - Office of Oil and Natural Gas

Prepared by

Advanced Resources International

February 2006

Much of the analysis in this report was performed in late 2005. The domestic oil resource recovery potential outlined in the report is based on six basin-oriented assessments released by the United States Department of Energy in April 2005. These estimates do not include the additional oil resource potential outlined in the ten basin-oriented assessments or recoverable resources from residual oil zones, as discussed in related reports issued by Department of Energy in February 2006. Accounting for these, the future recovery potential from domestic undeveloped oil resources by applying EOR technology is 240 billion barrels, boosting potentially recoverable resources to 430 billion barrels.

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EXECUTIVE SUMMARY

This report assembles information on the size and nature of remaining domestic oil resources and the efforts underway to convert these resources into reserves and economic production. As such, it provides information that could lessen U.S. dependence on foreign energy and reduce the increasing "energy tax" that imports impose on consumers and the domestic economy.

In a national address on energy, President Bush stated: *"Our dependence on foreign energy is like a foreign tax on the American people. It is a tax our citizens pay every day in higher gasoline prices and higher costs to heat and cool their homes. It's a tax on jobs and a tax that is increasing every year."*[1]

However, the U.S. does not have to passively accept continuing increases in oil imports and the "energy tax". Large volumes of technically recoverable domestic oil resources remain undeveloped and are yet to be discovered, estimated at 400 billion barrels, from an undeveloped remaining oil in-place of over a trillion (1,124 billion) barrels.

While pursuing this remaining domestic oil resource base poses considerable economic risk and technical challenge to producers, it enabled exploration drilling to add 1,232 million barrels of discoveries to proved U.S. reserves last year (2003)[2], and it enabled enhanced oil recovery (EOR), still an emerging industry, to produce 660,000 barrels per day of "stranded" oil not otherwise recoverable[3].

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[1] Speech presented by President George W. Bush to the National Small Business Conference, Washington, DC, White House, Office of the Press Secretary, April 27, 2005 "President Discusses Energy at National Small Business Conference."

[2] Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquid Reserves*, 2003 Annual Report, November, 2004.

[3] Special Report: 2004 Worldwide EOR Survey, *Oil and Gas Journal,* April 12, 2004.

This large undeveloped oil resource base offers promise that a renaissance is possible for the domestic oil industry, greatly improving the nation's trade balance and energy security.

1. <u>The U.S. Remains a Major Oil Producing Country</u>. Domestic oil, while in the midst of transformation, still provides over 7 million barrels per day of petroleum production. This makes the U.S. the world's third largest oil producer (in 2004), behind Saudi Arabia and the Russian Federation[4]:

- Saudi Arabia 10.58 MMB/D
- Russian Federation 9.28 MMB/D
- USA 7.24 MMB/D

Domestic oil production has declined somewhat in the past five years but, with timely implementation of the policies and actions set forth in this report, this decline can be reversed. As important, these policies and actions would greatly help the domestic oil industry maintain its technology leadership in oil recovery around the world.

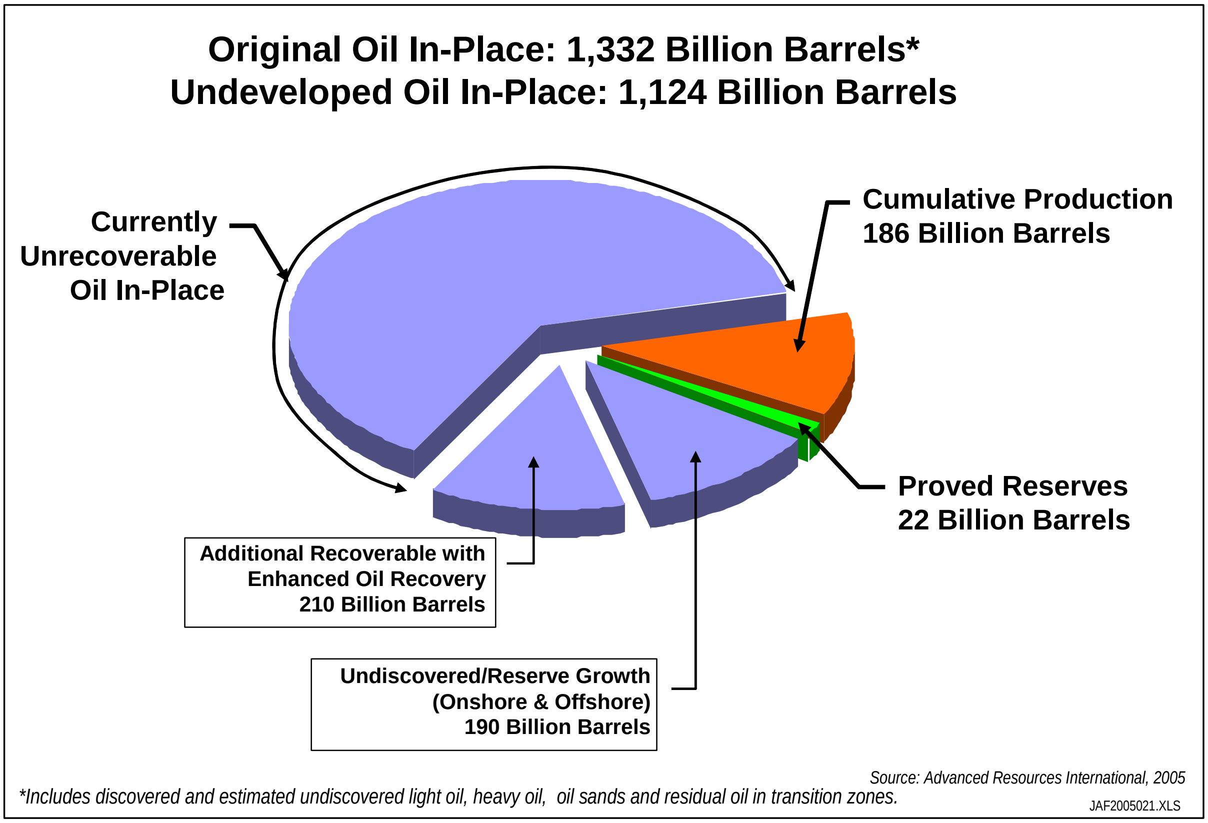
2. <u>While a Mature Hydrocarbon Province, the U.S. Still Has 400 Billion Barrels of Undeveloped Technically Recoverable Oil Resource</u>. Undeveloped domestic oil resources still in the ground (in-place) total 1,124 billion barrels. Of this large in-place resource, 400 billon barrels is estimated to be technically recoverable, Figure EX-1. This resource includes undiscovered oil, "stranded" light oil amenable to CO2-EOR technologies, unconventional oil (deep heavy oil and oil sands) and new petroleum concepts (residual oil in reservoir transition zones[5]). The U.S. oil industry, as the leader in enhanced oil recovery technology, faces the challenge of further molding this technology towards economically producing these more costly remaining domestic oil resources.

Table EX-1 provides summary information on the size and nature of the original, developed and undeveloped domestic oil resources. Note that the domestic oil resources addressed by this report do not include shale oil. This additional large

[4] BP Statistical Review of World Energy, June 2004.
[5] The residual oil in transition zones is the oil in a reservoir that is below the traditional oil-water contact.

domestic resource is being addressed by other DOE studies and reports. (Additional perspective on the potential of undeveloped domestic oil and shale oil resources, prepared independently by the U.S. House of Representatives Committee on Resources, is provided in Attachment 1.)

Figure EX-1. Original, Developed and Undeveloped Domestic Oil Resources



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- Of the 582 billion barrels of oil in-place in discovered fields, 208 billion has been already produced or proven, leaving behind 374 billion barrels[6]. A significant portion of this 374 billion barrels is immobile or residual oil left behind ("stranded") after application of conventional (primary/secondary) oil recovery technology. With appropriate enhanced oil recovery (EOR)

[6] Estimated oil in-place from U.S. Department of Energy, Office of Fossil Energy (2005). Produced and proven reserves from the Energy Information Administration (2004).

technologies, 100 billion barrels of this "stranded" resource may become technically recoverable from already discovered fields.[7]

Table EX-1. Original, Developed and Undeveloped Domestic Oil Resources

	Original Oil In-Place (BBbls)	Developed to Date		Remaining Oil In-Place (BBbls)	Future Recovery*		
		Conventional Technology (BBbls)	EOR Technology (BBbls)		Conventional Technology (BBbls)	EOR Technology (BBbls)	Total
I. Crude Oil Resources							
1. Discovered [1]	582	(194)	(14)	374	-	100	100
• Light Oil	482	(187)	(2)	293	-	80	80
• Heavy Oil	100	(7)	(12)	81	-	20	20
2. Undiscovered [2,3]	360	-		360	119	60	179
3. Reserve Growth [4,5]	210	-		210	71	40	111
4. Transition Zone [6]	100	-		100	-	Unknown	Unknown
II. Oil Sands [7]	80	-	**	80	-	10	10
TOTAL	1,332	(194)	(14)	1,124	190	210	400

*Technically recoverable resources
** Less than 0.5 billion barrels

1. Source: DOE/FE Basin Reports, (Advanced Resources, 2005), recoverable from existing and future "stranded" oil resources estimated by Advanced Resources.
2. Source: USGS National Assessment of Oil and Gas Resources Update (USGS; October 2004) Conventional Oil Resources (40.43 billion barrels) and Continuous Oil Resources (2.13 billion barrels). Oil in–place estimated by assuming 33% recovery efficiency. Future recovery potential assumes 50% recovery efficiency with enhanced oil recovery for undiscovered and reserve growth.
3. Source: Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2003 Update (MMS Fact Sheet, December 2004).
4. Source: Estimates of Inferred Reserves for the 1995 USGS National Oil and Gas Resource Assessment (USGS OFP 95-75L, January 1997).
5. Source: Assumptions for the Annual Energy Outlook 2004 (EIA, February 2004).
6. Source: Preliminary Estimates by Advanced Resources Int'l and Melzer Consulting (2005).
7. Source: Major Tar Sand and Heavy Oil Deposits of the United States (Lewin and Associates, Inc., July 1983). Recoverable estimated by Advanced Resources.

- Undiscovered domestic oil is estimated to be 360 billion barrels in-place, with 119 billion barrels (43 billion barrels from the onshore and 76 billon barrels from the offshore) being recoverable with primary/secondary recovery.[8]

[7] Upside of range for potential ultimate recovery, estimated by Advanced Resources International (2005).
[8] USGS National Assessment of Oil and Gas Resources Update (USGS; October 2004) Conventional Oil Resources (40.43 billion barrels) and Continuous Oil Resources (2.13 billion barrels). Oil in–place estimated by assuming 33% recovery efficiency. Upside of range assumes 50% recovery efficiency with enhanced oil recovery for undiscovered and reserve growth. Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2003 Update (MMS Fact Sheet, December 2004).

Application of "advanced" EOR could add another 60 billion barrels of technically recoverable resource from this category.[9]

- Future reserve growth in discovered oil fields could amount to 210 billion barrels of oil in-place, with 71 billion barrels (60 billion barrels from the onshore and 11 billion barrels from the offshore) being recoverable with primary/secondary recovery.[10] Application of "advanced" EOR could raise this technically recoverable volume by up to 40 billion barrels.[11]

- With advances in thermal EOR technology, domestic oil sands, holding 80 billion barrels of resource in-place, could provide up to 10 billion barrels of future technically recoverable domestic oil resource.[12]

As points of comparison, current proved crude oil reserves are 22 billion barrels and annual domestic crude oil production is about 2 billion barrels[13].

The estimates of remaining recoverable domestic oil resources from undiscovered and reserve growth are from the latest national resource assessments by the U.S. Geological Survey (USGS) and the U.S. Minerals Management Service (MMS) (provided in Appendices 3A, 3B, and 4). The estimates of recoverable oil resources using EOR technology on "stranded" oil and oil sands are based on work by Advanced Resources International for DOE/FE's Office of Oil and Natural Gas[14].

[9] This assumes an improvement from a traditional 33% to an improved 50% recovery efficiency of oil in-place.

[10] Estimates of Inferred Reserves for the 1995 USGS National Oil and Gas Resource Assessment (USGS OFP 95-75L, January 1997). Assumptions for the Annual Energy Outlook 2004 (EIA, February 2004).

[11] This assumes an improvement from a traditional 33% to an improved 50% recovery efficiency of oil in-place.

[12] Major Tar Sand and Heavy Oil Deposits of the United States (Lewin and Associates, Inc., July 1983). Recoverable estimated by Advanced Resources.

[13] Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquid Reserves*, 2003 Annual Report, November, 2004.

[14] U.S. Department of Energy/Office of Fossil Energy Project Facts: "Recovering "Stranded Oil" Can Substantially Add to U.S. Oil Supplies, Six Reports Examine Basin-Oriented Strategies For Increasing Domestic Oil Production", http://fossil.energy.gov/news/techlines/2005/tl_basin_assessment.html

3. Policies and Incentives That Promote Development and Use of More Efficient Enhanced Oil Recovery (EOR) Technologies and That Support Access Could Help Convert These Resources into Reserves and Production. A broad portfolio of oil recovery policies and technologies, plus targeted "risk mitigation" incentives, would help industry convert these higher cost, undeveloped domestic oil resources into economically feasible reserves and production. Eight specific actions would be of highest value:

- **Reducing the Financial and Investment Barriers Associated with EOR Could Be Accomplished by Undertaking Various "Risk Mitigation" Actions Available to federal and state governments.** Important federal actions could involve modifying Section 43 of the federal tax code (that contains investment tax credits for EOR technology) and providing royalty relief until payout (on federal lands) for new and expanded EOR projects. This would provide downside protection for EOR investment against the risk of substantially lower future oil prices. In providing these "risk-mitigation" incentives, the government is deferring (or reducing) near-term revenues (which may not have materialized without the provision of these incentives) to gain much larger tax and royalty revenues in the longer term.

- **Reducing the Geological and Technical Barriers of EOR Could Be Accomplished Through an Aggressive Program of Research and Field Tests.** Optimizing the performance of current EOR practices and pursuing new, more efficient technology will help lower the geological and technical risks involved with enhanced oil recovery, particularly for pursuing "stranded" oil and "residual oil in transition zones" with CO_2 injection.

- **Encouraging the Production and Productive Use of CO_2 from Natural Sources and Industrial Emissions Would Greatly Increase the Supplies of "EOR-Ready" CO_2.** Expansion and modification of natural gas treating facilities in the Green River and Wind River Basins could offer new sources of

CO_2 for EOR. Other near-term options include capture of high-purity CO_2 from hydrogen, ethanol and other chemical production facilities. Finally, efficient capture and separation of by-product CO_2 from the next generation of low emission power plants could provide massive, long-term sources of "EOR-Ready" CO_2.

- **Integrated Energy Systems Would Reduce the Energy Penalty Associated with Producing Heavy Oil and Capturing "EOR-Ready" CO_2.** Demonstrating an integrated "zero emissions" heat, hydrogen and electricity generation system, that provides steam for heavy oil recovery and "EOR-Ready" CO_2 from gasifying the residue products of heavy oil and oil sand upgrading/refining, would provide an improved, energy efficient pathway for domestic oil recovery.

- **Collaboration with Canada on Oil Sands and Heavy Oil Technology Would be Most Valuable for Increasing the Recovery of Domestic Resources.** Engaging in collaborative Canadian/U.S. efforts, such as sharing technology and conducting jointly-funded field R&D on oil sands and heavy oil, would also help develop oil recovery technologies appropriate for domestic resources.

- **In-depth Evaluation of the Geologic Settings and Economic Feasibility of Undiscovered Oil Resources Could Help Formulate Additional Supportive Policies.** Current efforts on evaluating domestic oil resources on federal lands and formulating incentives for developing deep oil and gas resources in the Gulf of Mexico are examples of existing policies that support the development of domestic resources.

- **Improving the Information Base on Already Discovered Domestic Oil Fields Would Accelerate the Pace of "Reserve Growth".** One productive step to boost "reserve growth" would be conducting in-depth studies and reservoir characterizations of existing large domestic oil fields.

- **Increased Investments in Technology Development and Transfer Would Lead to Higher Domestic Oil Recovery Efficiencies.** New models of public-private partnerships plus field projects demonstrating optimum recovery of domestic oil resources would help foster high oil recovery practices and technologies. An expanded program of technology transfer would help address the barriers that currently inhibit the full development and production of domestic oil by independent producers.

4. <u>A New Public/Private Effort Targeted at Maximizing Recovery of Domestic Oil Resources Would Have Large Benefits to the Nation's Economy, to State Budgets and to Consumers</u>. The benefits to the economy of increasing oil production from undeveloped domestic resources are large. For example:

- The ultimate trade balance would improve by $8 trillion, cumulatively, assuming one-half of the future technically recoverable resource (200 billion barrels) becomes economically recoverable and oil prices average $40 per barrel. [15]

- State and local treasuries would gain $700 billion of revenues from future royalties, severance taxes, and state income taxes on oil production.[16] The

[15] The U.S. net oil trade balance in 2003 resulted in a 1.1% reduction in GDP, a $110 billion loss. "How Big A Threat", *Economist*, November 4, 2004.
[16] Each barrel of domestic oil provides about $3.50 of revenue to state and local treasuries, at an oil price of $40 per barrel.

federal budget would gain $1.4 trillion of revenues from future royalties from production on federal lands and corporate income taxes.[17]

- The decline in domestic oil production would be reversed, creating new, well-paying direct and indirect jobs.

[17] Each barrel of domestic oil provides about $7 of revenue to the Federal treasury, at an oil price of $40 per barrel.

1. INTRODUCTION

1.1 BACKGROUND. Significant quantities of domestic oil still remain undiscovered and undeveloped. With a remaining domestic oil resource in-place of well over one trillion barrels, this large resource base offers the potential for adding 400 billion barrels of technically recoverable domestic oil. If aggressively pursued with appropriate technology, the U.S. has sufficient undeveloped resources to support the continuation of a viable and growing domestic oil industry. This report discusses four areas that constitute the remaining domestic oil resource base, namely:

1. Domestic “Stranded” Oil
2. Domestic Heavy Oil
3. Domestic Oil Sands
4. Undiscovered Oil, Reserve Growth and New Concepts

1.2 STUDY OBJECTIVE. This report, summarizing the size and status of domestic oil resources and the technologies that would enable these resources to be efficiently developed, has been prepared in response to language set forth in the Congressional Budget for the DOE/Fossil Energy Oil Technology Program.

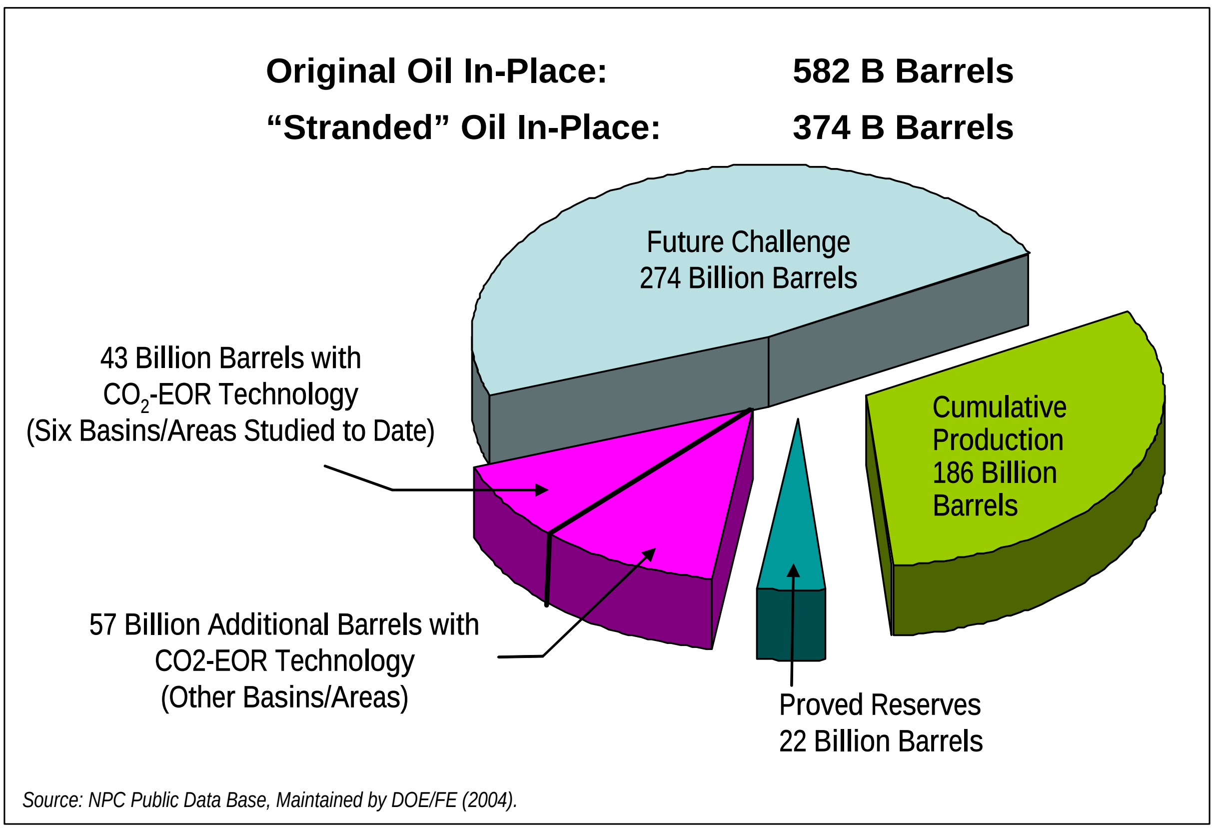
1.3 STUDY METHODOLOGY. The study entailed four tasks: (1) assembling the latest publicly available assessments for domestic resources; (2) reviewing the technical literature on their extraction, production and upgrading technologies; (3) discussing the status of technology, particularly the “cutting-edge” activities, with selected companies and individuals; and, (4) preparing this summary report.

2. DOMESTIC "STRANDED" OIL

For the domestic "stranded" oil resource, the study sets forth seven major findings:

1. **The remaining ("stranded") domestic oil resource in <u>already discovered fields</u> is massive, amounting to 374 billion barrels of oil in-place.** Significant volumes of domestic "stranded" oil, in existing oil fields, occurs in several dozen states, with significant concentrations in Alaska, California, Louisiana, the Mid-Continent and Texas. (The "stranded" oil resource of 374 billion barrels in already discovered fields, Figure 1, includes the "stranded" heavy oil resource, discussed later.)

Figure 1. "Stranded" Domestic Oil Resources in Existing Oil Fields



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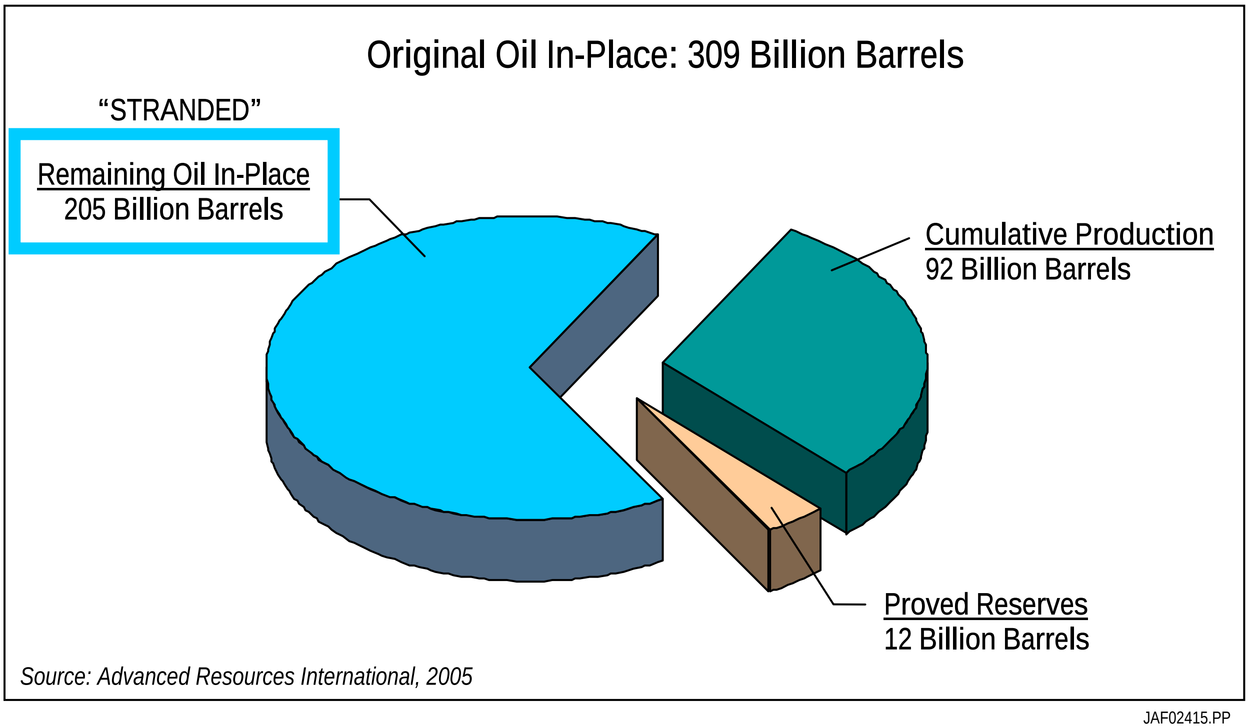
2. **In this study, six domestic oil basins/areas holding 205 billion barrels of "stranded" oil (in already discovered fields) were assessed.** This work to date on six areas has assembled an oil field data base containing 895 reservoirs (in California, Gulf Coast, Oklahoma, Illinois, Alaska and Louisiana offshore). Extrapolating the oil in-place in the oil field data base to the total oil resource in these six domestic basins/areas has identified 205 billion barrels of "stranded" oil in already discovered oil fields, Figure 2.

Figure 2. Domestic "Stranded" Oil Resources in Six Basins/Areas Assessed



3. **With "state-of-the-art" CO2 enhanced oil recovery technology (EOR), as much as 43 billion barrels of "stranded" oil (in the six basins and areas) could become technically recoverable.** Of the 895 oil reservoirs in the data base, 533 large reservoirs screen favorably for CO2-EOR, with 32.9 billion barrels of technically recoverable resource. When the CO2-EOR potential in these 533 large favorable oil reservoirs is extrapolated to the "stranded" oil resources in each of the six state/areas, the CO2-EOR potential becomes 43.3 billion barrels of technically recoverable resource, Table 1[18].

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[18] U.S. Department of Energy/Fossil Energy: Basin-Oriented Strategies for CO2 Enhanced Oil Recovery: California, Onshore Gulf Coast, Offshore Louisiana, Oklahoma, Alaska and Illinois, March 2005.

Table 1. Technically Recoverable Oil Resource From CO2-EOR, Six Areas Assessed to Date

Basin/Area	Large Favorable Reservoirs (Six Areas)		All Reservoirs (Six Areas)		
	Number	Technically Recoverable	OOIP* (Billion Barrels)	ROIP** (Billion Barrels)	Technically Recoverable (Billion Barrels)
California	88	4.6	83.3	57.3	5.2
Gulf Coast	205	5.9	60.8	36.4	10.1
Oklahoma	63	5.4	60.3	45.1	9.0
Illinois	46	0.5	9.4	5.8	0.7
Alaska	32	12.0	67.3	45.0	12.4
Louisiana Offshore (Shelf)	99	4.5	28.1	15.7	5.9
Total	533	32.9	309.2	205.3	43.3

*Original Oil in Place, in all reservoirs in basin/area; ** Remaining Oil in Place, in all reservoirs in basin/area.
Source: Advanced Resources International, 2005.

Application of advanced thermal and other EOR technologies to the "stranded" oil resource in these six basins/areas would add to the technically recoverable resource from application of CO2-EOR set forth above.

4. **Applying enhanced oil recovery technology to the "stranded" light (and heavy) oil resource, in the remaining oil basins/areas yet to be assessed, could provide an additional 53 billion barrels, raising the national potential of EOR to 100 billion barrels of domestic oil from already discovered oil fields.**

- Extrapolating the work to on the six basins/areas to the rest of the domestic oil resource base yet to be assessed (with much of it in geologically favorable oil fields of the Permian Basin and the Rockies) could add 53 billion barrels of technically recoverable resource. If successfully implemented, widespread application of CO2 and other enhanced oil recovery technologies could raise the average national oil recovery efficiency to over 50%.

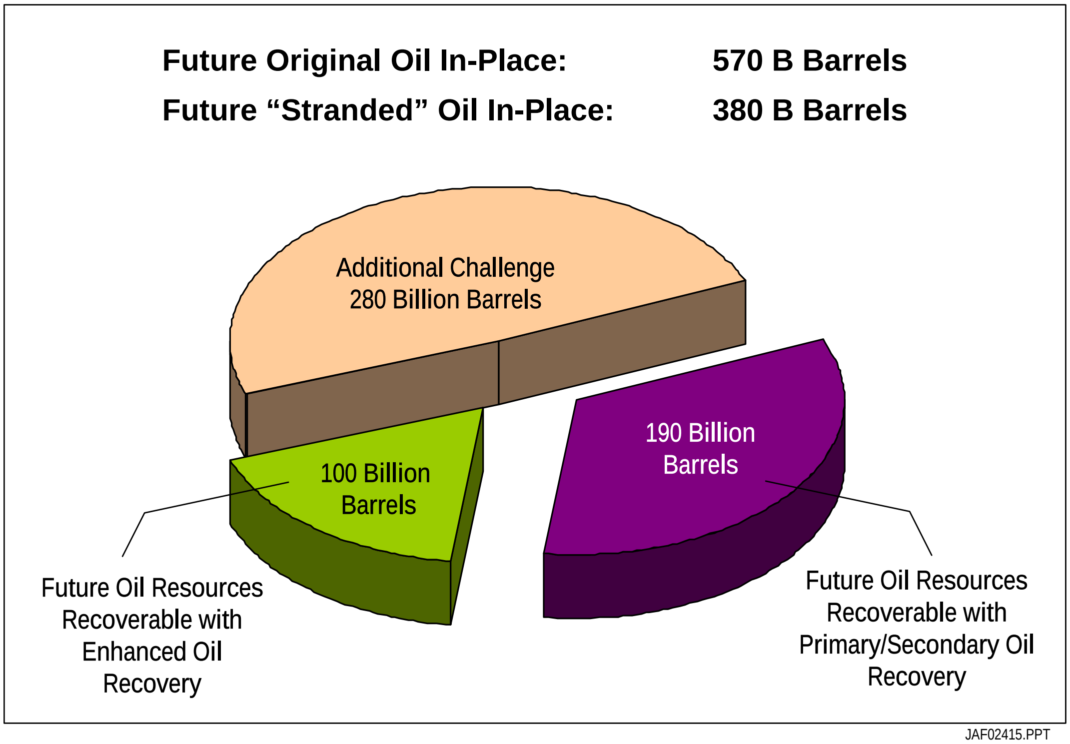
- More “advanced” CO_2-EOR and other EOR technologies, such as gravity stable CO_2 injection and horizontal wells, could improve the recovery efficiency of “stranded” oil from domestic reservoirs. Miscibility enhancers, conformance control agents, and advanced immiscible CO_2-EOR technology could extend the application of CO_2-EOR to reservoir and basin settings currently excluded from further development. Extending these technologies to recovery of “residual oil in the transition zone” (ROZ) would add additional volumes of recoverable oil. Successful pursuit of advanced EOR technology will be central to achieving the 70% national oil recovery efficiency goal established by DOE/FE for its oil technology R&D program.

5. **An additional 110 billion barrels of domestic oil could become recoverable from application of enhanced oil recovery to undiscovered oil fields, to expanded portions of discovered oil fields, and to domestic oil sands.**

- As discussed further below, the USGS and MMS estimate that 190 billion barrels of oil remains to be discovered or further developed from domestic oil fields using <u>conventional oil recovery</u> technology. However, the recovery efficiency (the portion of oil recovered relative to the total volume of oil in-place) of conventional technology is only about one-third of the oil in-place. (This means that the total oil in-place in future and expanded domestic oil fields equals 570 billion barrels. For example, 570 billion barrels of OOIP X 33% recovery factor = 190 billion barrels recoverable.)

- Increasing the recovery efficiency in these “to be discovered and developed” oil fields to 50% of the oil in-place by applying <u>enhanced oil recovery</u> would add another 100 billion barrels of technically recoverable domestic oil resource, Figure 3. (For example, 570 billion barrels of OOIP X (50%-33%) recovery factor = 100 billion barrels recoverable.)

Figure 3. Original and "Stranded" Domestic Oil Resources from Future Oil Fields



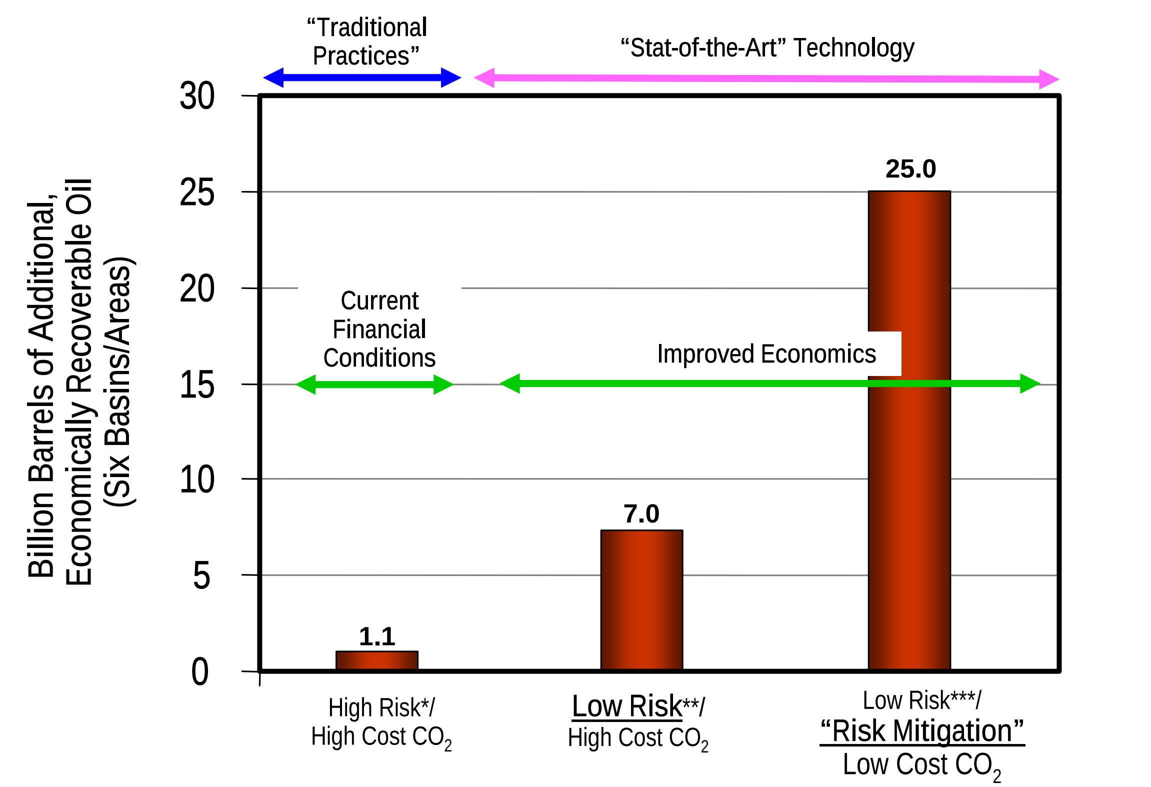
- An additional 10 billion barrels of domestic oil resource would become recoverable from the large domestic oil sands ("tar sands") resource, discussed further in Chapter 4.

6. **Application of EOR technology already provides an important volume of domestic oil production.** CO2-EOR is already being applied to selected, geologically favorable oil reservoirs with access to affordably priced natural and industrial sources of CO2. Based on the latest (April, 2004) *Oil and Gas Journal's* enhanced oil recovery survey[19], approximately 206,000 barrels per day is being produced domestically from the application of CO2-EOR, with the bulk of this oil production coming from the Permian Basin. Another 102,000 barrels per day is produced using hydrocarbon miscible and flue gas immiscible enhanced oil recovery from fields that would be amenable to CO2-EOR should affordable supplies of CO2 become available. Finally, application of thermal EOR technology, primarily in the large heavy oil fields of California, provides 346,000 barrels per day, as further discussed in Chapter 3.

[19] Special Report: 2004 Worldwide EOR Survey, *Oil and Gas Journal,* April 12, 2004.

7. The keys to converting the large technical potential from enhanced oil recovery to economic reserves are three — accelerated development of improved EOR technology, "risk mitigation" policies and actions, and large affordable "EOR-Ready" supplies of CO2. A preliminary look at how much of the large CO2 enhanced oil recovery technical potential could be converted to economic reserves shows that "state-of-the-art" CO2-EOR technology, when combined with "risk mitigation" actions and low cost supplies of CO2, would enable a significant portion, — 25 billion barrels — of the domestic "stranded" oil (in the six areas and basins studied) to become economically recoverable, Figure 4.

Figure 4. Impact of Technology and Financial Conditions on Economically Recoverable Oil from Domestic Reservoirs Using CO2-EOR (Million Barrels)



* Assumes an oil price of $25 per barrel, a CO2 cost of 5% of the oil price and a "High Risk" ROR hurdle rate of 25% (before tax).
** Assumes an oil price of $25 per barrels, a CO2 cost of 5% of the oil price and a "Low Risk" ROR hurdle rate of 15% (before tax).
*** Assumes an oil price of $35 per barrel, a CO2 cost of 2% of the oil price and a "Low Risk" ROR hurdle rate of 15% (before tax).

Note: CO2 is assumed delivered to the oil field at pressure. CO2 cost at $25 per barrel oil is equal to $1.25 per Mcf or about $24 per tonne.

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However, with "traditional practices" application of CO2-EOR technology (small volume CO2 injection and high CO2 costs), only a modest portion of the resource, approximately 1 billion barrels, is economically recoverable. Even with application of "state-of-the-art" EOR technology, the economically recoverable oil from CO2-EOR remains modest, at about 7 billion barrels. This is because current industry investment decisions for CO2-EOR and competing projects are made under "price expectations" of about $25 per barrel. This more disciplined approach to capital allocation is based on prior experiences with volatile and sharply declining oil prices. It also reflects concerns that future oil prices could slip well below current levels, causing these high front-end cost projects to become uneconomic.

8. Financial "risk-mitigation" policies would provide an important first step. Financial "risk mitigation" policies (such as royalty relief, reduced state production taxes and increased federal investment tax credits for EOR, that together have the effect of lowering the minimum required "oil price expectations" for economically feasible capital investment by $10 per barrel), when applied with improved CO2-EOR technology and affordable supplies of CO2, are a key step for capturing the full potential from CO2-EOR.

The proposed "risk mitigation" policies are designed to encourage increased investment in CO2-EOR by potentially insuring against the risk that oil prices could slip well below current levels. Briefly, these potential "risk mitigation" actions are as follows:

- The first proposed "risk mitigation" action of federal and state royalty relief until payout would provide early financial support, particularly to offshore CO2-EOR projects. By encouraging the development of projects that would otherwise not occur, overall federal and state royalty revenue collections would increase. Saskatchewan, Canada has used similar "risk mitigation" provisions to encourage the development of the Weyburn CO2-EOR project and encourage the increased pursuit of CO2-EOR in the Province.

- The second proposed "risk mitigation" action of reducing the state production (severance) taxes is already in place in a limited number of the oil producing states. Further modifications to state production and other tax provisions could provide additional encouragement for investments in CO_2-EOR.

- The third proposed "risk mitigation" action, modifications to the federal Section 43 tax credit for enhanced oil recovery, offers the greatest potential for protection against a sharp fall in the oil price. An important feature is that should oil prices remain high, this would be a "no-cost" "risk mitigation" action. Currently, Section 43 provides a 15% tax credit for certain costs associated with qualified enhanced oil recovery projects, with phase-out of the tax credit starting at about $36 per barrel and total phase-out at $42 per barrel. However, because of the restrictive nature of the credit, particularly the constraints imposed by the "alternative minimum tax" (AMT) provisions and lack of "transferability", most independent oil producers have been precluded from using this Section 43 EOR tax credit. Modest modifications to Section 43 provisions, including increasing the tax credit to 25% and removing the AMT and transferability limitations, would be of great value as a "risk-mitigation" action.

9. Two complementary actions, in addition to the "risk mitigation" policies discussed above, would help overcome barriers to large scale implementation of EOR for recovering domestic "stranded" oil. These are:

- A series of "basin-opening" pilot field projects, significant size field demonstrations of "state-of-the-art" technologies, and appropriate investments in advanced EOR technology would help to reduce the technical and geological risks of applying EOR in new geological basins and settings.

- Incentives for producing "EOR-Ready" CO_2 would help provide increased supplies of affordable CO_2 from industrial sources, such as natural gas treating facilities and new hydrogen production plants at domestic oil refineries. Market aggregation and integrated collection of high concentration CO_2 from cement plants, fertilizer complexes, ethanol plants, oxygen-fired combustion processes and coal gasification facilities would add to the total. Finally, capture of CO_2 from the next generation of low emission power plants could provide sufficient “EOR-Ready” CO_2 to fully meet the CO_2-EOR requirements set forth in this Chapter.

3. DOMESTIC HEAVY OIL

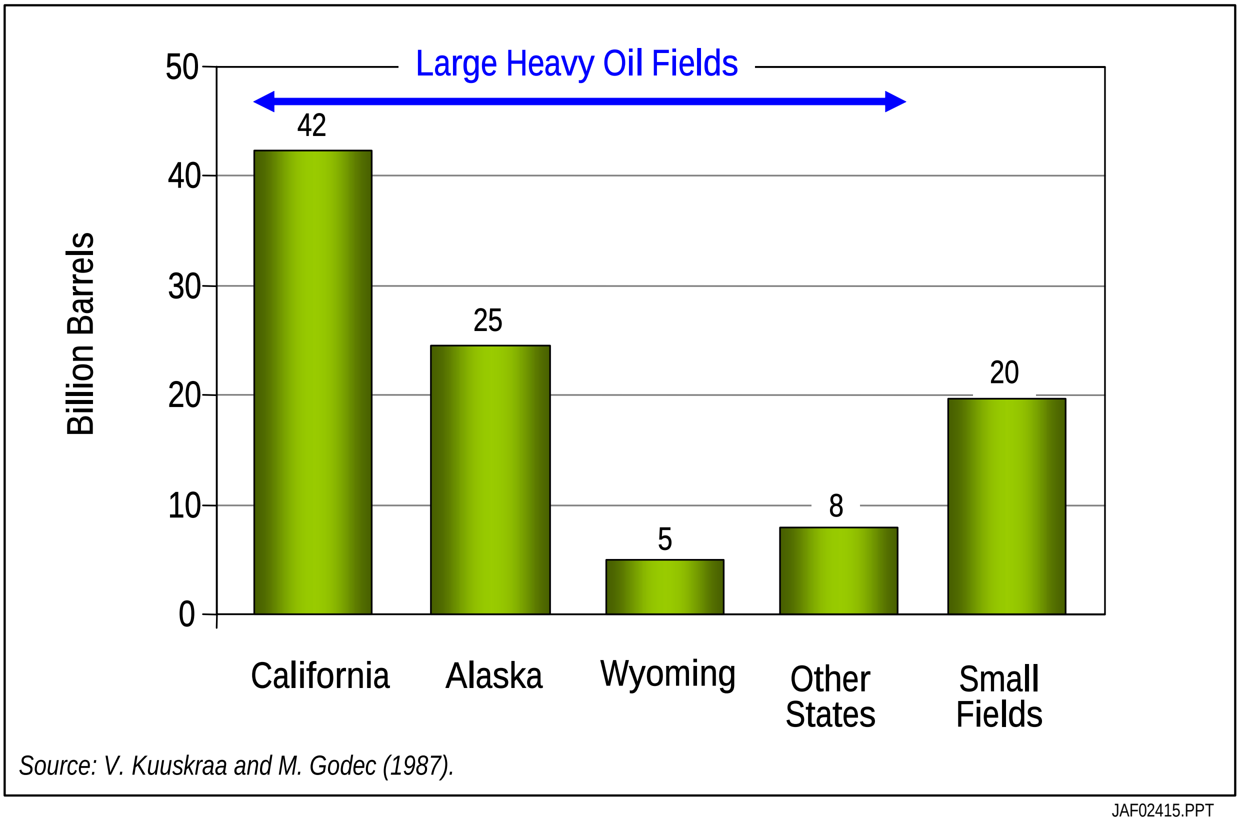
"Heavy oil" is an asphaltic, dense, viscous type of crude oil that has an API gravity between 10^o and 20^o (920 to 1,000 kilograms per cubic meter). Generally, this oil has a viscosity between 100 and 10,000 centipoise (cp), and does not flow readily in the reservoir without dilution (with solvent) and/or the introduction of heat. For domestic heavy oil resources, the study sets forth seven findings:

1. **The domestic heavy oil resource is large, on the order of 100 billion barrels of original oil in-place (OOIP).** This resource is concentrated in 248 large, heavy oil reservoirs, holding 80 billion barrels of OOIP. While the resource is primarily located in California (42 billion barrels), Alaska (25 billion barrels), and Wyoming (5 billion barrels), numerous other states, such as Arkansas, Louisiana, Mississippi and Texas, also contain significant volumes of heavy oil, Figure 5. Extrapolating the large heavy oil reservoir data base to all domestic heavy oil resources leads to an estimate of 100 billion barrels of OOIP[20].

2. **Application of thermal enhanced oil recovery (EOR) has enabled industry to recover a significant portion of the shallow heavy oil resource base.** Widespread use of steam injection and, to a lesser extent, in-situ combustion and cyclic steam injection (technologies that enable this viscous heavy oil to flow more readily and thus to be recovered efficiently) have enabled industry to economically produce heavy oil in shallow (less than 3,000 feet of depth) reservoirs, particularly in California. These technologies have generally been applied to large fields, since thermal EOR applied to smaller fields often have lower profit margins due to the greater capital expense per barrel of incremental oil recovered.

[20] Kuuskraa, V.A. and Godec, M.L., Lewin and Associates, Inc., A Technical and Economic Assessment of Domestic Heavy Oil, U.S. Department of Energy under subcontract to the Interstate Oil Compact Commission, April 1987.

Figure 5. Size and Distribution of the U.S. Heavy Oil Resource.



Data from the California Department of Conservation shows that the production of heavy oil in California using thermal EOR, waterflooding and primary depletion, while significant at 510,000 barrels per day, has been declining, Table 2. Of this, approximately 344,000 barrels per day is from thermal EOR, based on the latest (April, 2004) *Oil and Gas Journal's* enhanced oil recovery survey[21].

[21] Special Report: 2004 Worldwide EOR Survey, *Oil and Gas Journal*, April 12, 2004.

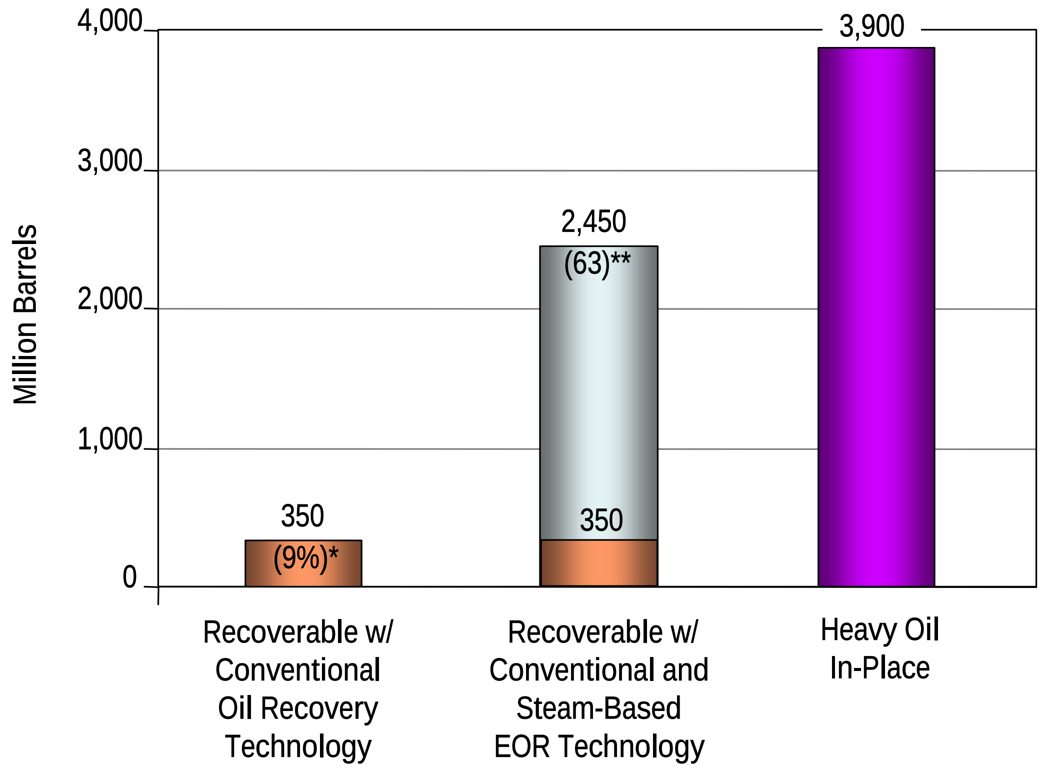
Table 2. Heavy Oil Production in California (January of each year)

Year	Heavy Oil (20^{o} API Gravity and Below)		
	Number of Producing Wells	Production (bbl/day)	% of State Production
1994	29,873	627,405	67.9
1995	29,113	644,726	67.6
1996	29,693	664,981	69.9
1997	30,524	656,415	71.9
1998	31,641	659,300	70.1
1999	30,467	618,680	71.8
2000	30,372	581,453	70.2
2001	30,754	551,125	68.9
2002	30,636	521,357	65.6
2003	30,727	510,137	65.8

* Sources: Conservation Committee of California Oil and Gas Producers for figures through 1994. Department of Conservation for subsequent years.

3. **Advances in heavy oil recovery technology, particularly steam-based EOR, provide an example of how higher recovery efficiencies are being achieved in the shallow portion of the heavy oil resource base.** Application of steam injection has enabled the giant Kern River shallow heavy oil field, with 3,900 million barrels of original oil in-place, to produce and prove nearly 2,450 million barrels of domestic heavy oil. This is far in excess of the 350 million barrels that was judged to be recoverable with conventional methods, Figure 6. This example demonstrates that with efficient thermal EOR technology, nearly two-thirds (63%) of the resource in-place may become recoverable from favorable shallow heavy oil fields, much more than the 9% recoverable with primary/secondary recovery technology.

Figure 6. Oil Recovery from the Shallow, Geologically Favorable Kern River Heavy Oil Field, California



*(9%) Recovery Efficiency with Conventional Technology
** (63%) Recovery Efficiency with Enhanced Heavy Oil Recovery Technology
Source: Advanced Resources International EOR Database (2005).

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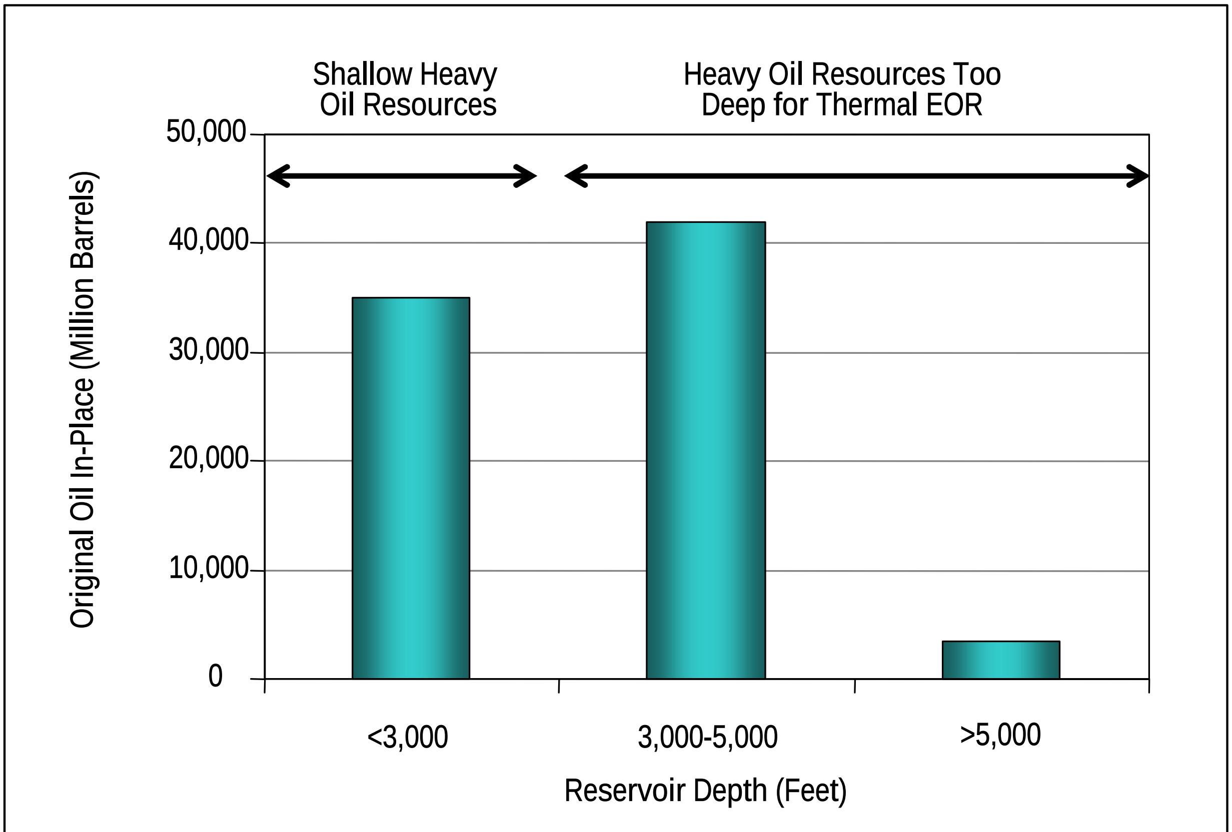
4. However, a significant portion of the domestic heavy oil resource is in reservoirs that are <u>too deep</u> for efficient application of thermal EOR. For example, of the 80 billion barrels of OOIP in the 248 large domestic heavy oil reservoirs, about 45 billion barrels of OOIP is in reservoirs that are too deep for efficiently using today's steam-based EOR technology. The distribution of the heavy oil resource by depth is shown on Figure 7. Because of depth limits in applying today's thermal EOR technology, a significant volume of the heavy oil resource remains "stranded".

Figure 7. Distribution of Domestic Heavy Oil Resources by Depth



Source: Advanced Resources International/Lewin & Associates, Inc., 1987.

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5. Further advances in heavy oil recovery technology will be required to efficiently and economically recover this large volume of deep "stranded" heavy oil. Development of more advanced technologies involving horizontal wells, low cost immiscible CO2, and advanced thermal EOR technology could significantly increase the recovery of this otherwise "stranded" oil. Joint U.S. and Canadian efforts targeted at developing more effective technologies for producing deep heavy oil resources would be valuable to both countries.

6. Particular emphasis needs to be placed on evaluating technologies that could help recover more of the underdeveloped heavy oil resource in Alaska. Advanced oil recovery technologies, such as miscibility enhanced CO2-EOR and CO2-philic mobility control agents, will be essential for recovering more from the largely undeveloped 25 billion barrel heavy oil resource in Alaska, in the Schrader Bluff, West Sak and other formations, without disturbing the permafrost.

Initial steps are being taken to produce a portion of the in-place oil resource from two large heavy oil reservoirs on the Alaska North Slope. The Schrader Bluff Formation in the Milne Point Unit has experienced a steady growth in heavy oil production, reaching 19,000 barrels per day in 2003, from a few thousand barrels per day in the 1990s. The West Sak Formation in the Kuparuk River Unit, after years of experimentation and delay, produced 7,800 barrels of heavy oil per day in 2003. The Unit operator has submitted plans to the Department of Natural Resources, Alaska to conduct an aggressive program of horizontal well drilling and water injection to increase West Sak heavy oil production to 45,000 barrels per day by 2007.

Further advances in heavy oil recovery technology, adapted particularly to the special geological, reservoir, environmental, and operational situations in Alaska, will be essential for increasing oil recovery from Alaska's large heavy oil endowment.

7. Finally, there is an urgent need to update the data and information on domestic heavy oil. A more up-to-date, in-depth assessment of domestic heavy oil would be of high value to energy policy makers and industry.

The primary national study on domestic heavy oil (and one still used by Congress and others) was authored by Kuuskraa and Godec eighteen years ago in 1987. It was prepared by Advanced Resources International (then called Lewin and Associates, Inc.) for U.S. DOE under a subcontract with the Interstate Oil and Gas Compact Commission. This built on and expanded upon earlier work by Meyer and Schenk[22].

[22] Meyer, R.F. and C.J. Schenk, "Estimate of World Heavy Crude Oil and Natural Bitumen", Third International Conference on Heavy Crude and Tar Sands, Long Beach, CA, July 22-23, 1985.

An update of the domestic heavy oil resource was conducted in the late 1980s and early 1990s by the National Institute for Petroleum and Energy Research (NIPER).

Since these past studies, much has been learned about the heavy oil resource base and heavy oil extraction technology. An up-to-date study of heavy oil could provide valuable insights on formulating policies, initiatives and technology for more efficiently developing this large domestic resource.

4. DOMESTIC OIL SANDS

Oil sands (previously called "tar sands") contain bitumen and extra heavy oil, with an API gravity of less then 10^o or a viscosity greater than 10,000 cp. Recovering this resource requires the introduction of heat, solvents or the use of mining to extract the hydrocarbon. For the domestic oil sand resource, the study sets forth four findings:

1. The domestic oil sand resource is substantial, on the order of 60 to 80 billion barrels of original oil in-place. While the resource is distributed widely, the bulk of it is concentrated in five states — Utah (19 to 32 billion barrels), Alaska (19 billion barrels), Alabama (6 billion barrels), California (5 billion barrels), and Texas (5 billion barrels), Figure 8[23]. Considerable uncertainty exists with respect to the quality of the oil sand in Utah, reflected in the wide range of the resource estimate. (The term "oil sands" rather than the previously established term "tar sands" is used in this report for compatibility with Canadian oil sands.)

2. Very little of the large domestic oil sand resource has been developed to date. Except for a limited number of in-situ oil sand recovery efforts in California, summarized on Table 3, and past mining of oil sand for road asphalt, essentially all of the original oil sand resource is still in-place. Improvements in the energy balance and the efficiency of oil sand recovery technology will be required to produce significant volumes of oil from domestic oil sands.

[23] Lewin and Associates, Inc., Major Tar Sand and Heavy Oil Deposits of the United States, Interstate Oil Compact Commission in cooperation with the USGS and U.S. Department of Energy, July 1983.

Figure 8. Size and Distribution of U.S. Oil Sand Resources

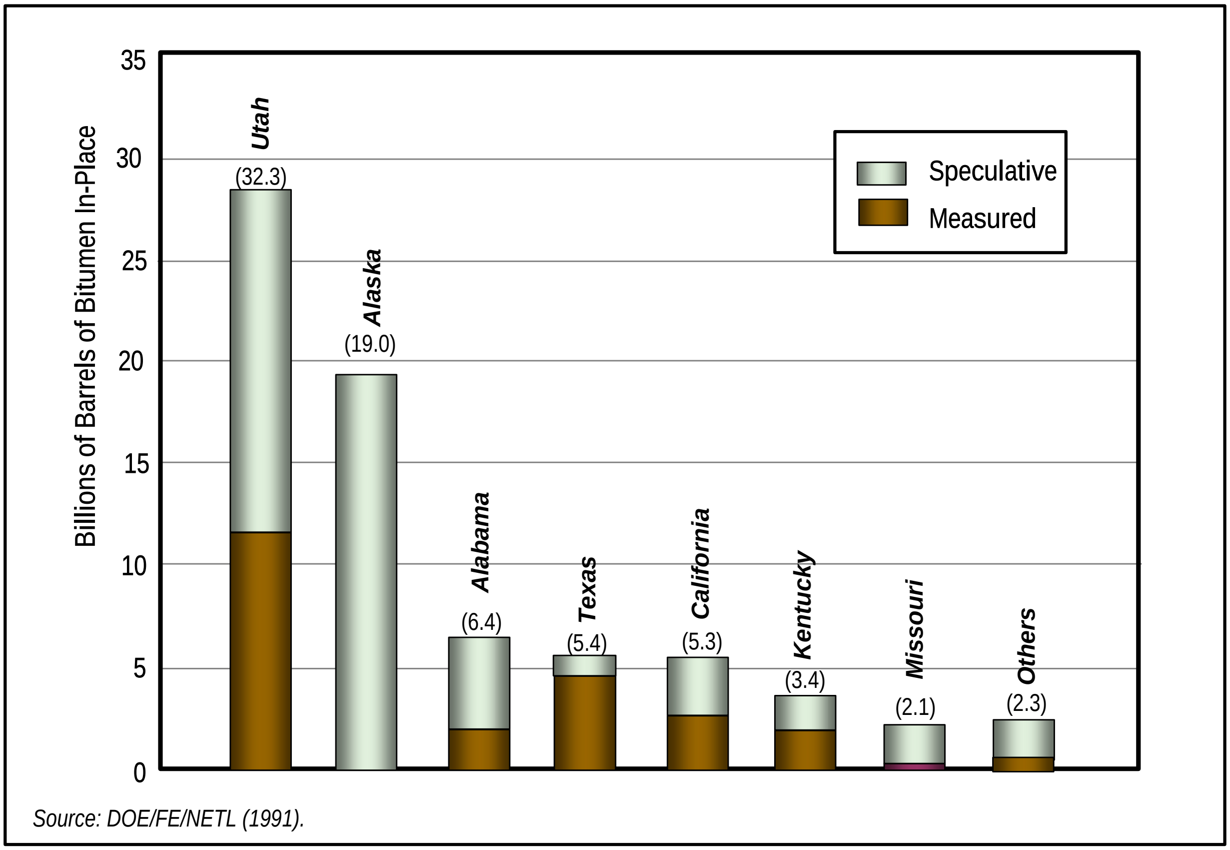
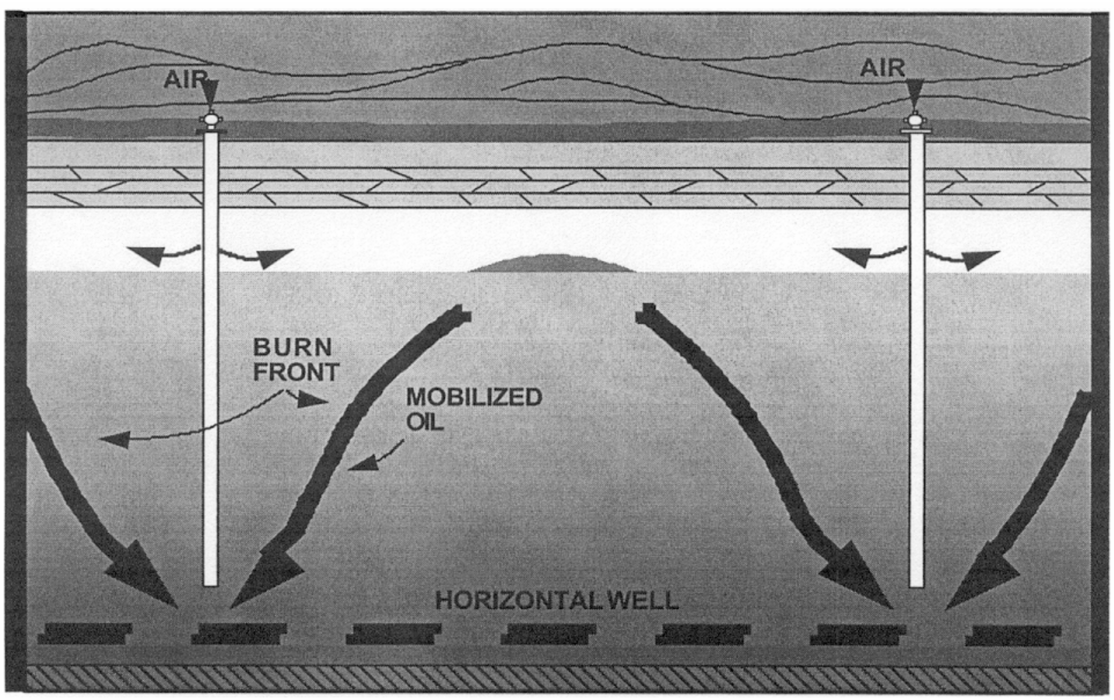


Table 3. Oil Production from California Oil Sands (2003)

Oil Sand Deposits	Oil Gravity (API°)	Latest Production (Bbls)	Active Wells	Cumulative Recovery (Million Bbls)
1. Cat Canyon	6-10°	435,000	201	335
2. Casmelia	Variable	171,000	107	45
3. Oxnard	5 °	147,000	41	44
4. Zaca	4-6 °	220,000	28	33

3. Advanced technologies being pursued for in-situ oil sand development in Canada could provide valuable options for recovering domestic oil sands. Work in Canada on SAGD (Steam Assisted Gravity Drainage), VAPEX (combination of solvent and heat), and "Top Down Combustion" (Figure 9) could prove to be applicable to the geologically challenging domestic oil sand resource. As such, joint U.S. and Canadian research and technology development would be of great value toward unlocking domestic oil sands. With these and other advances in technology, up to 10 billion barrels of domestic oil sands could become technically recoverable.

Figure 9. Illustrative Schematic of the "Top Down Combustion" Technology



4. An integrated "zero emissions" oil sand recovery, upgrading and refining system appears essential for achieving a positive energy balance and for economically producing domestic oil sands. A "zero emissions" oil sand production, upgrading and refining system, involving gasification of oil sand residues to produce steam, hydrogen and electricity, while productively using the by-product CO2 for deep heavy oil and "stranded" oil recovery, would be an important part of an integrated domestic oil sands recovery system.

5. UNDISCOVERED OIL, RESERVE GROWTH AND NEW CONCEPTS

The volume of remaining undeveloped domestic oil set forth in this report is not a static value. Rather, it grows with increases in knowledge and the discovery and further development of oil fields. As such, significant volumes of domestic oil resources will be added in future years from the following sources:

- Additional reserves and resources from the discovery of new fields and the future growth of reserves in already discovered fields (due to additional delineation drilling and new pool discoveries), and

- New oil resource concepts, such as the residual oil in the transition zone of an oil field, called the residual oil zone (ROZ).

1. Undiscovered Domestic Oil and Reserve Growth Could Provide 190 Billion Barrels of Future Technically Recoverable Domestic Oil Resources. Even though the U.S. is a mature hydrocarbon province, significant volumes of oil remain undiscovered. In addition, the size of already discovered oil fields continues to grow with development well drilling, a phenomena called "reserve growth".

The USGS, MMS and EIA provide estimates for technically recoverable volumes of undiscovered oil (119 billion barrels) and for "reserve growth" (71 billion barrels), Table 4. The recently completed assessment of the Central North Slope of Alaska by the USGS adds an estimated 4 billion barrels of oil to the undiscovered oil volumes on Table 4[24].

[24] "U.S. Geological Survey 2005 Oil and Gas Resource Assessment of the Central North Slope, Alaska: Play Maps and Results," USGS Open-File Report 2005-1182.

Table 4. Technically Recoverable Undiscovered Domestic Oil and Reserve Growth

	Undiscovered Recoverable [1,2]	Reserve Growth [3,4]	Total
	(Billion Barrels)	(Billion Barrels)	(Billion Barrels)
1. Onshore L-48	21	47	68
2. Offshore L-48	51	11	62
3. Alaska (onshore & offshore)	47	13	60
Total	119	71	190

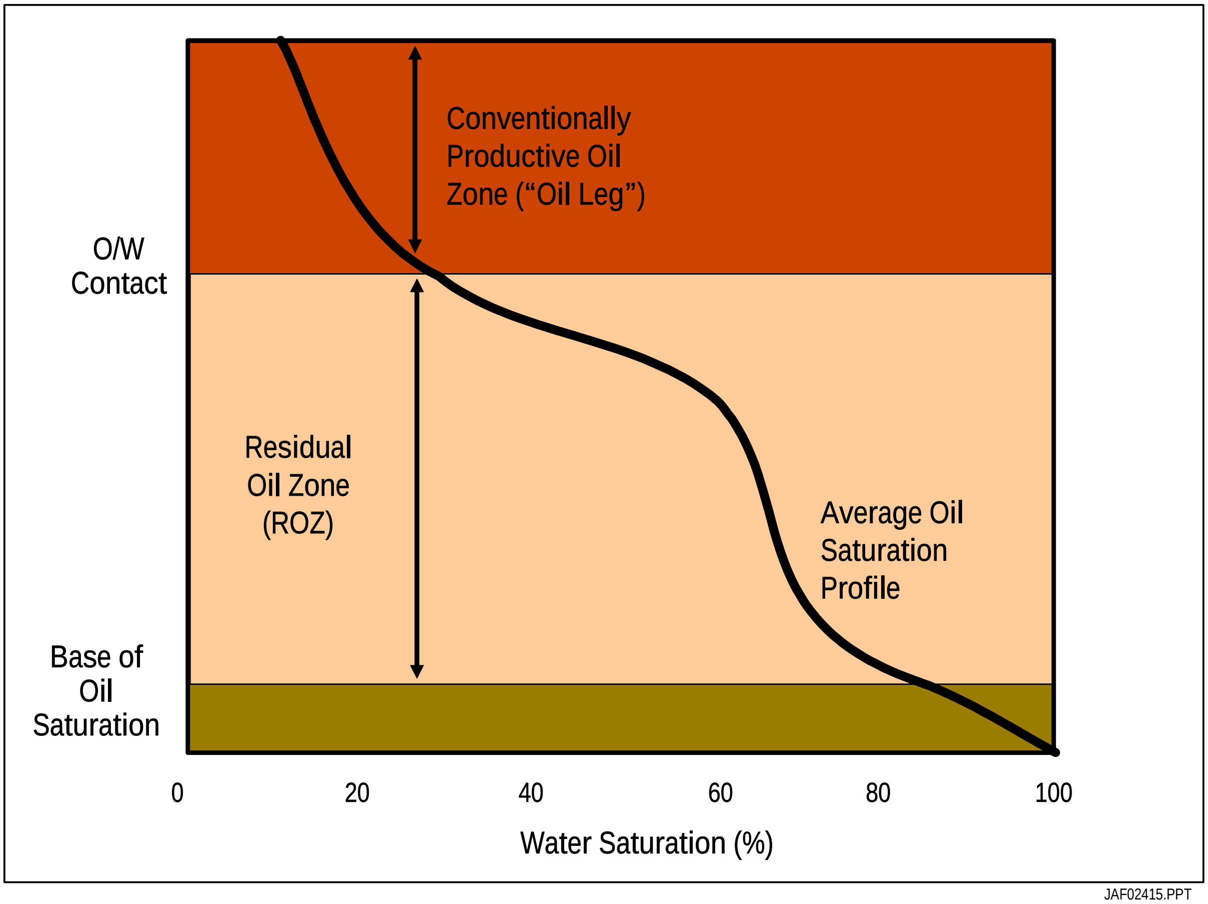
1. Source: USGS National Assessment of Oil and Gas Resources Update (USGS; October 2004) Conventional Oil Resources (40.43 billion barrels) and Continuous Oil Resources (2.13 billion barrels).
2. Source: Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2003 Update (MMS Fact Sheet, December 2004).
3. Source: Estimates of Inferred Reserves for the 1995 USGS National Oil and Gas Resource Assessment (USGS OFP 95-75L, January 1997).
4. Source: Assumptions for the Annual Energy Outlook 2004 (EIA, February 2004).

Importantly, the above undiscovered and reserve growth oil are the conventionally recoverable portion of a much larger in-place resource, given that only about one-third of the original oil in-place is recoverable with current primary and secondary oil recovery technology.

Using the conventional oil recovery factor of one-third, three times as much oil in-place, or 570 billion barrels, would be added to the domestic oil resource warehouse, with 380 billion barrels becoming "stranded" and the target for future enhanced oil recovery technology. (Chapter 2. Domestic Stranded Oil discusses how an estimated 100 billion barrels of this future "stranded" oil could become recoverable with CO2 and other EOR technologies.)

2. Residual Oil in the Transition Zone (ROZ) Is a New Oil Resource Concept Being Further Investigated. Detailed examination of well logs drilled below the traditional water-oil contact zone (below the "oil leg") of an oil reservoir is beginning to reveal important new information on domestic oil resources. The presence of oil does not terminate sharply at the oil-water contact at the base of the oil reservoir. Rather, the well logs show that an extensive "transition zone" exists below the oil-water contact for many reservoirs, Figure 10.

Figure 10. Example Residual Oil Saturation Profile Below the "Oil Leg" of a Major Permian Basin Oil Reservoir.



"Transition zone," or residual oil zone (ROZ), subsurface conditions exist relatively broadly in oil fields with an aquifer base, as indicated by an on-going study of oil reservoirs in the Permian and other basins. As such, the U.S. may have another large, previously undefined, source of undeveloped "stranded oil".

While estimates of the size of the ROZ are highly speculative at this time, a preliminary estimate of an additional 100 billion barrels of "stranded" oil in-place would not be unreasonable. With full understanding of the hydrodynamics of alternative geological settings favorable to ROZ and development of appropriate enhanced oil recovery methods involving horizontal wells and advanced CO2-EOR, a portion of the "stranded" oil in the ROZ could become recoverable.

Oil produced from the ROZ would likely be associated with a high water-to-oil ratio, resulting in increased lifting costs, water management and disposal considerations, similar to introducing CO2-EOR to the “watered-out” portion of the main oil reservoir. Minimizing water management costs, such as avoiding water coning, would be a priority goal for economically producing oil from the ROZ.

6. SUMMARY AND FINDINGS

6.1 BACKGROUND*.* Domestic oil resources are far from being depleted. Only a portion of the domestic oil resource pyramid, the portion that is easiest to recover, has been developed so far. Large additional volumes, in excess of 1,000 billion barrels of undiscovered, "stranded" and unconventional oil remain in the ground, awaiting new extraction concepts and development initiatives. Importantly, a portion of this resource is extractable with the best of technology available today, when combined with supporting policies and incentives. Additional significant volumes could be produced with advances in technology and knowledge.

The previous sections of this report have documented that the remaining undeveloped technically recoverable domestic oil resource is large, on the order of 400 billion barrels. The question is — *What set of actions would help convert these resources into economically recoverable reserves and, most importantly, into increased domestic oil production?*

Pursuing the undeveloped domestic oil resource poses considerable economic risks and technical challenges for producers. The risks and challenges stem from a lack of information on the actual geologic condition of the remaining resource (e.g., the distribution and saturation of the residual oil in the reservoir's pore space), uncertainties on how well oil recovery technology (often adapted from other settings) will perform in a new setting or basin, and the inherent volatility and uncertainty surrounding world oil prices. To date, this combination of geologic, technical and economic risks have posed severe barriers to the full development of the remaining domestic oil resource.

Nonetheless, leaving this domestic oil resource in the ground, while steadily increasing our oil imports, would be bad public policy. The loss to our domestic economy, the deterioration of our energy trade balance, the decline in state revenues for education and other human resource development, and the export of high-paying oil service jobs would be massive. New public-private partnerships that help overcome the barriers to domestic oil development are required. Prompt action on these topics would provide major benefits to the domestic economy and to our nation's future energy outlook.

6.2 OVERCOMING BARRIERS. Eight steps could be taken toward overcoming these barriers and for reducing the geological, technical and financial barriers hindering the development of domestic oil resources.

1. **Mitigating the Financial and Investment Barriers Associated with Enhanced Oil Recovery Could Be Accomplished by Undertaking Various "Risk Mitigation" Actions Available to federal and state governments.** These actions could involve reductions in federal/state royalties and state severance taxes (until payout) to provide "risk mitigation" during the initial years of a commercial scale project. They could also involve modifying Section 43 of the federal tax code (that contains investment tax credits for application of EOR technology) to provide downside protection of investment during periods of low oil prices.

2. Reducing the Geological and Technical Barriers of Enhanced Oil Recovery Could Be Accomplished Through an Aggressive Program of Research and Field Tests. Optimizing the performance of current CO_2-EOR (and other EOR) practices and pursuing new, more efficient technology will help lower the geological and technical risks involved with enhanced oil recovery. This was the pathway used by the DOE and the Gas Research Institute to reduce geologic and technical risks which helped commercialize domestic unconventional gas, that now accounts for over one-third of domestic natural gas production. Similar successes are achievable for domestic oil resources, including jointly pursuing "stranded" oil and "residual oil in the transition zone" with CO_2 injection.

3. **Encouraging the Production and Productive Use of CO_2 from Natural Sources and Industrial Emissions Would Provide Increased Oil Production While Lowering Greenhouse Gas Emissions.** Recent discoveries of natural CO_2 deposits,

in association with a commercial helium resource, in the St. John's Field in Arizona and expansion of natural gas treating facilities in the Wind River Basin are examples of just two of the emerging options for new sources of CO_2. Other innovative concepts would include capture of high volume by-product CO_2 from centralized refinery coke and residues gasification facilities and sale of high-purity CO_2 from ethanol, hydrogen and other chemical production facilities. Finally, production and efficient separation of by-product CO_2, particularly from next-generation, low-emission power plants, could provide large, long-term sources for "EOR-Ready" CO_2, sufficient to meet the full CO_2 requirements for recovery of "stranded" oil.

4. **Integrated Energy Systems Would Reduce the Energy Penalty Associated with Producing and Capturing "EOR-Ready" CO_2.** Demonstrating an integrated "zero emissions" steam, hydrogen and electricity generation system, that provides "EOR-Ready" CO_2 from gasifying the residue products from heavy oil and oil sand upgrading and refining, would provide an innovative, energy efficient approach toward future oil recovery.

5. **Collaboration with Canada on Oil Sand and Heavy Oil Technology Would be Very Valuable.** Finally, engaging in collaborative Canadian/U.S. efforts, such as sharing technology and conducting jointly-funded field R&D on oil sands and heavy oil, would help develop more efficient recovery technologies appropriate for domestic oil resources.

6. **In-depth Evaluation of the Geologic Settings and Economic Feasibility of Undiscovered Oil Resources Could Help Formulate Additional Supportive Policies.** The current efforts on evaluating domestic oil resources on federal lands and formulating incentives for developing deep oil and gas resources in the Gulf of Mexico are examples of policies that support the development of domestic resources.

7. **Improving the Information Base on Domestic Oil Fields Would Accelerate the Pace and Level of Reserve Growth in Already Discovered Oil Resources.** One productive step to boost "reserve growth" would be conducting in-depth studies and characterization of existing domestic oil fields. Similar "basin and field studies" prepared by the Gas Research Institute provided a tremendous boost to the development of domestic unconventional gas.

8. **Increased Investments in Technology Development and Transfer Would Lead to Higher Domestic Oil Recovery Efficiencies.** New models of public-private partnerships could be designed to help launch larger scale field projects demonstrating high oil recovery ideas and technologies. State-federal partnerships devoted to technology transfer would help address the barriers that currently inhibit the development and production of domestic unconventional oil by independent producers.

6.3 IMPACTS AND BENEFITS. The returns to the domestic economy from a successful implementation of these actions would be tremendous. Assuming that half (200 billion barrels) of the above undeveloped domestic oil resource becomes economic (at oil prices of $40 per barrel), and assuming that the implementation of the above set of required actions occurs expeditiously, this would result in:

- The ultimate trade balance would improve by $8 trillion, cumulatively, assuming one-half of the future technically recoverable resource (200 billion barrels) becomes economically recoverable and oil prices average $40 per barrel.
- State and local treasuries would gain $700 billion of revenues from future royalties, severance taxes, and state income taxes on oil production.
- The decline in domestic oil production would be reversed, creating new, well-paying direct and indirect jobs.

APPENDIX 1

U.S. House of Representatives, Committee on Resources, News Release, September 28, 2004

Committee on Resources
U.S. House of Representatives
News Release

For Immediate Release
Tuesday, September 28, 2004
Contact Brian Kennedy at (202) 226-9019

"America has no shortage of oil. Washington has a shortage of political will to let American workers go get it."

- Chairman Richard W. Pombo

Washington, DC – As oil prices climb to record highs above $50 per barrel, some have asserted that we are "running out" of this resource. In truth, we are not running out of oil in America. We can safely increase domestic production by at least 17.2 million barrels per day by 2025.

"America has no shortage of oil for the foreseeable future," House Resources Committee Chairman Richard W. Pombo (R-CA) said. "Washington has a shortage of the political will required to let American workers go get it. We have not increased domestic supply in thirty years. As a result, our dependence on foreign oil has skyrocketed to the point where we are sending $200 billion overseas to import this resource every year. At least a fraction of that sum should be spent at home to increase supply, lower prices, and create jobs."

"Increasing conservation and the use of renewable and alternative fuels must also be part of a balanced energy plan," Pombo continued. "That is why more than one half of the domestic recommendations in the Administration's energy plan - held up in the Senate for the last four years - targeted these goals. But like it or not, the reality is that America runs on oil right now. We cannot conserve our way out of an empty tank of gas. We have to produce more at home, and there is plenty at home to produce."

By combining conservation efforts with additional domestic production, the United States can close the gap between supply and demand to become more energy efficient. With current production and proposed development in North America, the United States could increase its supply by 17.2 million barrels per day by 2030. Click HERE to see how.

"Contrary to the claims of special interest groups, we can produce more energy to grow our economy and continue environmental achievements at the same time," Pombo said. "These efforts go hand in hand. They are not mutually exclusive."

* Since 1973, the fuel efficiency of passenger cars, vans, pickups and SUV's has increased by more than 60%. (Energy Information Administration, Monthly Energy Review, October 2003)

* From 1970 to 2000, total emissions of the six major pollutants decreased almost 30%. At the same time, total energy consumption rose 45%, GDP increased 160%, and population grew 38%. (Environmental Protection Agency, EIA, U.S. Census Bureau)

* From 1970 to 2000, the number of drivers on American roads increased 68%, total vehicle miles traveled per year grew 142%, and heavy-duty truck travel increased 227%. At the same time, however, the EPA estimates that total on-road vehicle emissions decreased 77%.

“Secure and affordable energy supplies fuel our economy - they are its lifeblood. In turn, a strong economy fuels investment in the research and technology that give us the positive environmental trendlines we see today. We cannot have one without the other."

###

Committee on Resources
U.S. House of Representatives
News Release

Efforts to Increase Domestic Supply Could Yield an Additional 17.20 Million Barrels a Day by 2030

	Increase in N.A. (Canada and U.S.) Oil Production (MM bpd) by				
Description	**2010**	**2015**	**2020**	**2025**	**2030**
NPR-A Northeast - 1	.20	.25	.35	.40	.40
NPR-A Northwest - 2	.00	.10	.15	.20	.20
ANWR - 3	.00	.30	.80	1.10	1.20
U.S. Oil Shale - 4, 5	.00	.40	2.00	3.00	4.00
AK Heavy Oil - 6	.15	.30	.50	.70	.80
U.S. Heavy Oil - 7	.00	.10	.30	.50	.50
U.S. Tar Sands - 8	.00	.10	.30	.50	.50
Enhanced CO2 Recovery - 9	.30	.80	1.20	1.70	2.00
AK OCS - 10	.15	.30	.80	1.20	1.50
Alberta Tar Sands - 11, 12	.90	1.50	2.25	3.00	4.00
Canadian Atlantic OCS - 13	.30	.60	.70	.80	.80
Canadian Pacific OCS - 14	.00	.20	.50	.80	.80
Canadian Arctic OCS - 15	.00	.20	.50	.50	.50
Totals	2.00	5.15	10.35	14.40	17.20
This breaks down as:					
AK Onshore	.35	.95	1.80	2.40	2.60
AK Offshore - 16	.15	.30	.80	1.20	1.50
U.S. Heavy Oil & Tar Sands	.00	.20	.60	1.00	1.00
U.S. Oil Shale	.00	.40	2.00	3.00	4.00
Enhanced CO2 Recovery	.30	.80	1.20	1.70	2.00
Canada	1.20	2.50	3.95	5.10	6.10
Totals - 17	2.00	5.15	10.35	14.40	17.20

Endnotes:

1. Based upon NPR-A NE program documents. Also, USGS Fact Sheet 045-02 (2002), "U.S. Geological Survey 2002 Petroleum Resource Assessment of the National Petroleum Reserve in Alaska (NPRA). This assessment concluded that technically recoverable, undiscovered oil beneath the Federal part of NPR-A likely ranges between 5.9 and 13.2 billion barrels, with a mean (expected) value of 9.3 billion barrels. An estimated 1.3 to 5.6 billion barrels of those technically recoverable oil resources are economically recoverable at market prices of $22 to $30 per barrel.

2. Based upon NPR-A NW program documents. Ibid., USGS Fact Sheet 045-02 (2002).

3. Peak oil production at ANWR (1.2 MM bpd) is shown higher than the usual estimates (0.9 MM bpd). Assumes incentives to inject excess North Slope Gas hydrates and other NS gas into the ANWR fields in order to achieve higher daily production rates. AK heavy oil production is also assisted by such incentives.

4. Bunger, James W. et al, "Is oil shale America's answer to peak-oil challenge?", Oil & Gas Journal, Aug. 9, 2004, p. 16. Worldwide, the oil shale resource base is conservatively estimated at 2.6 trillion bbl and is located in about 26 countries. (Dyni, John R., "Oil Shale," USGS, rev. Feb. 27, 2003, cf [http://emd.aapg.org/technical_areas/oil_shale.htm].) Almost 80% of the world's oil shale endowment, about 2 trillion bbl, including both eastern and western deposits, is located within the US. (Duncan, D.C., and Swanson, V.E., "Organic-Rich Shales of the US and World Land Areas," USGS Circular 423, 1965.) Bunger et al found that US oil shale will produce higher quality oil than Alberta tar sands with less expense.

5. Johnson, H.R., Crawford, P.M., and Bunger, J.W., principal authors, Strategic Significance of America's Oil Shale Resource, DOE Office of Naval Petroleum and Oil Shale Reserves, Volumes I (Assessment of Strategic Issues) and II (Oil Shale Resources Technology and Economics), March 2004. The report noted that the world's remaining conventional oil resources total 2.7 trillion barrels while North America's unconventional resources total 3.7 trillion barrels – 1.7 trillion in Alberta tar sands and 2.0 trillion in US oil shale. US oil shale is primarily found in Colorado, Utah, Wyoming, Kentucky, Ohio, and Indiana. As much as 750 billion barrels of US oil shale has a richness of 25 gal/ton or greater and could be produced with near-term adaptations of existing technology (Vol. I, p. 10). The report found that it is possible that an oil shale industry could be initiated by 2011 with an initial production of 200,000 bpd, with an aggressive goal of 2 million bpd by 2020. Ultimate capacity could reach 10 million bpd, a comparable capacity to the long-term prospects for Alberta's tar sands. Oil shale's direct economic value to the Nation may approach $1 trillion by 2020, not counting other equally or more valuable strategic and national security benefits that may not be fully measurable in dollars (Vol. I, p. 10).

6. Kuuskraa, V.A. and Godec, M.L., Lewin and Associates, Inc., A Technical and Economic Assessment of Domestic Heavy Oil, U.S. Department of Energy under subcontract to the Interstate Oil Compact Commission, April 1987. Report estimated that Alaska has 25 billion barrels of heavy oil in large reservoirs (each over 20 million barrels). The West Sak field alone contains more than 10 billion barrels of heavy oil.

7. Ibid. Report documented more than 100 billion barrels originally in-place in the U.S. heavy oil resource base. More than 80 billion barrels are in 248 large, heavy oil reservoirs (each over 20 million barrels). The bulk of the heavy oil resource is located in three states – California with 42 billion barrels, Alaska with 25 billion barrels, and Wyoming with 5 billion barrels. Smaller accumulations of 1 to 2 billion barrels (in reservoirs over 20 million barrels each) exist in Texas, Louisiana, Mississippi, and Arkansas. The report found that 4.5 to 9.1 billion barrels were economically recoverable at oil prices of $15 to $30 per barrel (constant 1986 dollars). At prices of $40 to $50 per barrel (1986 constant), nearly 20 billion barrels become economic. This 1987 report obviously fails to take into account technological advances since that time, nor does it assume Federal or state production incentives. Of note, more than 50 billion barrels is located in depths of less than 4000 feet. The resources documented in this report do not include resources classified as tar sands.

8. Lewin and Associates, Inc., Major Tar Sand and Heavy Oil Deposits of the United States, Interstate Oil Compact Commission in cooperation with the USGS and U.S. Department of Energy, July 1983. Report found that the total U.S. tar sand resource base is estimated at 54 billion barrels of oil. The measured in-place resource for major deposits is 22 billion barrels and the speculative resource in-place for major deposits is estimated at 31 billion barrels (not including the resource base offshore California). These resources are concentrated in Utah (20.1 BBO), Alaska (10.0 BBO), Alabama (6.5 BBO), Texas (4.8 BBO), California (4.7 BBO), and Kentucky (3.4 BBO).

9. Kuuskraa, Vello A., President, Advanced Resources International, " 'Stranded' Oil Resources: The New Domestic Oil Prize," testimony before the U.S. House of Representatives, Subcommittee on Energy and Mineral Resources, Committee on Resources, on "Advances in Technology: Innovations in the Domestic Energy and Mineral Sector," July 15, 2004. Of the original U.S. domestic oil resources in place of 582 billion barrels, only 183 billion barrels have been produced. There are an additional 22 billion barrels of proved reserves. 60 billion additional barrels are potentially producible with advanced CO2 enhanced oil recovery technology. CO2 EOR currently produces 200,000 bpd in the US. Mr. Kuuskraa testified that a CO2 EOR policy initiative could add 1 million bpd by 2015 and 2 million bpd by 2025.

10. Most of the offshore Alaska production will be from the Arctic, but 120,000 bbl/day in 2015; 200,000 bbl/day in 2020; 180,000 bbl/day in 2025; and 140,000 bbl/day in 2030 will be from the North Aleutian Basin/Bristol Bay per unofficial estimates by MMS. Starting in 2015, the production from the Alaska OCS could easily be two to three times larger than the estimates included in this table. The Arctic OCS has the geologic potential of including at least half a dozen Prudhoe Bay-sized accumulations.

11. Radler, Marilyn, "Worldwide Reserves Increase as Production Holds Steady," Oil & Gas Journal, Dec. 23, 2002, p. 113. Commercial success of Alberta tar sands production resulted in the recent addition of 174 billion barrels of tar sand to Canada's proved oil reserves. Production currently approximates 900,000 barrels per day. The Energy Information Administration's International Energy Outlook 2003, on page 40, estimates that 1.7 trillion barrels of oil are in place within the Alberta tar sands.

12. Park, Gary, "Oil Sands Bombshell," Petroleum News, March 14, 2004, p. 19. On March 3, 2004, a Canadian Energy Research Institute study found that over the next 13 years, production of oil from Alberta oil sands would more than double to 2.2 million barrels per day with oil prices of US$25 per barrel. Production could reach 2.8 million bpd with oil prices at US$32 per barrel and 3.5 million bpd at an "unconstrained" level.

13. Per the Canada-Nova Scotia Offshore Petroleum Board, the mean risked recoverable hydrocarbons for the Nova Scotian offshore is 3 billion barrels of oil and 33 trillion cubic feet of gas. (Hydrocarbon Potential of the Deep-Water Scotian Slope, Canada-Nova Scotia Offshore Petroleum Board, October, 2002). Offshore Newfoundland and Labrador, as of May 2003, 2.5 billion barrels of recoverable oil and 9.9 trillion cubic feet of recoverable natural gas have been discovered. Undiscovered resources studies have resulted in estimates of an additional 6 to 12 billion barrels of recoverable oil. (Sedimentary Basins and Hydrocarbon Potential of Newfoundland and Labrador, Report 2000-01, Government of Newfoundland and Labrador, Department of Mines and Energy).

14. Article, "B.C. girds for offshore drilling," globeandmail.com, February 18, 2004. British Columbia provincial government has made an initiative to remove the offshore drilling moratoria. Per the British Columbia Ministry of Energy and Mines, the British Columbia offshore is estimated to contain at least 9.8 billion barrels of oil and 41.8 trillion cubic feet of gas.

15. Extensive oil and natural gas discoveries have been made in the vicinity of the Mackenzie River delta both onshore and offshore. Production awaits construction of a pipeline and further discoveries.

16. Although all of the AK Onshore and Offshore production is not from the North Slope or Arctic OCS, at least 95% will be. These estimates point to the need for another oil pipeline from the NS by 2020 - latest 2025.

17. EIA estimated in its 2004 Annual Energy Outlook that U.S. oil imports may reach 19.8 million barrels of oil per day by 2025.

APPENDIX 2

Fact Sheet On Domestic Oil Resources

FACT SHEET ON DOMESTIC OIL RESOURCES

Summary. The U.S. still has substantial volumes of undiscovered and undeveloped crude oil resources. Undiscovered oil and reserve growth (in already discovered fields) hold 190 million barrels of recoverable domestic oil, essentially equal to what has been produced to date. With enhanced oil recovery and the development of oil sands and residual oil in transition zones, the total undeveloped remaining domestic oil resource becomes 400 billion barrels. This is nearly twenty times current proved crude oil reserves of 21.9 billion barrels, and two hundred times annual crude oil production of 1.88 billion barrels (in 2003). (Annual domestic oil production is 2.07 billion barrels when lease condensate is included).

Undiscovered Conventional Oil. The U.S. has an estimated 119 billion barrels of undiscovered oil, recoverable with traditional primary and secondary technology - - 43 billion barrels from the onshore and 76 billion barrels from the offshore, based on the most recent national resource assessments by the Department of Interior (USGS/MMS). (See Appendices 3A, 3B and 4 for supporting information on undiscovered domestic oil resources.) These undiscovered resources are being steadily converted to proved reserves through exploration drilling. Last year (2003), total domestic discoveries of crude oil were 1,232 million barrels.

Reserve Growth of Conventional Oil Fields. The U.S. has an estimated 71 billion barrels of oil "reserve growth" remaining in already discovered fields, also recoverable with traditional technology. Of this, 60 billion barrels is from the onshore and 11 billion barrels is from the offshore, based on resource assessments by the USGS and EIA. For the past ten years, about one billion barrels have been added to proved reserves, each year from this category by development well drilling and more aggressive secondary oil recovery ("water flooding") practices. Last year (2003), for the first time, reserve growth for domestic oil was negative, after adjustments were made to account for reserve mark-downs due to sale of properties and the low end-of-year prices for heavy oil.

Stranded Oil. The U.S. has 200 billion barrels of crude oil that could become recoverable by applying enhanced oil recovery (EOR) to discovered and future oil fields. Of this, 100 billion barrels is from applying EOR to the 374 billion barrels of remaining in already discovered oil fields (being studied by the DOE/FE). Another 100 billion barrels would be from using EOR on the 370 billion barrels that will become “stranded” in future oil fields.

Today, enhanced oil recovery provides about 660,000 barrels of oil production per day, primarily from application of CO2-EOR in West Texas and from use of steam flooding in California’s shallow heavy oil deposits. With appropriate energy policies, incentives and progress in technology, substantially increased production could accrue from increased application of EOR.

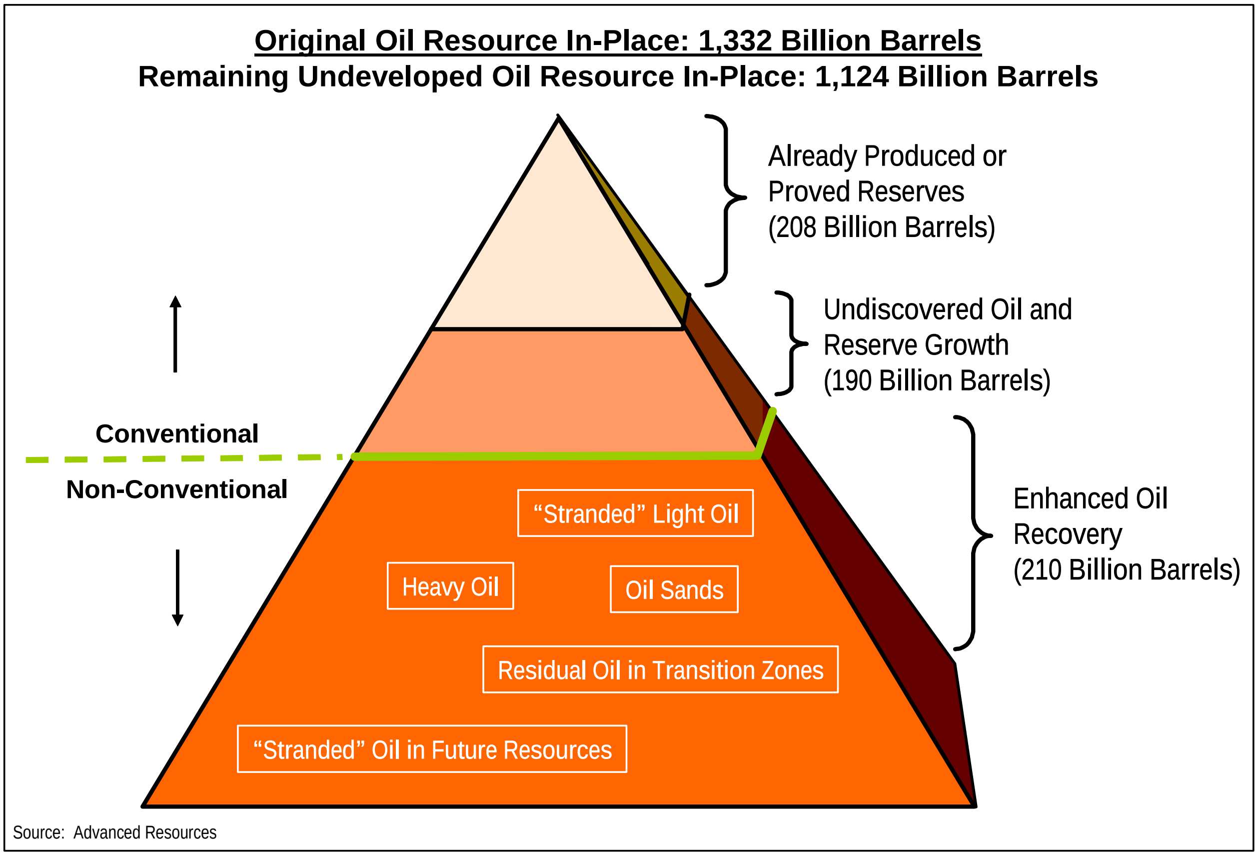
Residual Oil in Transition Zones. A significant but essentially undocumented volume of “stranded” oil exists below the oil-water contact zones of many domestic oil fields. Work on just two major West Texas oil fields has established a residual oil transition zone (ROZ) resource in-place of 2 to 3 billion barrels and has identified a larger—15 to 20 billion in-place—ROZ target in the Permian Basin. Preliminary extrapolation of this work to other fields that appear to exhibit similar characteristics could add 100 billion barrels of oil in-place to national totals. The current national level OOIP estimates do not include this residual oil as it is not in the conventionally defined “pay zone”. Two significant field projects, with publicly-reported results, are conducting CO_2-EOR in both the main pay interval and in the ROZ. However, further work is required to confirm what portion of this residual oil is technically recoverable using appropriate enhanced oil recovery technologies.

Oil Sands. The U.S. has 10 billion barrels of oil sands that could become recoverable, from a resource base estimated at 80 billion barrels. Application of thermal EOR technology and adaptation of innovative technologies being pursued on Canadian oil sands could facilitate the efficient recovery of domestic oil sands.

<u>In-Place Resources and Recoverable Reserves.</u> The above 400 billion barrels of future domestic oil are the recoverable portion of a much larger domestic oil in-place resource. The original domestic oil in-place resource is estimated at 1,332 billion barrels, of which 183 billion barrels have been produced and 22 billion barrels have been placed into proved reserves, leaving 1,124 billion barrels behind, as shown in Figure A-1.

Full recovery of undiscovered oil in new fields, reserve growth in existing fields and the use of enhanced oil recovery technology on "stranded" oil account for the estimate of 400 billion barrels of future recoverable domestic oil resource.

Figure A-1. The Domestic Oil Resource Pyramid



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APPENDIX 3A

USGS National Assessment of Oil and Gas Resources, Update (October, 2004): Conventional Oil

APPENDIX 3A
USGS NATIONAL ASSESSMENT OF OIL AND GAS RESOURCES UPDATE (OCTOBER, 2004), CONVENTIONAL OIL RESOURCES

Province Number and Name		Vintage	Conventional Oil (billions of barrels)		
			F95	F05	Mean
1a	North Slope ANWR	1998	5.72	15.95	10.36
1b	North Slope NPRA	2002	6.67	15.01	10.56
1c	North Slope Middle-ground Area	2004			
2	Central Alaska	2004	0.00	0.59	0.17
3	Southern Alaska	1995	0.19	2.20	0.97
4	Western Oregon-Wash.	1995	0.00	0.12	0.03
5	Eastern Oregon-Wash.	1995	0.00	0.00	0.00
7	Northern Coastal	1995	0.01	0.09	0.03
8	Sonoma-Livermore	1995	0.00	0.06	0.01
9	Sacramento Basin	1995	0.00	0.00	0.01
10	San Joaquin Basin	2004	0.08	0.85	0.39
11	Central Coastal	1995	0.10	1.17	0.49
12	Santa Maria Basin	1995	0.02	0.60	0.21
13	Ventura Basin	1995	0.28	2.27	1.06
14	Los Angeles Basin	1995	0.41	1.78	0.98
17	Idaho-Snake River Downwarp	1995	0.00	0.01	0.01
18	Western Great Basin	1995	0.00	0.37	0.06
19	Eastern Great Basin	1995	0.06	1.34	0.49
20	Uinta-Piceance Basin	2002	0.00	0.04	0.02
21	Paradox Basin	1995	0.11	0.61	0.31
22	San Juan Basin	2002	0.00	0.04	0.02
23	Albuquerque-Sante Fe Rift	1995	0.00	0.15	0.05
24	Northern Arizona	1995	0.00	0.32	0.07
25	S. Ariz.-S.W. New Mexico	1995	0.00	0.06	0.02
26	South-Central New Mexico	1995	0.00	0.00	0.00
27	Montana Thrust Belt	2002	0.01	0.19	0.08
28	Central Montana	1995	0.13	0.42	0.27
29	Southwest Montana	1995	0.00	0.13	0.03
31	Williston Basin	1995	0.25	1.17	0.65
33	Powder River Basin	1995	0.08	2.51	1.13
34	Big Horn Basin	1995	0.08	0.87	0.39
35	Wind River Basin	1995	0.05	0.32	0.16
36	Wyoming Thrust Belt	2003	0.01	0.08	0.04
37	Southwestern Wyoming	2002	0.01	0.07	0.03
38	Park Basins	1995	0.01	0.11	0.03
39	Denver Basin	2003	0.01	0.16	0.06

40	Las Animas Arch	1995	0.04	0.28	0.14
41	Raton Basin-Sierra Grande Uplift	2004	0.00	0.00	0.00
43	Palo Duro Basin	1995	0.01	0.07	0.03
44	Permian Basin	1995	1.59	4.52	2.89
45	Bend Arch-Ft. Worth Basin	2003	0.03	0.18	0.10
46	Marathon Thrust Belt	1995	0.01	0.04	0.02
47	Western Gulf	1995	0.73	4.56	2.29
49	East Texas Basin/LA-MS Salt Basins	1995	0.88	5.39	2.76
50	Florida Peninsula	2001	0.04	0.85	0.35
51	Superior	1995	0.00	0.44	0.05
53	Cambridge Arch-Central Kansas	1995	0.04	0.43	0.20
55	Nemaha Uplift	1995	0.03	0.29	0.12
56	Forest City Basin	1995	0.00	0.06	0.02
58	Anadarko Basin	1995	0.21	0.66	0.40
59	Sedgwick Basin/Salina Basin	1995	0.02	0.12	0.07
60	Cherokee Platform	1995	0.02	0.17	0.08
61	Southern Oklahoma	1995	0.05	0.57	0.24
62	Arkoma Basin	1995	0.00	0.07	0.01
63	Michigan Basin	1995	0.50	2.02	1.14
64	Illinois Basin	1995	0.05	0.57	0.26
65	Black Warrior Basin	2002	0.00	0.01	0.00
66	Cincinnati Arch	1995	0.01	0.04	0.02
67	Appalachian Basin	2002	0.01	0.10	0.05
68	Blue Ridge Thrust Belt	1995	0.00	0.00	0.00
69	Piedmont	1995	0.00	0.00	0.00
	TOTALS				40.43

APPENDIX 3B

USGS National Assessment of Oil and Gas Resources, Update (October, 2004): Continuous Oil

APPENDIX 3B

USGS NATIONAL ASSESSMENT OF OIL AND GAS RESOURCES UPDATE (OCTOBER, 2004), CONTINUOUS OIL RESOURCES

	Province Number and Name	Vintage	Continuous Oil (millions of barrels)		
			F95	F05	Mean
1a	North Slope ANWR	1998			
1b	North Slope NPRA	2002			
1c	North Slope Middle-ground Area	2004			
2	Central Alaska	1995			
3	Southern Alaska	1995			
4	Western Oregon-Wash.	1995			
5	Eastern Oregon-Wash.	1995			
7	Northern Coastal	1995			
8	Sonoma-Livermore	1995			
9	Sacramento Basin	1995			
10	San Joaquin Basin	2004			
11	Central Coastal	1995			
12	Santa Maria Basin	1995			
13	Ventura Basin	1995			
14	Los Angeles Basin	1995			
17	Idaho-Snake River Downwarp	1995			
18	Western Great Basin	1995			
19	Eastern Great Basin	1995			
20	Uinta-Piceance Basin	2002	24.83	56.84	38.78
21	Paradox Basin	1995	61.00	597.00	242.00
22	San Juan Basin	2002			
23	Albuquerque-Sante Fe Rift	1995			
24	Northern Arizona	1995			
25	S. Ariz.-S.W. New Mexico	1995			
26	South-Central New Mexico	1995			
27	Montana Thrust Belt	2002	12.90	50.60	27.90
28	Central Montana	2001			
29	Southwest Montana	1995			
31	Williston Basin	1995	97.00	283.00	167.00
33	Powder River Basin	2002	252.52	665.41	424.28
34	Big Horn Basin	1995			
35	Wind River Basin	1995			
36	Wyoming Thrust Belt	2003			
37	Southwestern Wyoming	2002	66.90	151.00	103.60
38	Park Basins	1995			
39	Denver Basin	2003	20.73	67.35	39.83

40	Las Animas Arch	1995			
41	Raton Basin-Sierra Grande Uplift	2004			
43	Palo Duro Basin	1995			
44	Permian Basin	1995			
45	Bend Arch-Ft. Worth Basin	2003			
46	Marathon Thrust Belt	1995			
47	Western Gulf	1995	752.00	1516.00	1089.00
49	East Texas Basin/LA-MS Salt Basins	2003			
50	Florida Peninsula	2000			
51	Superior	1995			
53	Cambridge Arch-Central Kansas	1995			
55	Nemaha Uplift	1995			
56	Forest City Basin	1995			
58	Anadarko Basin	1995			
59	Sedgwick Basin/Salina Basin	1995			
60	Cherokee Platform	1995			
61	Southern Oklahoma	1995			
62	Arkoma Basin	1995			
63	Michigan Basin	1995			
64	Illinois Basin	1995			
65	Black Warrior Basin	2002			
66	Cincinnati Arch	1995			
67	Appalachian Basin	2002			
68	Blue Ridge Thrust Belt	1995			
69	Piedmont	1995			
	TOTALS				2132.39

APPENDIX 4

MMS Update of Offshore Undiscovered Oil and Natural Gas Resource Estimates

MMS

U.S. Department of the Interior
Minerals Management Service
Office of Public Affairs

NEWS RELEASE
Release: #3212
Date: December 21, 2004

MMS Updates Offshore Undiscovered Oil and Natural Gas Resource Estimates

The Minerals Management Service has issued an interim update (PDF file) to estimates for undiscovered technically recoverable resources underlying offshore waters on the Outer Continental Shelf. Based on information obtained from new exploration activities in the Gulf of Mexico and in the Scotian Basin offshore Canada, MMS estimates that 76.0 billion barrels of oil and 406.1 trillion cubic feet of natural gas are technically recoverable from federal offshore areas. While the overall estimate for oil resources remained about the same as the 2000 Assessment, the MMS estimate for natural gas increased about 12 percent compared to the 2000 number. About 91 percent of this increase in the natural gas estimate is due to new information obtained from recent exploration activities in the Gulf of Mexico.

These estimates represent the potential hydrocarbons of an area that can be produced using current technology, without any consideration to economic feasibility. Current technology includes drilling in water in excess of 3000 meters (10,000 feet) deep and to depths in excess of 9600 meters (31,700 feet).

MMS conducts a comprehensive national assessment of the undiscovered oil and gas resources on the OCS every five years. The last comprehensive national assessment was completed in 2000. The national assessments also include estimates for undiscovered economically recoverable resources, which represent the portion of the undiscovered technically recoverable hydrocarbons that can be explored, developed and commercially produced at given costs and price considerations using present or reasonably foreseeable technology. Present technologies include subsea completions and tie-backs, extended reach drilling, multi-lateral completions, and floating production systems.

Interim updates to these assessments, such as the one issued today, are released in response to significant information obtained from new exploration and development activity, and on occasion to incorporate major improvements in methodology and modeling.

MMS utilizes statistical models that incorporate geological, engineering, and economic inputs to estimate the undiscovered technically recoverable resources. The chart below lists the low, mean, and high estimates for the Alaska, Atlantic, Gulf of Mexico and Pacific planning areas of the OCS.

Undiscovered Technically Recoverable Resources (UTRR) on the Outer Continental Shelf

	UTRR Oil (Bbbl)			UTRR Gas (Tcf)			UTRR BOE (Bbbl)		
	LOW	**MEAN**	**HIGH**	**LOW**	**MEAN**	**HIGH**	**LOW**	**MEAN**	**HIGH**
Alaska OCS	16.6	25.1	35.9	54.6	122.1	226.2	28.0	46.9	72.1
Atlantic OCS	1.9	3.5	5.3	19.8	33.3	50.6	5.4	9.4	14.3
Gulf of Mexico OCS	31.5	36.9	44.0	208.9	232.5	267.6	68.7	78.3	91.6
Pacific OCS	4.4	10.5	21.8	7.4	18.2	38.2	5.7	13.7	28.6
Total OCS	**62.1**	**76.0**	**93.0**	**326.2**	**406.1**	**520.0**	**122.0**	**148.3**	**180.4**

(Bbbl = billion barrels of oil, Tcf = trillion cubic feet of gas, BOE = total oil and gas in energy-equivalent barrels. LOW indicates a 95 percent chance of at least the amount listed existing. HIGH indicates a 5 percent chance of at least the amount listed occurring.

MEAN estimates represent the expected amount. Only the mean values are additive.)

MMS, part of the U.S. Department of the Interior, oversees 1.76 billion acres of the Outer Continental Shelf, managing offshore energy and minerals while protecting the human, marine, and coastal environments through advanced science and technology research. The OCS provides 30 percent of oil and 23 percent of natural gas produced domestically, and sand used for coastal restoration. MMS's collects, accounts for, and disburses mineral revenues from Federal and American Indian lands, with fiscal year 2004 disbursements of around $8 billion and more than $143 billion since 1982. The Land and Water Conservation Fund, which pays for acquisition of state and federal park and recreation land, gets nearly $1 billion a year.

MMS Main Website: www.mms.gov
Gulf of Mexico Website: www.gomr.mms.gov

MMS: Securing Ocean Energy & Economic Value for America
U.S. Department of the Interior