The Arctic National Wildlife Refuge: Independent Analysis of CBO's Federal Revenue Projections and Related National Energy Issues

Briefing for Members and Staff, U.S. House of Representatives
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The Congressional Budget Office (CBO) predicts the industry will spend $5.0 billion for exploration rights in the Arctic Refuge Coastal Plain.

- **To generate $5.0 billion in lease bonus revenues, bidders would have to pay $3,333 per leased acre for exploration rights on the 1,500,000-acre Arctic Refuge Coastal Plain.**

- **Under the FY 2006 budget reconciliation proposal, half of this amount would go to the State of Alaska; the federal half would be earmarked for the deficit reduction.**

- **If the entire $5.0 billion in lease bonus revenue is not realized, the federal portion of that shortfall must be added to the increase in the federal deficit caused by the reconciliation package.**

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Analysis of more than 90 state and federal lease sales on Alaska's North Slope since 1961 reveals an apparent disconnect between the CBO projections and history.

- **Sparked by the discovery of oil at Prudhoe Bay in 1967, prior to1990 the industry spent an average of $564 per acre for North Slope exploration rights. But shortly after the infamous Mukluk prospect came up dry in 1983 (a venture known in trade circles as the most expensive dry hole in history), lease revenues on the North Slope plummeted.**

- **Since 1990, the industry has paid, on average, $55 per leased acre. (Discoveries of new oil west of Prudhoe Bay during the 1990s did not alter this trend significantly; despite rising oil prices, between 2001 and 2005 the average bid price was $45 per leased acre.)**

Slide 4

(Rev.)

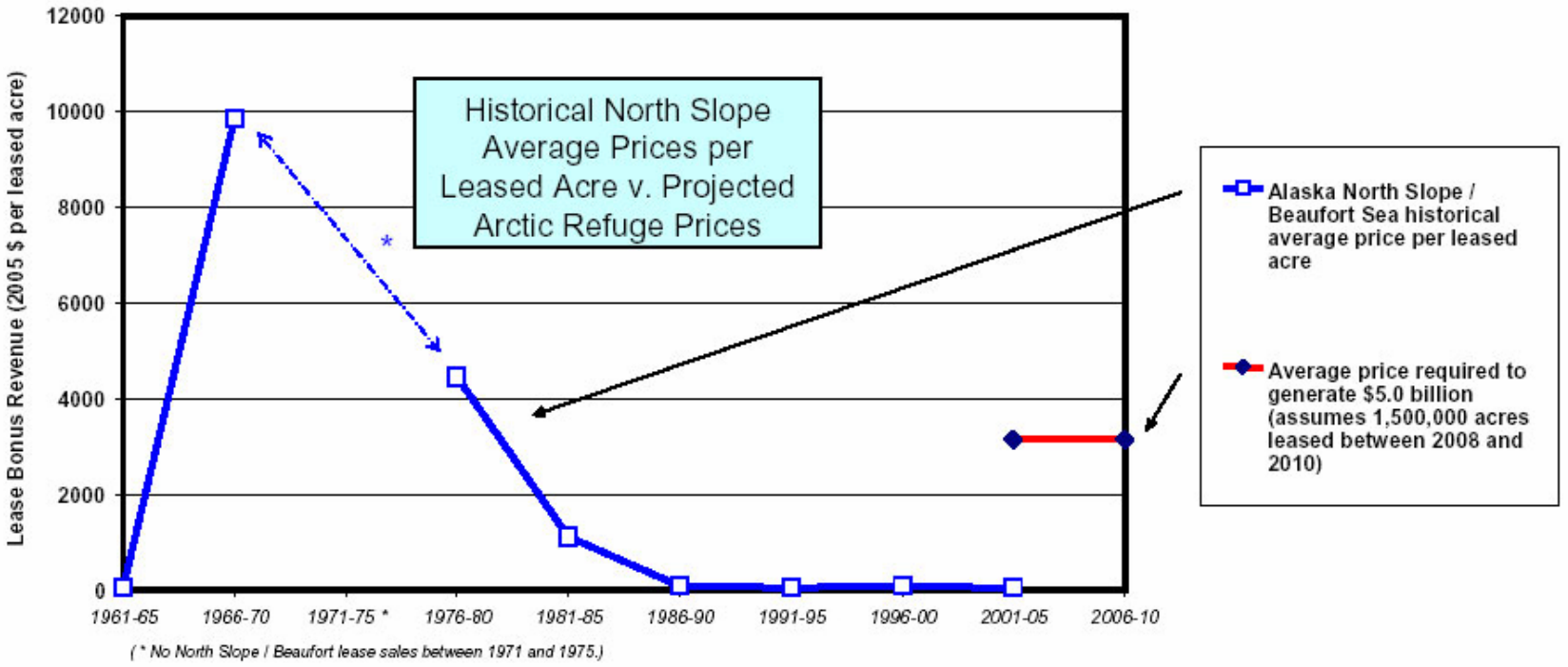
Alaska North Slope Petroleum Lease Revenues, 1961 - 2010

(Real [2005] $)

There is a significant disparity between the consistently low Alaska North Slope bonus bids during the last two decades (blue line on chart) and the amount that the Congressional Budget Office (CBO) anticipates companies will pay for exploration rights on the Arctic Refuge Coastal Plain (red bar at lower right).

CBO's estimate that Arctic Refuge leasing will contribute $2.5 billion to federal deficit reduction ignores factors that caused the steep decline in North Slope bidding during the 1980s and the subsequent pattern of significantly reduced Lease bonus bids. (See: Richard A. Fineberg, Projected Bonus Payments from Proposed Leasing on the Arctic Refuge Coastal Plain, Jan. 15, 2005 at http://www.finebergresearch.com.)

In March 2005, a federal lease sale just off the Arctic Refuge coast offered tracts with significant deposits of discovered oil. Despite high oil prices, to secure the rights to an estimated 200 million barrels of discovered oil, the industry was willing to spend approximately one-sixth the amount, per barrel, that CBO believes the industry will bid for the right to explore for undiscovered oil on the Arctic Refuge Coastal Plain.



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Bids for exploration and production rights on acreage with petroleum potential are based on the anticipated revenue that petroleum, if discovered, will bring in the future. Therefore, current high oil prices do not automatically translate into high lease bonus bids. In fact, the level of future lease bonus bidding may be even more difficult to predict than the uncertain price of oil.

It is one thing to discover oil and another to bring it to market at a profit. Although economies of scale and high oil prices in the late 1970's and the current decade have made Alaska's North Slope an inordinately profitable venture, the high costs of operating in the Arctic and transporting that oil to market have also stranded billions of barrels of discovered heavy oil and trillions of cubic feet of natural gas on Alaska's North Slope for decades.

Alaska is by no means the only petroleum province whose lease bonus bids have not risen with high oil prices.

- **Despite major oil discoveries and significant petroleum development in the Gulf of Mexico over the last four decades, lease bonus bids in that province have exhibited a pattern that is strikingly similar to that of the North Slope.**

The following chart displays the congruence between lease bonus bidding trends on the North Slope and the Gulf of Mexico.

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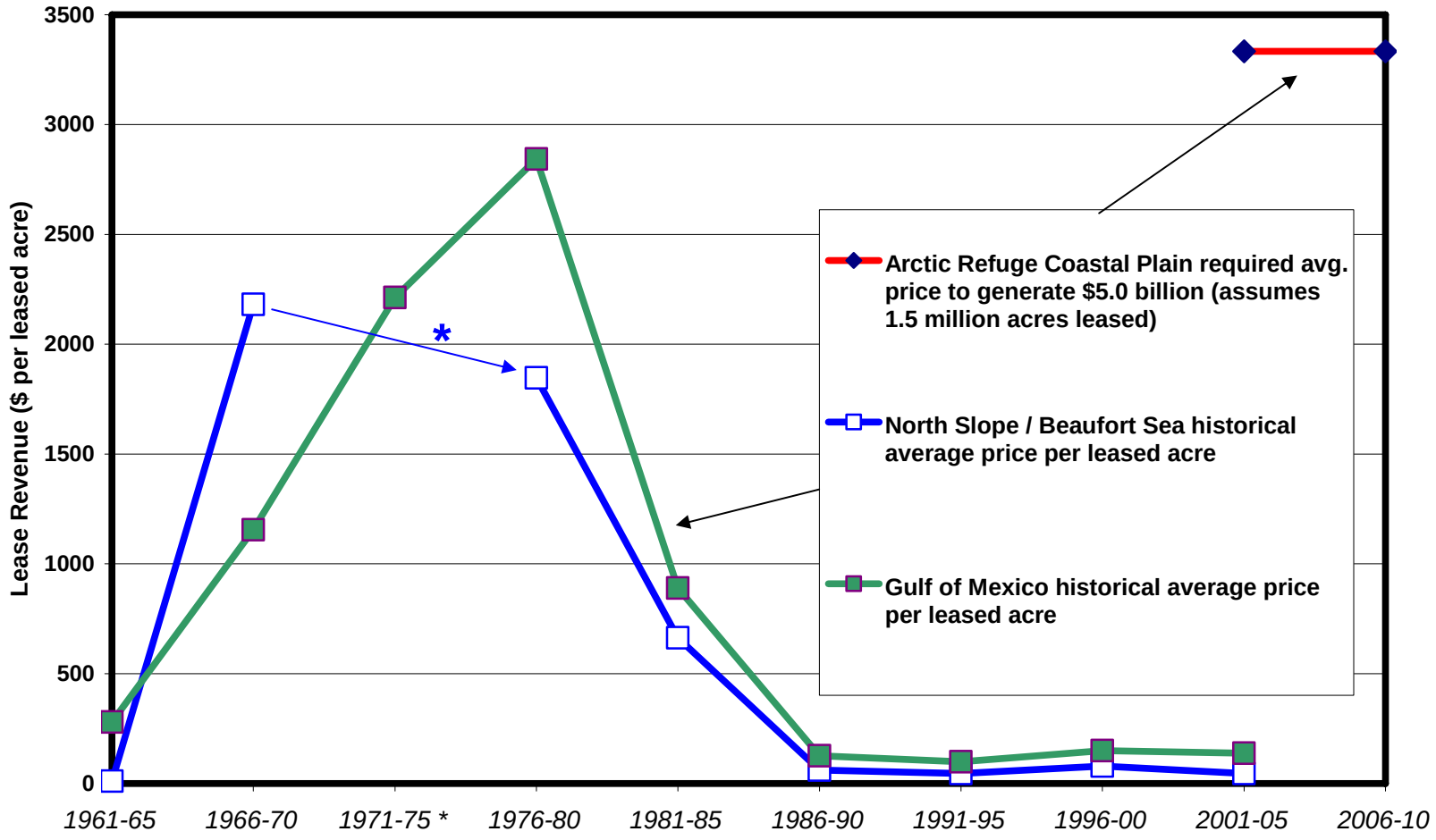
Alaska and Gulf of Mexico Lease Revenues, 1961 - 2010

(Nominal $)



** No North Slope / Beaufort lease sales during 1971-1975 period.*

Slide 7

From a national security perspective, it makes little sense to rely on exploration and development of the Arctic National Wildlife Refuge region as a central component of either a short or long-term national energy policy. To demonstrate this point, production from the Arctic Refuge region in the following chart is artificially elevated by the following assumptions: (1) early-year production can be accelerated under EIA's "high resource case" profile; (2) production from that region can be compressed into a 35-year window; and (3) oil prices will remain high enough to command production of every barrel of technically recoverable oil.

The following chart, developed from EIA projections through 2025, displays significant aspects of a troubling national energy picture:

- **This nation is on track to consume an estimated 475 billion barrels of oil between 2005 and 2050; more than 300 billion barrels of this amount (the growing blue swatch) will come from imports.**

- **Over this 45-year period, the mean technically recoverable volume of 10.4 billion barrels from the Arctic Refuge Coastal Plain region (the thin white sliver) represents, at most, approximately 3.3% of the shortfall between domestic production and likely consumption.**

- **Due to steadily increasing petroleum consumption, even under an unlikely development scenario that depicts annual Arctic Refuge region production rates far above those indicated by historical experience with North Slope reservoirs, this nation's total import requirement (and the percentage of petroleum that must come from imports) increases annually.**

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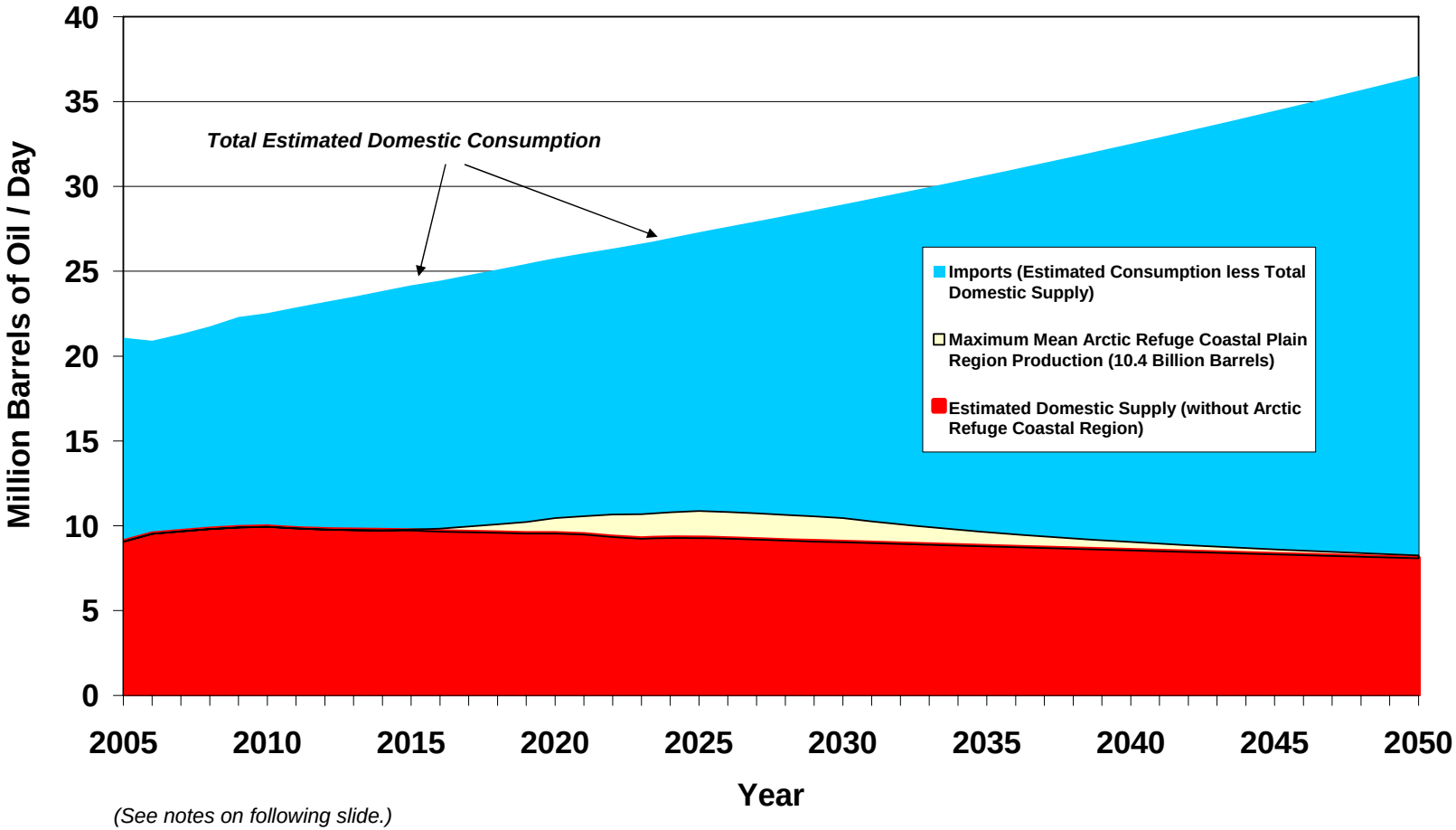
Estimated U.S. Imports, Domestic Supply and Potential Production from the Arctic National Wildlife Refuge Coastal Region, 2005-2050

(from AEO 2005 "Current Futures" [High Price] scenario and other EIA report data)



(See notes on following slide.)

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Estimated U.S. Imports, Domestic Supply and Potential Production from the Arctic Refuge Region (Selected Years)

	(Million barrels of oil / day)				
Year	***2010***	***2015***	***2020***	***2025***	***2050***
Arctic Refuge Development (Aggressive Test Scenario)	**0.00**	**0.06**	**0.91**	**1.59**	**0.17**
Total Domestic Oil Production (incl. Arctic Refuge region)	**9.94**	**9.78**	**10.45**	**10.87**	**8.25**
Total Domestic Oil Consumption	**22.54**	**24.17**	**25.76**	**27.30**	**36.51**
Net Crude + Product Imports	**12.60**	**14.39**	**15.31**	**16.43**	**28.26**
Imports as Percentage of Total Domestic Consumption	55.90%	59.54%	59.43%	60.18%	77.40%

Sources:

Production Profile for Arctic National Wildlife Refuge:

Accelerated production schedule created by Richard Fineberg, Research Associates; based on full production of U.S. Geological Survey mean estimate of technically recoverable oil (10.4 billion barrels), produced over a 35-year period. Annual production through 2027 equals first 13 years of production in EIA March 2004 high resource case (data provided by EIA), delayed two years in keeping with EIA July 2005 scenario, peaking,at 1.59 million barrels per day in 2025.

Total Domestic Oil Consumption:

2005-2025: Total Domestic Consumption from EIA, *Annual Energy Outlook 2005* , Table 11 (Current Futures Case).

2026-2050: Increased from 2025 at 1.12% p/a (2021-2025 EIA average).

Net Crude + Product Imports

2005-2025: From EIA, Annual Energy Outlook 2005, Table 11 (Current Futures Case); calculated as Total Domestic Oil Consumption less the sum of (Domestic Crude Production + Natural Gas Plant Liquids + Refinery Processing Gain + "Other Inputs").

2026-2050: Domestic supply decreasing 2.725% every 5 years (= 2021-2025 decline rate).

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Drilling advocates assert that oil from the Arctic Refuge could be available today if development had begun ten years ago.* They overlook this key point:

Aggressive conservation measures, implemented ten years ago (or now) would:

- **produce more immediate results; and**
- **reduce reliance on imported crude oil more than ten-fold, compared to Arctic Refuge development. ****

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** See, for example, the recent statement of Alaska Senator Lisa Murkowski:: "And we must remember that had ANWR production been authorized 10 years ago, we would have another source for domestic energy online." ("Examining the Price of Gas. . ." [eNews from Senator Lisa Murkowski, Sept. 9, 2005]).*

*** See following slides.*

Slide 11

Potential energy savings from oil conservation far exceed the potential gains from exploring and developing the Arctic Refuge region. Moreover, these benefits can be realized much more quickly. In September's Scientific American, Amory Lovins writes:

- **"[F]ull adoption of efficient vehicles, buildings and industries could shrink projected U.S. oil use in 2025 – 28 million barrels a day – by more than half, lowering consumption to pre-1970 levels." [1]**

- **Investment in conservation actually saves money, making this nation's economic goods more competitive, because "saving each barrel of oil through efficiency improvements costs only $12, less than one fifth of what petroleum sells for today."[2]**

(These gains, all limited to petroleum, do not include investment in alternative technologies, such as wind and solar.)

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[1] Amory Lovins, "More profit with Less Carbon: "More Profit withg Less Carbon: Focusing on energy efficiency will do more than protect the Earth's climate – It will make businesses and consumers richer,"," *Scientific American*, September 2005, p. 78.

[2] "More Profit with Less Carbon," pp. 74, 78.

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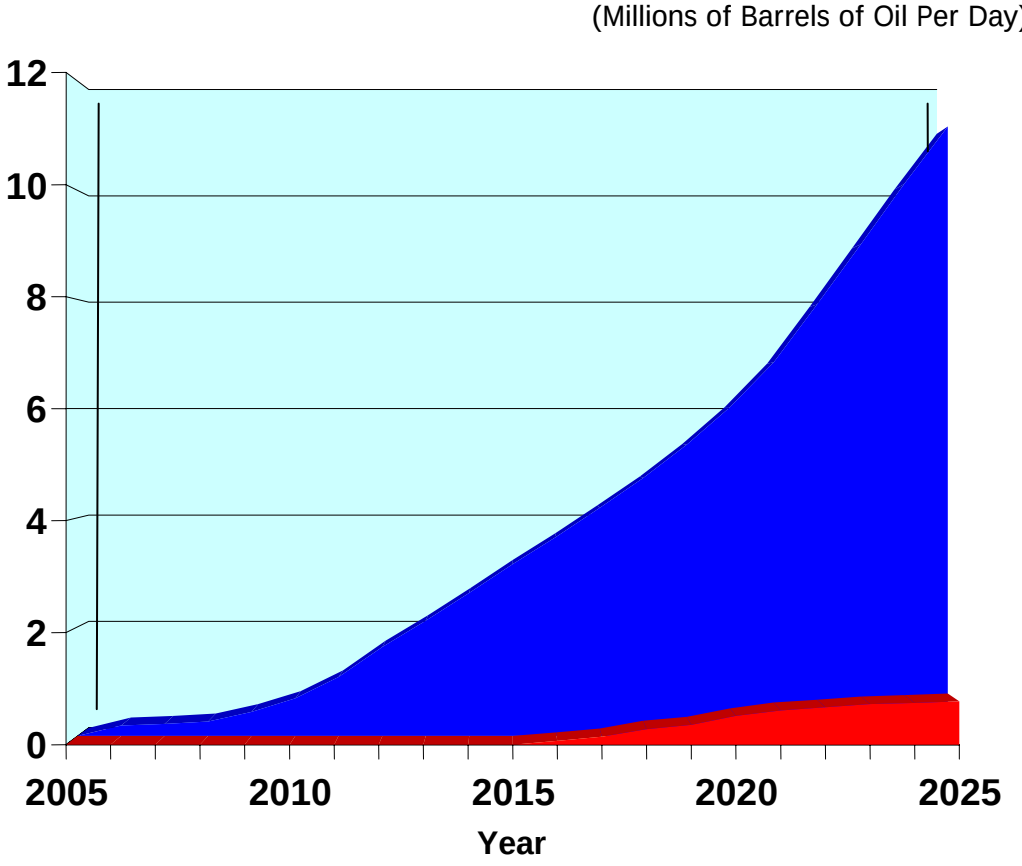
Savings from Oil Conservation Investment v. Arctic Refuge Drilling



Potential Savings from Oil Conservation Investment *

Potential Arctic Refuge Production

*(* See following slide.)*

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Savings from Oil Conservation Investment v. Arctic Refuge Drilling, 2010 - 2025 (Selected Years)

(Million barrels of oil / day)

Measure	*Year*	*2010*	*2015*	*2020*	*2025*
Arctic Refuge Development		**0.00**	**0.00**	**0.51**	**0.78**
Oil Conservation Investment Savings		**0.69**	**3.15**	**6.03**	**11.17**
Gain (Oil Conservation Investment v. Arctic Refuge Development)		0.69	3.15	5.52	10.39
Oil Conservation Measures (Subtotals)					
Savings Item	*Notes*				
New passenger vehicle fuel efficiency	Start 2008; 40 mpg by 2015; 55 mpg by 20205	0.27	1.65	3.33	4.89
Orig. Equipment Replacement Tires	Ramp 2011-2014 (3/4 of vehicles)	0.00	0.36	0.39	0.42
Synthetic Motor Oil	Ramp 2011-2012 (fuel gains only)	0.00	0.12	0.13	0.14
Convert farm vehicles to renewable fuels	(1bgy by 2015)	0.21	0.28	0.87	3.92
Long-Haul Trailer Trucks	61% FE gain, start 2008, 10 years	0.06	0.25	0.48	0.71
Other Trucks (total)		0.03	0.13	0.22	0.29
Truck Idle Reduction	Ramp 2009-2012	0.03	0.07	0.07	0.08
Industrial Process Heating	Start 2009; 14.6% by 2020	0.01	0.04	0.07	0.09
Displace Petrochem. Feedstocks	Start 2009; 13% by 2020	0.03	0.11	0.18	0.26
Air Traffic Management	Start 2008; 5% by 2020	0.02	0.07	0.13	0.14
Residential Savings	Oil heated homes; start 2009	0.02	0.09	0.16	0.23

Sources:

Production Profile for Arctic National Wildlife Refuge

Richard Fineberg, Research Associates; based on U.S. Geological Survey and Alaska Dept. of Revenue data (production 2016 thru 2065; scenario produces 7.3 billion barrels thru 2065, peaks at 0.788 million bpd in 2026-2027)

Oil Conservation Investment Savings

Ann Bordensky, Roland Hwang, Deron Lovaas and Luke Tonachel (Natural Resources Defense Council) and Anne Korin (Institute for the Analysis of Global Security *Securing America: Solving Our Dependence Through Innovation*, March 2005 (NRDC Issue Paper)

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In addition to the existing, off-the-shelf technology that could produce more than 10 times the Arctic Refuge region's production at its peak:

- **Additional vehicle efficiency gains can be achieved immediately.**

- **These gains require little or no investment and can be realized in the course of routine vehicle maintenance and operations.**

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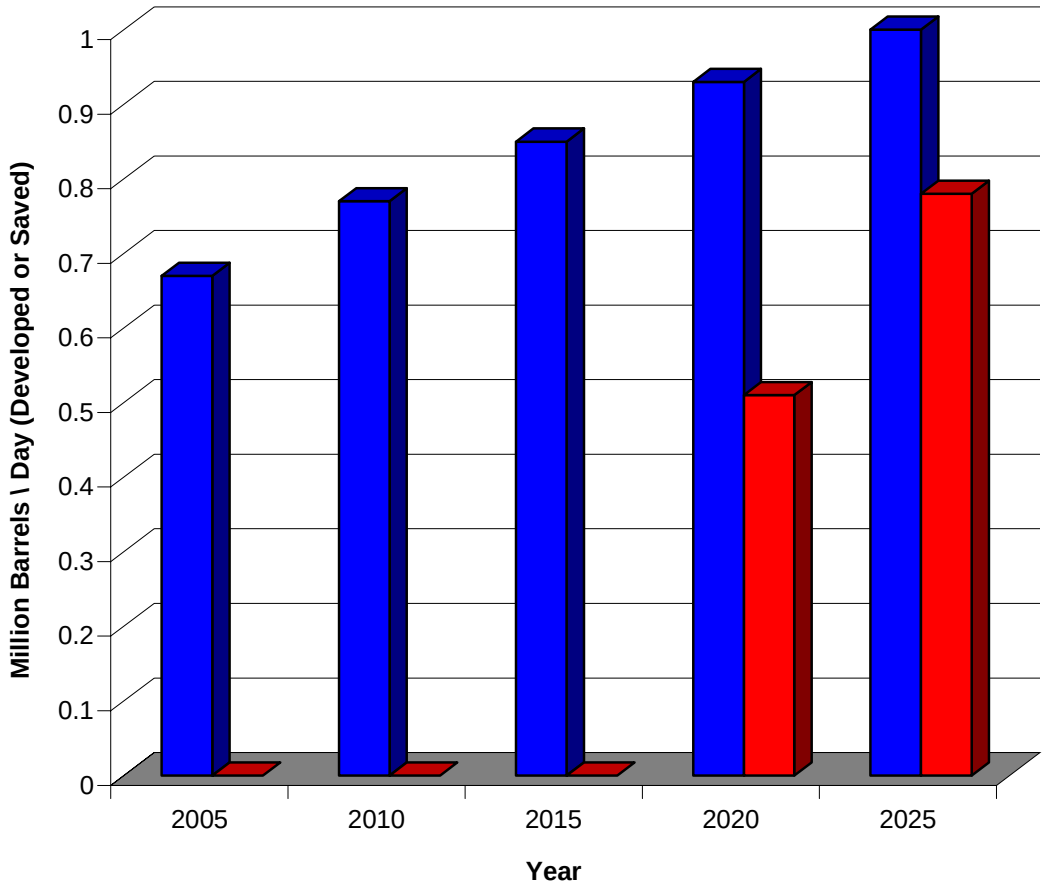
Immediate Petroleum Gain from Light Vehicle Maintenance, Operation v. Arctic Refuge Development

(Million Barrels / Day)



** Oil savings through increased tire pressure, reduced speed, reduced idling, car-pooling and engine tuning measures.*

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Immediate Light Vehiclel Oil Conservation Savings v. Arctic Refuge Drilling, 2010 - 2025 (Selected Years)

(Million barrels of oil / day)

Measure	*Year*	*2005*	*2010*	*2015*	*20*
Arctic Refuge Development		**0.00**	**0.00**	**0.00**	**0.**
Immediate Light Vehicle Oil Conservation Savings		0.67	0.77	0.85	0.
Gain (Immediate light vehicle conservation measures v. Arctic Refuge Development)		**0.67**	**0.77**	**0.85**	**0.**
Light Vehicle Gasoline Consumption		9.51	10.95	12.21	13.
Immediate Light Vehicle Oil Conservation Savings Measures					
Savings Item	*Comments*				
Check Tire Pressure					
% reduction	Estimated that more than 1/4 of all car and	2%	2%	2%	2
Oil Savings	1/3 of SUV tires are > 25% underinflated	0.19	0.22	0.24	0.
Enforce Speed Limits					
% reduction	Gain from holding drivers to 65 mph	2%	2%	2%	2
Oil Savings	(would also save lives)	0.19	0.22	0.24	0.
Turn Off Engine When In Line Idling					
% reduction	Turning off engine if idling more than 30	1%	1%	1%	1
Oil Savings	seconds could save 4.0 mil. Gpd	0.10	0.11	0.12	0.
Carpooling					
% reduction	Conservatively estimated	1%	1%	1%	1
Oil Savings		0.10	0.11	0.12	0.
Engine Tuning (replace oxygen sensors, etc.)					
% reduction	EPA estimates tuning measures could improve	1%	1%	1%	1
Oil Savings	gas mileage by 4% to 40%	0.10	0.11	0.12	0.
Total Immediate Light Vehicle Oil Conservation Savings Measures		0.67	0.77	0.85	0.

Sources:

Production Profile for Arctic National Wildlife Refuge:

Richard Fineberg, Research Associates; based on U.S. Geological Survey and Alaska Dept. of Revenue data (production 2016 thru 2065;scenario produces 7.3 billion barrels thru 2065 peaks at 0.788 million bpd in 2026-2027).

Immediate Light Vehicle Oil Conservation Measures:

Information from Luke Tonachel and Dan Lashof, Natural Resources Defense Council (NRDC), based on: U.S. Dept. of Energy and Environmental Protection Agency, "Keeping Your Ca (http://www.fueleconomy.gov/feg/maintain.shtml; accessed Sept. 6, 2005), Internationall Energy Agency, *Saving Oil in a Hurry* (2005; Executive Summary accessed Sept. 6, 2005 at http://www.iea.org/textbase/npsum/SavingOilSUM.pdf); and Ann Bordensky, Roland Hwang, Deron Lovaas and Luke Tonachel (NRDC) and (NRDC) and Anne Korin (Institute for the Analysis of Global Security), *Securing America: Solving Our Dependence Through Innovation* , March 2005 (NRDC Issue Paper).

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Since 2000, the U.S. Energy Information Administration (EIA) has outlined possible economic outcomes of petroleum development in the Arctic Refuge region in four reports to Congress.[3] EIA begins with geologic data developed and reported by the U.S. Geological Survey in 1998. According to USGS economists, that agency's three-year study "precluded accumulations as large as the Prudhoe Bay field," focusing instead on the potential of production from a combination of smaller – and therefore less economically attractive – fields that might be discovered on the Arctic Refuge Coastal Plain.[4] Although EIA and USGS estimate the mean amount of oil technically recoverable from the Arctic Refuge region to be 10.4 billion barrels, drilling advocates frequently claim that the region could produce 16 billion barrels – an amount they equate to 30 years of imports from Saudi Arabia.

This comparison is somewhat strained for two reasons:

- **USGS assigns a one in twenty probability to this scenario.**
- **Because this nation's demand for oil continues to increases while total domestic supply decreases, that widening gap will increase the demand for imports, increasing the need for Saudi imports, with or without Arctic Refuge development.**

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[3] U.S. Energy Information Agency, *Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment*, May 23, 2000 (Report # SR/O&G/2000-02); *The Effects of the Alaska Oil and Gas Provisions of H.R. 4 and S. 1766 on U.S. Energy Markets*, February 2002 (Report # SR/OIAF/2002-2); *Analysis of Oil and Gas Production in the Arctic National Wildlife Refuge*, March 2004 (Report # SR/OIAF/2004-4); *Impacts of the Modeled Provisions of H.R. 6 EH: The Energy Policy Act of 2005*, July 2005 (Report # SR/OIAF/2005-4).

[4] Emil Attanasi and J.H. Schuenemeyer, "Frontier areas and resource assessment: Case of the 1002 area of the Alaska North Slope" U.S.G.S. Open File Report 02-119, circa 1999, p. 10.

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Because assessing potential production from the Arctic Refuge region is an exercise in uncertainty, perhaps it is not surprising that analysts differ in their assessment of production potential from the Arctic Refuge region. Nevertheless, it is noteworthy that EIA estimates (1) larger fields and (2) higher early year production volumes, relative to the size of potential fields, than would seem to be justified by experience with North Slope reservoir.[5] These assumptions have public policy consequences. For example, inflated field sizes and accelerated production would tend to exaggerate economic effects and obscure environmental consequences of development.[6]

Under almost any conceivable development scenario, the number of separate fields that would have to be developed on the Arctic Refuge Coastal Plain to achieve production of the 10.4 billion barrel technically recoverable mean estimate posited by USGS and EIA:

- **is incompatible with the 2,000-acre requirements in H.R. 6;**
- **renders statements by development advocates that the Arctic Refuge region could produce 10.4 billion barrels of oil from an area the size of Dulles International Airport (approximately 2,000 acres) misleading, if not patently false.**

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[5] Contact the author for correspondence and additional information about the extended colloquy on which these conclusions are based.

[6] *To achieve production of the 10.4 billion barrel technically recoverable mean estimate for the Arctic Refuge Coastal Plain region posited by USGS, EIA assumes that "the largest projected field in ANWR is nearly 1.4 billion barrels. . . . this would be larger than any new field brought into production in decades. Subsequent fields are expected to be considerably smaller, with two additional fields with 700 million barrels of oil, five additional fields each with 340 million barrels of oil, and a large number of smaller fields."[6] Even if one grants that the field sizes are consistent with geological data and North Slope experience (and I do not), to produce 10.4 billion barrels of oil from the Arctic Refuge Coastal Plain region under this scenario would require approximately 20 additional fields of 300 million barrels each (1.4 + [0.7*2]+ .[0.34*5] + [0.3*20] = 10.5 billion barrels). In all, therefore, EIA estimates that to recover this quantity of oil would require discovery and development of approximately 28 separate petroleum reservoirs or fields.*

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Alaska's North Slope holds vast quantities of discovered and undiscovered oil and gas outside the Arctic Refuge region. Much of this potential oil lies closer to the Trans-Alaska Pipeline System than the Arctic Refuge, giving these potential resources an economic advantage over the undiscovered resources of the Arctic Refuge.

- **The Alaska Department of Revenue estimates that between 2006 and 2040 discovered and currently producing fields near Prudhoe Bay will produce more than 6.0 billion barrels of oil for shipment through the Trans-Alaska Pipeline System.[7]**
- **In addition, the U.S. Geological Survey (USGS) estimates that northern Alaska provinces outside the Arctic Refuge region hold large volumes of undiscovered onshore oil and gas. For example, USGS estimates that the mean technically recoverable volume of oil in two assessment areas west and south of the Arctic Refuge region – NPRA and the Central North Slope region – is 13.8 billion barrels.[8] This figure is nearly 33 percent greater than the agency's comparable estimate of Arctic Refuge region oil production potential.**
- **Together, these discovered and undiscovered resources constitute nearly twice the USGS estimate of technically recoverable oil that may lie beneath the Arctic Refuge Coastal Plain and state near-shore waters.[9]**

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[7] Alaska Department of Revenue, unpublished forecast data, December 2004.

[8] U.S. Geological Survey, *2002 Petroleum Resource Assessment of the National Petroleum Reserve in Alaska (NPRA*), 2002 (9.3 billion barrels); and *Oil and Gas Assessment of Central North Slope, Alaska, 2005* (4.5 billion barrels [including Natural Gas Liquids]).

[9] These figures represent conventional oil only and do not include approximately 90 percent of the discovered heavy oil deposits of the Prudhoe Bay region, other Alaska onshore and off-shore petroleum basins, discovered natural gas deposits of more than 35 trillion cubic feet (TCF), plus the estimated mean technically recoverable volume of undiscovered natural gas in NPRA and the Central North Slope region that total more than 97 TCF.

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A final note:

- **Even with its optimistic estimate of production from the Arctic Refuge region, EIA estimates that in 2025 development of the Arctic Refuge region will lower gasoline prices by less than $0.01 per gallon at the pump.** [10]

[10] U.S. Energy Information Agency, *Impacts of the Modeled Provisions of H.R. 6 EH: The Energy Policy Act of 2005*, July 2005 (Report # SR/OIAF/2005-4), pp. 11, 41.