### The Supply of Oil Projections to 2035

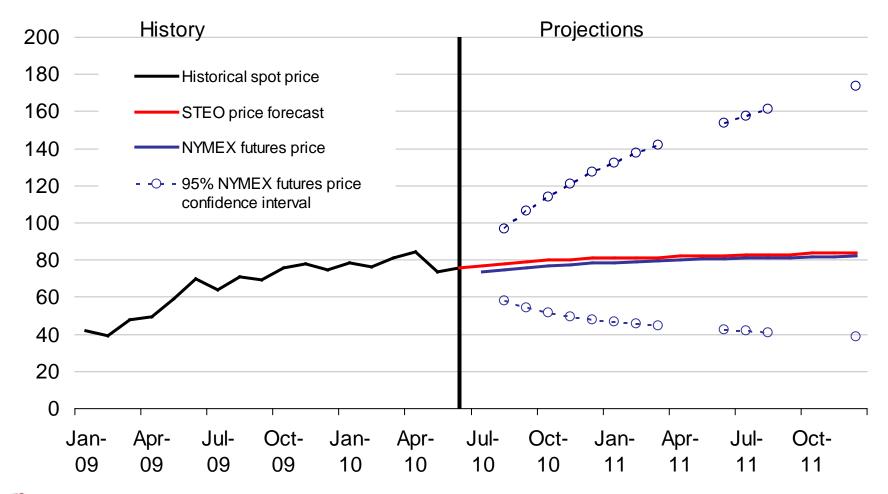
Oil and the Macroeconomy in a Changing World Federal Reserve Bank of Boston June 9, 2010 Boston, MA

Howard Gruenspecht, Deputy Administrator



## Near-term oil price uncertainty reflects uncertain demand, supply risks, and financial market influences

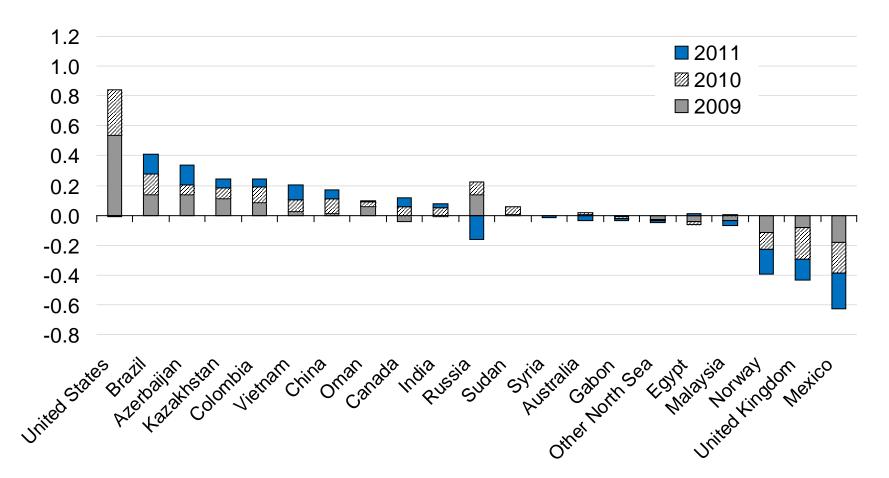
light, sweet crude oil price dollars per barrel





### In the near term, non-OPEC supply increases exceed declines

change from previous year million barrels per day





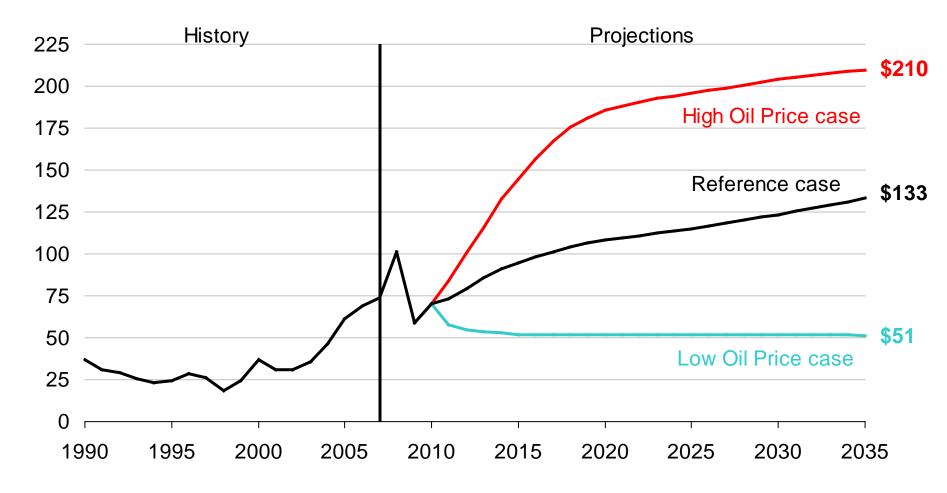
#### Main points on long-run liquids supply

- Investment and production decisions of key OPEC countries, which reflect both economic and non-economic considerations, are the single most important driver of EIA's alternative supply cases
- Unconventional liquids can be a significant source of supply growth over the next 25 years, but conventional sources remain dominant in the overall supply mix
- The limited response of non-OPEC conventional supply to higher prices and robust growth in demand for liquids outside the OECD suggest that an upward trend in real oil prices is sustainable
- Liquids supply and conventional crude supply <u>could</u> move in opposite directions in a high price scenario
- EIA does not project a resource-driven peak in total or conventional liquids supply over the next 25 years



## The *IEO* reflects long-term uncertainty using a wide set of price cases, each with its own supply scenario

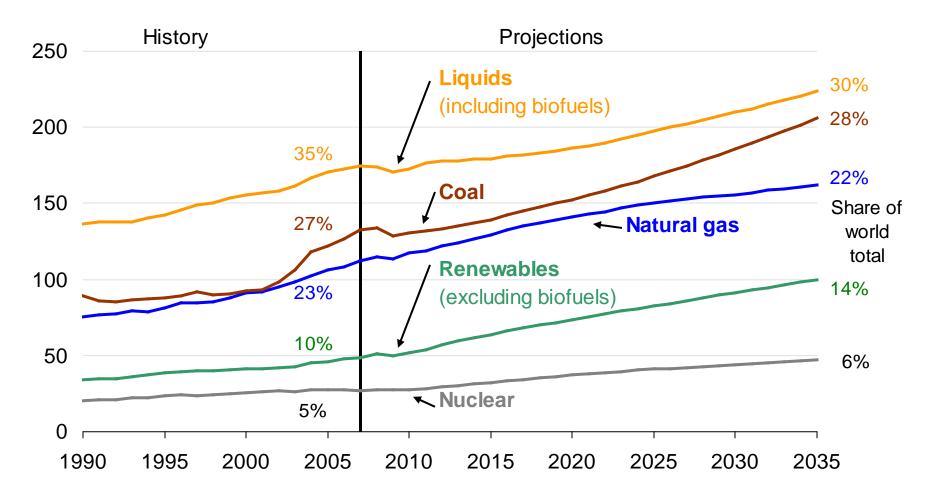
light, sweet crude oil price 2008 dollars per barrel





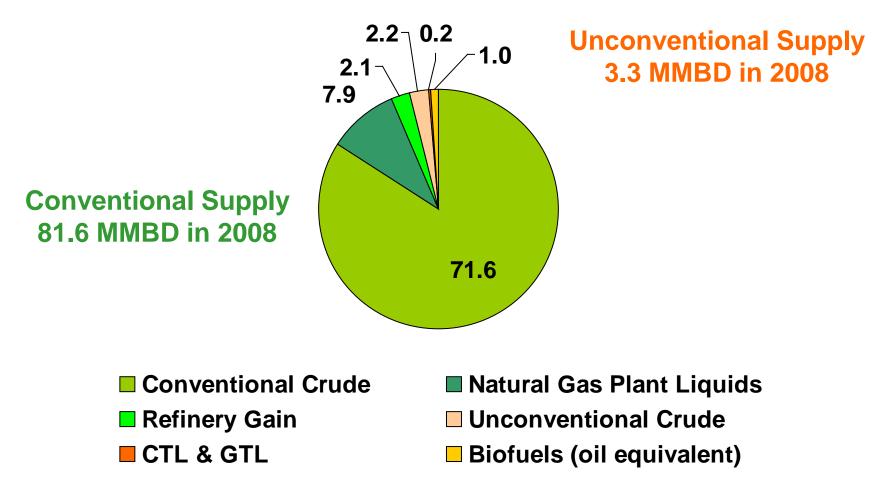
#### Liquids remain the largest part of world energy supply in the IEO2010 Reference case, although their share of the total energy use declines

world primary energy consumption quadrillion Btu





#### Liquid fuels are more than just conventional crude oil





## However, many alternatives to "easy" conventional oil face significant challenges

- Limited compatibility with existing fueling infrastructure and vehicles and limited scalability (current biofuels)
- Technology and cost challenges (advanced biofuels, CTL)
- Energy used in transformation (biofuels, GTL)
- Long gestation period for expensive projects in an uncertain price environment that adds to risk (oil sands, CTL, GTL)
- Future direction of environmental policy (CTL, oil sands)

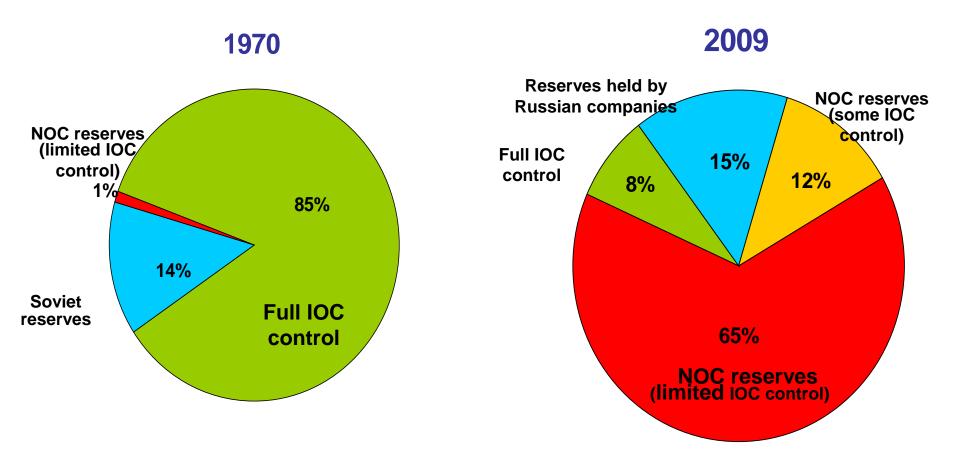


#### Long-term world supply scenarios for liquid fuels are driven by four fundamental factors

- Global liquids demand
  - sensitive to prices (unlike short-term demand), economic growth, demand policy decisions (e.g. fuel economy standards), and technology developments
- OPEC investment and production decisions
- Non-OPEC conventional liquids supply
- Unconventional liquids supply economics



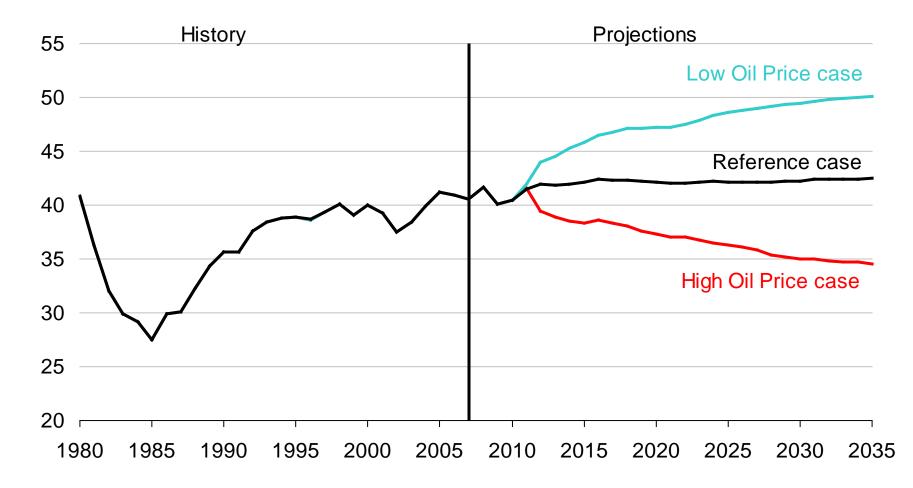
### Capital and operating decisions made by national oil companies (NOCs) will largely determine the level of future oil production



Source: PFC Energy; BP Statistical Review; Oil and Gas Journal

## OPEC behavior, reflected in its share of the global liquids market, is a driving assumption in each IEO supply case

OPEC share of liquids market percent





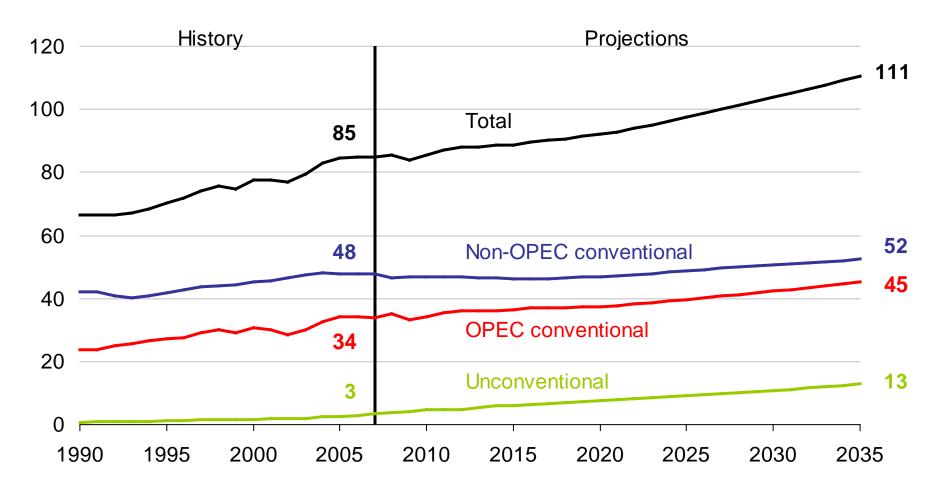
### The three oil supply scenarios in IEO2010 reflect different assumed OPEC decisions and non-OPEC investment environments

- Reference case
  - OPEC maintains approximately 40 percent of the global liquids market through 2035.
  - Non-OPEC resource rich nations continue current economic access restrictions in the mid-term, but trend towards more open market and investment practices post 2015.
  - Unconventional liquids grow in response to price increases
- High Oil Price case
  - OPEC progressively decreases its targeted share of the global liquids market, reaching about 35 percent in 2035.
  - Non-OPEC resource rich nations tighten economic access restriction, lowering foreign investment in their resources and reducing production potential.
  - Unconventional liquids grow in response to price increases
- Low Oil Price case
  - OPEC allows production to rise to about 50 percent of the global liquids market in 2035.
  - Non-OPEC resource rich nations quickly progress towards more a open market and investor friendly environment post 2015.
  - Unconventional liquids have lower economic viability



# OPEC producers maintain an approximate 40% share of total liquids production in the Reference case

liquids production million barrel per day





#### Adjustment in the global liquid fuels market: then and now

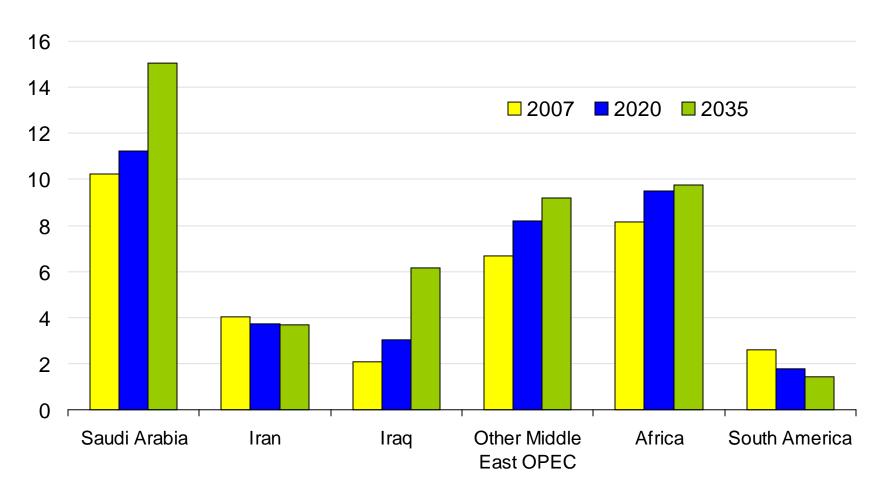
	1973 – 1985 Actual	2003 – 2015 IEO Ref Case
World Liquids Demand	+ 2	+ 9
OECD	- 4	- 2
Non-OECD	+ 6	+ 11
Non-OPEC Conventional Supply	+ 13	- 1
Unconventional Supply	≈ 0	+ 4
<b>OPEC Conventional Production</b>	- 14	+ 6

- In today's market, non-OECD countries drive projected growth in world liquids demand
- The projected non-OPEC supply response is much smaller than that during the 1970s and 1980s.



#### Growth in OPEC production of conventional liquids in the Reference case comes primarily from Saudi Arabia and Iraq

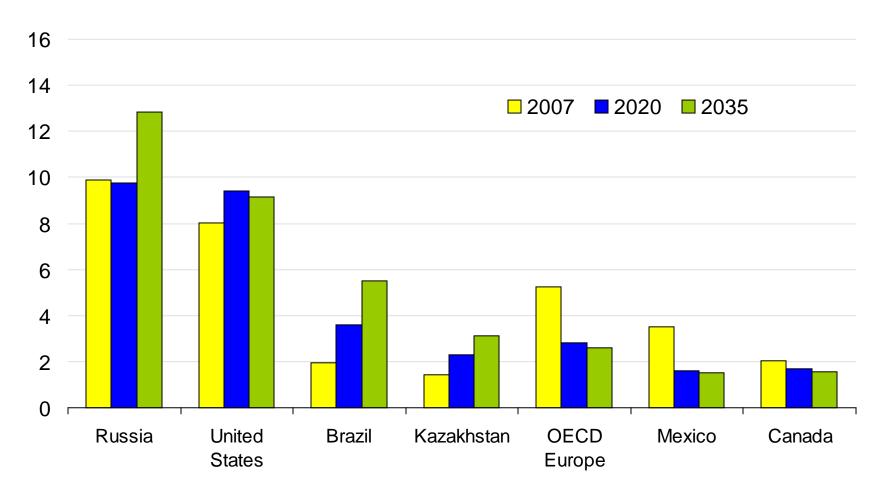
conventional liquids production million barrels per day





#### Brazil, Russia, Kazakhstan, and U.S. lead increases in non-OPEC conventional supplies in the IEO Reference Case

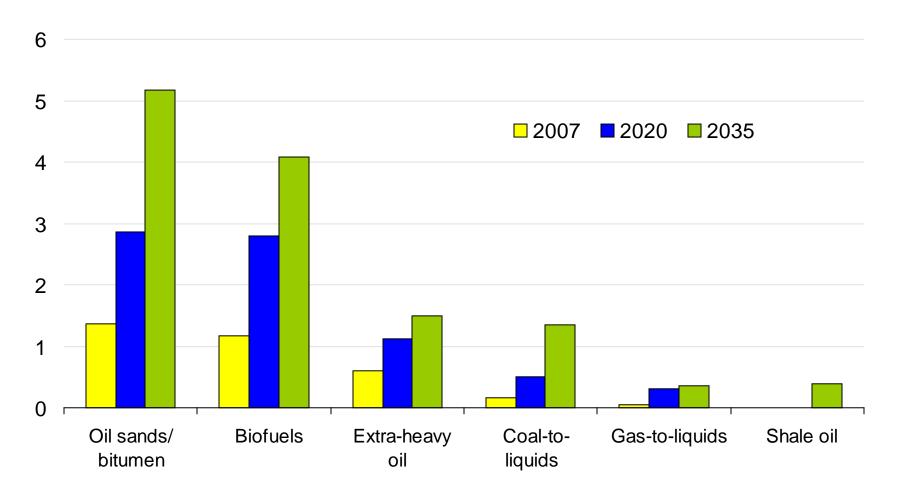
conventional liquids production million barrels per day





### Oil sands in Canada and biofuels account for 70% of the increase in total unconventional liquids in the IEO Reference Case

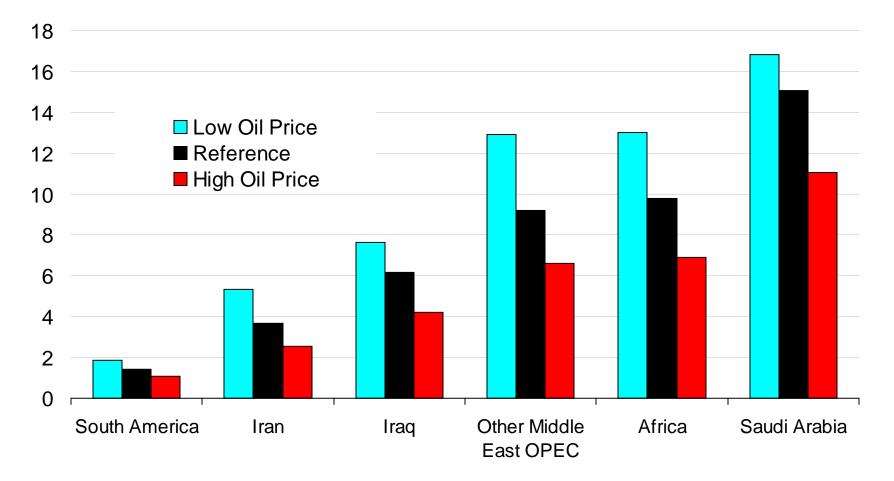
unconventional liquids production million barrels per day





#### OPEC members' conventional production varies depending on assumed OPEC market share objective

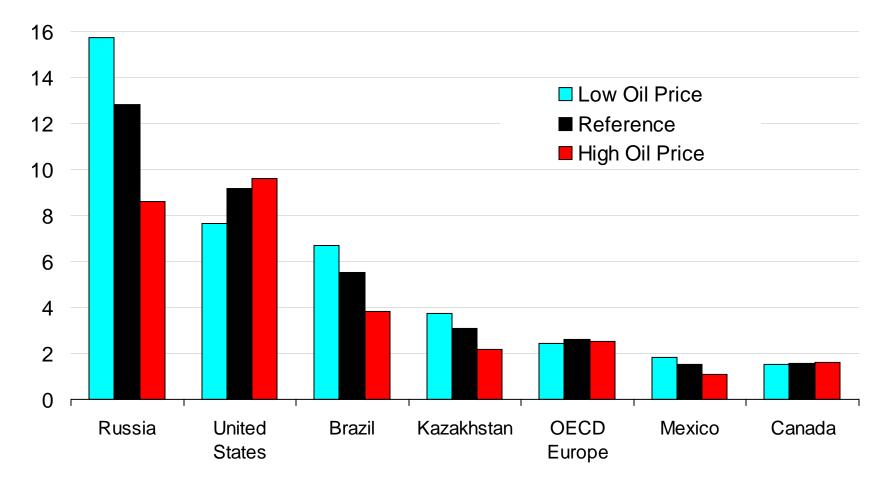
conventional liquids production in 2035 million barrels per day





## Leading growth areas in non-OPEC conventional supply respond differently to assumption changes between cases

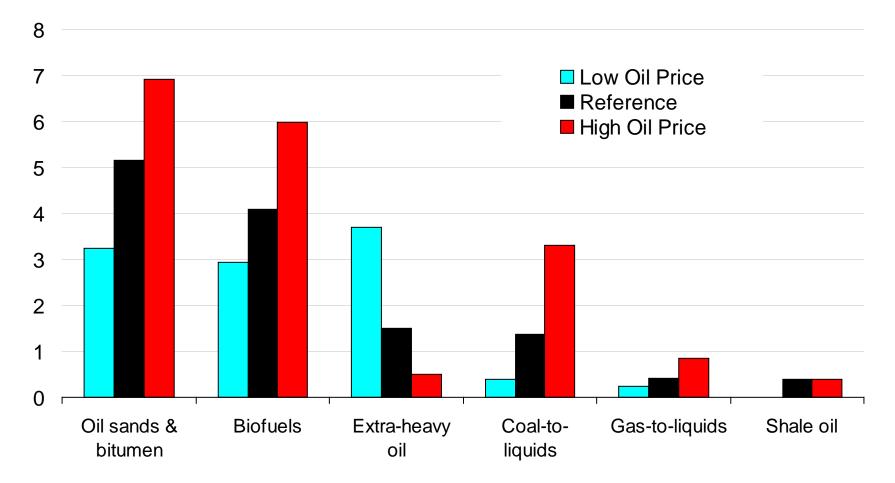
conventional liquids production in 2035 million barrels per day





# Production from unconventional sources varies widely depending on both prices and investor access

unconventional liquids production in 2035 million barrels per day





#### World Supply Summary: IEO2010 Reference case

World total liquids (million barrels per day of physical volumes)

				Changes		Avg Annual % change
	2008	2020	2035	'08-'20	'08-'35	'08-'35
Crude & lease condensate	71.6	71.5	82.4	-0.1	10.9	0.5
NGPL	7.9	10.8	12.6	2.8	4.6	1.7
Refinery gain	2.1	2.3	2.7	0.2	0.6	0.9
OPEC conventional subtotal	35.0	37.5	45.3	2.5	10.3	1.0
Non-OPEC conventional subtotal	46.6	47.0	52.5	0.4	5.8	0.4
Oil sands	1.5	2.9	5.2	1.5	3.6	4.6
Extra-heavy crude oil	0.7	1.1	1.5	0.5	0.8	3.1
Shale oil	0.0	0.0	0.4	0.0	0.4	16.3
Biofuels (physical volumes)	1.5	2.8	4.1	1.3	2.6	3.7
Coal-to-liquids	0.2	0.5	1.4	0.3	1.2	8.2
Gas-to-liquids	0.1	0.3	0.4	0.3	0.3	7.6
OPEC unconventional subtotal	0.7	1.3	1.7	0.7	1.0	3.6
Non-OPEC unconventional subtotal	3.3	6.3	11.2	3.0	7.9	4.7
OPEC total liquids	35.6	38.8	47.0	3.2	11.3	1.0
Non-OPEC total liquids	49.9	53.3	63.6	3.4	13.7	0.9
OPEC Market Share (%)	42%	42%	42%			



Howard Gruenspecht, FRB Boston, June 9, 2010

Source: EIA, International Energy Outlook 2010 21

#### World Supply Summary: Differences Across Side Cases

#### World liquids supplies in three oil price cases (million barrels per day)

	2008		2020		2035					
		Low Price Case	Ref Case	High Price Case	Low Price Case	Ref Case	High Price Case			
Conventional production	81.6	93.1	84.5	72.3	112.2	97.7	77.6			
OPEC	35.0	44.9	37.5	30.0	57.6	45.3	32.4			
Non-OPEC	46.6	48.2	47.0	42.3	54.6	52.5	45.2			
Unconventional production	3.9	7.2	7.6	9.8	10.5	12.9	17.9			
OPEC	0.7	2.5	1.3	0.6	3.9	1.7	0.6			
Non-OPEC	3.3	4.7	6.3	9.2	6.6	11.2	17.3			
Total liquids production	85.5	100.2	92.1	82.1	122.7	110.6	95.5			
of which crude and lease condensate	71.6	80.4	71.5	56.7	97.4	82.4	63.2			



#### For more information

U.S. Energy Information Administration home page

Short-Term Energy Outlook

Annual Energy Outlook

www.eia.gov/emeu/steo/pub/contents.html

www.eia.gov/oiaf/aeo/index.html

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International Energy Outlook

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National Energy Information Center (202) 586-8800 Live expert from 9:00 AM – 5:00 p.m. EST Monday – Friday (excluding Federal holidays) email: InfoCtr@eia.doe.gov



### **Back-up slides**



#### **OPEC Supply Summary: IEO2010 Reference case**

OPEC Total Liquids (million barrels per day of physical volumes)

									Average Annual
	2008	2015	2020	2025	2030	2035 08-'20		08-'35	% Chg 08-'35
Crude & Lease Condensate	31.8	31.9	32.3	34.2	36.8	39.7	0.5	7.9	
NGPL	3.1	4.4	5.1	5.4	5.4	5.5	2.0	2.4	
Refinery Gain	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	
Conventional Subtotal	35.0	36.4	37.5	39.7	42.3	45.3	2.5	10.3	
Oil Sands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Extra-Heavy Crude Oil	0.7	0.8	1.1	1.2	1.3	1.4	0.4	0.8	3.0
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Biofuels (physical volumes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Gas-to-Liquids	0.0	0.2	0.2	0.3	0.3	0.3	0.2	0.3	
Unconventional Subtotal	0.7	1.0	1.3	1.4	1.6	1.7	0.7	1.0	3.6
Total Liquids	35.6	37.4	38.8	41.2	43.9	47.0	3.2	11.3	1.0
Non-OPEC Total Liquids Supplies	(million barre	els per day o	of physical v	olumes)					
Crude & Lease Condensate	39.7	38.8	39.1	40.4	41.7	42.7	-0.6	3.0	0.3
NGPL	4.8	5.2	5.7	6.1	6.6	7.1	0.9	2.2	1.4
Refinery Gain	2.1	2.2	2.2	2.3	2.5	2.7	0.2	0.6	0.9
Conventional Subtotal	46.6	46.2	47.0	48.8	50.8	52.5	0.4	5.8	0.4
Oil Sands	1.5	2.4	2.9	3.5	4.2	5.2	1.4	3.6	4.6
Extra-Heavy Crude Oil	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	8.5
Shale Oil	0.0	0.0	0.0	0.1	0.2	0.4	0.0	0.4	16.3
Biofuels (physical volumes)	1.5	2.4	2.8	3.2	3.5	4.1	1.3	2.6	3.7
Coal-to-Liquids	0.2	0.3	0.5	0.8	1.1	1.4	0.3	1.2	8.2
Gas-to-Liquids	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	4.4
Unconventional Subtotal	3.3	5.2	6.3	7.7	9.2	11.2	3.1	8.0	4.7
Total Liquids	49.9	51.3	53.3	56.5	60.0	63.6	3.5	13.8	0.9



Average Annual

#### **OPEC Supply Summary: IEO2010 High Price case**

OPEC Total Liquids (million barrels per day of physical volumes)

	2008	2015	2020	2025	2030	2035 08-	.'20 08	-'35	Average Annual % Chg 08-'35
Crude & Lease Condensate	31.8	26.9	24.9	25.1	25.7	27.0	-6.9	-4.9	-0.6
NGPL	3.1	4.5	5.1	5.3	5.3	5.4	2.0	2.3	2.1
Refinery Gain	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5
Conventional Subtotal	35.0	31.4	30.0	30.5	31.0	32.4	-5.0	-2.6	-0.3
Oil Sands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Extra-Heavy Crude Oil	0.7	0.4	0.4	0.4	0.4	0.4	-0.2	-0.2	-1.7
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Biofuels (physical volumes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Gas-to-Liquids	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	15.3
Unconventional Subtot	0.7	0.6	0.6	0.6	0.6	0.6	0.0	0.0	-0.1
Total Liquids	35.6	32.0	30.6	31.1	31.7	33.0	-5.0	-2.6	-0.3
Non-OPEC Total Liquids Supplies (m	illion barrel	s per day of	f physical vo	olumes)					
Crude & Lease Condensate	39.7	37.8	34.8	34.6	35.4	36.2	-4.9	-3.5	-0.3
NGPL	4.8	5.2	5.6	6.0	6.4	6.9	0.8	2.1	1.3
Refinery Gain	2.1	2.0	1.9	1.9	1.9	2.0	-0.1	0.0	-0.1
Conventional Subtotal	46.6	45.0	42.3	42.5	43.8	45.2	-4.3	-1.4	-0.1
Oil Sands	1.5	3.6	4.9	5.6	6.3	6.9	3.4	5.4	5.8
Extra-Heavy Crude Oil	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	9.4
Shale Oil	0.0	0.0	0.0	0.1	0.2	0.4	0.0	0.4	16.3
Biofuels (physical volumes)	1.5	2.4	3.3	4.5	5.5	6.0	1.8	4.5	5.2
Coal-to-Liquids	0.2	0.3	0.7	1.5	2.4	3.3	0.6	3.1	11.8
Gas-to-Liquids	0.0	0.1	0.2	0.3	0.5	0.6	0.1	0.6	10.1
Unconventional Subtot	3.3	6.4	9.2	12.1	15.0	17.3	5.9	14.0	6.4
Total Liquids	49.9	51.4	51.5	54.6	58.8	62.5	1.6	12.6	0.8



#### **OPEC Supply Summary: IEO2010 Low Price case**

OPEC Total Liquids (million barrels per day of physical volumes)

			ŗ	0005					Average Annual % Chg
Omeda 8 Lagas Osnalanasta	2008	2015	2020	2025	2030	2035 08-		-'35	08-'35
Crude & Lease Condensate	31.8	37.4	40.2	44.2	48.5	52.7	8.4	20.9	1.9
NGPL	3.1	4.0	4.6	4.8	4.8	4.8	1.5	1.7	
Refinery Gain	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	
Conventional Subtotal	35.0	41.5	44.9	49.1	53.3	57.6	9.9	22.6	1.9
Oil Sands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Extra-Heavy Crude Oil	0.7	1.5	2.3	2.6	3.1	3.7	1.6	3.0	6.6
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Biofuels (physical volumes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Gas-to-Liquids	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	14.8
Unconventional Subtot	0.7	1.6	2.5	2.8	3.3	3.9	1.8	3.2	6.8
Total Liquids	35.6	43.2	47.3	51.9	56.6	61.5	11.7	25.9	2.0
Non-OPEC Total Liquids Supplies (m	nillion barrel	s per day of	f physical vo	olumes)					
Crude & Lease Condensate	39.7	39.5	40.1	41.1	42.8	44.6	0.4	4.9	0.4
NGPL	4.8	5.2	5.7	6.1	6.5	7.0	0.8	2.2	1.4
Refinery Gain	2.1	2.3	2.4	2.5	2.7	3.0	0.3	0.9	1.4
Conventional Subtotal	46.6	47.0	48.2	49.7	52.0	54.6	1.6	8.0	0.6
Oil Sands	1.5	2.2	2.4	2.7	3.0	3.2	0.9	1.7	2.8
Extra-Heavy Crude Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.9
Biofuels (physical volumes)	1.5	1.6	2.0	2.2	2.6	2.9	0.5	1.4	2.5
Coal-to-Liquids	0.2	0.2	0.2	0.3	0.4	0.4	0.1	0.2	3.2
Gas-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3
Unconventional Subtot	3.3	4.0	4.7	5.2	6.0	6.6	1.5	3.3	2.7
Total Liquids	49.9	51.0	52.9	54.9	57.9	61.2	3.0	11.3	0.8



#### World Supply Summary: IEO2010 Reference case

World Total Liquids (million barrels per day of physical volume)

	2008	2015	2020	2025	2030	2035 08	-'20	08-'35	Average Annual Percent Chg 08-'35
Crude & Lease Condensate	71.6	70.8	71.5	74.6	78.6	82.4	-0.1	10.9	0.5
NGPL	7.9	9.6	10.8	11.5	12.0	12.6	2.9	4.6	
Refinery Gain	2.1	2.2	2.3	2.4	2.5	2.7	0.2	0.6	0.9
OPEC Conventional Subtotal	35.0	36.4	37.5	39.7	42.3	45.3	2.5	10.3	
Non-OPEC Conventional Subtotal	46.6	46.2	47.0	48.8	50.8	52.5	0.4	5.8	0.4
Oil Sands	1.5	2.4	2.9	3.5	4.2	5.2	1.4	3.6	4.6
Extra-Heavy Crude Oil	0.7	0.8	1.1	1.2	1.4	1.5	0.5	0.8	3.1
Shale Oil	0.0	0.0	0.0	0.1	0.2	0.4	0.0	0.4	16.3
Biofuels (physical volume)	1.5	2.4	2.8	3.2	3.5	4.1	1.3	2.6	3.7
Coal-to-Liquids	0.2	0.3	0.5	0.8	1.1	1.4	0.3	1.2	8.2
Gas-to-Liquids	0.1	0.3	0.3	0.4	0.4	0.4	0.3	0.4	8.2
OPEC Unconventional Subtotal	0.7	1.0	1.3	1.4	1.6	1.7	0.7	1.0	3.6
Non-OPEC Unconventional Subtotal	3.3	5.1	6.3	7.7	9.2	11.2	3.0	7.9	4.7
OPEC Total Liquids	35.6	37.4	38.8	41.2	43.9	47.0	3.2	11.3	1.0
Non-OPEC Total Liquids	49.9	51.3	53.3	56.5	60.0	63.6	3.4	13.7	0.9
OPEC Market Share	41.7%	42.1%	42.1%	42.2%	42.3%	42.5%			



#### World Supply Summary: IEO2010 High Price case

World Total Liquids (million barrels per day of physical volume)

									Percent Chg
	2008	2015	2020	2025	2030	2035 08	3-'20	08-'35	08-'35
Crude & Lease Condensate	71.6	64.7	59.7	59.7	61.1	63.2	-11.9	-8.3	-0.5
NGPL	7.9	9.6	10.7	11.3	11.7	12.3	2.8	4.4	1.6
Refinery Gain	2.1	2.1	2.0	1.9	1.9	2.1	-0.2	-0.1	-0.1
OPEC Conventional Subtotal	35.0	31.4	30.0	30.5	31.0	32.4	-5.0	-2.6	-0.3
Non-OPEC Conventional Subtotal	46.6	45.0	42.3	42.5	43.8	45.2	-4.3	-1.4	-0.1
Oil Sands	1.5	3.6	4.9	5.6	6.3	6.9	3.4	5.4	5.8
Extra-Heavy Crude Oil	0.7	0.5	0.5	0.5	0.5	0.5	-0.2	-0.2	-1.1
Shale Oil	0.0	0.0	0.0	0.1	0.2	0.4	0.0	0.4	16.3
Biofuels (physical volume)	1.5	2.4	3.3	4.5	5.5	6.0	1.8	4.5	5.2
Coal-to-Liquids	0.2	0.3	0.7	1.5	2.4	3.3	0.6	3.1	11.8
Gas-to-Liquids	0.1	0.2	0.4	0.5	0.7	0.8	0.3	0.8	11.1
OPEC Unconventional Subtotal	0.7	0.6	0.6	0.6	0.6	0.6	0.0	0.0	-0.1
Non-OPEC Unconventional Subtotal	3.3	6.4	9.2	12.1	15.0	17.3	5.9	14.0	6.4
OPEC Total Liquids	35.6	32.0	30.6	31.1	31.7	33.0	-5.0	-2.6	-0.3
Non-OPEC Total Liquids	49.9	51.4	51.5	54.6	58.8	62.5	1.6	12.6	0.8
OPEC Market Share	41.7%	38.4%	37.3%	36.3%	35.0%	34.6%			



Average Annual

#### World Supply Summary: IEO2010 Low Price case

World Total Liquids (million barrels per day of physical volume)

									Percent Chg
	2008	2015	2020	2025	2030	2035 08-'20	) (	08-'35	08-'35
Crude & Lease Condensate	71.6	76.9	80.4	85.3	91.3	97.4	8.8	25.8	1.1
NGPL	7.9	9.2	10.2	10.9	11.3	11.8	2.3	3.8	1.5
Refinery Gain	2.1	2.4	2.5	2.6	2.8	3.1	0.3	0.9	1.3
OPEC Conventional Subtotal	35.0	41.5	44.9	49.1	53.3	57.6	9.9	22.6	1.9
Non-OPEC Conventional Subtotal	46.6	47.0	48.2	49.7	52.0	54.6	1.6	8.0	0.6
Oil Sands	1.5	2.2	2.4	2.7	3.0	3.2	0.9	1.7	2.8
Extra-Heavy Crude Oil	0.7	1.5	2.3	2.6	3.1	3.7	1.6	3.0	6.6
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.9
Biofuels (physical volume)	1.5	1.6	2.0	2.2	2.6	2.9	0.5	1.4	2.5
Coal-to-Liquids	0.2	0.2	0.2	0.3	0.4	0.4	0.1	0.2	3.2
Gas-to-Liquids	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.2	6.0
OPEC Unconventional Subtotal	0.7	1.6	2.5	2.8	3.3	3.9	1.8	3.2	6.8
Non-OPEC Unconventional Subtotal	3.3	4.0	4.7	5.2	6.0	6.6	1.5	3.3	2.7
OPEC Total Liquids	35.6	43.2	47.3	51.9	56.6	61.5	11.7	25.9	2.0
Non-OPEC Total Liquids	49.9	51.0	52.9	54.9	57.9	61.2	3.0	11.3	0.8
OPEC Market Share	41.7%	45.8%	47.2%	48.6%	49.4%	50.1%			



Average Annual