Energy Outlook Development

- 100 countries
- 15 demand sectors
- 20 fuel types
- Technology & policy

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Energy Use Evolves Over Time

Global Percent Mix of Fuels
Quadrillion BTUs

Source: Smil, Energy Transitions (1800-1960)
Population Trends Impact Energy Use

World Population
Billions of people

- North America: 0.45 (2010), 0.55 (2040)
- Latin America: 0.48 (2010), 0.58 (2040)
- Europe: 0.61 (2010), 0.63 (2040)
- Middle East: 2010: 0.21, 2040: 0.32
- Africa: 1.79 (2010), 2040:
- Russia/Caspian: 0.28 (2010), 0.27 (2040)
- Asia Pacific: 4.59 (2010), 3.79 (2040)

Other Asia Pacific
India
China

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Economic Growth Drives Energy Demand

**GDP**
- Trillion 2005$
- **2010-2040 AAGR %**
  - World: 2.8%
  - Other Non OECD: 3.9%
  - China: 5.6%
  - Other OECD: 1.8%
  - United States: 2.3%

**Energy Demand**
- Quadrillion BTUs
- **2010-2040 AAGR %**
  - World: 1.0%

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Electricity Generation Leads Growth

Energy Demand by Sector

Electricity Generation

Industrial

Transportation

Res/Comm

Quadrillion BTUs

2010

2025

2040

Electricity Demand

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Transportation

65%

Heavy duty transportation demand grows 65 percent by 2040.
Light Duty Vehicle Fleet Grows, Mix Changes

Powertrain Technology
Millions of Vehicles

2010

North America
Europe OECD
Other OECD
China
India
Middle East
Latin America
Other Non OECD

- Advanced*
- CNG
- LPG
- Conv. Diesel
- Conv. Gasoline

*Full Hybrid, Plug-in Hybrid, Electric Vehicles
Light Duty Vehicle Fleet Grows, Mix Changes

Powertrain Technology
Millions of Vehicles

2025

- Advanced*
- CNG
- LPG
- Conv. Diesel
- Conv. Gasoline

North America
Europe OECD
Other OECD
China
India
Middle East
Latin America
Other Non OECD

*Full Hybrid, Plug-in Hybrid, Electric Vehicles
Light Duty Vehicle Fleet Grows, Mix Changes

Powertrain Technology
Millions of Vehicles

- North America
- Europe OECD
- Other OECD
- China
- India
- Middle East
- Latin America
- Other Non OECD

- PHV/EV
- Full Hybrid
- CNG
- LPG
- Diesel Conv
- Mogas Conv

*Full Hybrid, Plug-in Hybrid, Electric Vehicles*
U.S. Transportation Demand & Fleet Shift

Transportation MBDOE

Light Duty Vehicle Fleet
Million Cars

Rail
Marine
Aviation
Heavy Duty
Light Duty

Conv. Diesel
Hybrid
CNG/LPG
PHV/EV
Conv. Gasoline

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Gas Into Transportation

By Sector

- Heavy Duty
- Marine
- Rail
- Light Duty

2040 by Region

- AP
- NA
- LA
- ME
- EU
- RC
- AF

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Transportation Fuel Demand Shifts to Diesel

OECD
MBDOE
45
30
15
0
2000 2020 2040

Non OECD
MBDOE
45
30
15
0
2000 2020 2040

Transportation fuel demand shifts from gasoline, ethanol, and other to diesel. Non-OECD countries see a significant increase in diesel demand, while OECD shows a decrease in demand for gasoline and ethanol.
Refining Converts Oil Into Many Products

Refining: Link between crude oil production and products demand

Crude Oil Input

Refinery

- LPG / Propane
- Chemicals feed
- Gasoline
- Aviation fuels
- Diesel
- Fuel oil
- Lubes/Other
- Wax/Asphalt

Source: U.S. Department of Labor
Electricity generation

85% Global electricity demand will grow by 85 percent over the Outlook period.

2010

2040
Electricity Demand by Region

Non OECD

Thousand TWh

OECD

Thousand TWh

- Russia/Caspian
- Southeast Asia
- Middle East
- Africa
- India
- China
- Other Non OECD
- Other OECD
- Europe OECD
- North America

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Economic Choices for U.S. Electricity

Baseload, Startup 2030

2012 cents/kWh

$60/ton of CO₂

$0/ton

*Wind and solar exclude costs for integration, backup capacity and additional transmission

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United States Energy Demand and Supply

By Sector
Quadrillion BTUs

By Fuel
Quadrillion BTUs

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Tale of Two Worlds

Non OECD
Quadrillion BTUs

OECD
Quadrillion BTUs

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CO₂ Emissions Plateau

By Region
Billion Tons

- Rest of Non OECD
- India
- China
- OECD

Emissions per Capita
Tons per Person

- China
- India
- U.S.
- Europe

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Energy Mix Continues to Evolve

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Supply

60%

Oil and gas will supply about 60 percent of global energy demand in 2040, up from 55 percent in 2010.
Remaining Oil Resource

Crude and Condensate (BBO)

- North America: ~1,100 BBO
- Europe: ~100 BBO
- Middle East: ~1,100 BBO
- Russia/Caspian: ~1,000 BBO
- Asia Pacific: ~150 BBO
- Latin America: ~650 BBO
- Africa: ~200 BBO
- Global: ~4,300 BBO

Source: IEA
Remaining Global Gas Resource

Over 200 years coverage at current demand

North America

North America

Europe OECD

Europe OECD

Middle East

Middle East

Russia/Caspian*

Russia/Caspian*

Asia Pacific

Asia Pacific

World

World

Unconventional

Unconventional

Conventional

Conventional

Latin America

Latin America

Africa

Africa

Source: IEA; *Includes Europe Non OECD
Natural Gas Supply and Demand Shifts

North America Gas Supply
- Local Unconventional
- Local Conventional
- LNG

Global Gas Supply
- Rest of World Unconventional
- North America Unconventional
- Rest of World Conventional
- North America Conventional

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Regional Energy Trends Evolve

By Region
Percent of World Total

North America
Europe
Russia/Caspian
China
Other AP
Africa
Middle East
Latin America

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Energy Use Evolves Over Time

Global Percent Mix of Fuels

Percent

Other Renewables

Nuclear
Hydro
Gas
Oil
Coal
Biomass

Source: Smil, Energy Transitions (1800-1960)
Conclusions