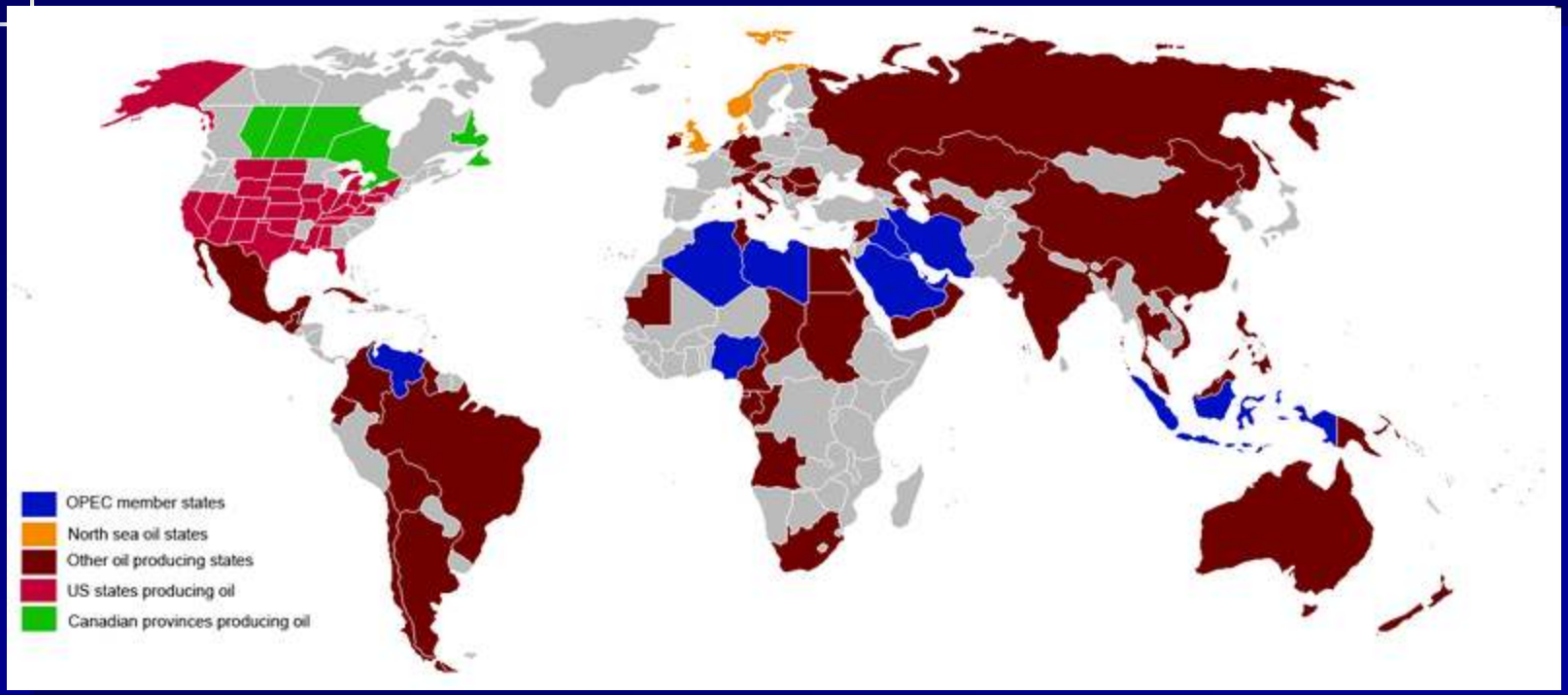
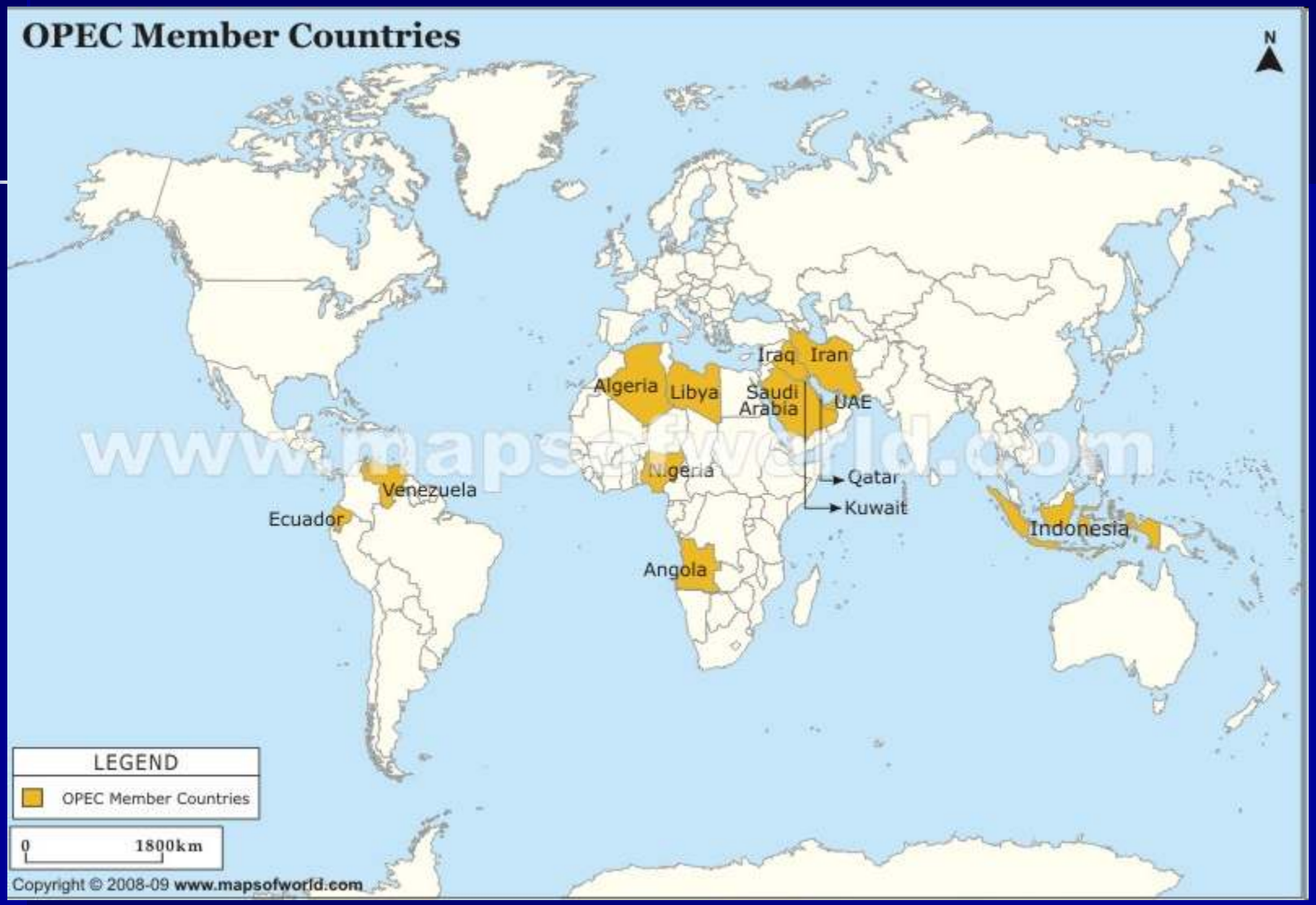
Oil Producing Countries




OPEC Member Countries
N
Iraq
Iran
Algeria
Libya
Saudi Arabia
UAE
Nigeria
Qatar
Kuwait
Venezuela
Ecuador
Indonesia
Angola
LEGEND
OPEC Member Countries
0
1800km
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Antalya
İçel (Mersin)
Adana
Gaziantep
Nicosia
CYPRUS
Aleppo
Latakia
SYRIA
Mosul
Irbīl
Karkūk
Rasht
Zanjān
Qazvīn
Tehrān
Mashhad
Qom
Kermānshāh
Arāk
Beirut
LEBANON
Damascus
Ḥimṣ
Mediterranean Sea
Haifa
Golan Heights
ISRAEL
Jerusalem
West Bank*
Amman
Baghdad
Tigris
De Facto Boundary
IRAQ
Esfahān
IRAN
Alexandria
Port Said
Gaza Strip*
JORDAN
Al 'Aqabah
Cairo
Al Jīzah
Suez
Ahvāz
An Nāṣirīyah
Al Başrah
Abādān
Kermān
Zāhedān
Shīraz
Kuwait
KUWAIT
Būshehr
Gulf of 'Aqaba
Tabūk
Ḥafar al Bāṭin
Bandar 'Abbās
Strait of Hormuz
Persian Gulf
Asyūṭ
Ḥā'il
Al Jubayl
Ad Dammām
Dhahran
Manama
BAHRAIN
QATAR
Doha
Dubai
OMAN
Abu Dhabi
Gulf of Oman
Muscat
EGYPT
Luxor
Buraydah
Aswān
Yanbu' al Baḥr
Medina
Riyadh
SAUDI
ARABIA
UNITED ARAB EMIRATES
De Facto Boundary
no defined boundary
Administrative Boundary
Ḥalā'ib
Jiddah
Mecca
Red Sea
OMAN
Nile
Port Sudan
Abhā
Ṣalālah
SUDAN
Jīzan
no defined boundary
Al Ghaydah
Omdurman
Khartoum
ERITREA
Asmara
Sanaa
Wad Madanī
YEMEN
Arabian Sea

Oil Production Rank

Countries	Amount	Date
# 1	**Saudi Arabia**:	10,250,000 bbl/day 2007
# 2	**Russia**:	9,876,000 bbl/day 2007
# 3	**United States**:	8,457,000 bbl/day 2007
# 4	**Iran**:	4,033,000 bbl/day 2007
# 5	**China**:	3,725,000 bbl/day 2008

Oil Production Rank 2

# 6	**Mexico**:	3,501,000 bbl/day	2007
# 7	**Canada**:	3,425,000 bbl/day	2007
# 8	**United Arab Emirates**:	2,948,000 bbl/day	2007
# 10	**Venezuela**:	2,667,000 bbl/day	2007
# 11	**Kuwait**:	2,613,000 bbl/day	2007
# 12	**Norway**:	2,565,000 bbl/day	2007

Oil Production 3

# 13	**Nigeria**:	2,352,000 bbl/day	2007
# 14	**Brazil**:	2,277,000 bbl/day	2007
# 15	**Algeria**:	2,173,000 bbl/day	2007
# 16	**Iraq**:	2,094,000 bbl/day	2007
# 17	**Angola**:	1,910,000 bbl/day	2008
# 18	**Libya**:	1,845,000 bbl/day	2007
# 19	**United Kingdom**:	1,690,000 bbl/day	2007
# 20	**Kazakhstan**:	1,445,000 bbl/day	2007
# 21	**Qatar**:	1,125,000 bbl/day	2007

Proven Reserves

# 1	**Saudi Arabia**:	262,700,000,000 barrels
# 2	**Canada**:	178,900,000,000 barrels
# 3	**Iran**:	133,300,000,000 barrels
# 4	**Iraq**:	112,500,000,000 barrels
# 5	**United Arab Emirates**:	97,800,000,000 barrels
# 6	**Kuwait**:	96,500,000,000 barrels
# 7	**Venezuela**:	75,590,000,000 barrels
# 8	**Russia**:	69,000,000,000 barrels
# 9	**Libya**:	40,000,000,000 barrels
# 10	**Nigeria**:	36,000,000,000 barrels

Proven Reserves 2

# 11	**Mexico**:	33,310,000,000 barrels
# 12	**Kazakhstan**:	26,000,000,000 barrels
# 13	**Angola**:	25,000,000,000 barrels
# 14	**United States**:	22,450,000,000 barrels
# 15	**China**:	18,260,000,000 barrels
# 16	**Qatar**:	16,000,000,000 barrels
# 17	**Brazil**:	15,120,000,000 barrels
# 18	**Algeria**:	12,460,000,000 barrels
# 19	**Norway**:	9,859,000,000 barrels
# 20	**Oman**:	6,100,000,000 barrel

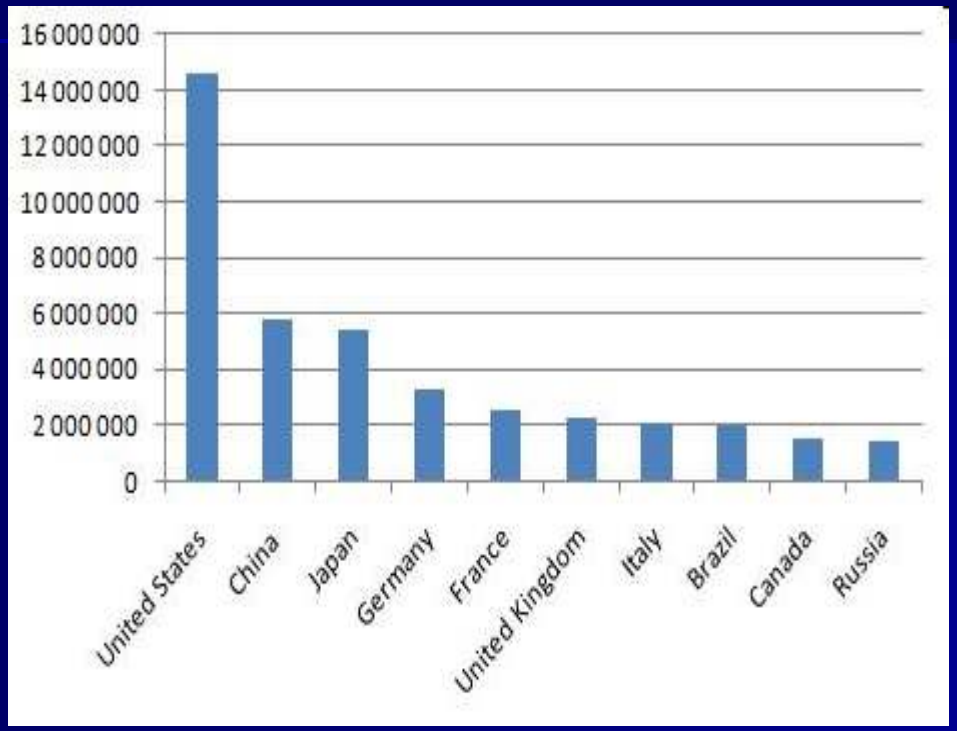
Oil Consumption By Country

Rank	Countries	Amount	Date
# 1	United States:	20,680,000 bbl/day	2007
# 3	China:	7,578,000 bbl/day	2007
# 4	Japan:	5,007,000 bbl/day	2007
# 5	Russia:	2,858,000 bbl/day	2007
# 6	India:	2,722,000 bbl/day	2007
# 7	Germany:	2,456,000 bbl/day	2007
# 8	Brazil:	2,372,000 bbl/day	2007
# 9	Canada:	2,371,000 bbl/day	2007
# 10	Saudi Arabia:	2,311,000 bbl/day	2007

GDP by Country

# 1	**United States**:	$13,201,820,000,000.00	2006
# 3	**Japan**:	$4,340,133,000,000.00	2006
# 4	**Germany**:	$2,906,681,000,000.00	2006
# 5	**China**:	$2,668,071,000,000.00	2006
# 6	**United Kingdom**:	$2,345,015,000,000.00	2006
# 7	**France**:	$2,230,721,000,000.00	2006
# 8	**Italy**:	$1,844,749,000,000.00	2006
# 9	**Canada**:	$1,251,463,000,000.00	2006
# 10	**Spain**:	$1,223,988,000,000.00	2006

GDP by Country, IMF 2010



Energy: Key Concepts

- Renewable vs Non Renewable Resources
  - Recruitment vs. Allocation
  - Malthusian Scarcity Never Avoided
  - Time Frame Determined by how long it takes to develop substitutes

Goal: A Pareto Optimal Sharing of the Resource over two generation: The Present and the Future.

Key Challenges with Energy

- Each Sector has its own Regime
- Oil Issues
  - Geopolitics
  - Cartels: OPEC, Oil Companies
    - Goal: Control Supply, Control Price
    - Maximize Profits without allowing Substitutes
    - Petro Dollars, 3rd World Debt, Dollar Flows, Terrorism Funding
  - Climate Change, Green House Gas

Why We Need and Energy Policy

- Market Failures in Energy/Oil
  - Externalities
  - Common Property Resources
  - Market Structure-Monopoly & Cartels
  - Intertemportal
  - Government Policies
- **Or…5 of the 6 Types of Failures**

Oil Dependency

- Foreign Oil vs. Domestic Oil
- Oil Dependence
  - Lack of Substitutes is an issue of Time
- Time in Economics is understood as:
  - Immediate Run: Everything Fixed
  - Short Run: At least one Factor Fixed
  - Long Run: Everything Variable

Oil and Time

- The Short Run in Oil and Energy is a long period of time.
  - High Cost of New Investments
  - Lead Time for New Technologies
  - Demand for Energy is inelastic
  - Most *easy actions* have been taken
    - Substitute Energy in home heating/industry
    - Weatherization
    - Transportation: efficiency/dependence

Price Elasticity and Short Run

- Inelastic Demand means we can't Adjust Very Easily to Price Increases
  - No Substitutes
  - High Capital Costs
- Oil Price Spikes Tend to be Followed by Price Declines
- High Capital Costs Result in Long Break Even Periods for Investments

New Concepts

- Proprietary Policies
- Compensatory Policies
- Time Effect on Compensatory Policies
- Captured Agencies/Policies-Stakeholders!
- Feasibility Analysis
  - Scientific, Fiscal/Financial
  - Social, Political
  - Cost Effective, Economic

New Concepts Continued

- Efficiency Effects vs. Volume Effects
  - Automobile Mileage Improvements Countered by more Cars per Household and more Miles Driven
  - New Highways for Congestion Countered by more Cars, Miles Driven, Population
    - Population Growth Puget Sound 30%
    - 85% I-5 Corridor
    - Vehicle Miles Increase 148% 1990-2010

Geography of Oil Percentage of World Total

- Eastern Hemisphere 70%
- OPEC 56%
- Persian Gulf 44%
- Saudi Arabia 17% (Iraq + Iran Greater)
- Russia 13%
- United States 7%
- Mexico & Venezuela 5% each

Economic Models

- Box Model
  - Resource Uncertainty from Price and Technology
- Intertemporal Allocation Model
  - Forecasting Methodology
  - Data and Assumptions
  - Sensitivity Analysis
- Uses: Direction and Time

Why Government

- Only Government is Powerful Enough
- Ability to Provide
  - Incentives
  - Subsidies
  - R&D Investments
  - Leadership
- Proven Ability: Manhatten Project, Space Program, Weapon Systems, etc.