



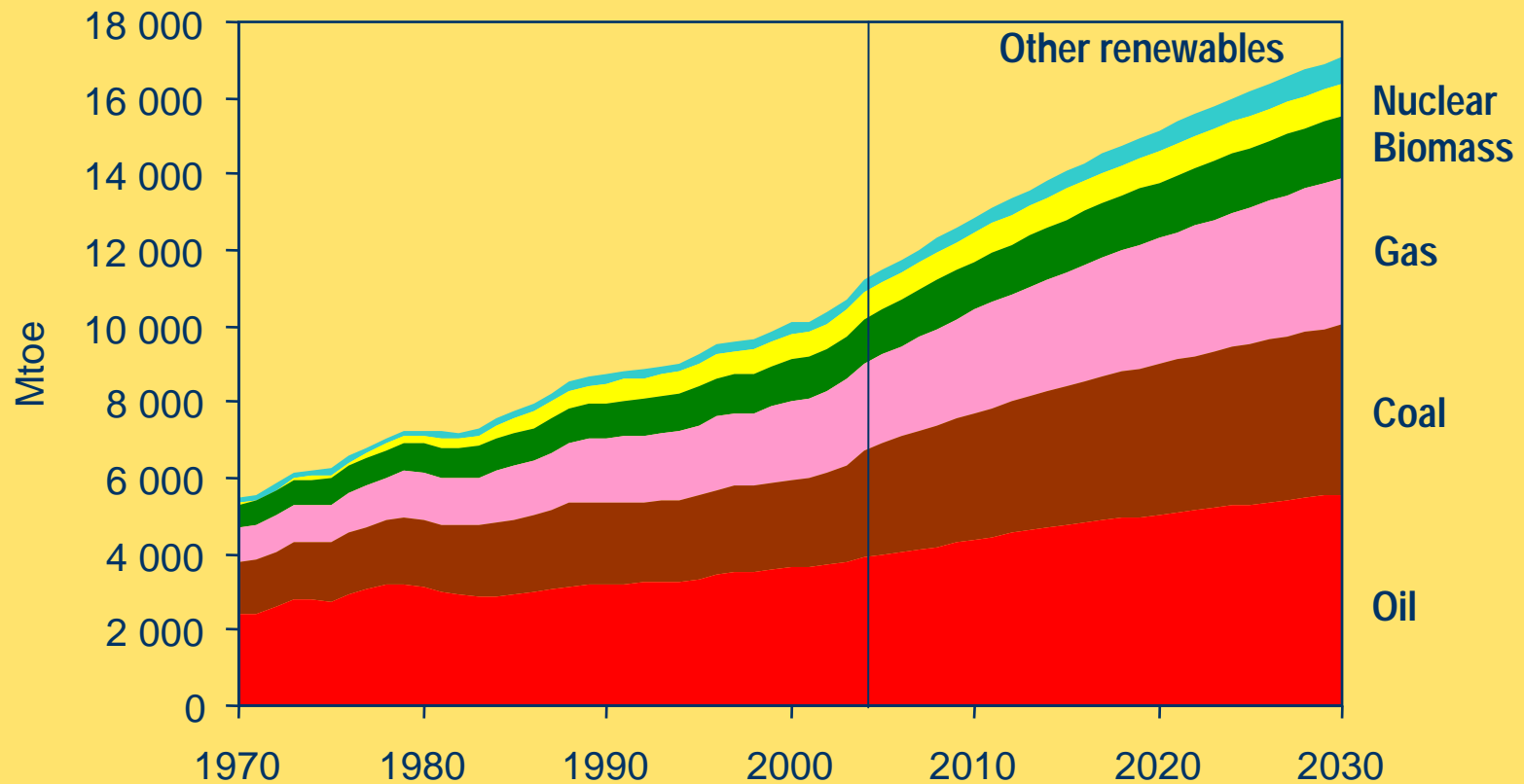
INTERNATIONAL ENERGY AGENCY



# **World Energy Outlook 2006**

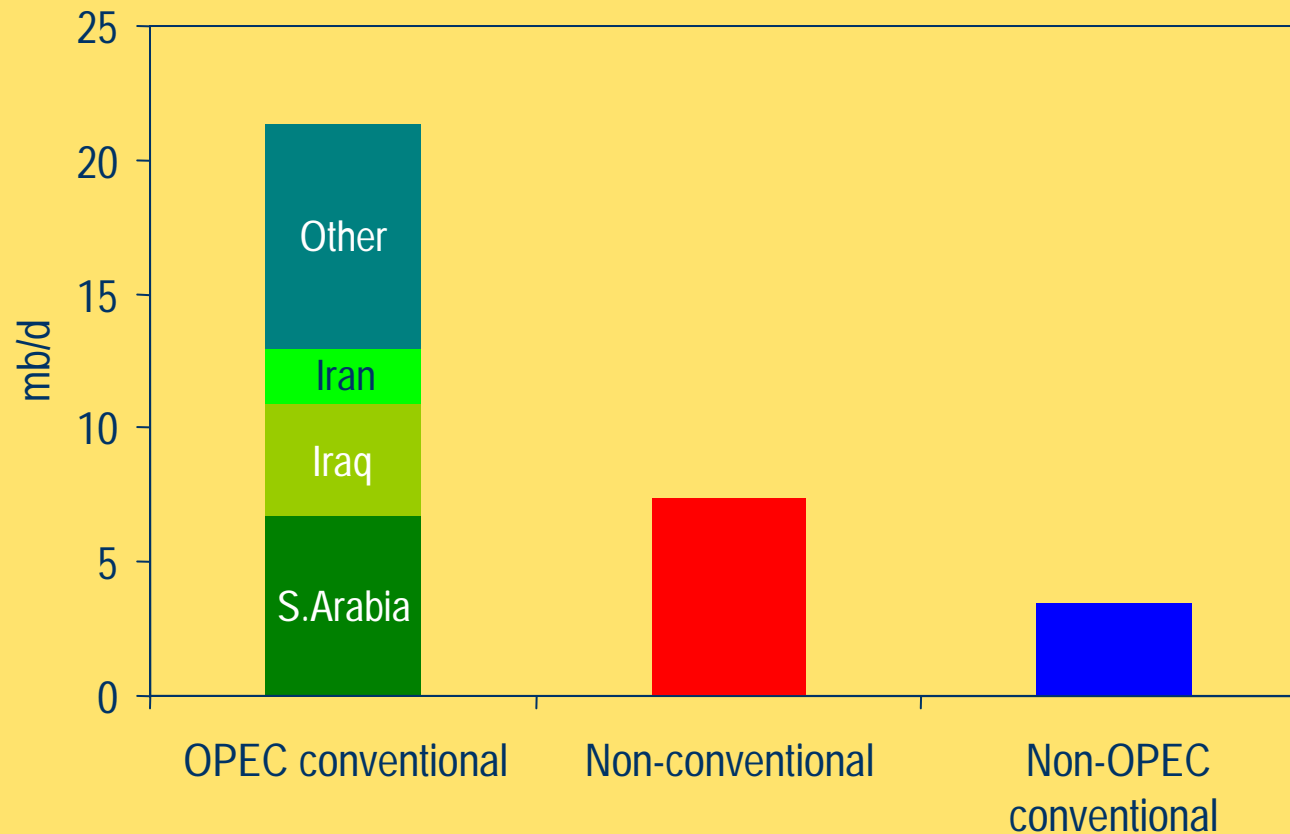
***Dr. Fatih Birol  
Chief Economist  
International Energy Agency***

# The Reference Scenario: World Primary Energy Demand



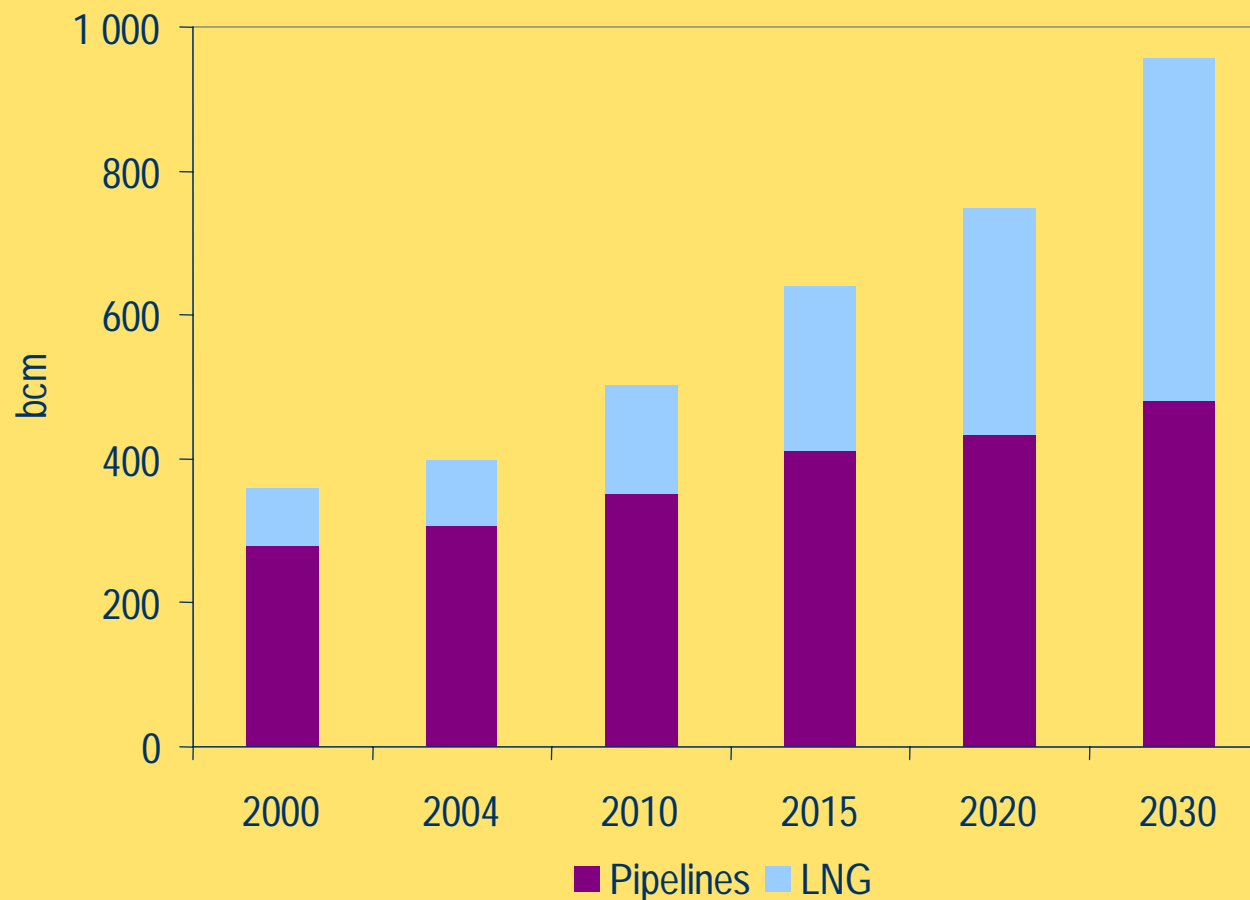
***Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms***

## Reference Scenario: Increase in World Oil Supply, 2004-2030



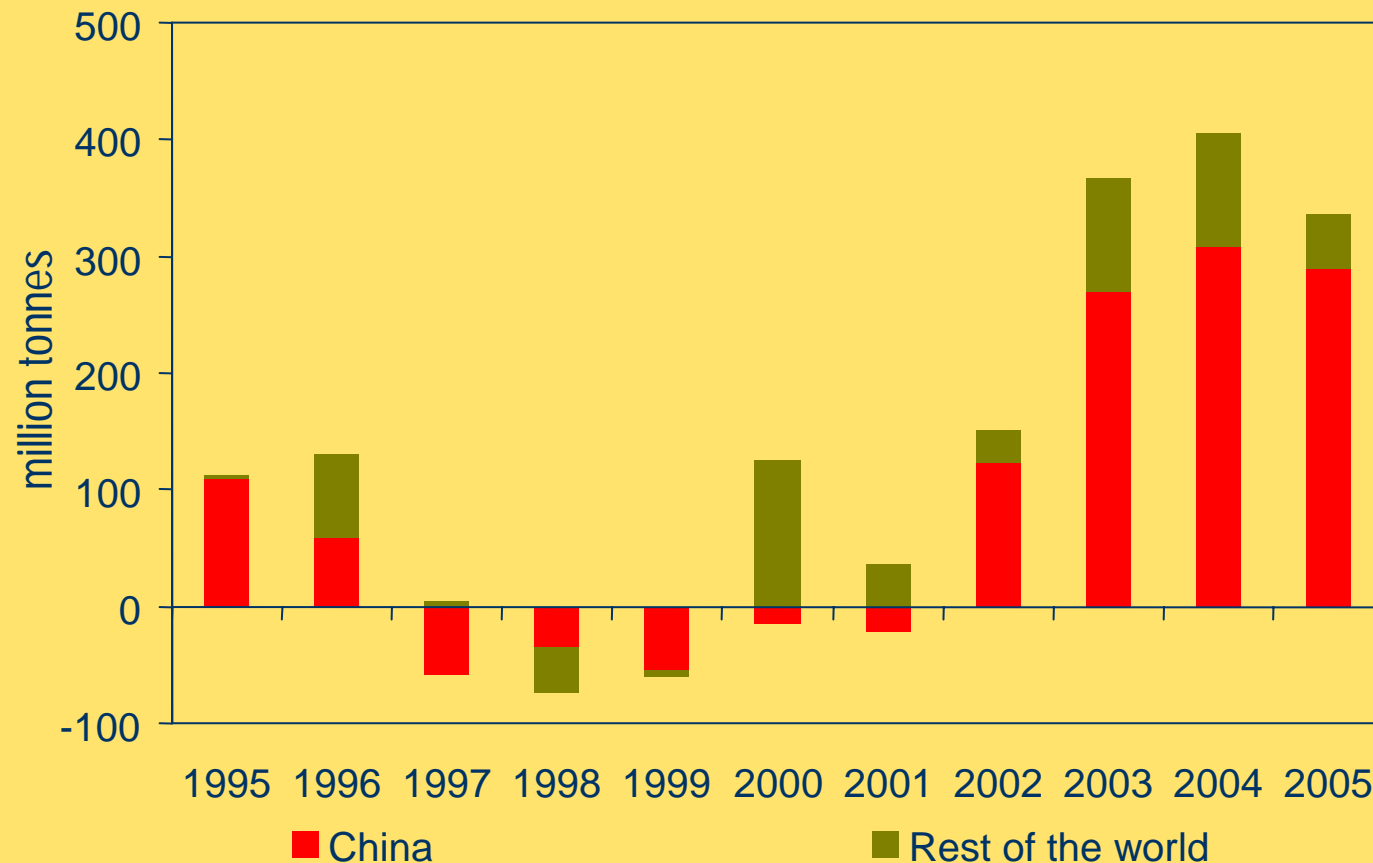
***The share of OPEC in world oil supply increases sharply as conventional non-OPEC production peaks towards the middle of next decade***

## Reference Scenario: World Inter-regional Natural Gas Trade



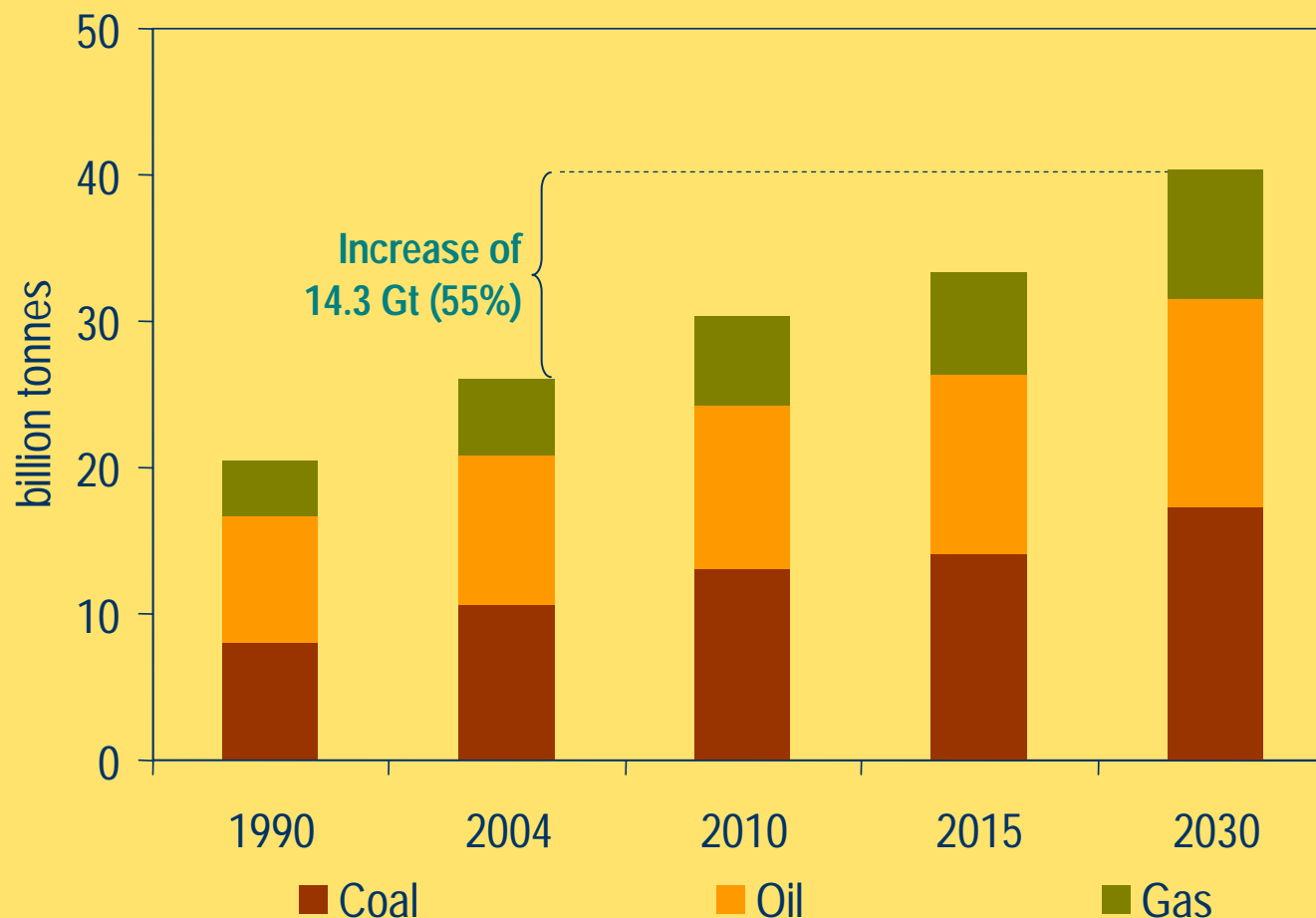
***Global gas trade expands by 1.5 times, with two-thirds of the increase coming from Russia, the Middle East & North Africa – mostly as LNG***

# Annual Increase in Coal Demand



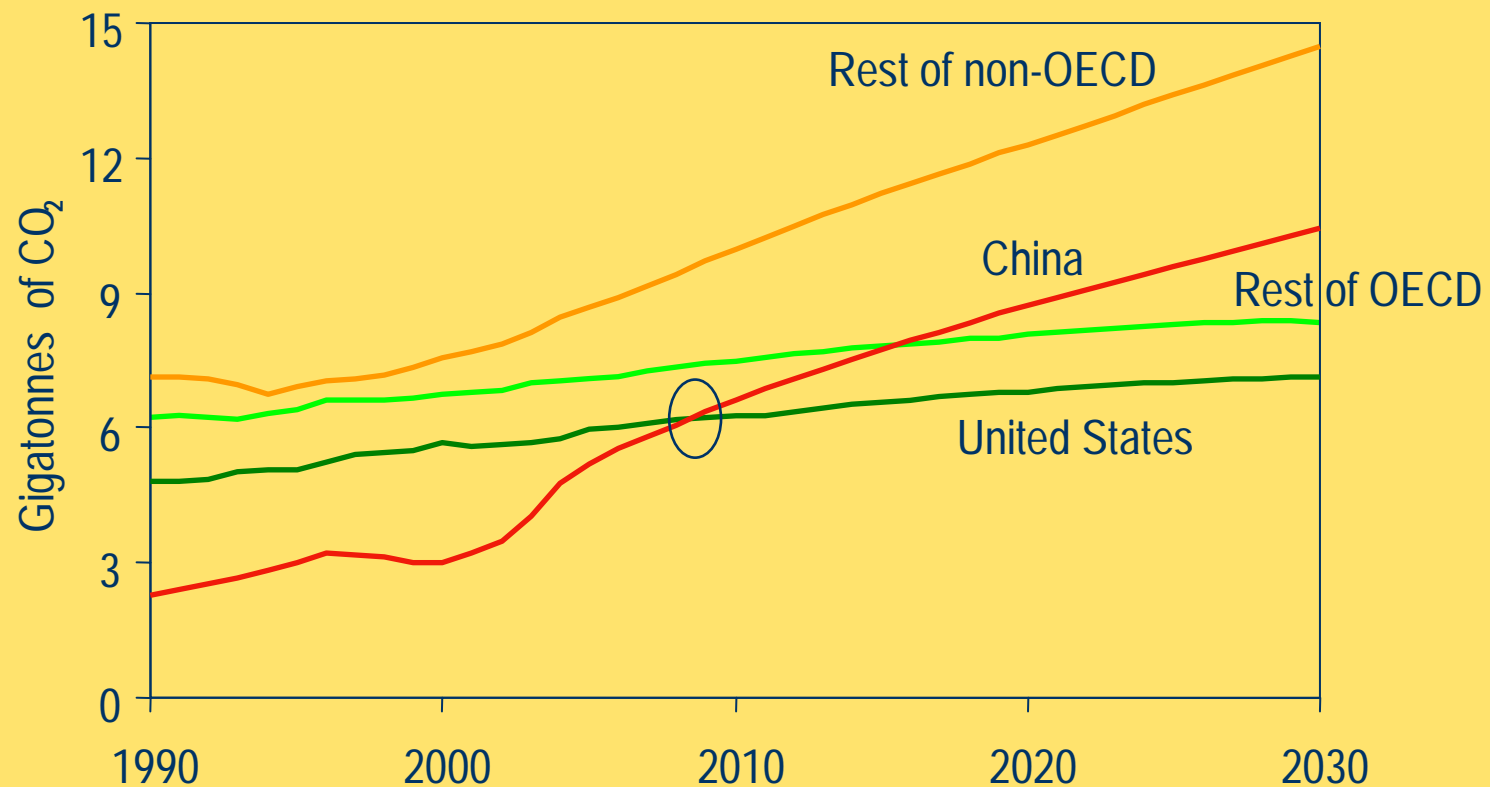
***Global coal demand in the recent years has grown much faster than previously – mainly driven by China***

## Reference Scenario: Energy-Related CO<sub>2</sub> Emissions by Fuel



***Half of the projected increase in emissions comes from new power stations, mainly using coal & mainly located in China & India***

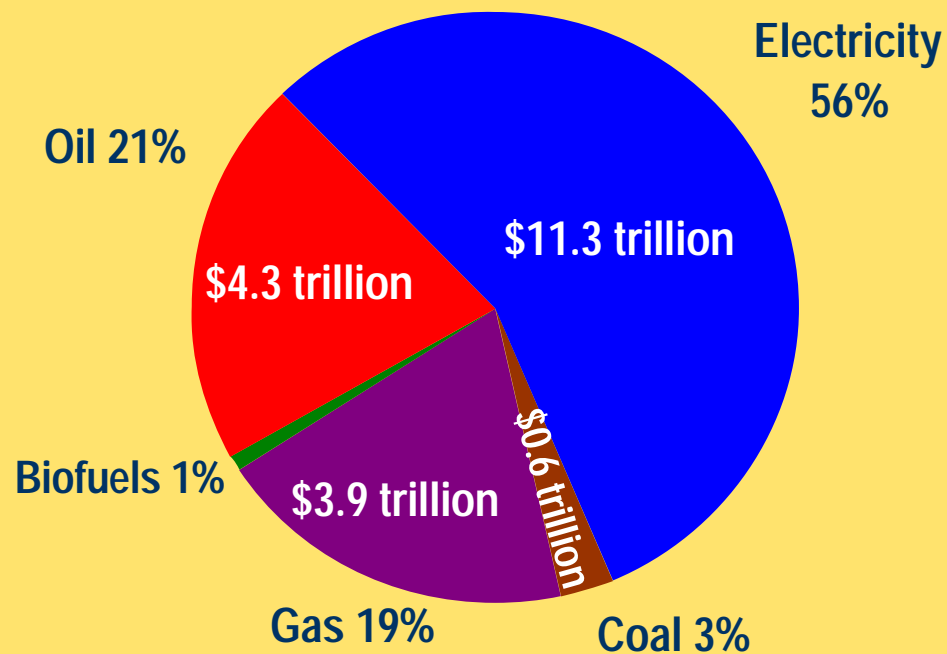
# Reference Scenario: Energy-Related CO<sub>2</sub> emissions by Region



***China overtakes the US as the world's biggest emitter before 2010, though its per capita emissions reach just 60% of those of the OECD in 2030***

## Reference Scenario: Cumulative Investment, 2005-2030

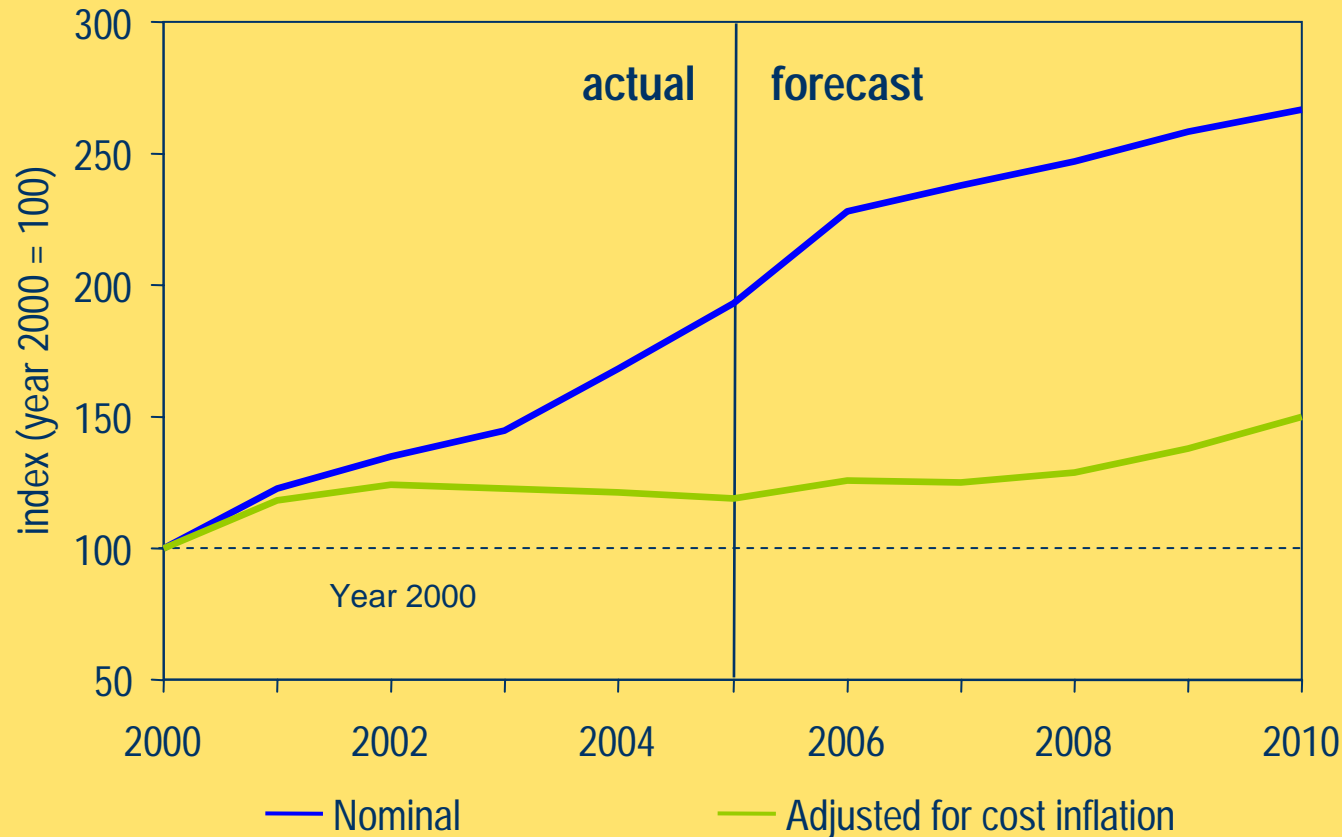
**\$20.2 trillion (in \$2005)**



***Investment needs exceed \$20 trillion – \$3 trillion more than previously projected, mainly because of higher unit costs***

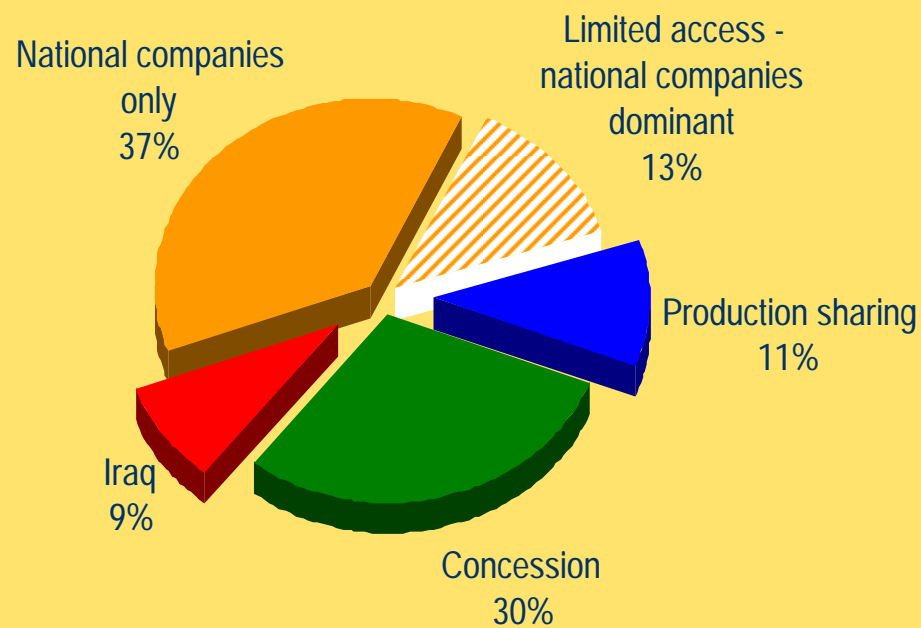


# Global Upstream Oil & Gas Investment: Impact of Cost Inflation



***Annual upstream investment doubled to \$225 billion between 2000 and 2005, but most of the increase was due to cost inflation***

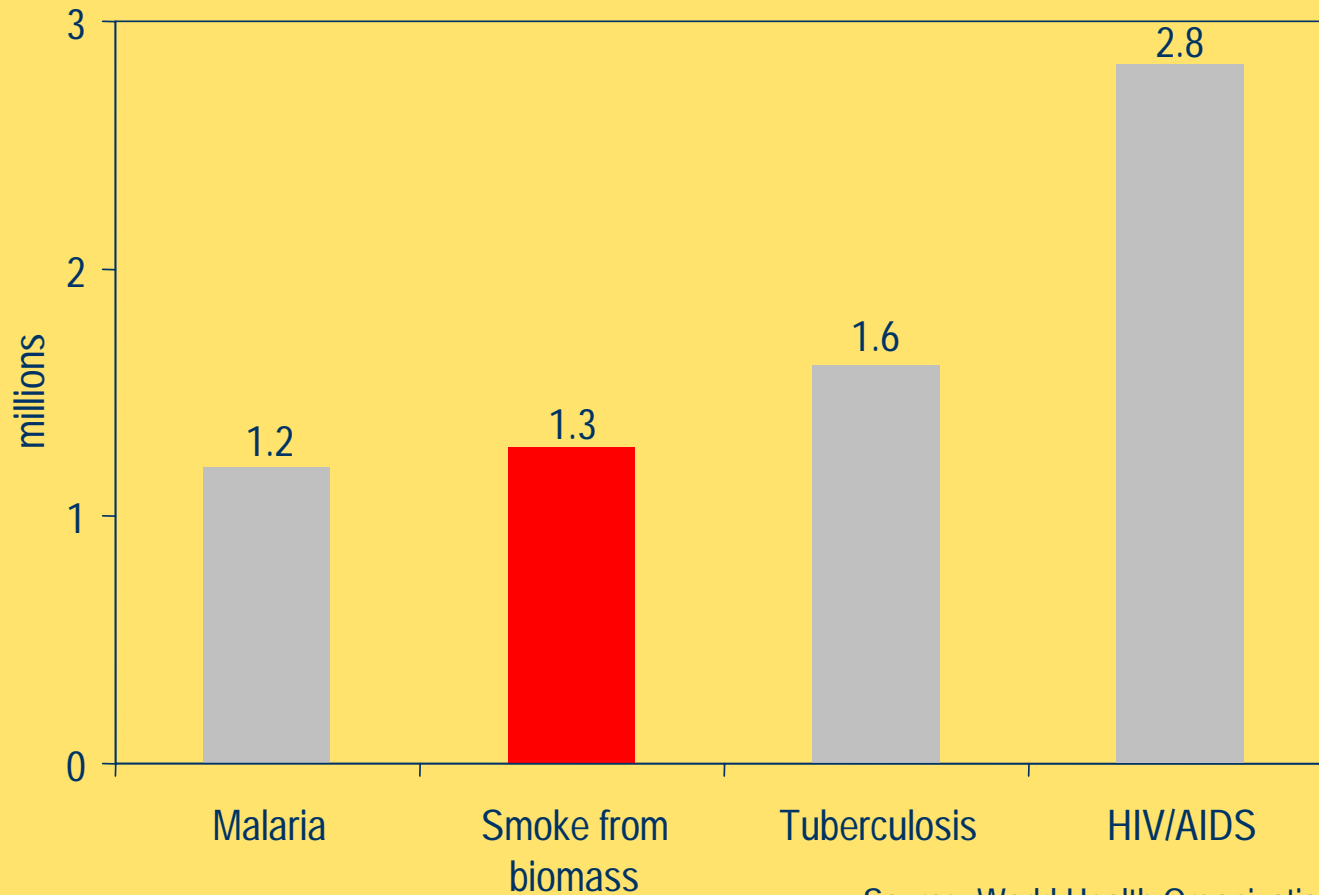
## Access to oil reserves



Total reserves = 1 290 billion barrels

*Access to much of the world's remaining oil reserves is restricted*

# Energy Poverty: Annual Deaths from Indoor Air Pollution



Source: World Health Organization

***The number of people using dirty traditional biomass for cooking is set to grow from 2.5 billion now to 2.7 billion in 2030 absent new policies***

## The Energy Future Absent New Policies

- Security of oil supply is threatened
  - *Oil production in non-OPEC countries is set to peak*
  - *Production will be increasingly concentrated in a small number of countries*
- Gas security is also a growing concern
  - *Europe's production has already peaked - US to follow*
  - *Import dependence in both regions & other key regions will grow absent new policies*
- Investment **over the next decade** will lock in technology that will remain in use for up to 60 years



INTERNATIONAL ENERGY AGENCY

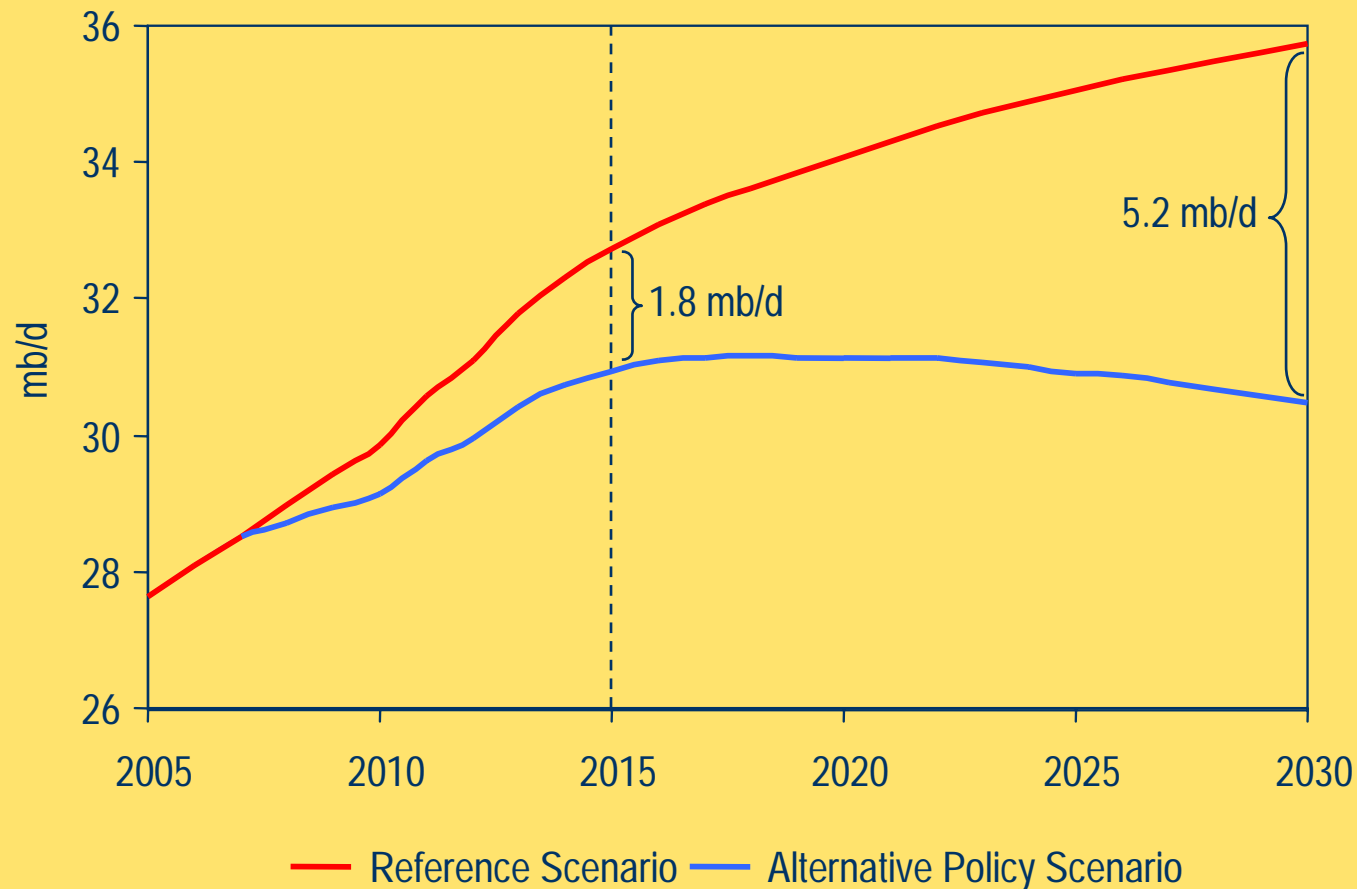


# Alternative Policy Scenario

## Alternative Policy Scenario: Mapping a Better Energy Future

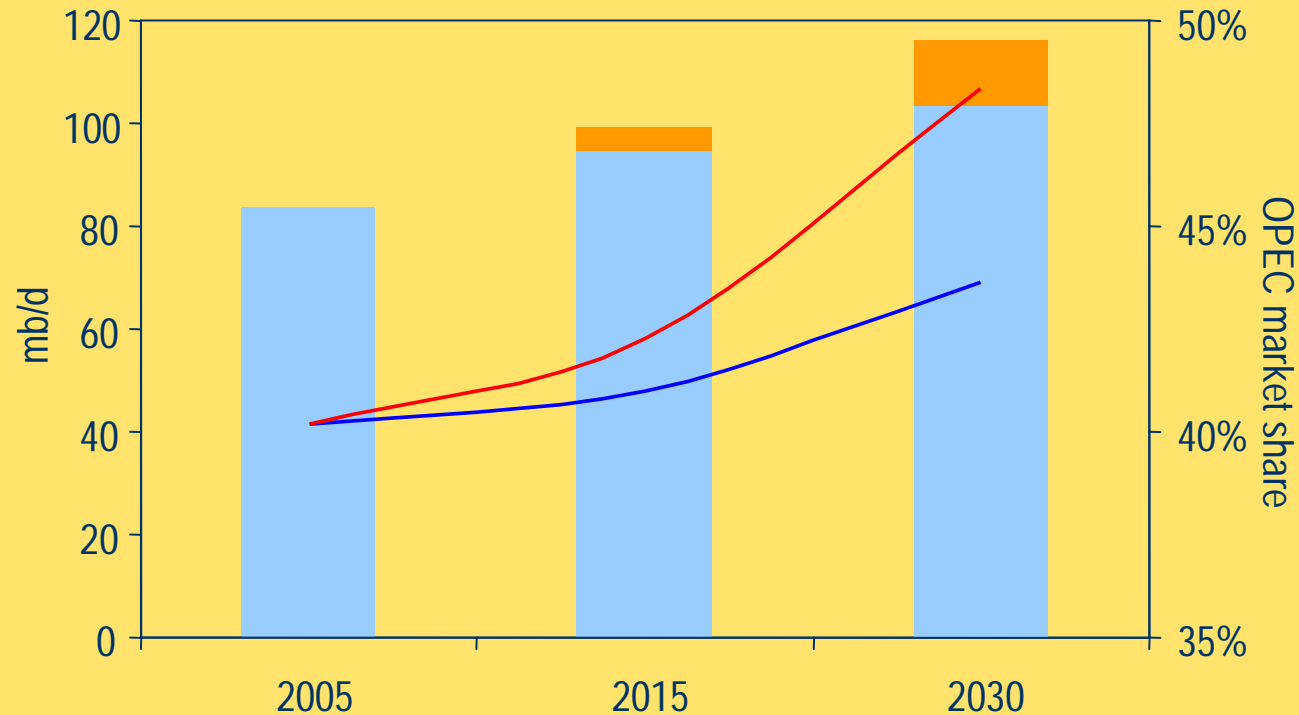
- Analyses impact of government policies under consideration to enhance security & curb emissions
- Demonstrates that we can significantly reduce growth in energy demand & emissions and stimulate alternative energy production
  - *Oil demand is reduced by 13 mb/d in 2030 - equivalent to current output of Saudi Arabia & Iran*
  - *Oil savings in 2015 savings reach 5 mb/d*
  - *CO<sub>2</sub> emissions are 6.3 Gt (16%) lower in 2030 – equivalent to the current emissions of US and Canada*
- Delaying action by 10 years would reduce the impact on emissions in 2030 by three-quarters

## Alternative Policy Scenario: OECD Oil Imports



***In stark contrast with the Reference Scenario, OECD oil imports level off soon after 2015 & then begin to decline***

# The Alternative Policy Scenario: Global Oil Supply

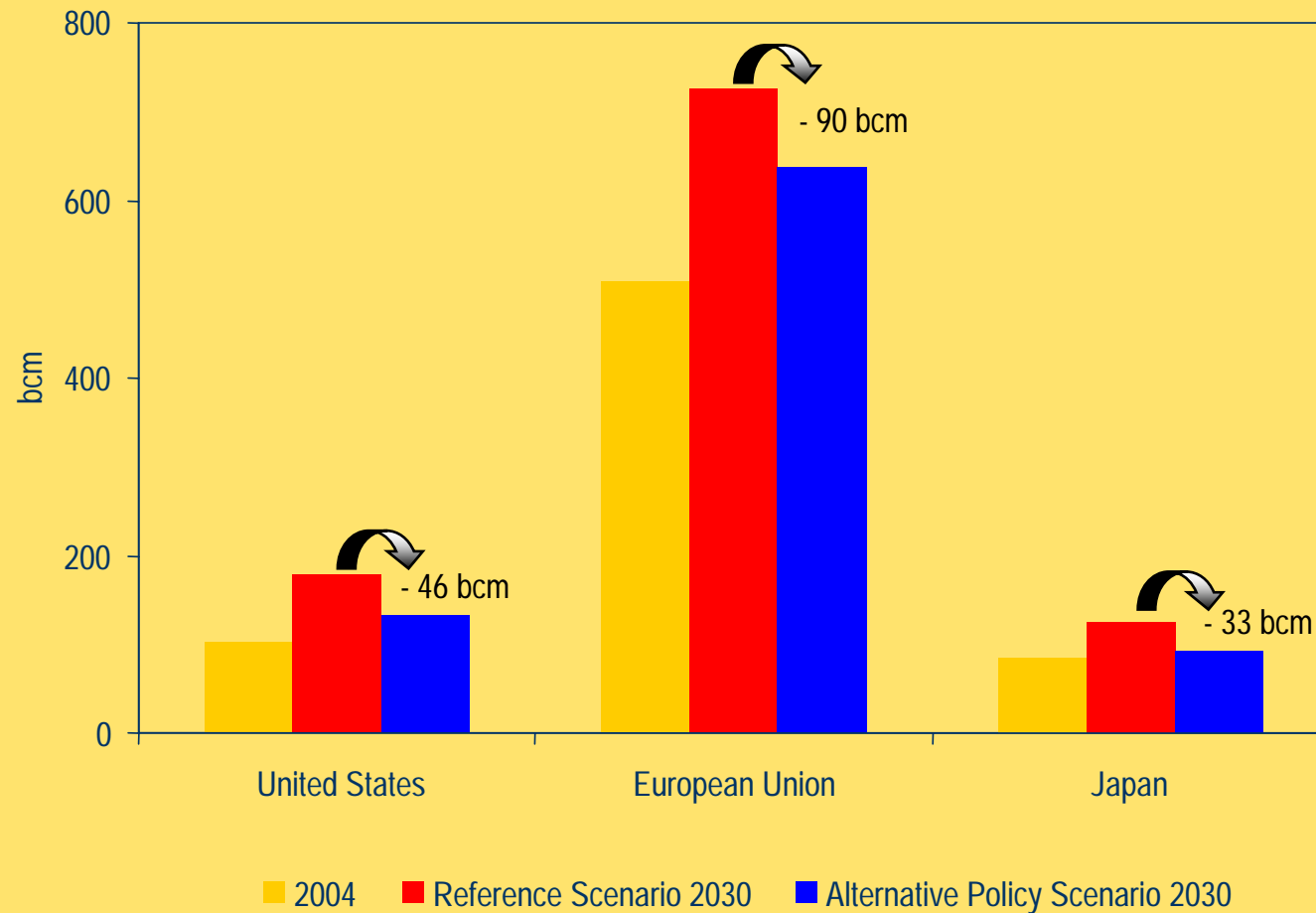


■ Alternative Policy Scenario      ■ Reduction compared with Reference Scenario  
— OPEC share in APS (right axis)      — OPEC share in RS (right axis)

***OPEC's share of global oil production rises from 40% now to 43% in 2030 in the APS, compared with a jump to 49% in the RS***

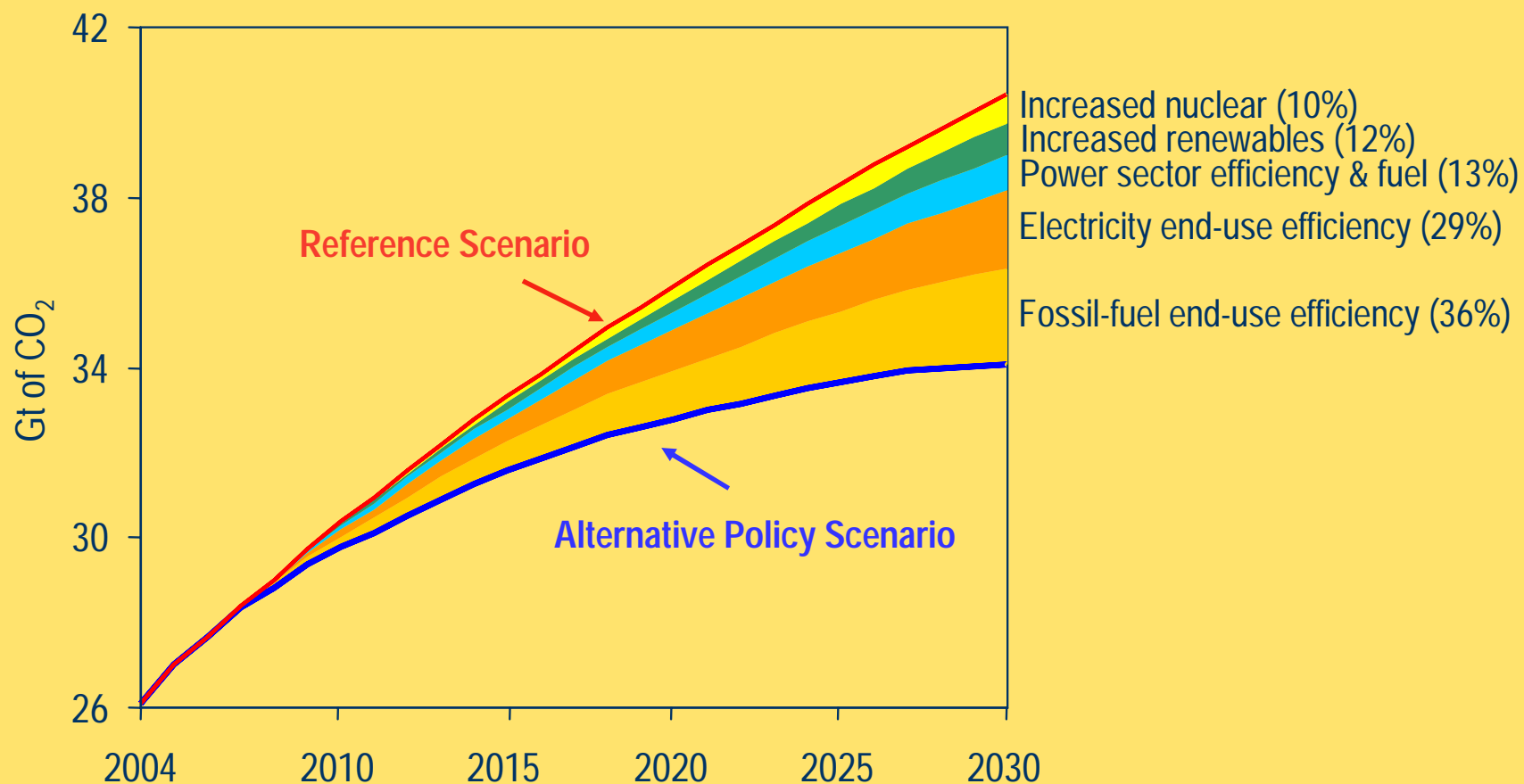


## The Alternative Policy Scenario: Gas Imports, 2004-2030



***Gas imports in the main consuming regions are significantly lower in the APS compared with the RS***

## The Alternative Policy Scenario: Key Policies for CO<sub>2</sub> Reduction



***Improved end-use efficiency accounts for over two-thirds of avoided emissions in 2030 in the APS***

## The Alternative Policy Scenario : Key policies that Make a Global Difference

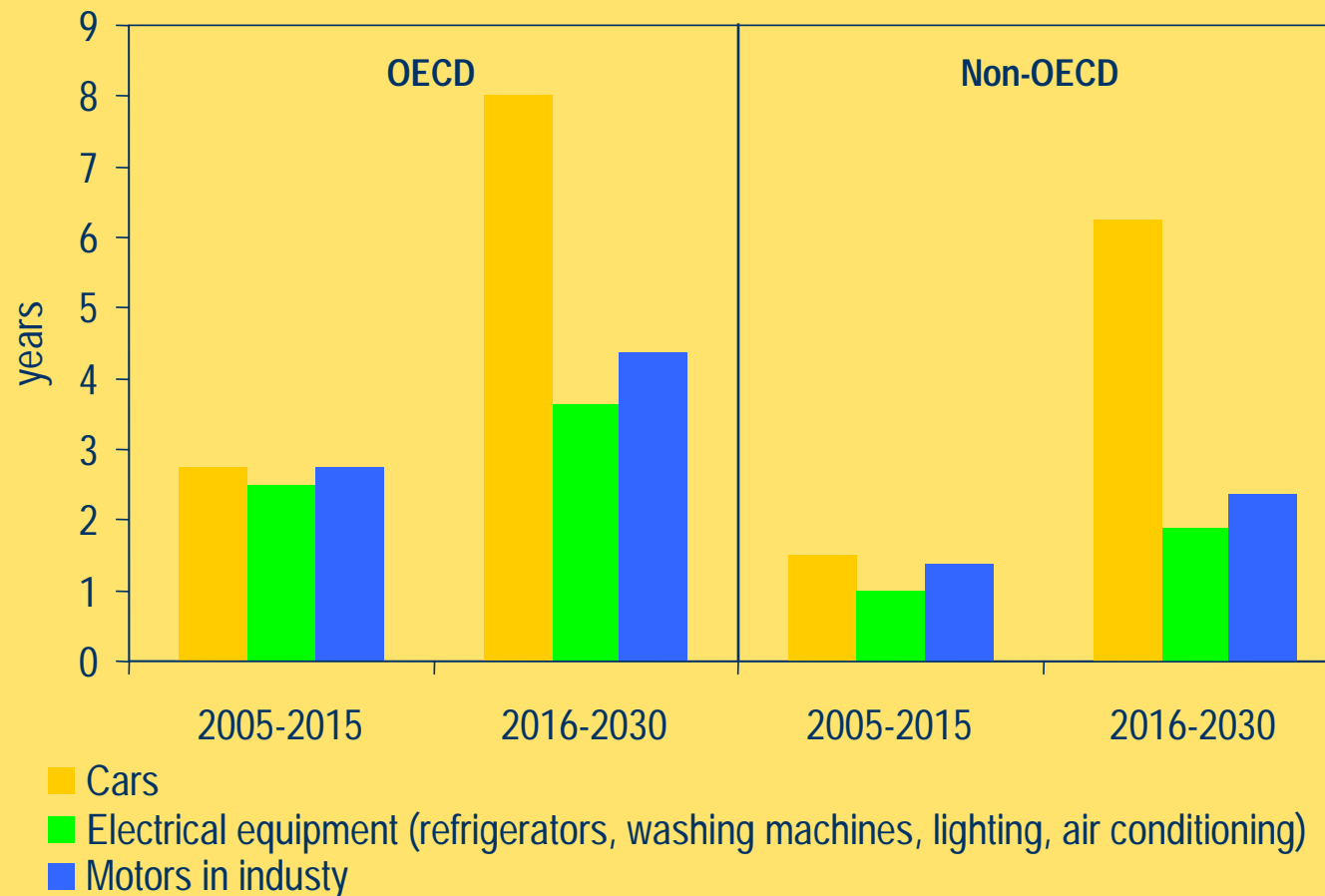
	<i>Energy efficiency</i>	<i>Power generation</i>
<b>US</b>	<ul style="list-style-type: none"> <li>● Tighter CAFE standards</li> <li>● Improved efficiency in residential &amp; commercial sectors</li> </ul>	<ul style="list-style-type: none"> <li>● Increased use of renewables</li> </ul>
<b>EU</b>	<ul style="list-style-type: none"> <li>● Increased vehicle fuel economy</li> <li>● Improved efficiency in electricity use in the commercial sector</li> </ul>	<ul style="list-style-type: none"> <li>● Increased use of renewables</li> <li>● Nuclear plant lifetime extensions</li> </ul>
<b>China</b>	<ul style="list-style-type: none"> <li>● Improved efficiency in electricity use in industry</li> <li>● Improved efficiency in electricity use in the residential sector</li> </ul>	<ul style="list-style-type: none"> <li>● Increased efficiency of coal-fired plants</li> <li>● Increased use of renewables</li> <li>● Increased reliance on nuclear</li> </ul>

***A dozen policies in the US, EU & China account for around 40% of the global emissions reduction in 2030 in the Alternative Policy Scenario***

## The Alternative Policy Scenario: Cost Effectiveness of Policies

- Total energy investment – from production to consumption – are lower than in the RS
- Consumers spend \$2.4 trillion *more* in 2005-2030 in more efficient cars, refrigerators etc
- ..but producers need to spend almost \$3 trillion *less*
  - *Each \$1 invested in more efficient electrical appliances saves \$2.2 in investment in power plants & networks*
  - *Each \$1 invested in more efficient oil-consuming equipments (mainly cars) saves \$2.4 in oil imports*
- The higher initial investments by consumers are more than outweighed by fuel-cost savings

## The Alternative Policy Scenario: Investment Payback Periods

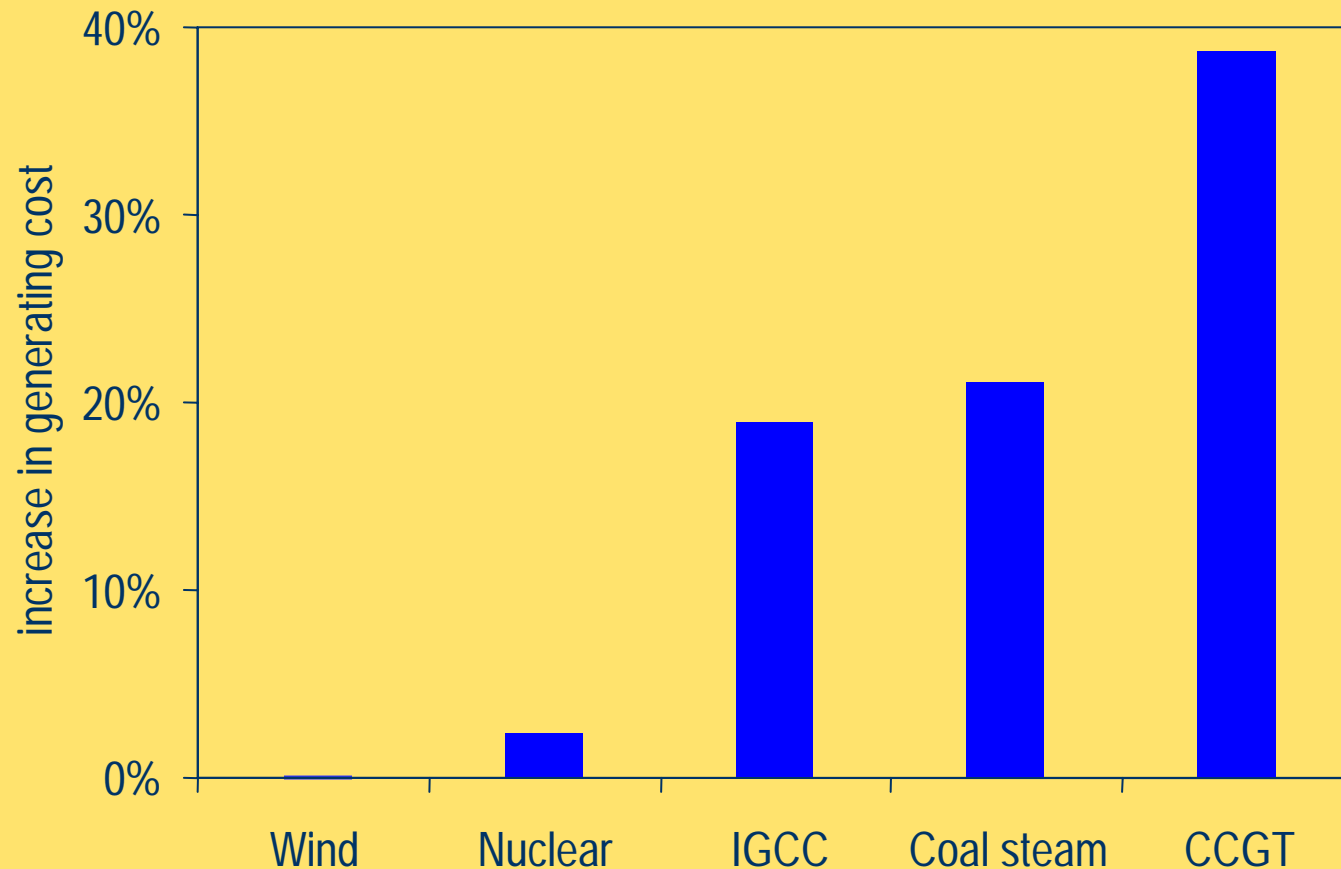


***The payback periods of new policies are very short, especially in non-OECD countries for policies introduced before 2015***

## Renewed Interest in Nuclear Power

- Growing concerns over energy security, surging fossil-fuel prices & rising carbon emissions
- Positive aspects of nuclear power
  - *proven technology for large-scale baseload electricity generation*
  - *reduce dependence on imported gas*
  - *no emissions of greenhouse gases or local pollutants*
  - *produces electricity at competitive & stable cost*
  - *uranium resources abundant & widespread*
- But governments need to play a stronger role in facilitating investment where nuclear is accepted

## Impact of a 50% Increase in Fuel Price on Generating Costs



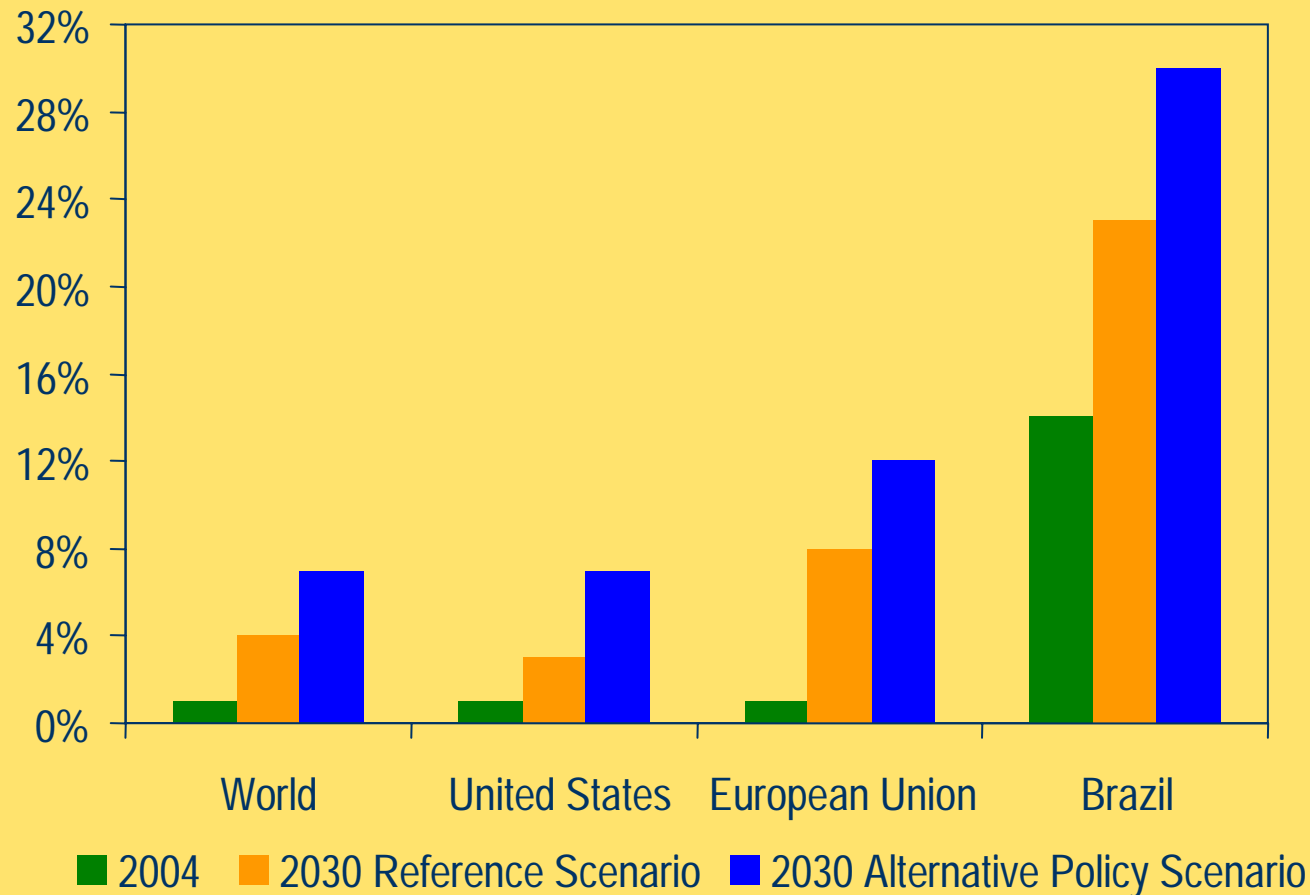
***Nuclear generating costs are far less sensitive to fuel price increases than gas or coal plants***

## Outlook for Biofuels

- Interest in biofuels is soaring
- Biofuels can help address twin threats of growing energy insecurity & climate change through
  - *Increased diversity of geographic & fuel sources*
  - *Lower greenhouse-gas emissions - depending on how they are produced*
- Higher oil prices have made biofuels more competitive, but further cost reductions are needed
- Availability of arable land will constrain biofuels potential in the medium term
- Long-term prospects hinge on new technology



## Share of Biofuels in Road-Transport Fuel Consumption



***Biofuels are set to play a much larger role in meeting world road-transport fuel demand***

## Summing Up

- The Reference Scenario projects a vulnerable, dirty and expensive global energy system
- The WEO maps out a cleaner, cleverer and more competitive energy future based on new policies – on energy efficiency, renewables and nuclear
- Economic cost of these policies would be more than outweighed by the economic benefits
- Strong political will and urgent government action is needed to create clear incentives to change existing investment patterns