International Ministerial Conference
Nuclear Power for the 21st Century
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"World Energy Needs and Resources and Environmental Challenges of the 21st Century"

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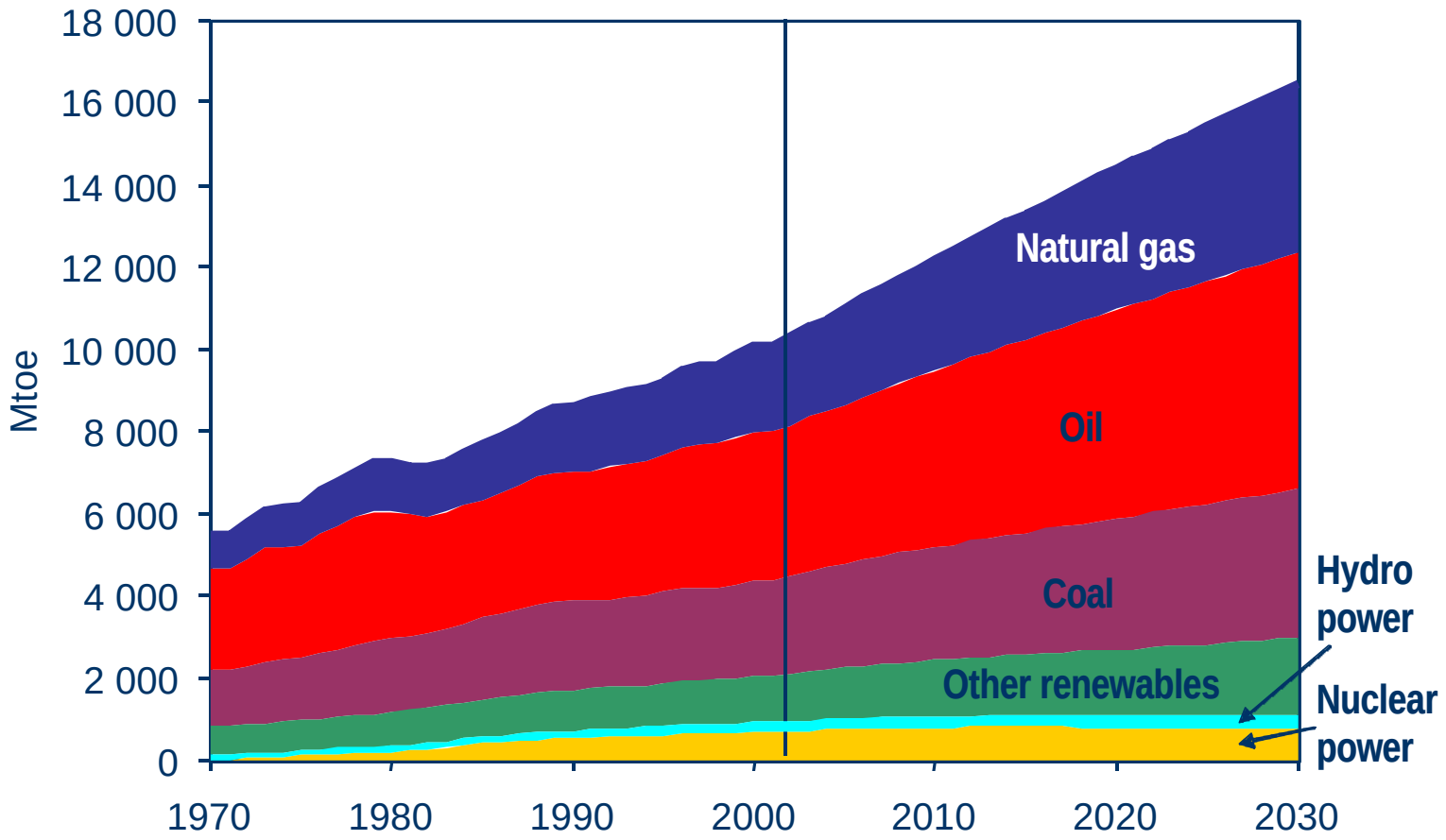
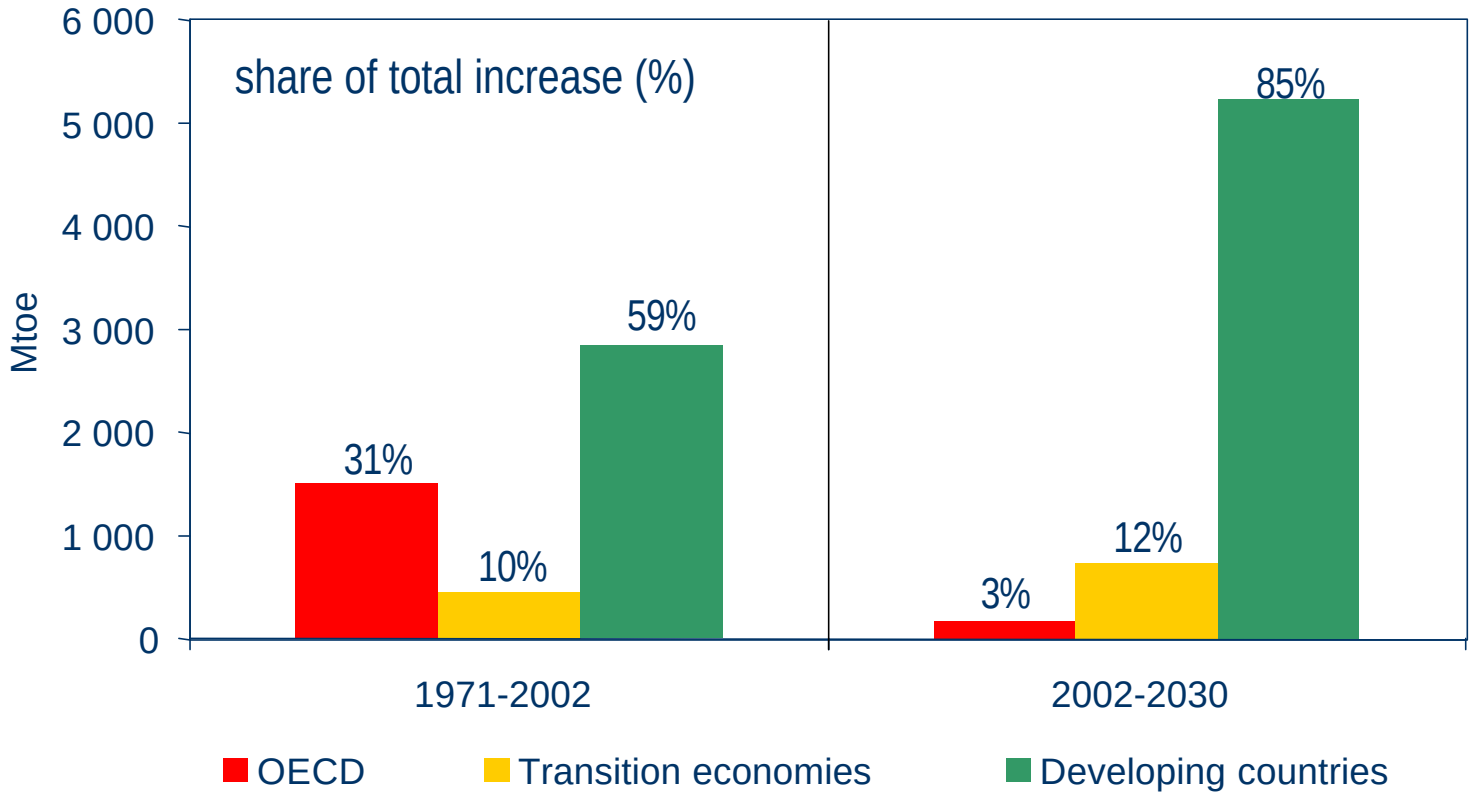
World Primary Energy Demand



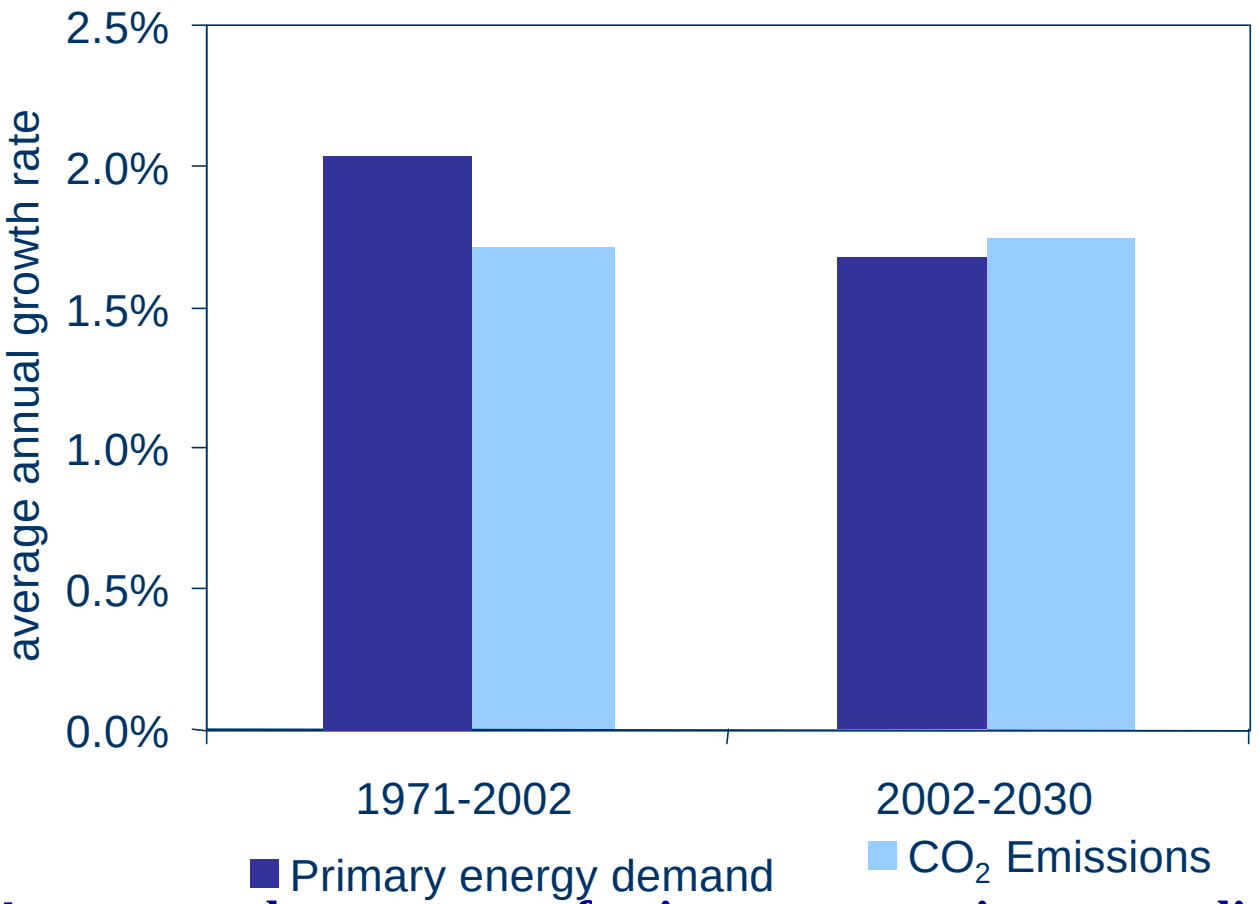
Fossil fuels will continue to dominate the global energy mix, while oil remains the leading fuel

Increase in World Primary Energy Production by Region



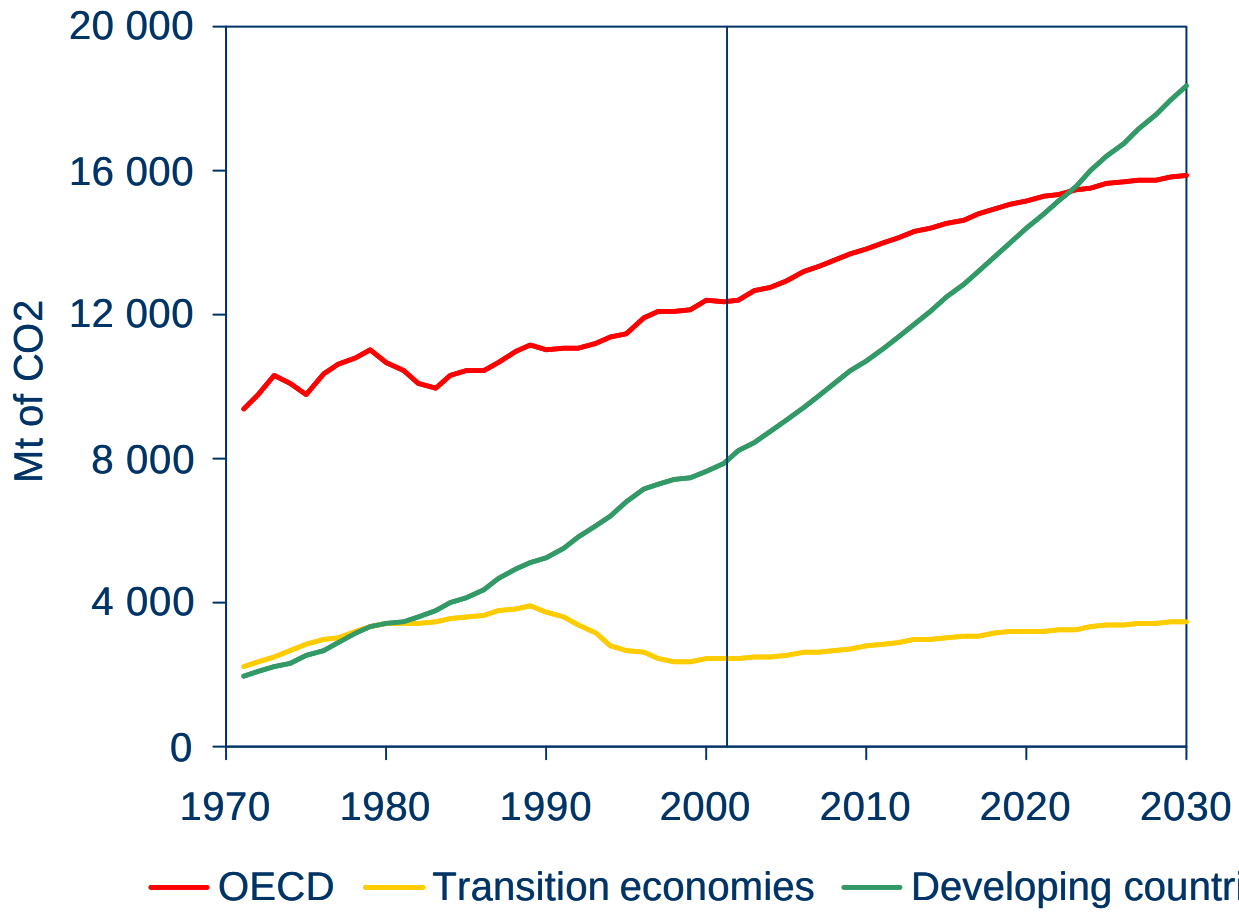
Almost all the increase in production to 2030 occurs outside the OECD

Growth in World Energy Demand and CO_2 Emissions



Average carbon content of primary energy increases slightly through 2030 – in contrast to past trends

World Energy-Related CO_2 Emissions



Global emissions grow 62% between now & 2030, with developing countries' emissions overtaking OECD's in the 2020s

This is not Sustainable!

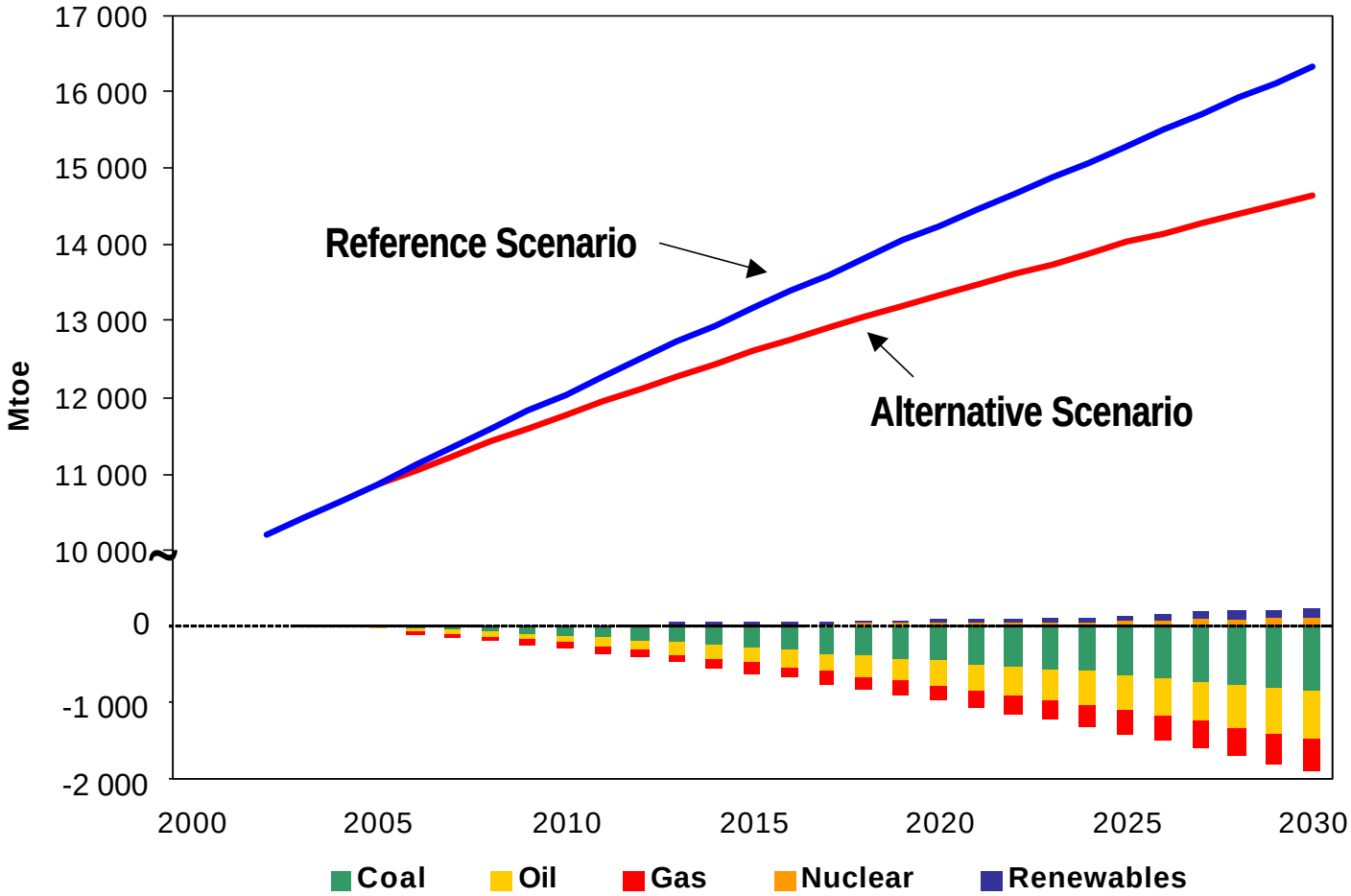
But the Future Is Not Predetermined…

World Alternative Policy Scenario

World Alternative Policy Scenario

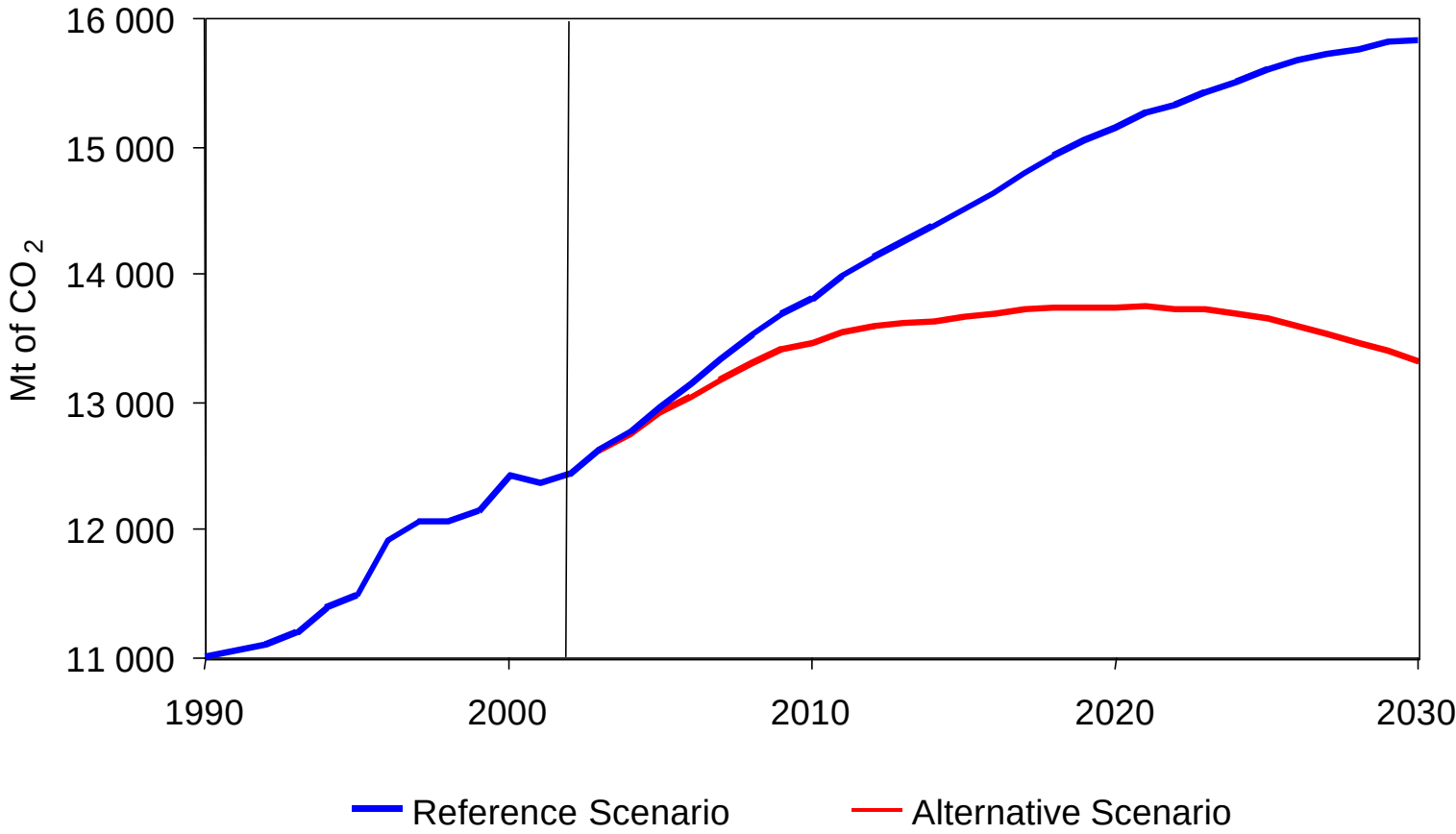
- Analyses impact of new environmental & energy-security policies worldwide
  - OECD: Policies currently under consideration
  - Non-OECD: Also includes more rapid declines in energy intensity resulting from faster deployment of more-efficient technology
- Impact on fuel mix, CO_2 emissions & investment needs
- Basic macroeconomic & population assumptions as for Reference Scenario, but energy prices change

World Primary Energy Demand in Reference & Alternative Scenarios



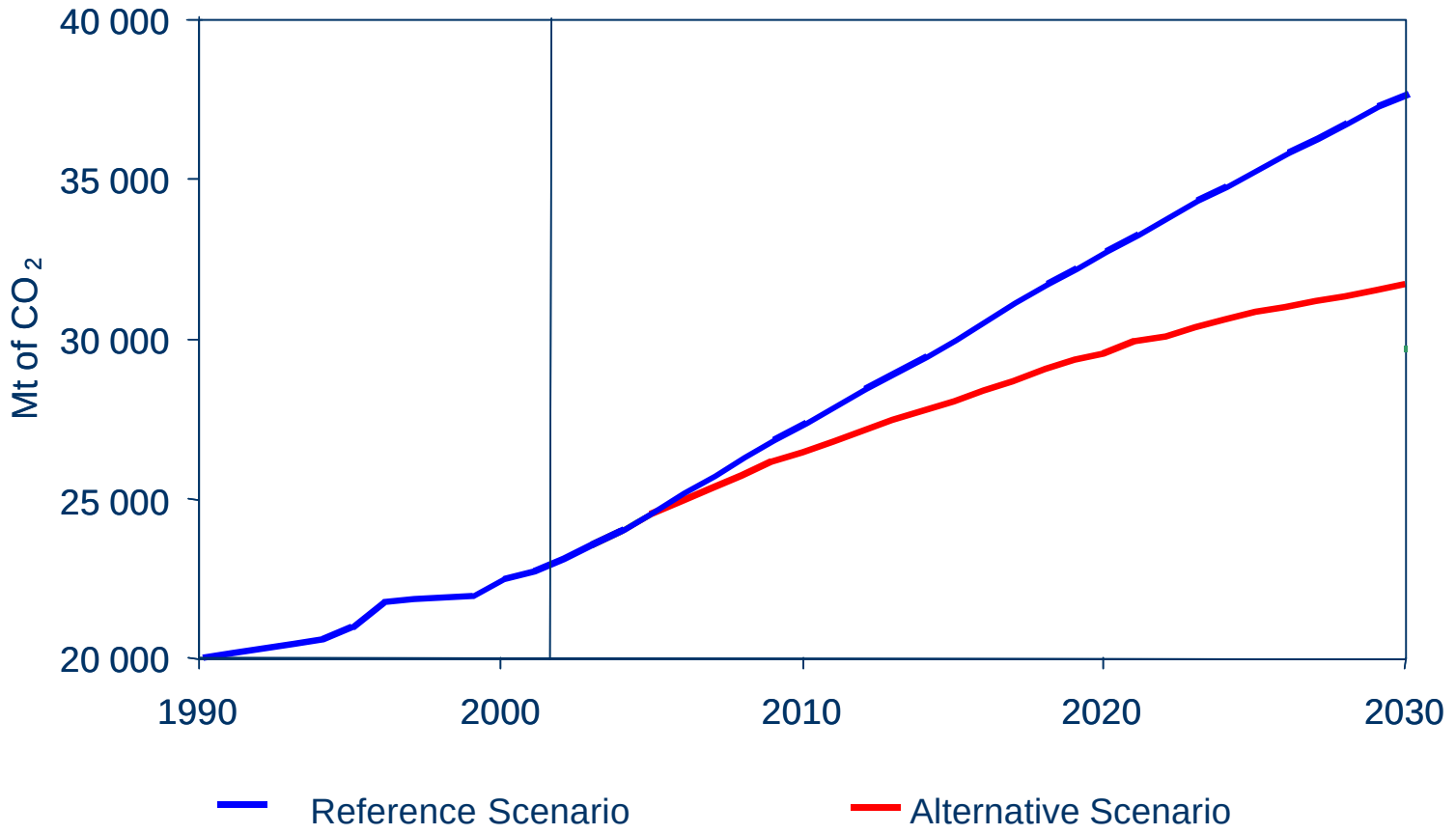
In Alternative Scenario, use of nuclear power goes up in absolute terms but still falls as portion of total consumption

OECD CO_2 Emissions in the Reference and Alternative Scenarios



OECD CO_2 emissions peak around 2020, 25% higher than in 1990

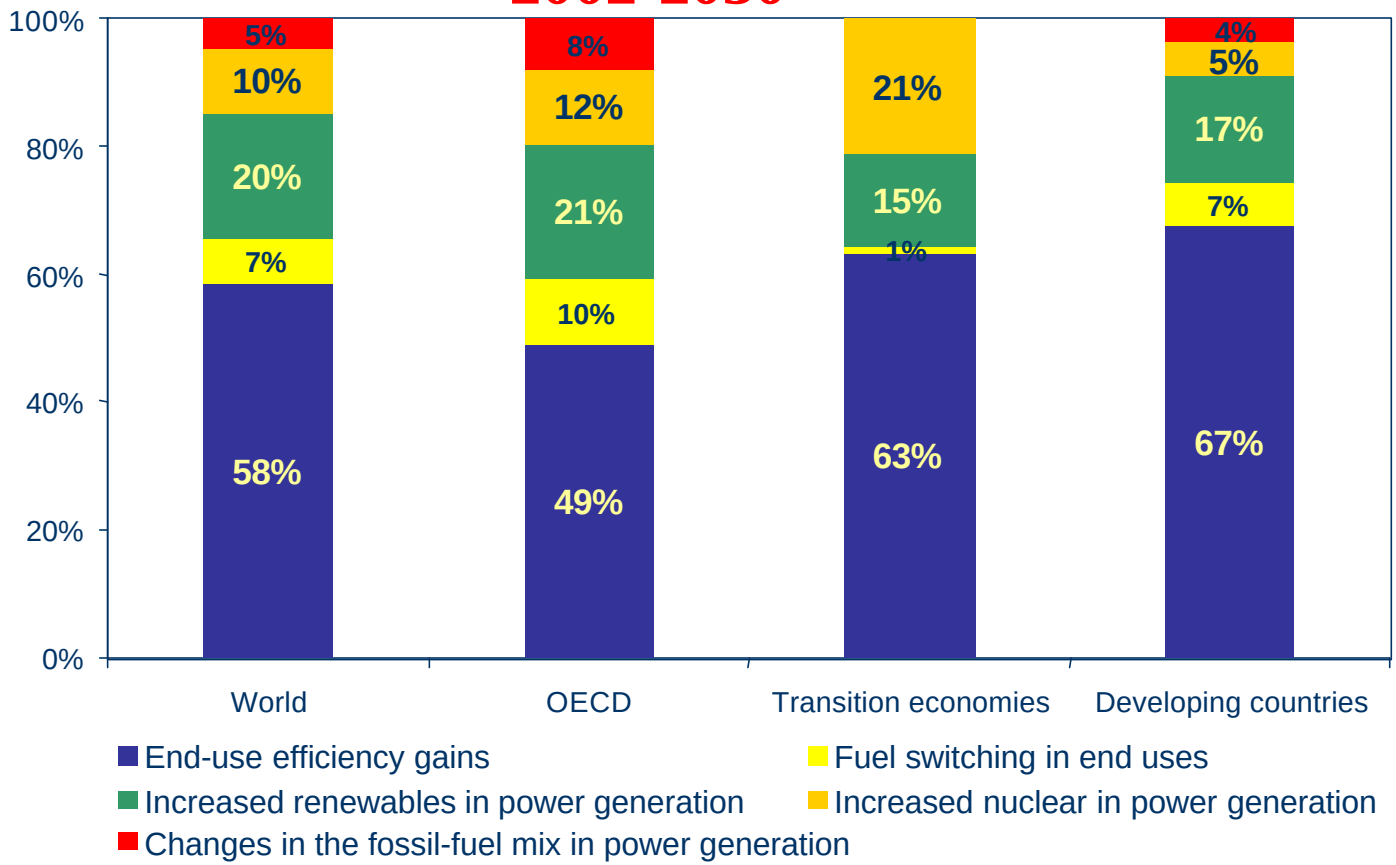
Global CO_2 Emissions in the Reference & Alternative Scenarios



CO_2 emissions are 16% less in the Alternative Scenario in 2030

Contributory Factors in CO_2 Reduction Alternative vs. Reference Scenario

2002-2030



Improvements in end-use efficiency contribute for more than half of decrease in emissions, and nuclear for 10%

Avoiding 1 Billion Tons of CO_2 per Year

Coal	Replace 300 conventional, 500-MW coal power plants with "zero-emission" power plants, or ...
CO_2 Sequestration	Install 1000 Sleipner CO_2 sequestration plants
Wind	Install 200 x current US wind generation in lieu of unsequestered coal
Solar PV	Install 1300 x current US solar generation in lieu of unsequestered coal
Nuclear	Build 140 1-GW power plants in lieu of unsequestered coal plants

To meet the energy demand & stabilize CO_2 concentrations unprecedented technology changes must occur in this century

[Adapted from Pacala & Socolow, *Science* 2004]

Outlook for Nuclear Power

- Existing plants are expected to have a longer life and higher capacity factor
- Competition still very challenging for new nuclear
  - Short term vs. natural gas
  - Medium term vs. coal
  - Long term vs. renewables/CO_2 sequestration?
- Prospects improve with carbon value
- Finland example very interesting

Competitiveness of Existing Nuclear Plants

- Relatively high capital, low operating costs - best suited for baseload operation
- Nearly all existing plants can compete:
  - Capital costs are sunk
  - A few high cost plants have shut down
  - Performance is improving
  - Power output is being raised
  - Life extensions expected

Financial Risks of Nuclear Power

- All investments contain a degree of risk…
- … But three uncertainties in particular increase risks of new nuclear power investments
  - Long lead time for projects
  - High up-front capital cost/lack of flexibility
  - Waste disposal and decommissioning costs

Conclusions

- Projected global market trends raise serious concerns
- More vigorous policies would curb rate of increase in energy demand and emission significantly
- But a truly sustainable energy system will call for faster technology development & deployment
- Urgent and decisive government action needed
- Nuclear energy has to play an important role as part of the global energy mix… but industry and governments must make this happen