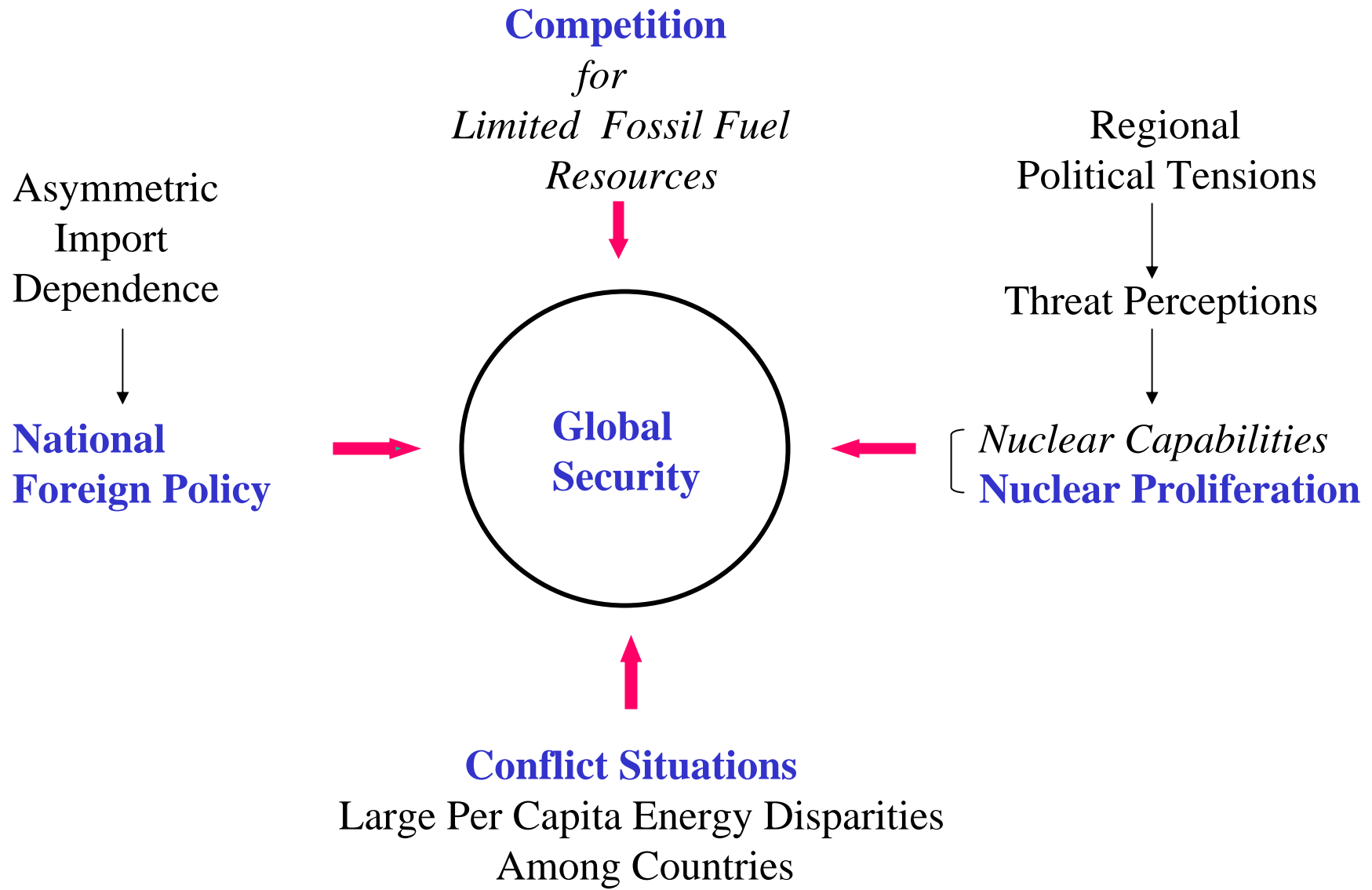


Energy & Global Security

Indian Perspective

Energy & Global Security



Energy Supply Pattern

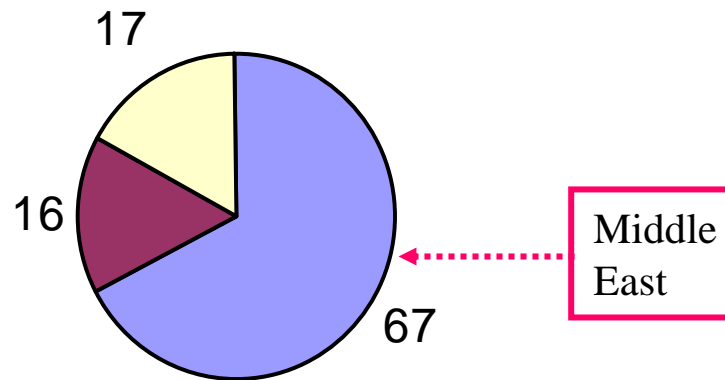
2003-04

(mtoe)

Fuel	Requirement	Domestic Production	Import	Import Dependence
Crude Oil	123	33	90	73% ← Middle East
Natural Gas	29	29	-	-
Coal	159	145	14	9%
Hydro	7	7	-	-
Nuclear	5	5	-	-
Renewables	1	1	-	-
Biomass (Traditional Use)	143	143	-	-
Total	467	830	104	22%

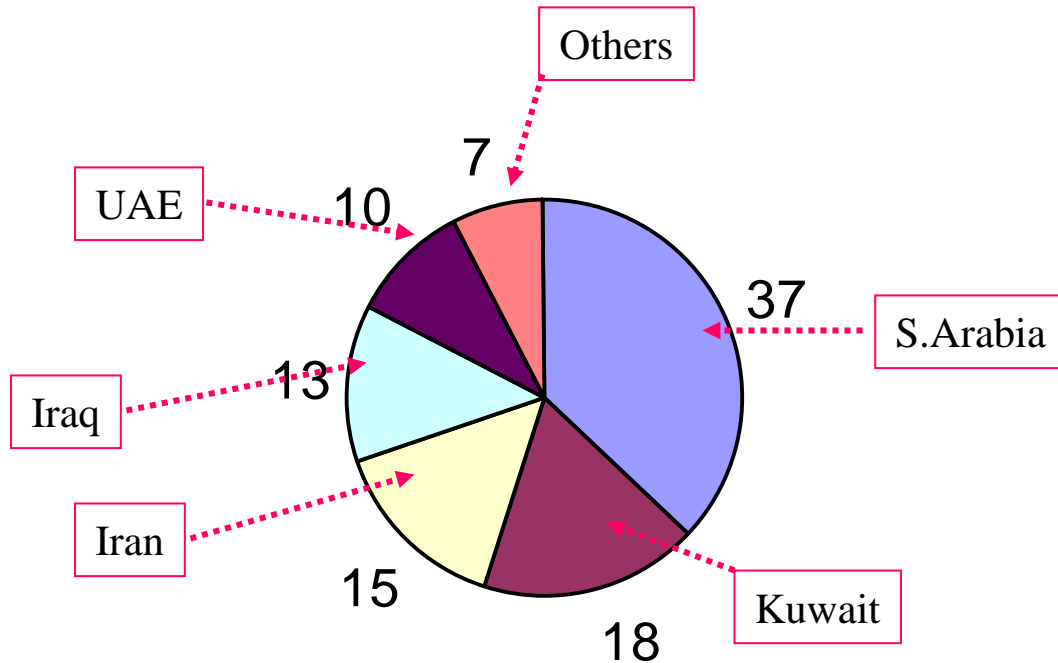
Source: Integrated Energy Policy (August 2006), Planning Commission

Oil Imports (2004-05) in (% Shares)



Source: Integrated Energy Policy (August 2006), Planning Commission - Referred to as "IEP" in all these slides

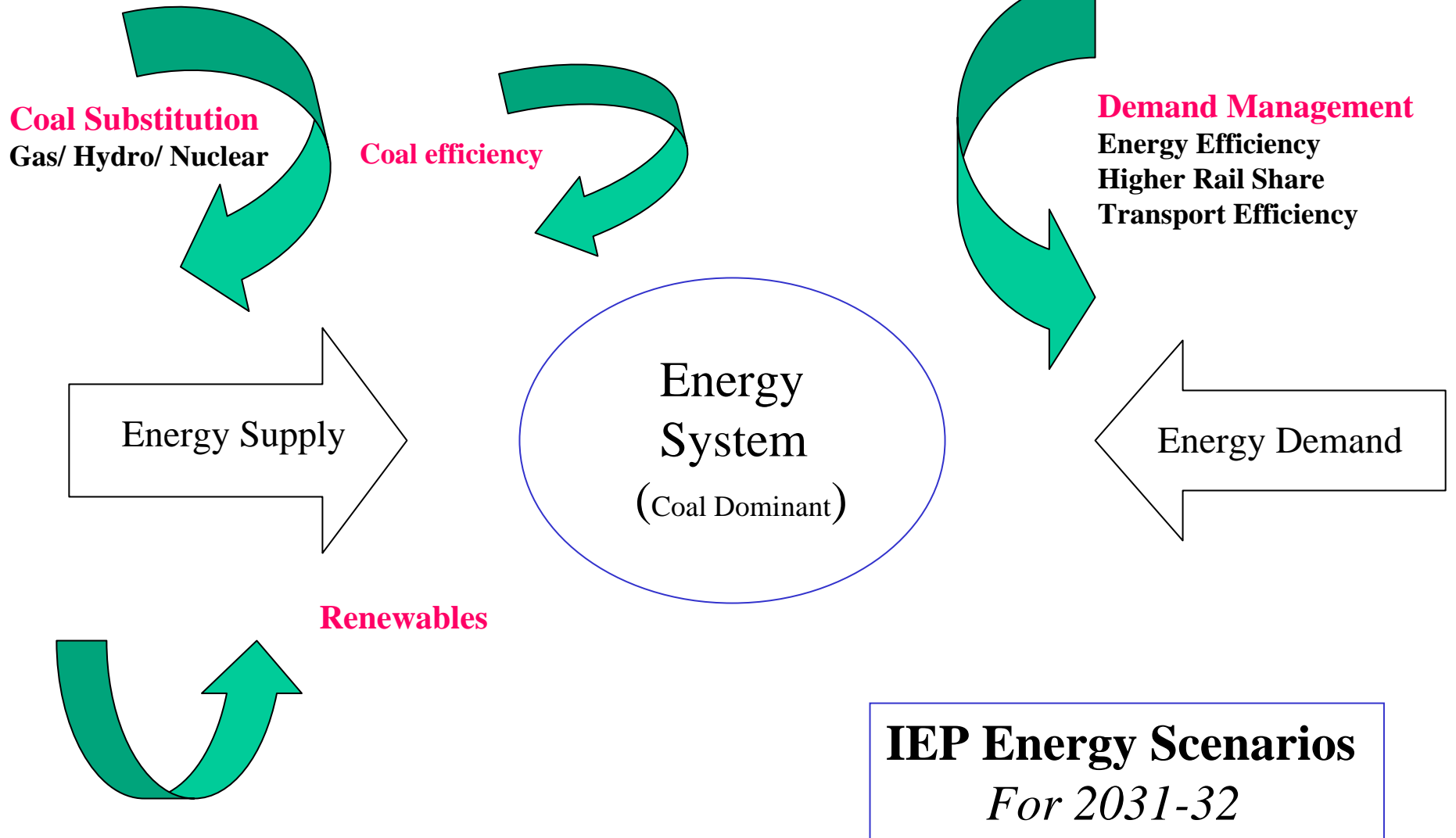
Oil Imports from Middle East (%Shares) 2004-05



■ S. Arabia ■ Kuwait ■ Iran ■ Iraq ■ UAE ■ Others

Source: Integrated Energy Policy (August 2006), Planning Commission - Referred to as “IEP” in all these slides

IEP Approach



IEP Base Case (BC) for 2031-32

(8% GDP Growth)

Fuel	Requirement	Domestic Production	Import	Import Dependence (mtoe)
Crude Oil	486	35	451	93%
Natural Gas	105	100	5	5%
Coal	1022	560	462	45%
Hydro	13	13	-	-
Nuclear	76	76	-	-
Renewables	2	2	-	-
Biomass (Traditional Use)	185	185	-	-
Total	1889	971	918	49%

Middle East



Diverse Sources



IEP: Coal Substitution Scenario (CSS) 2031-32 (8% Growth)

(Mtoe)

Scenario	BC	Coal Substitution by			After Coal Substitution
		Hydro	Nuclear	Gas	
Crude Oil	486			Iran Gas Pipeline ?	486 ↖ Middle East
Natural Gas	105			+92	197
Coal	1022	-69	-24	-94	835
Hydro	13	+22			35
Nuclear	76		+22		98
Renewables	2		Steep Step Up in Nuclear		2
Biomass (Traditional Use)	185				185
Total	1889				1838

IEP: Efficiency Scenario (ES) 2031-32 (8% Growth)

Scenario	CSS	Coal Efficiency, DSM, Increased Rail Share, Transport Efficiency	Post Efficiency	Forced Renewables
Crude Oil	486	-125	361	350 ← Middle East
Natural Gas	197	-26	171	150 ← Iran Gas ?
Coal	835	-128	707	632
Hydro	35		35	35
Nuclear	98		98	98
Renewables	2		2	87
Biomass (Traditional Use)	185		185	185
Total	1838	-279	1559	1537

IEP Efficiency Scenario: Electricity Generation Capacities

Source	MW (Load Factor)
Coal	269,997 (67%)
Gas	119,815 (27-36%)
Nuclear	63,060 (68%)
Hydro	150,153 (30%)
IGCC	3,137 (68%)
Wind	33,341 (20-25%)
Biomass	51,200 (70-75%)
Solar	10,000 (17.5%)
Total	700,703 (50%)

Strategic Implications of Different Scenarios

	Total Energy Requirement (mtoe)	Overall Import Dependence	Oil Import Dependence	Gas Import Dependence	Oil + Gas Import Dependence	Nuclear Share	Non-Fossil Fuel Share
BC	1889	49%	93%	5%	77%	4.0%	15%
CSS	1838	45%	93%	49%	80%	5.3%	17%
ES	1537	28%	90%	33%	73%	6.4%	26%

Share in World Fossil Fuel Resources (2031-32)

	BC	CSS	ES
Oil	9.7%	9.7%	7.0%
Gas	2.8%	5.3%	4.0%
Coal	37.2%	30.4%	23.0%

Sources: IEP & Trade Estimates from world Energy Outlook 2004 of International Energy Agency

India's Share in Primary Energy vis-à-vis CO₂ Emissions

	2002	2020	2030
<u>Primary Energy</u> (Mtoe)			
World	10200	13345	14654
India	538	762	902
India's share	5.3%	5.7%	6.2%
<u>CO₂ Emissions</u> (Mt)			
World	23116	29583	31686
India	1016	1501	1818
India's share	4.4%	5.1%	5.7%
India's share in World Population	16.8%	17.6%	18.7%

Source: IEA's World Energy Outlook 2004

Strategic Interventions

1. Political Tensions + Nuclear Capabilities → **Nuclear Proliferation**
International Effort to Diffuse Tension
2. India's Per Capita CO₂ Emissions Low- Undue curtailment of Coal Use will force the Country's Dependence on **Imported Gas (Middle East) & Nuclear**

Technical & Economic Cooperation to transfer Clean Coal Technologies

3. Technical & Economic Cooperation to transfer
Efficient Technologies for **Energy Demand Management, Renewables & Biomass Conversion into Useful Energy**
4. **India's Oil Import Dependence on Middle East sources will increase;**
Oil substitution & demand management alone can help
4. Regional Gas Grids from Middle East/ Central Asian Countries, Myanmar
5. Regional Electricity Grids among Asian Countries
6. **Global Strategy & Cooperation to move towards Renewables**