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Joint ICTP-IAEA Workshop on Sustainable Energy Development: Pathways and Strategies after Rio+20

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Indicators of Sustainable Development: Energy Sector of Pakistan

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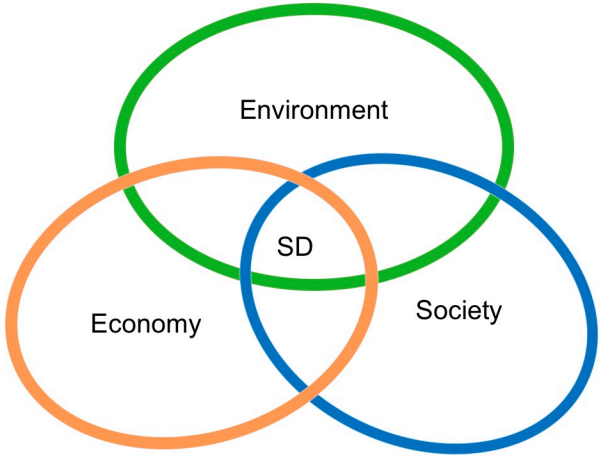
Sustainable Energy Development: Pathways and Strategies after RIO +20.

Outlines of Presentation

- Energy Sector Issues in Pakistan
- Historical Trends of ISED
- Findings

According to Brundtland Commission ;

“ Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.



WCED (World Commission on Environment and Development, 1987).

Issues Related to Energy Sector of Pakistan

- Slow Development of Indigenous Energy Resources
- Shift from Hydro to Fossil Fuels in Electricity Generation Mix
- Domination of Fossil Fuels in Energy Mix
- Heavy Reliance on Imported Oil
- Inefficiencies and Lack of Conservation Strategies
- Lower Affordability and Access to Energy/Electricity
- Irrational Tariff Structure
- Degradation of the Environment

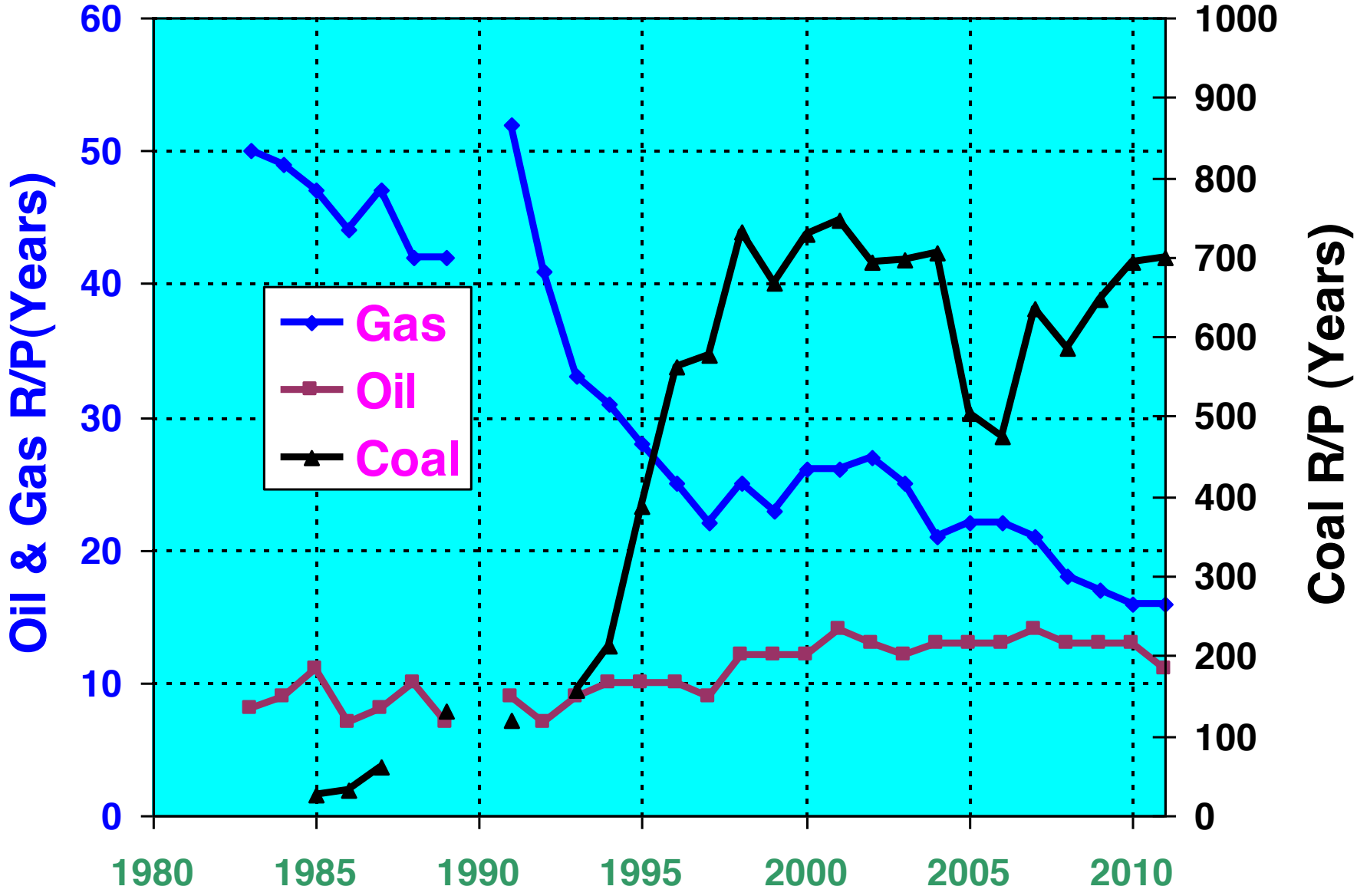
Exploitation of Hydro Power Resources

Technical Potential of Hydro Power = 59,000 MW

Year	Installed Hydro Capacity	Exploitation
	MW	%
1980	1,567	2.66
1983	2,547	4.32
1993	4,626	7.84
2002	5,041	8.54
2011	6,481	10.98

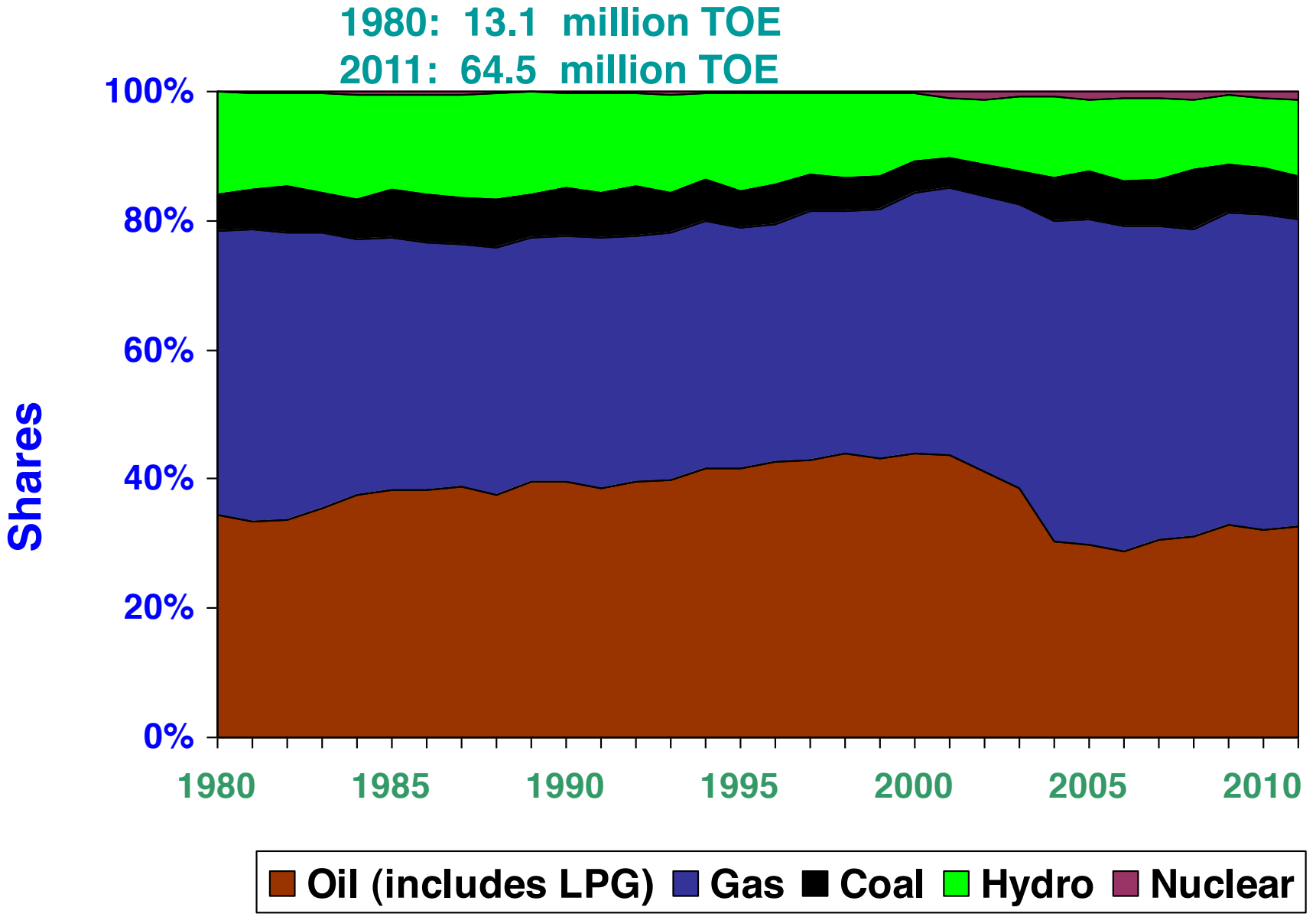
Source: WAPDA, Power System Statistics 2011 and earlier issues

Reserve to Production Ratio



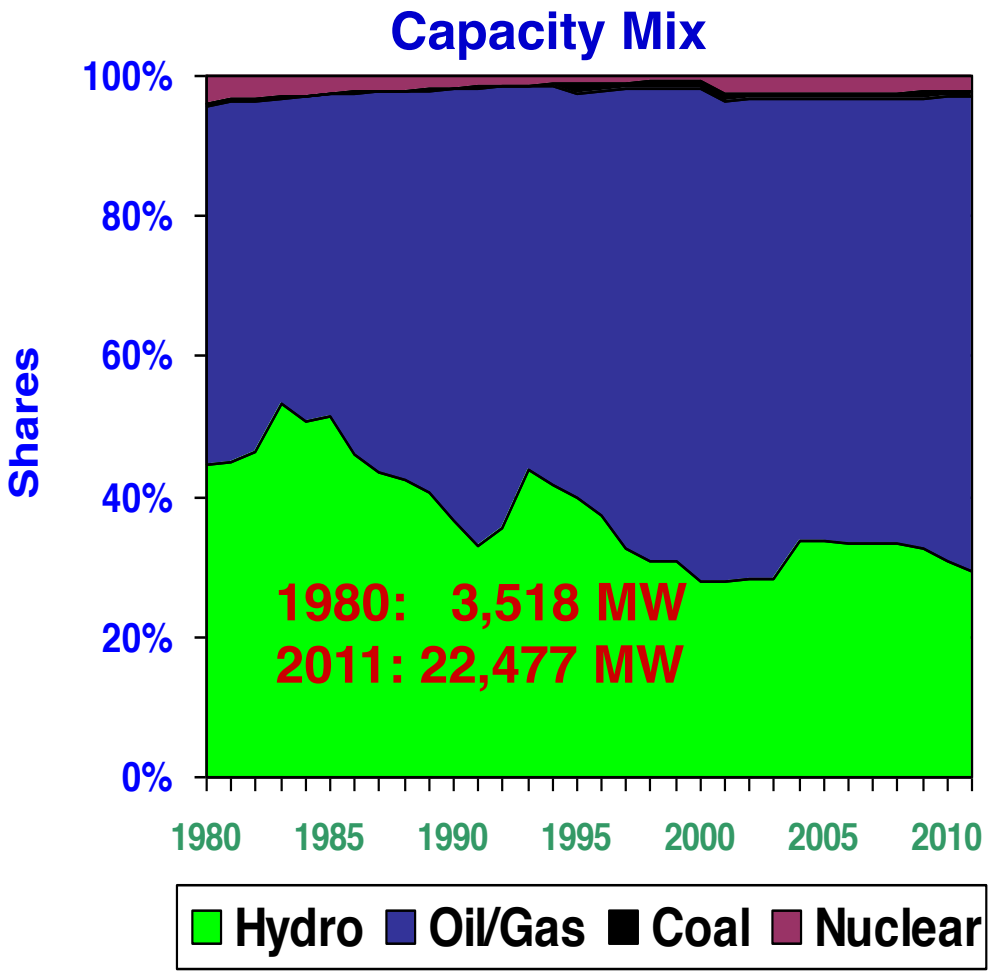
Source: Pakistan Energy Yearbook 2011 and earlier issues

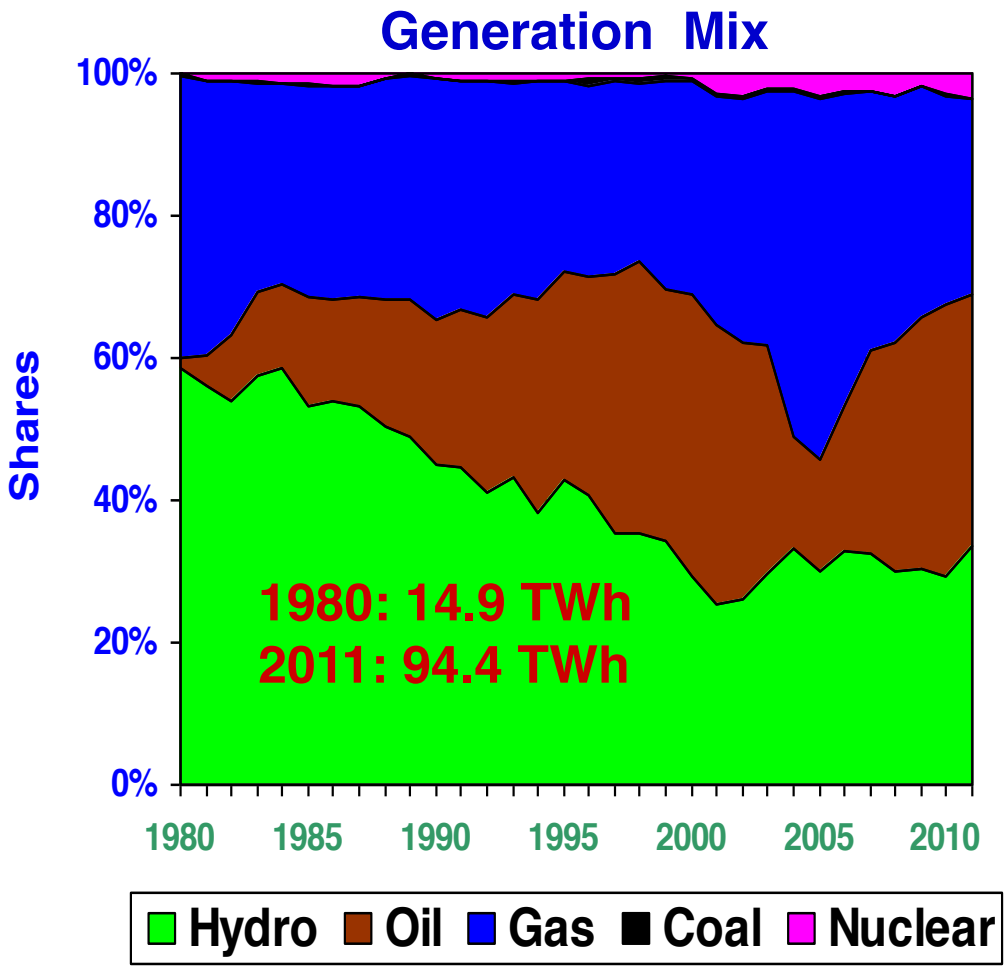
Diversification in Primary Energy Mix



Source: Pakistan Energy Yearbook 2011 and earlier issues

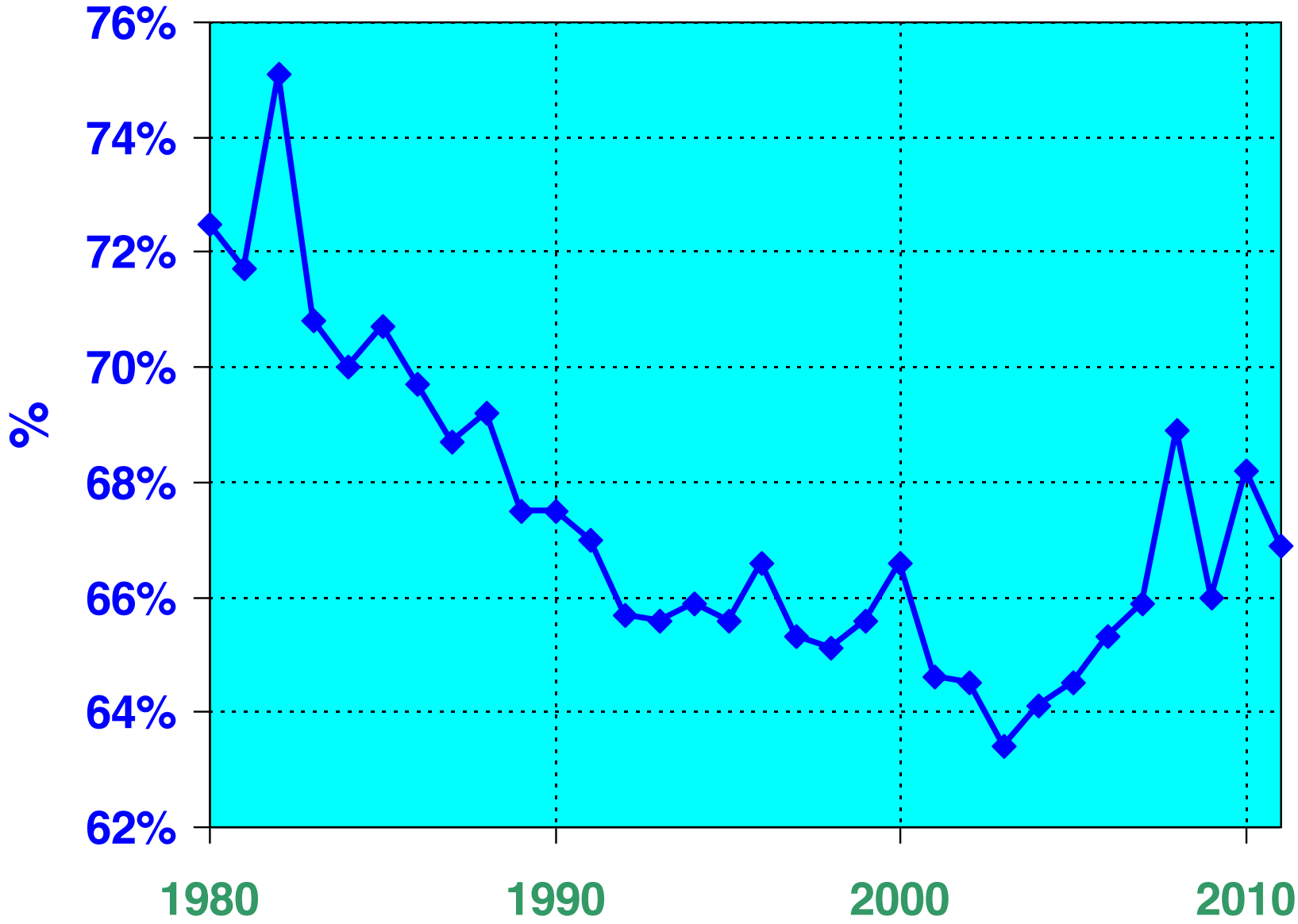
Mix in Electricity Capacity and Generation





Sources: Pakistan Energy Yearbook 2011 and earlier issues
WAPDA, Power Systems Statistics 2011 and earlier issues

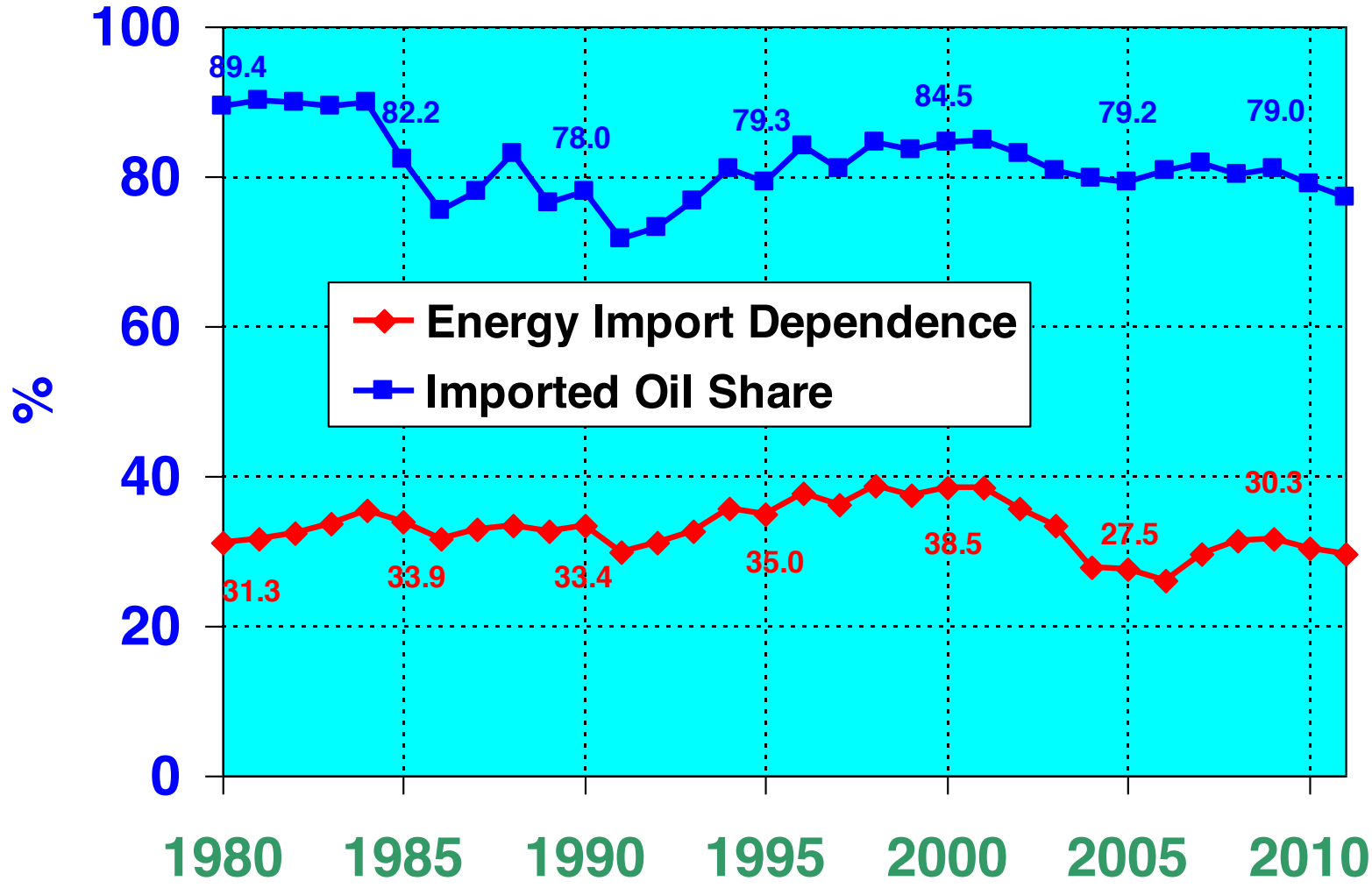
Ratio of Final Energy* to Primary Energy



* Including Non-Energy Use

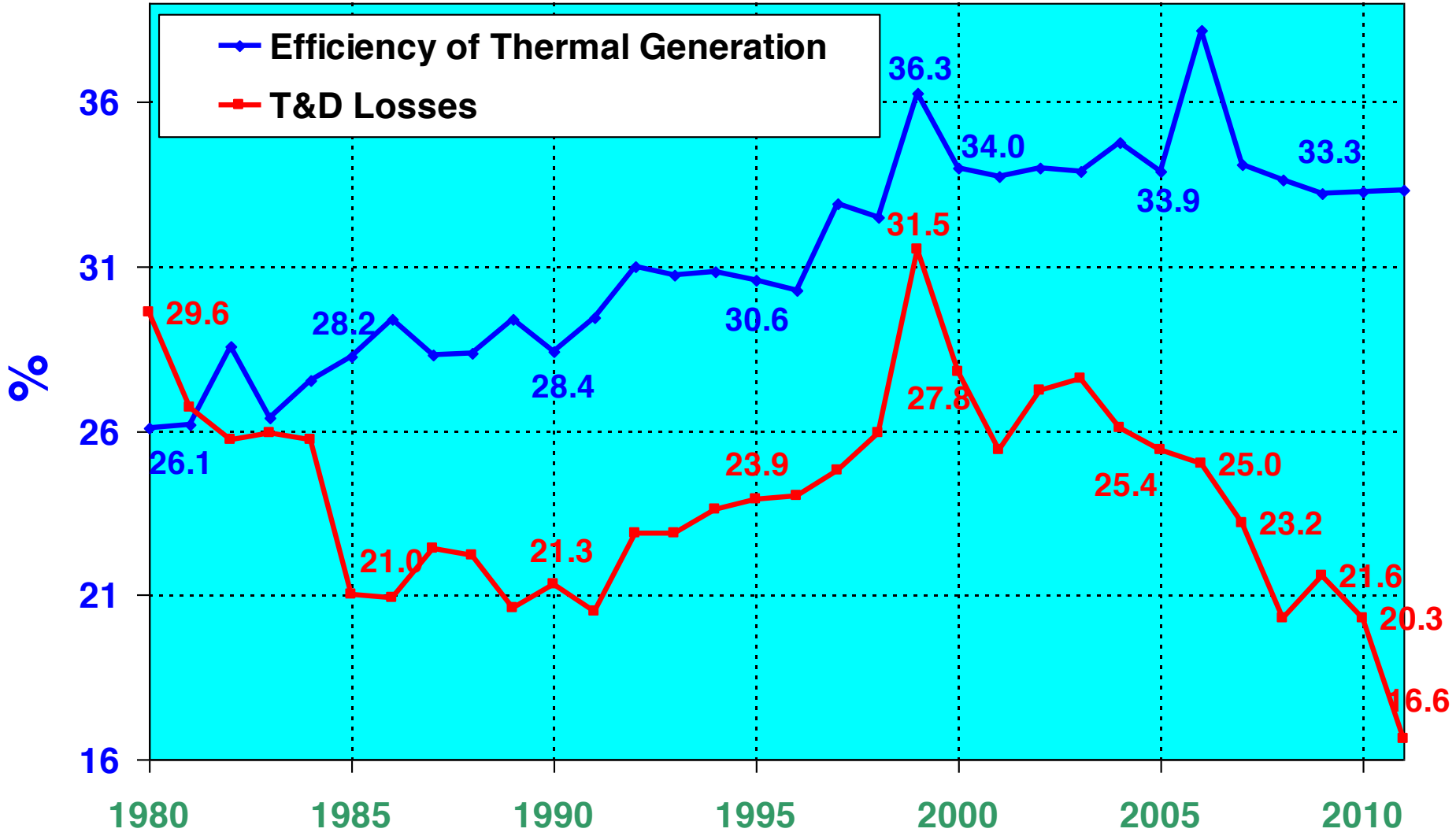
Source: Pakistan Energy Yearbook 2011 and earlier issues

Energy Import Dependence



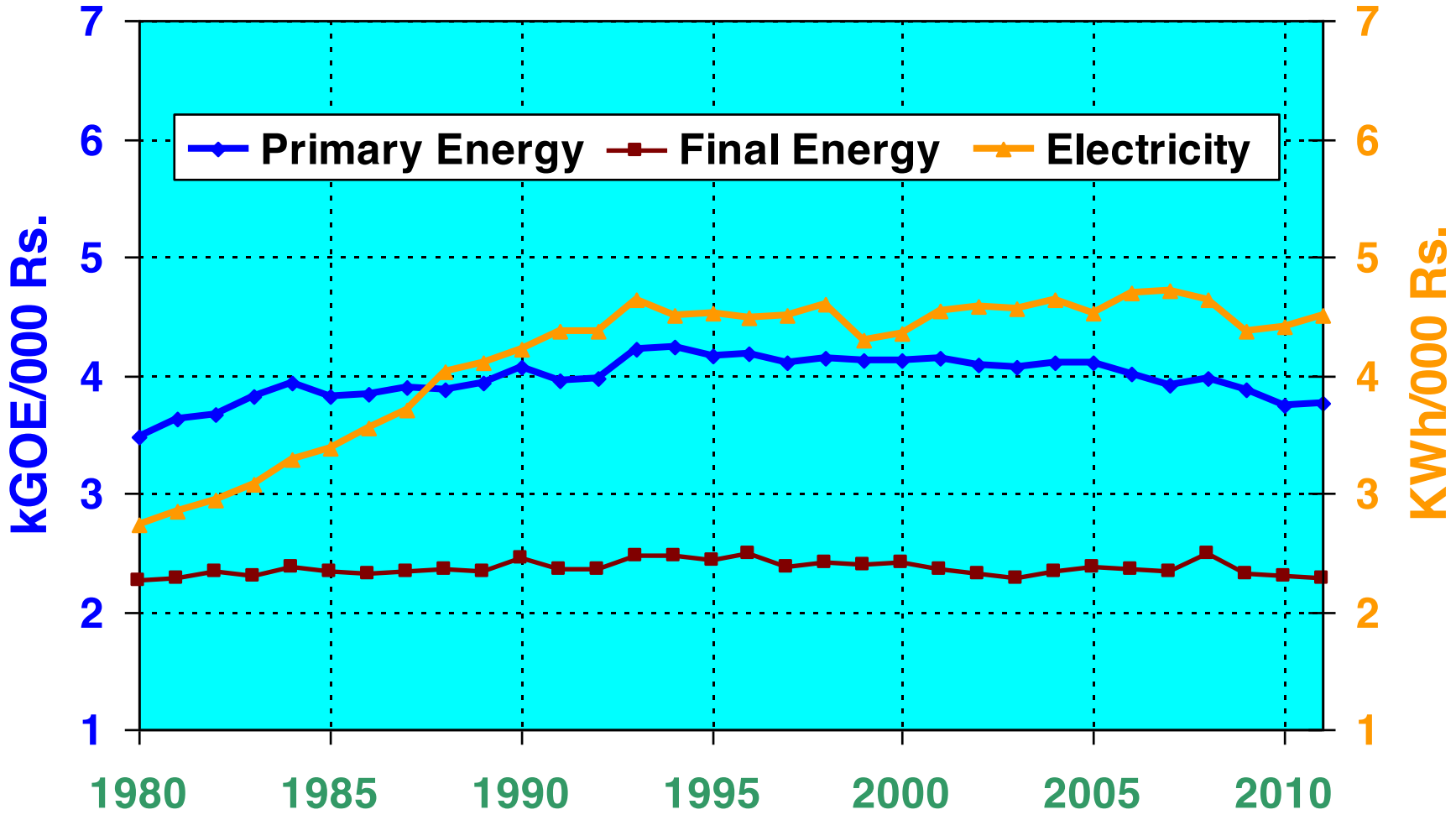
Source: Pakistan Energy Yearbook 2011 and earlier issues

Efficiency in Electricity Sector



Sources: Pakistan Energy Yearbook 2011 and earlier issues
WAPDA, Power Systems Statistics 2011 and earlier issues

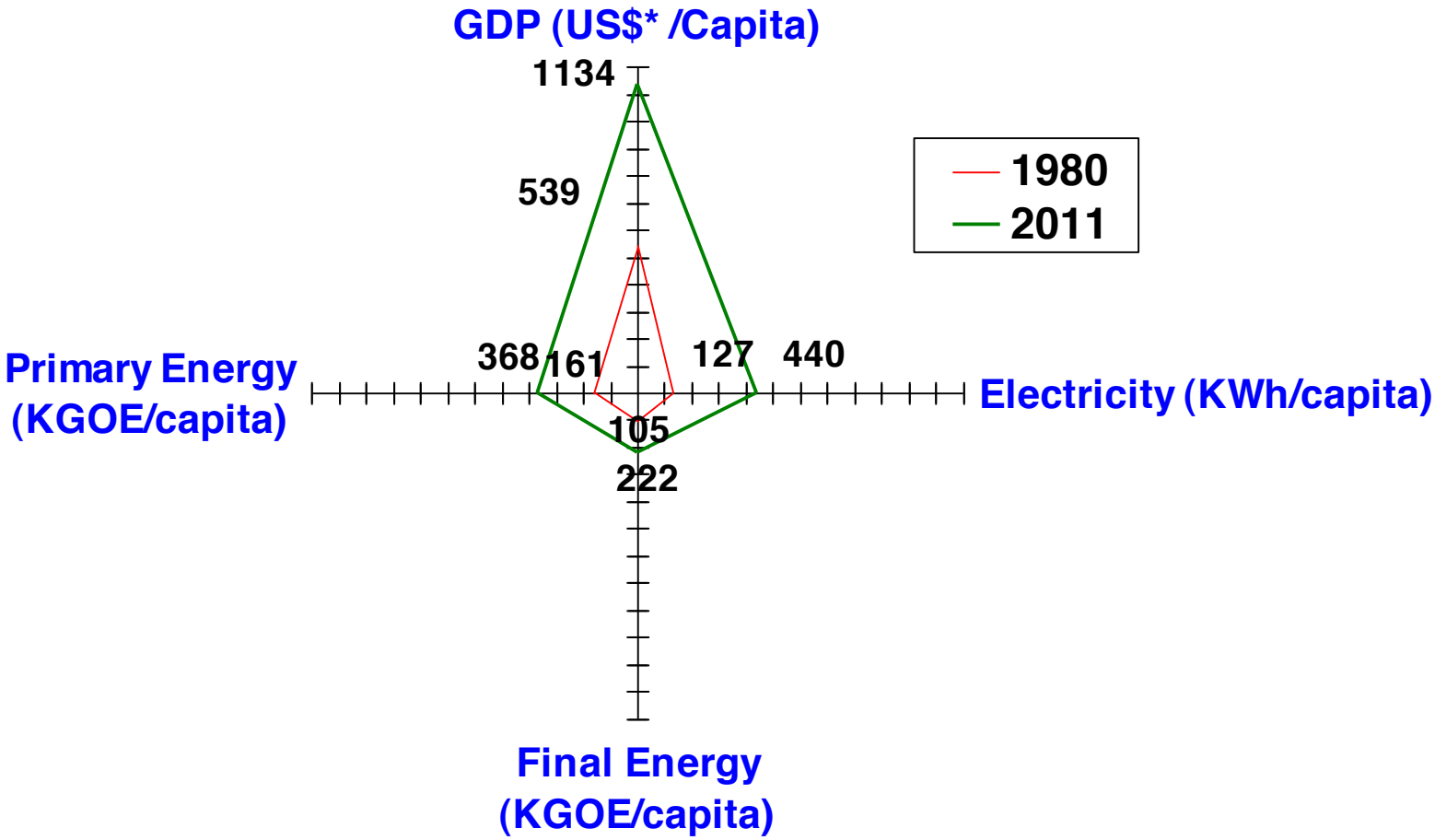
Energy Use per Unit of GDP*



* At Constant Prices of Year 2010-11

Sources: Pakistan Energy Yearbook 2011 and earlier issues
Pakistan Economic Survey 2011 and earlier issues

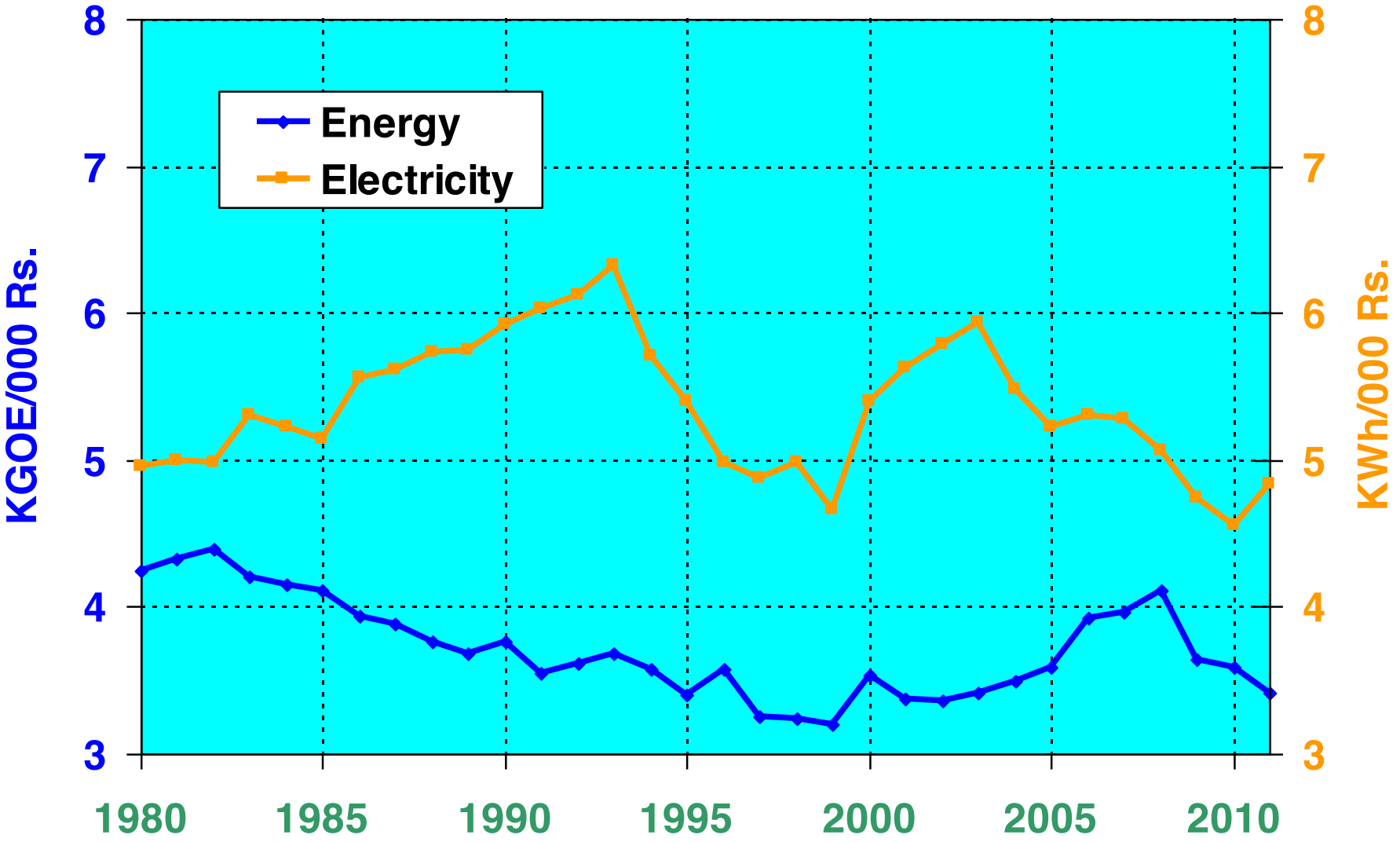
Energy/Electricity Use per Capita



* At Constant Prices of Year 2010-11

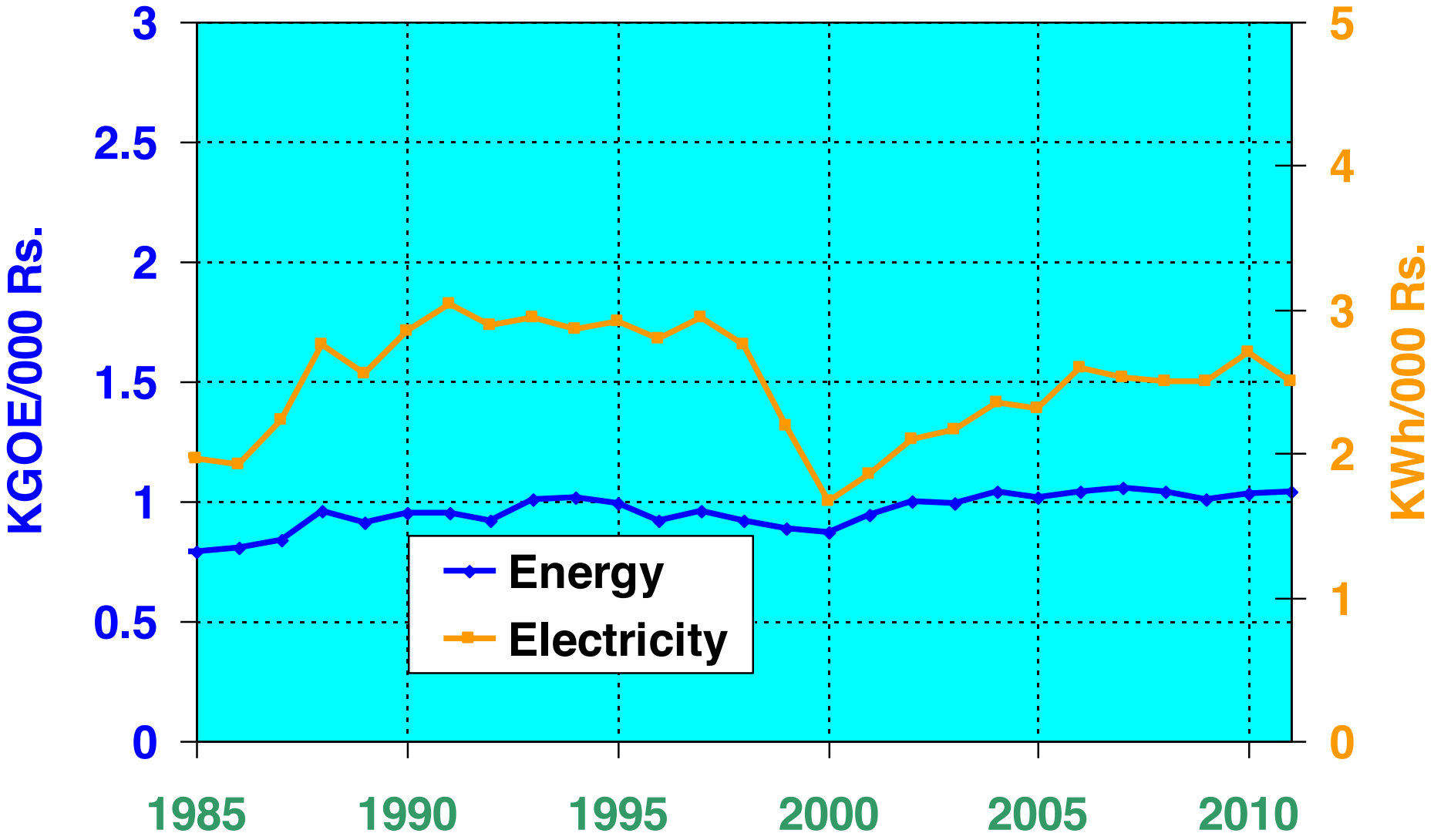
Sources: Pakistan Energy Yearbook 2011 and earlier issues
Pakistan Economic Survey 2011 and earlier issues

Energy Intensities of Industrial Sector



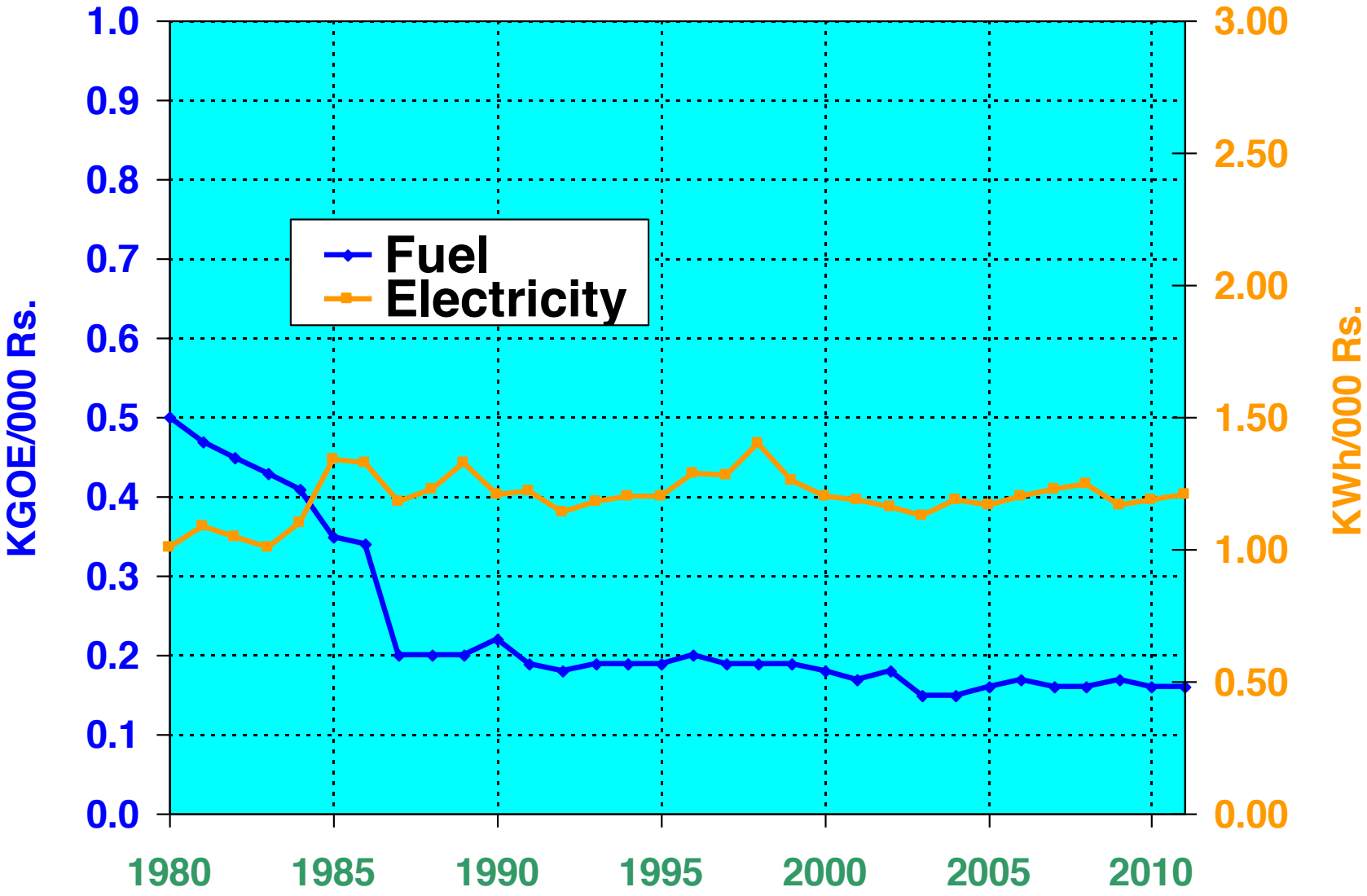
Sources: Pakistan Energy Yearbook 2011 and earlier issues
Pakistan Economic Survey 2011 and earlier issues

Energy Intensity of Agriculture Sector



Sources: Pakistan Energy Yearbook 2011 and earlier issues
WAPDA, Power Systems Statistics 2011 and earlier issues

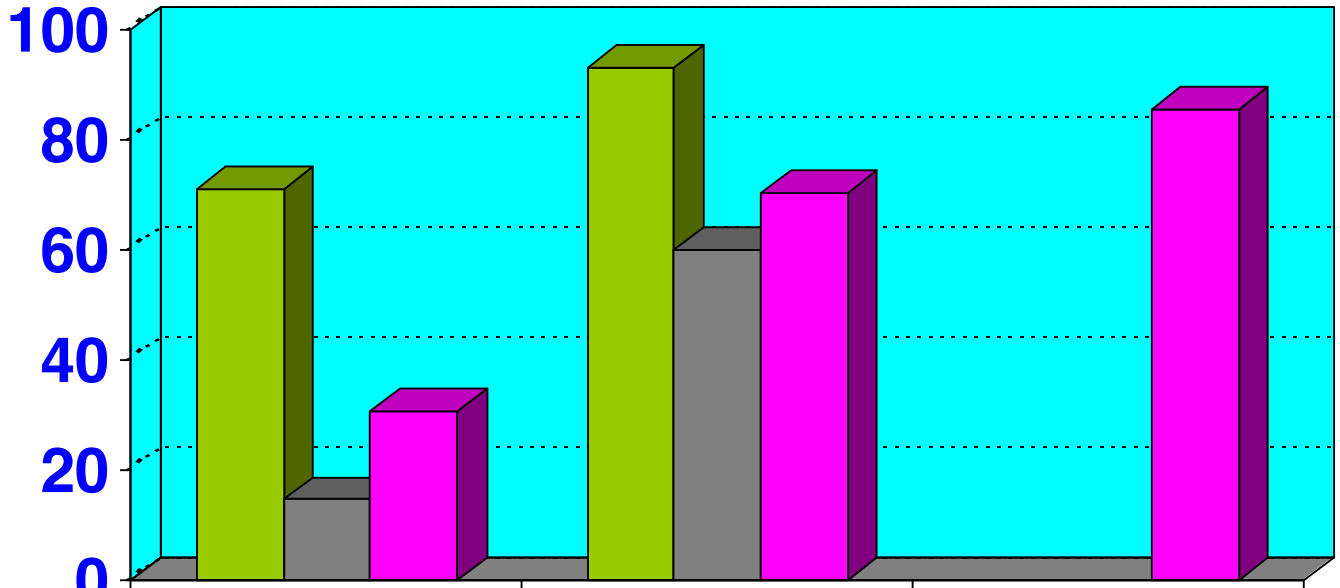
Energy Intensity of Service Sector



Sources: Pakistan Energy Yearbook 2011 and earlier issues
Pakistan Economic Survey 2011 and earlier issues

Access to Electricity

Share of Household with Electricity

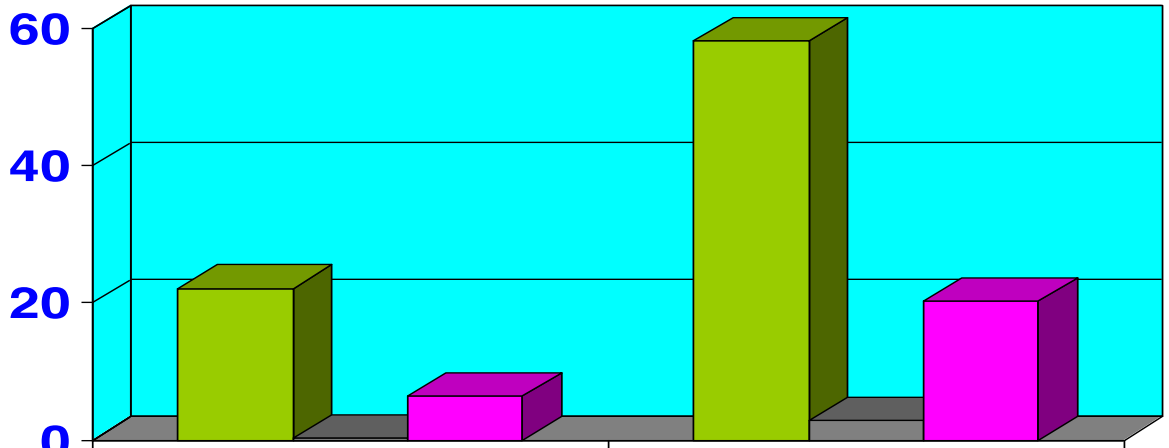


	1980	1998	2011
Urban	71.04	93.14	
Rural	14.66	60.07	
Total	30.58	70.46	85.43

Sources: 1998 Census Report of Pakistan
WAPDA, Power Systems Statistics 2011

Access to Piped Natural Gas

Share of Household with Natural Gas Connections

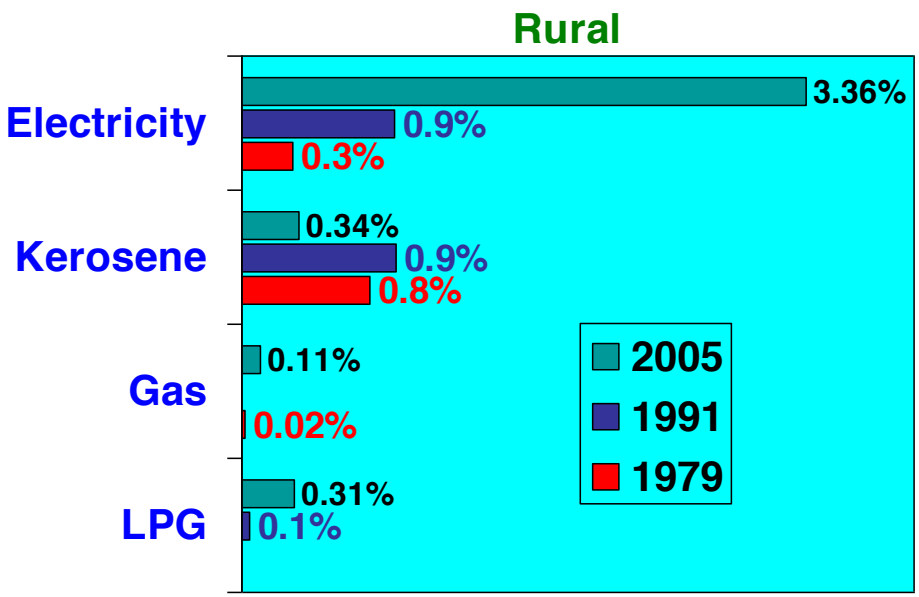


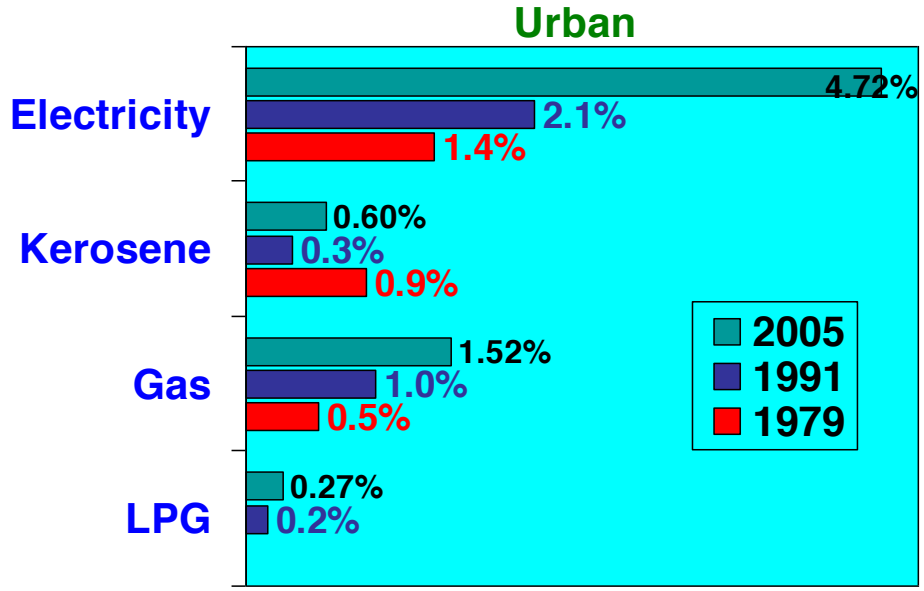
	1980	1998
Urban	22.11	58.14
Rural	0.30	2.83
Total	6.46	20.19

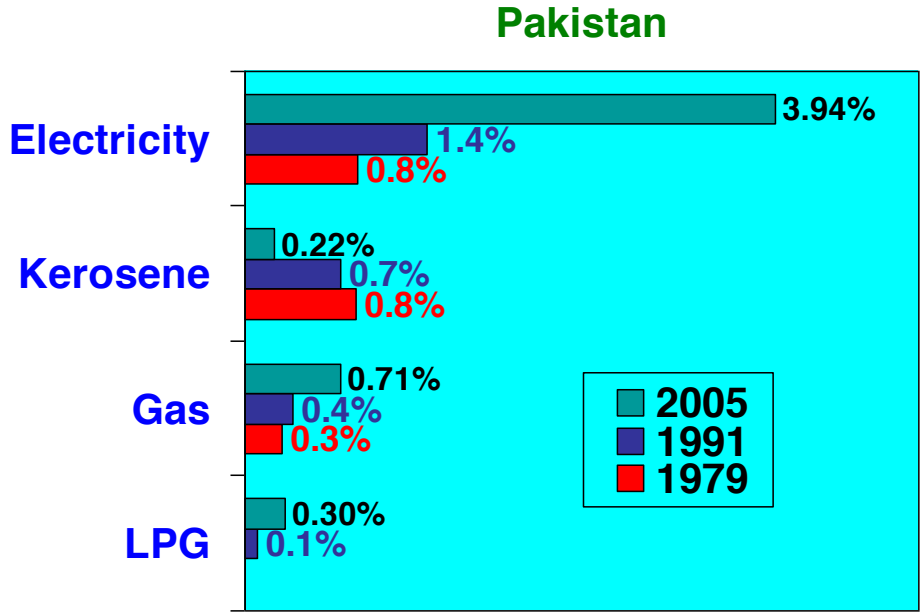
	Gas connection per million of population	Index of Gas connection
1992	13,926	100
1998	22,973	165
2011	36,102	259

Sources: Pakistan Energy Yearbook 2011 and earlier issues
Pakistan Economic Survey 2011 and earlier issues
1998 Census Report of Pakistan

Household Expenditure on Fuel and Electricity

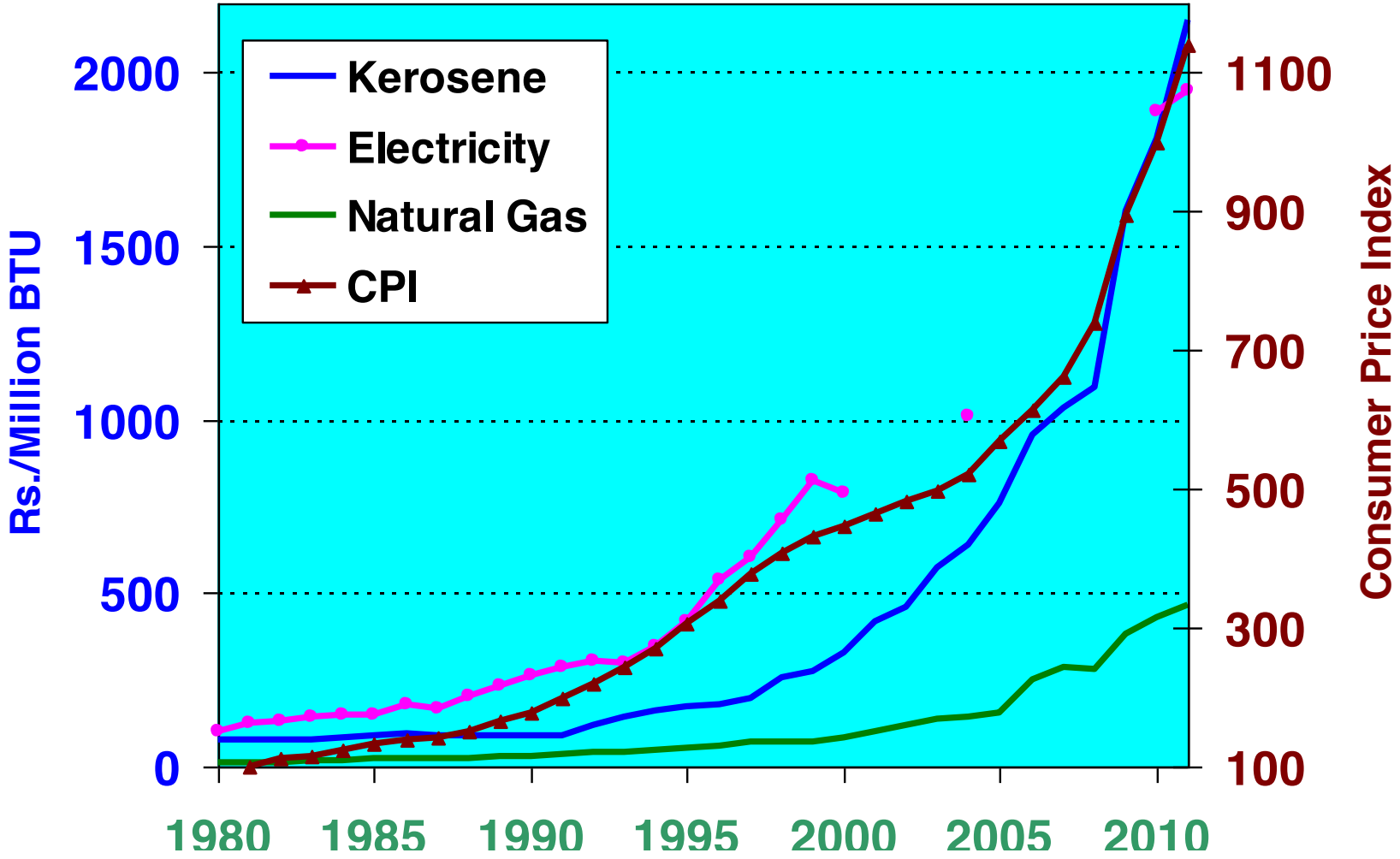






Sources: Household Integrated Economic Survey 2004-05
HESS Survey 1993.
Household Income and Expenditure Survey,1979

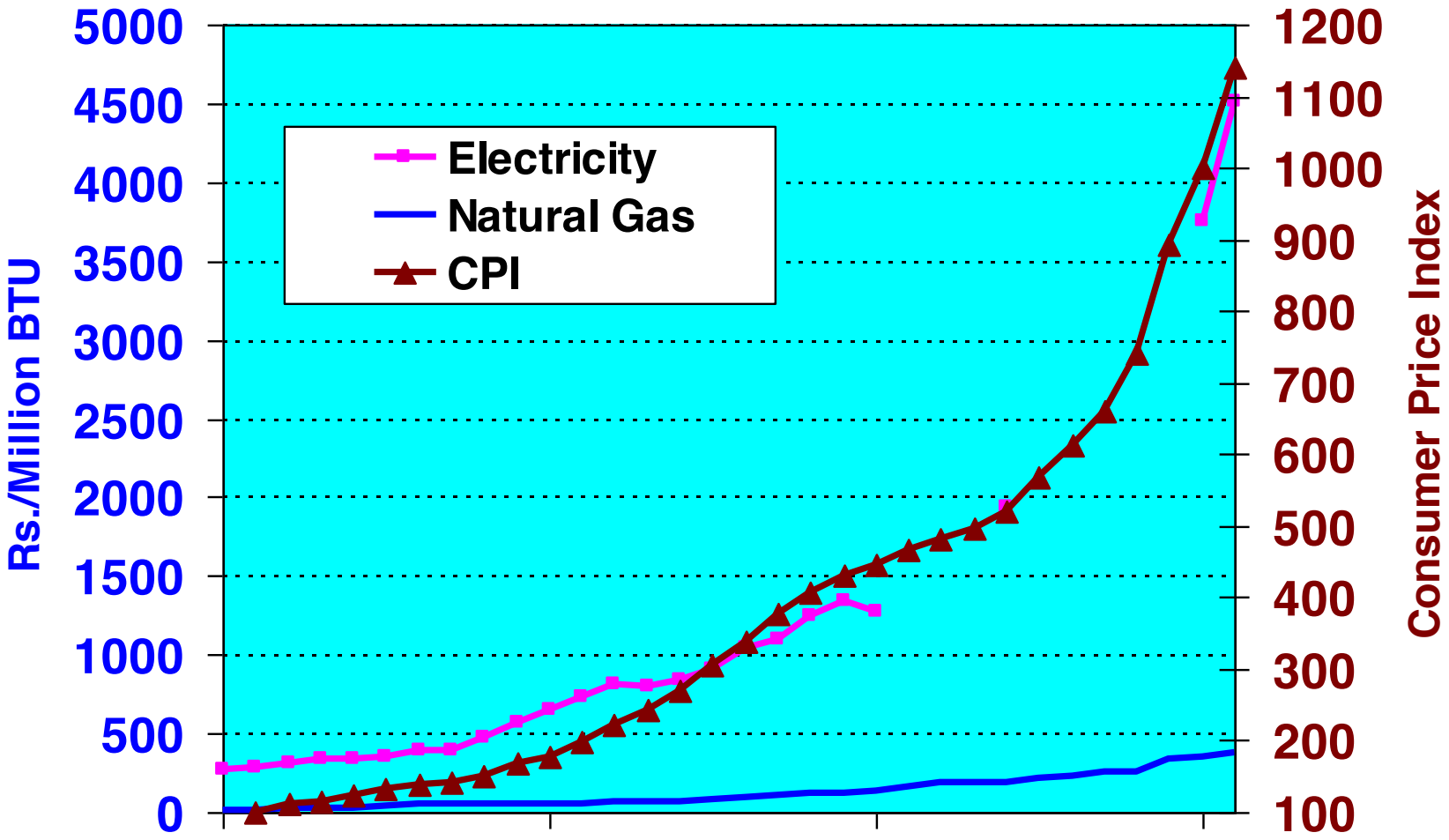
Energy Prices for Household



There have been 27, 20 and 42 fold increase in price of Kerosene, Electricity and Gas respectively

Sources: NEPRA
Pakistan Economic Survey
WAPDA, Power Systems Statistics

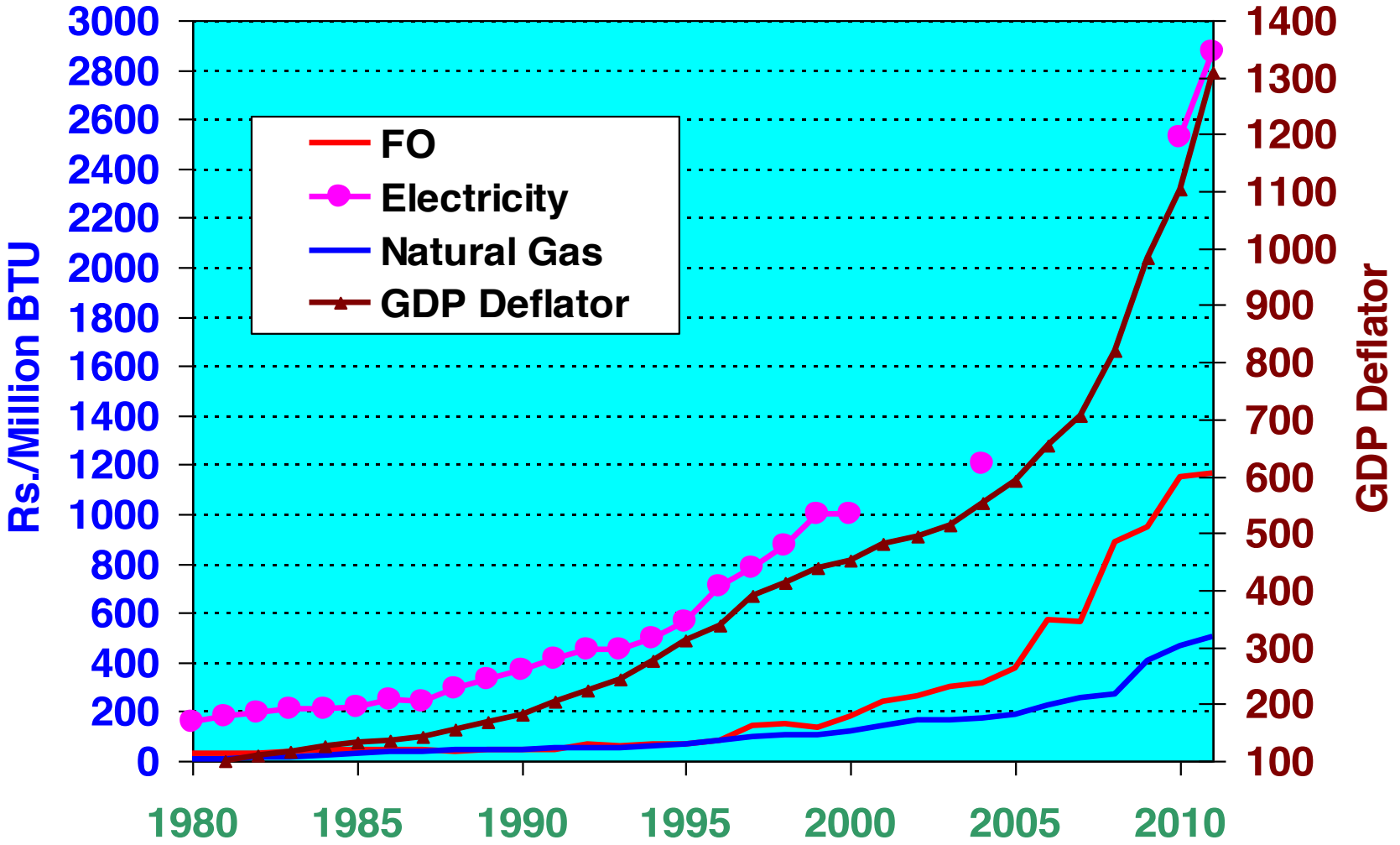
Energy Prices for Commercial Sector



There have been 17 and 20 fold increase in price of Electricity and Gas respectively

Sources: NEPRA
Pakistan Economic Survey
WAPDA Power Systems Statistics

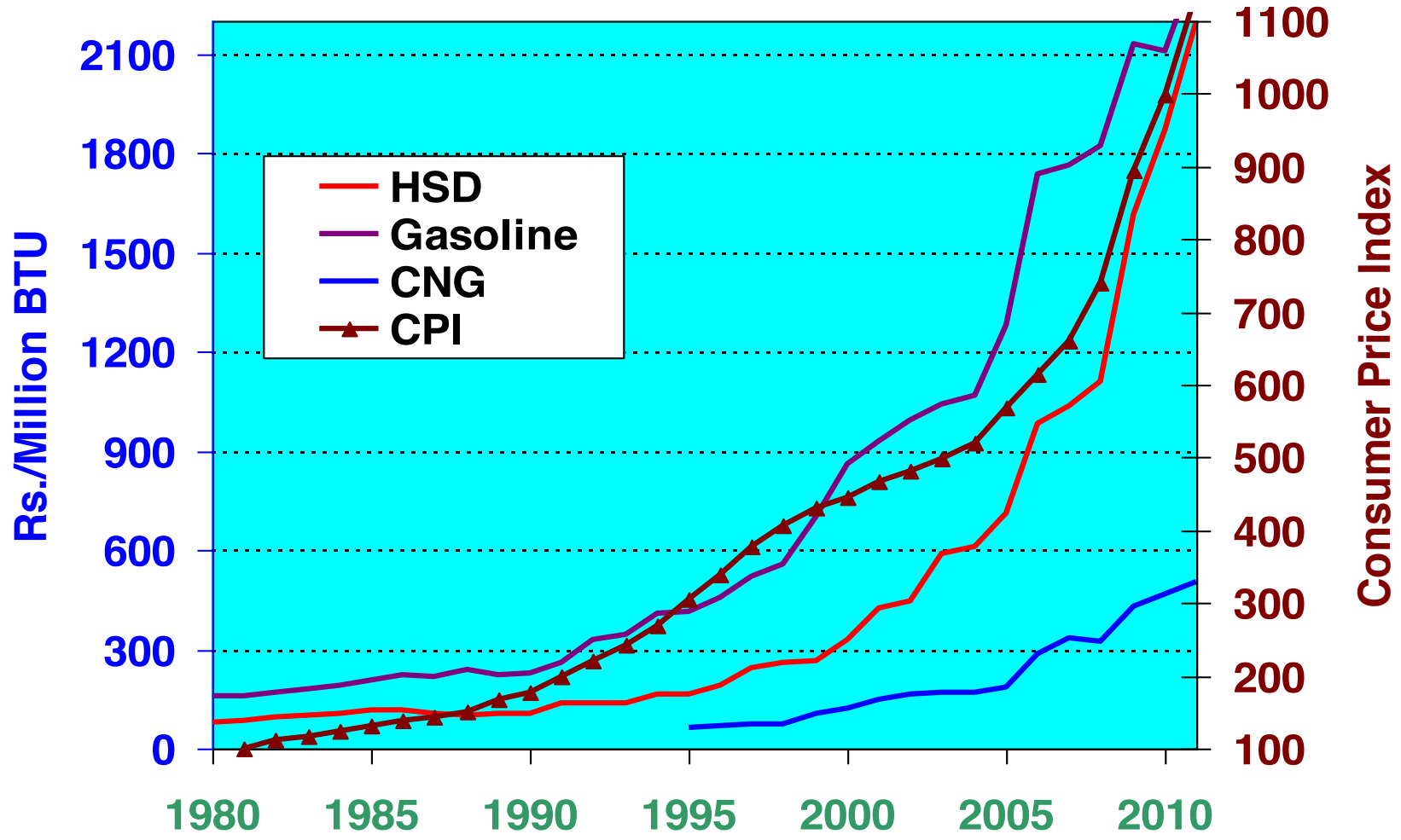
Energy Prices for Industrial Sector



There have been 18, 38 and 47 fold increase in price of Electricity, FO and Gas respectively

Sources: NEPRA
Pakistan Economic Survey
WAPDA Power Systems Statistics

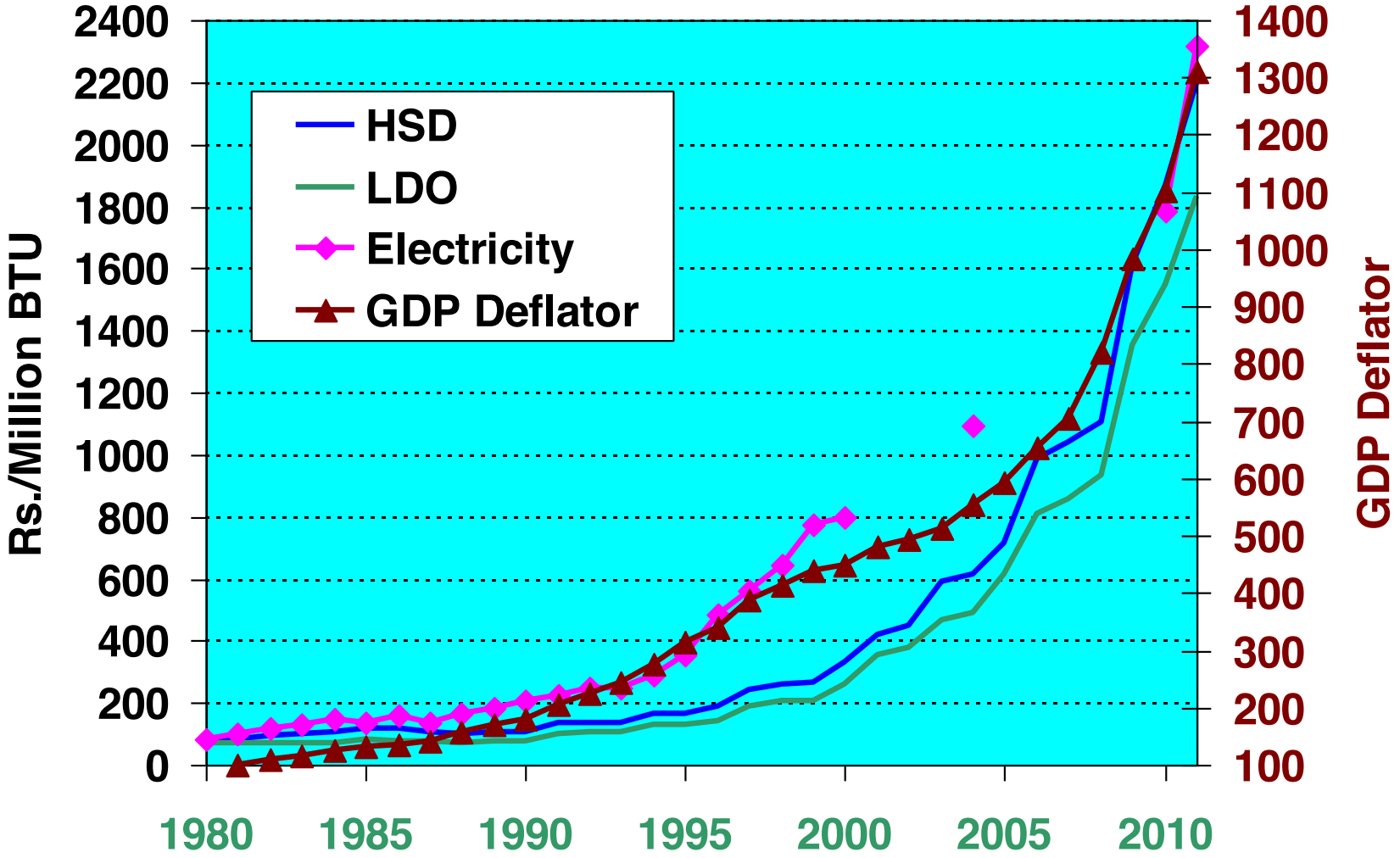
Energy Prices for Transport Sector



There have been 27 and 15 fold increase in price of HSD and Gasoline respectively

Sources: NEPRA
Pakistan Economic Survey
WAPDA Power Systems Statistics

Energy Prices for Agriculture Sector



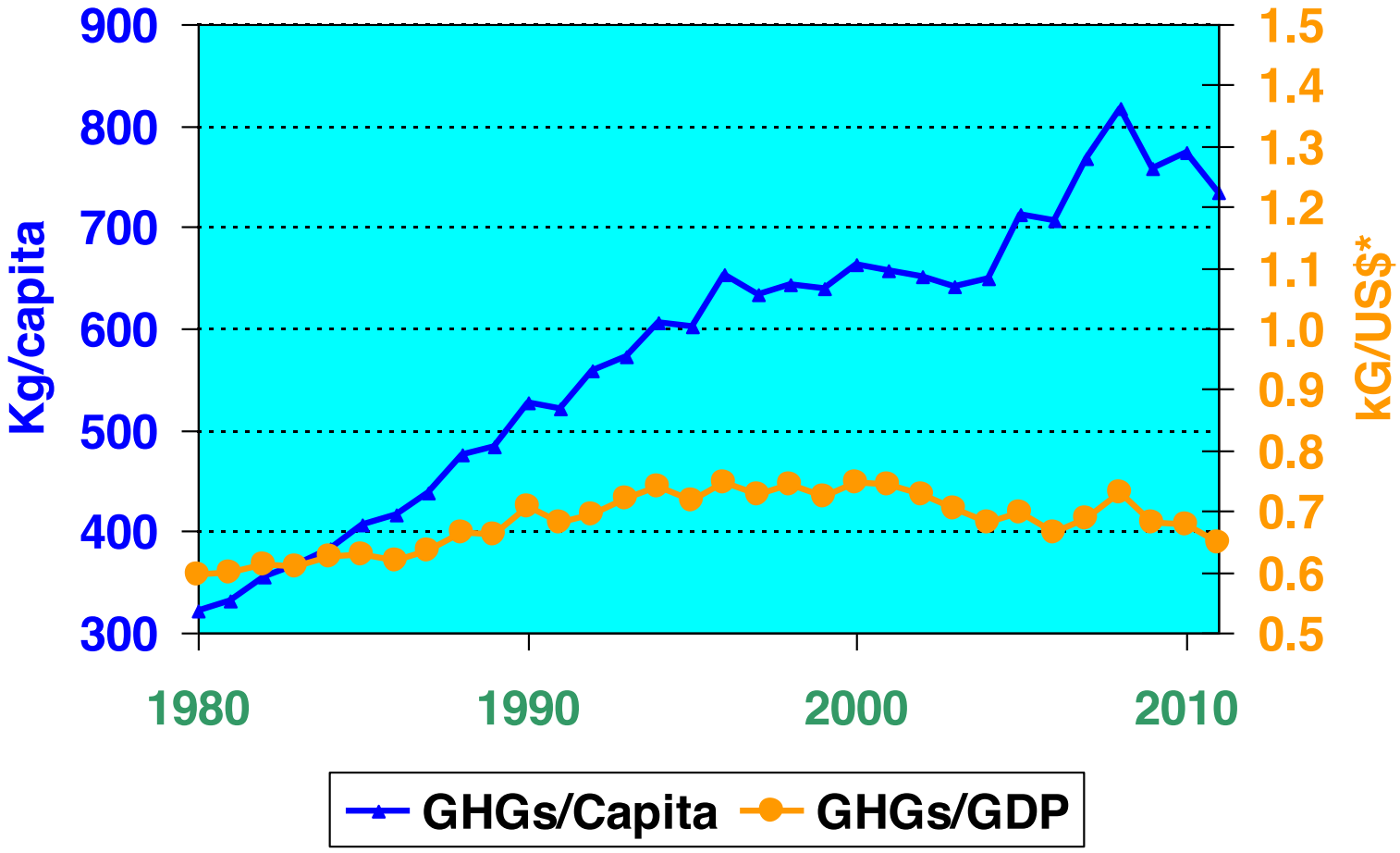
There have been 25, 27 and 28 fold increase in price of LDO, HSD and Electricity respectively

Sources: NEPRA
Pakistan Economic Survey
WAPDA Power Systems Statistics

Highlights of End-Use Prices

- Price of All Energy Products Increased in Real Terms
- Biggest Increase in Real Price of Gas Price for Industrial Sector
- Second Biggest Increase in Real Price of Gas Price for Household Sector
- Third Biggest Increase in Real Price of FO for Industrial Sector
- The Minimum Increase in Real Price of Gasoline in Transport Sector

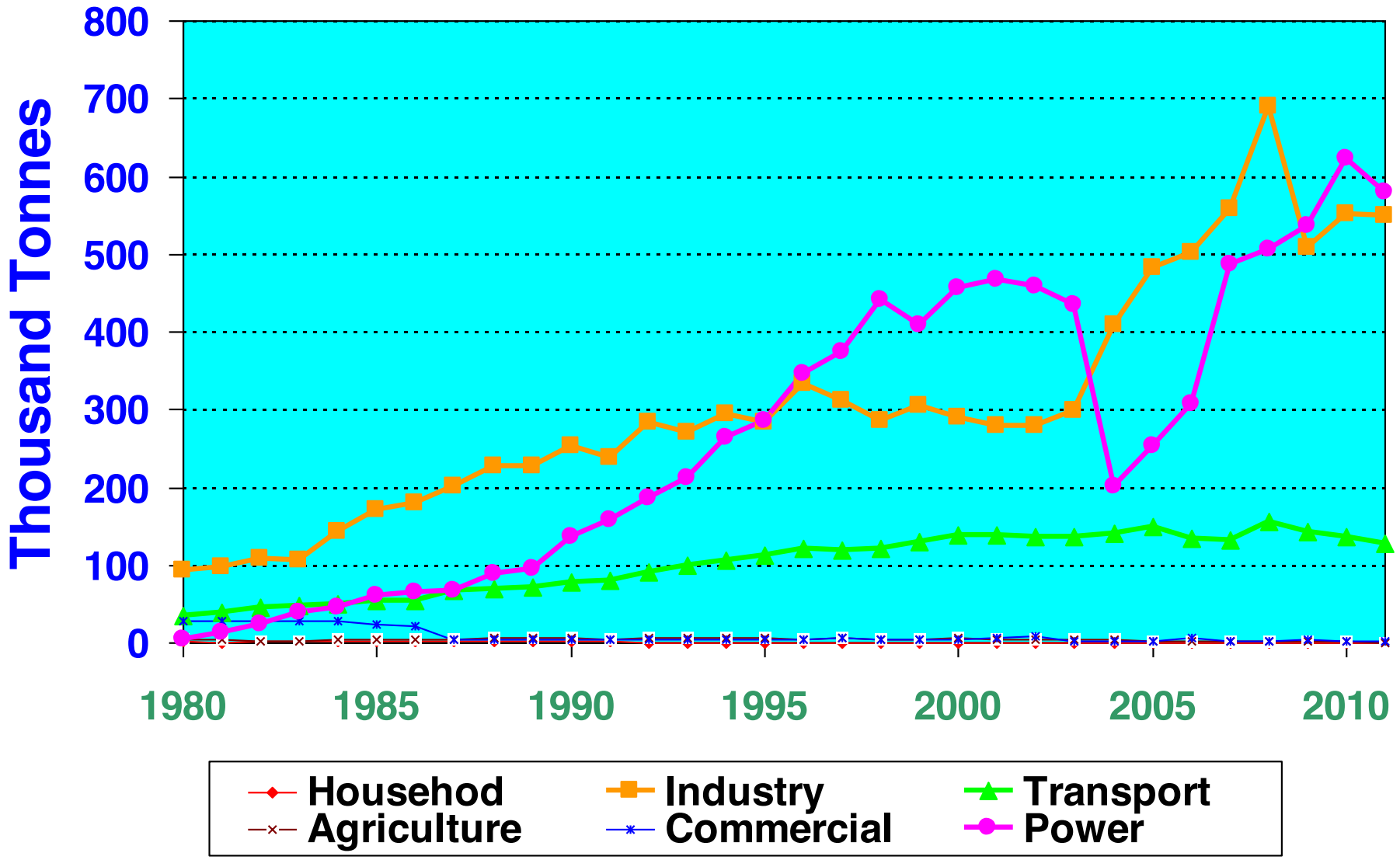
GHG Emissions per Capita from Energy Sector and per Unit of GDP



* At Constant Prices of Year 2010-11

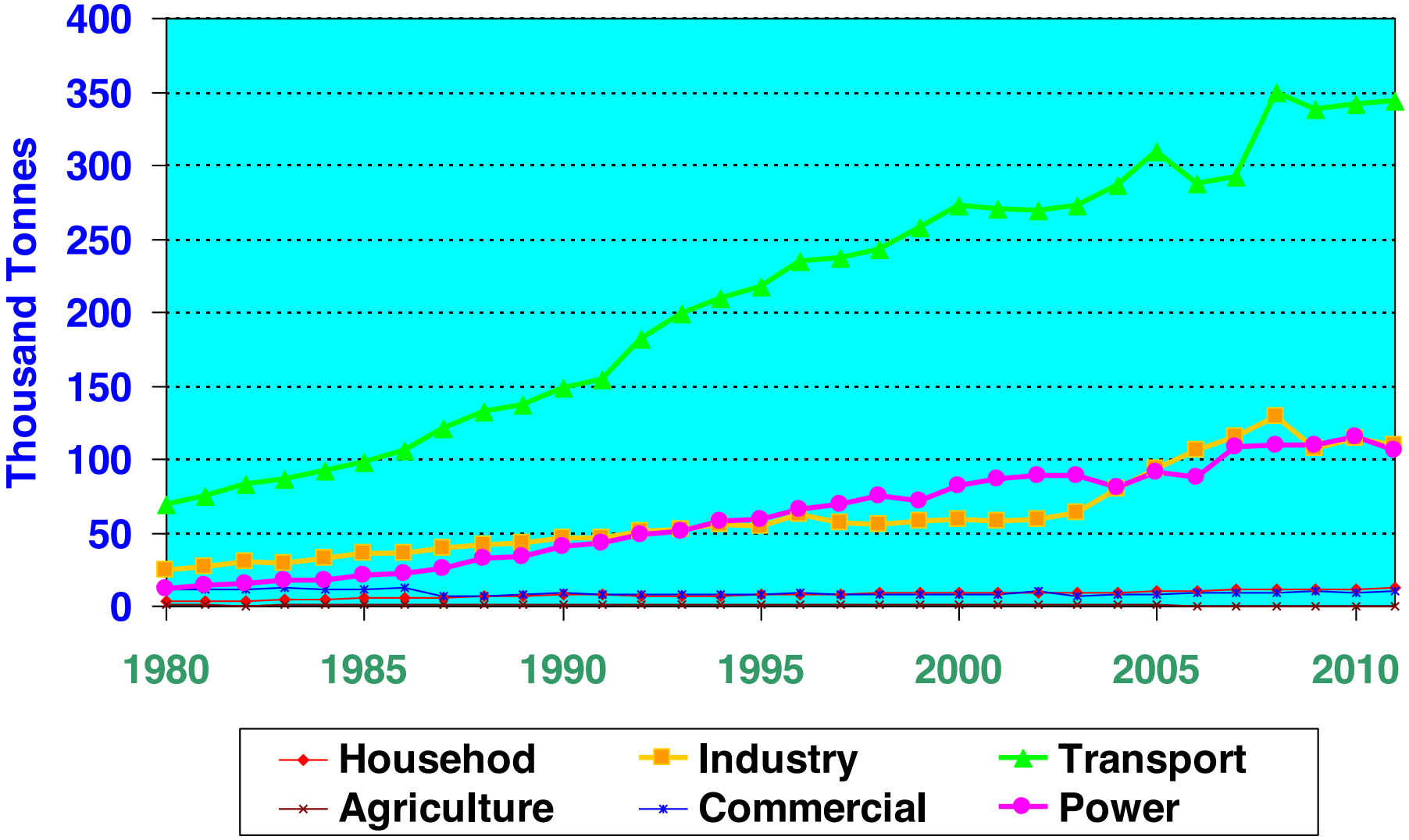
Sources: Based on Pakistan Energy Yearbooks
IPCC Methodologies (1996)

SO_2 Emissions by Sector



Sources: Based on Pakistan Energy Yearbooks
IPCC Methodologies (1996)

NO_x Emissions by Sector



Sources: Based on Pakistan Energy Yearbooks
IPCC Methodologies (1996)

Findings (1/3)

- **Improvement in energy accessibility; particularly of electricity in the household sector**
- **Switching over to natural gas from furnace oil for power generation**
- **Induction of CNG in the transport sector**
- **Rational pricing of natural gas and electricity**
- **Rationalization of electricity prices to make those reflective of fuel cost**
- **Efficiency improvement in electricity generation.**

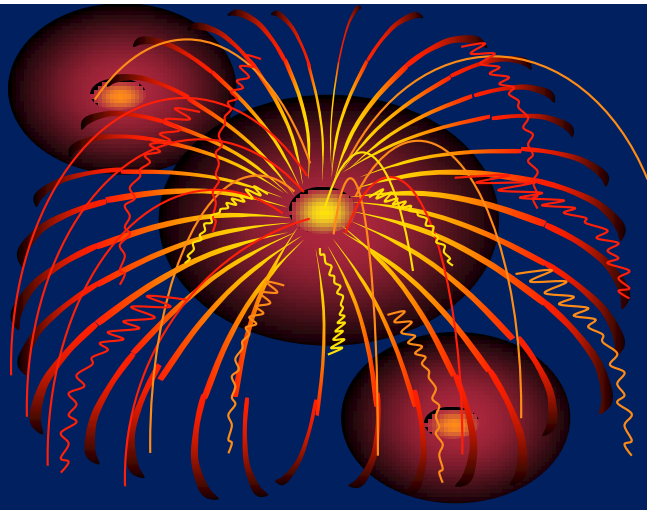
Contd…

Findings (2/3)

- **Energy import dependence was 39% of total primary energy in 2000 which decrease to 30% of total primary energy in 2011 due to intensive use of natural gas as its share increased from 41% in the year 2000 to 48% in 2011. Some of these policies in the past have led to :**
  - ✓**Improvement in quality of life**
  - ✓**Energy security**
  - ✓**Efficient use of energy**
  - ✓**Reduction in environmental burden of energy use.**

Finding (3/3)

- **But all these positive impacts are not sustainable as there has been a continuous decline in the reserve to production ratio of natural gas which implies that the above mentioned improvements are not sustainable.**



Thank You