

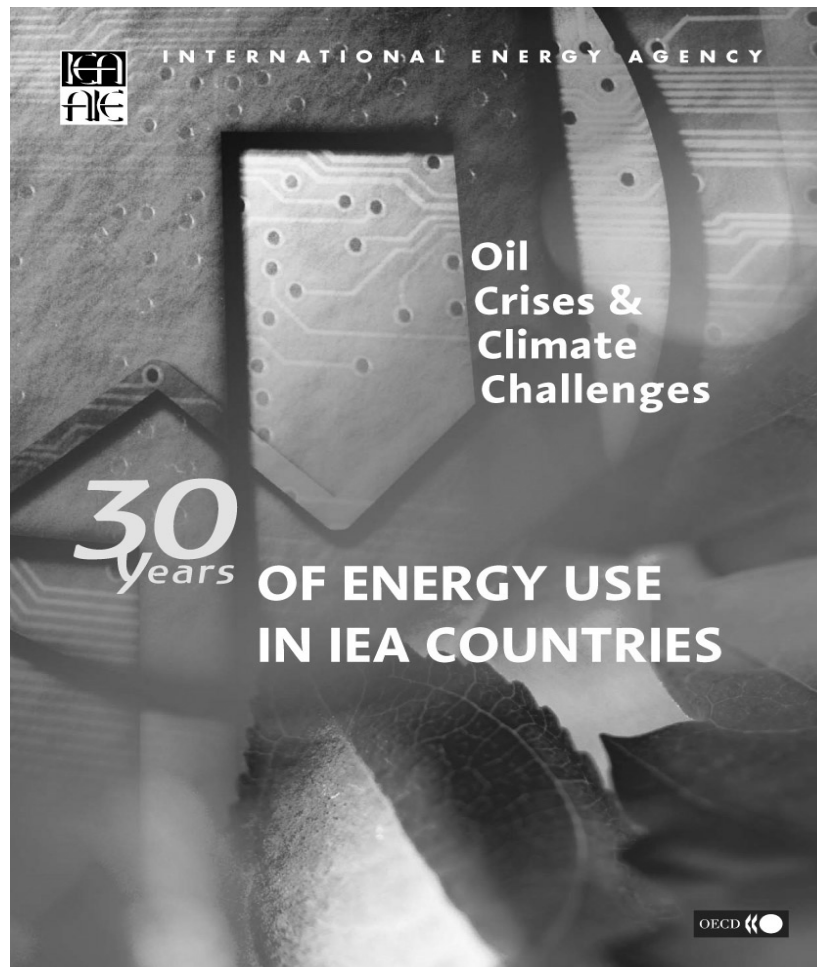


Oil Crises and Climate Challenges 30 Years of Energy Use in IEA Countries

Oil
Crises &
Climate
Challenges

30
Years

OF ENERGY USE
IN IEA COUNTRIES



**Fridtjof Unander, International Energy Agency
ISED Meeting, UN, 13 September 2004**



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IN IEA COUNTRIES

Aim of the Study

- I Review of trends in energy use and CO₂ emissions since IEA was founded 30 years ago**
- I Based on IEA Energy Indicator Database**
- I Looks in detail at how energy efficiency and factors such as economic activity and structure, lifestyle, prices and fuel mix have shaped developments**
- I Provide a “state-of-the-art” publication on energy use developments**

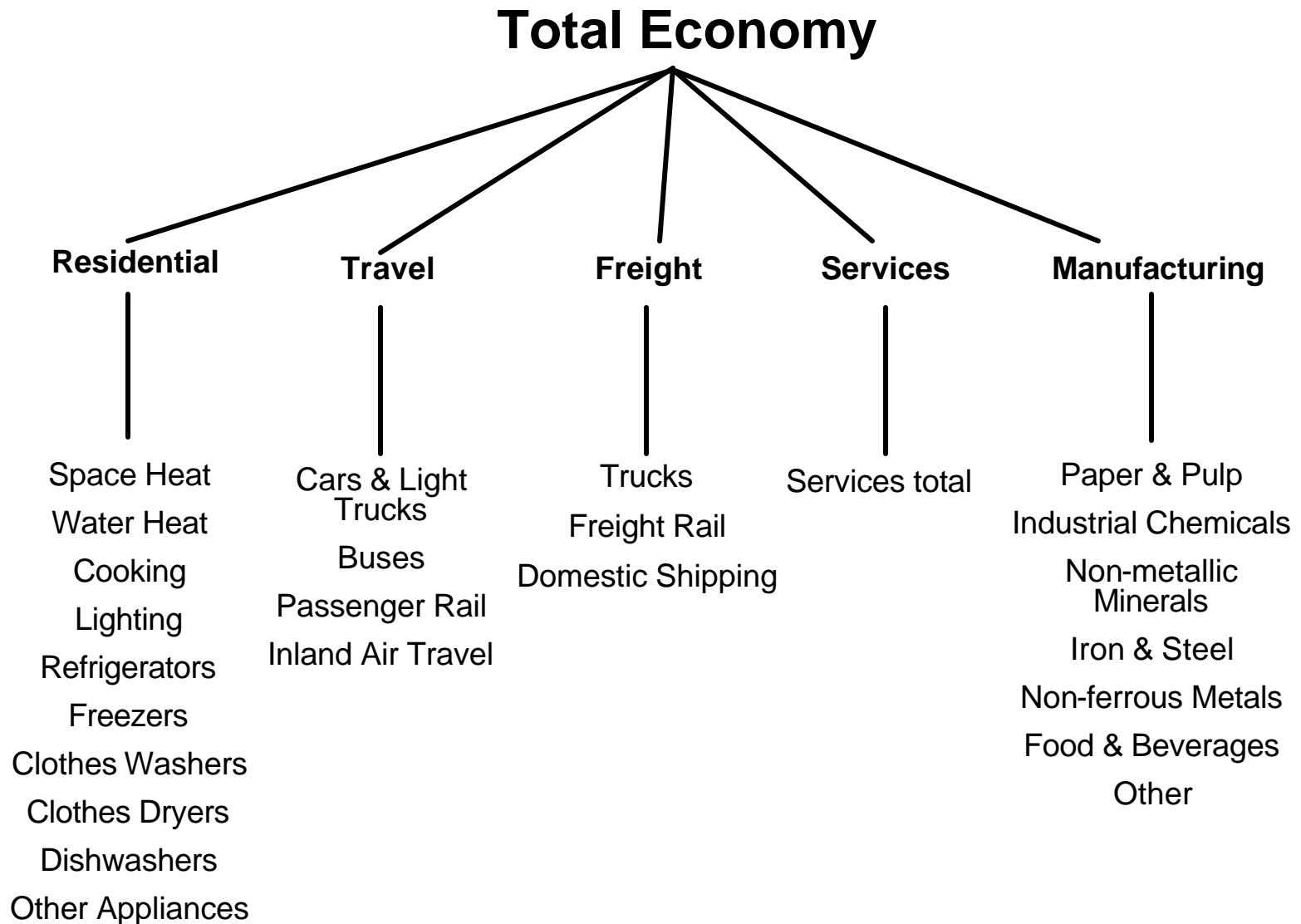


Sector & End-use Coverage

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How to Understand Aggregate Trends?

IEA's Decomposition Approach

$$E = \overset{\text{Energy Service}}{\overleftrightarrow{A}} \overset{\text{Energy Savings}}{\leftarrow S_j} * I_j$$

- A** **sectoral activity**
- S_j** **sectoral structure or mix of activities within a sub-sector j**
- I_j** **energy intensity of each sub-sector or end-use j**

- ***Use Laspeyres indices to follow changes over time***
- **Can be extended to economy-wide indices (weighting sector indices at base-year values)**



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Key Findings

- I Significant energy savings achieved through the late 1980s.
 - I Since 1990 energy savings rates have slowed in all sectors.
 - I Only a few countries still show a strong decoupling of CO₂ emissions from GDP growth after 1990.
-
- ⇒ *Oil price shocks in the 1970s did more to reduce emissions and to increase efficiency than achieved by policies implemented in the 1990s.*
 - ⇒ *As a consequence, CO₂ emissions are now growing rapidly along with oil and electricity demand.*

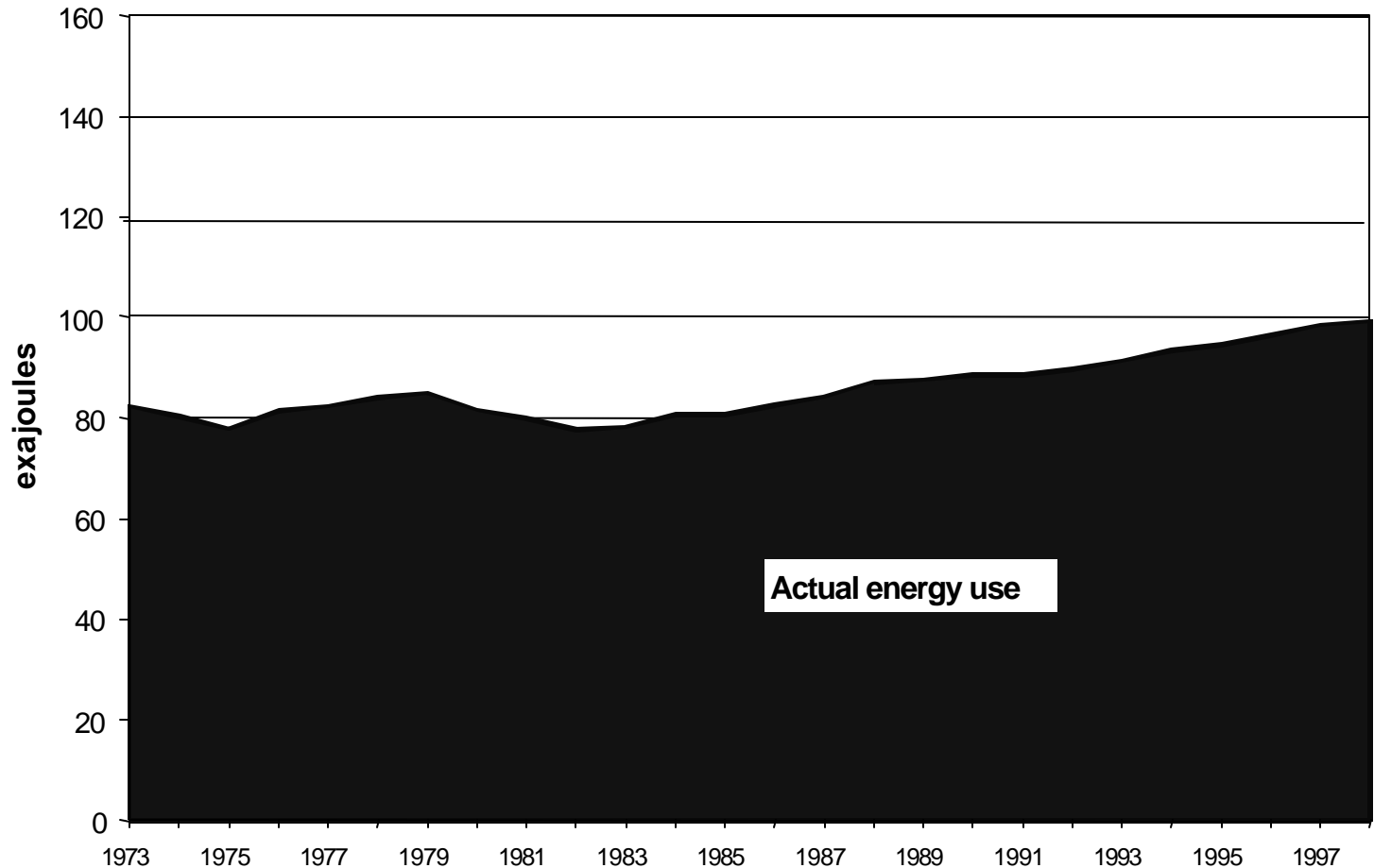


Energy Demand in IEA-11

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Moderate growth in demand since 1973

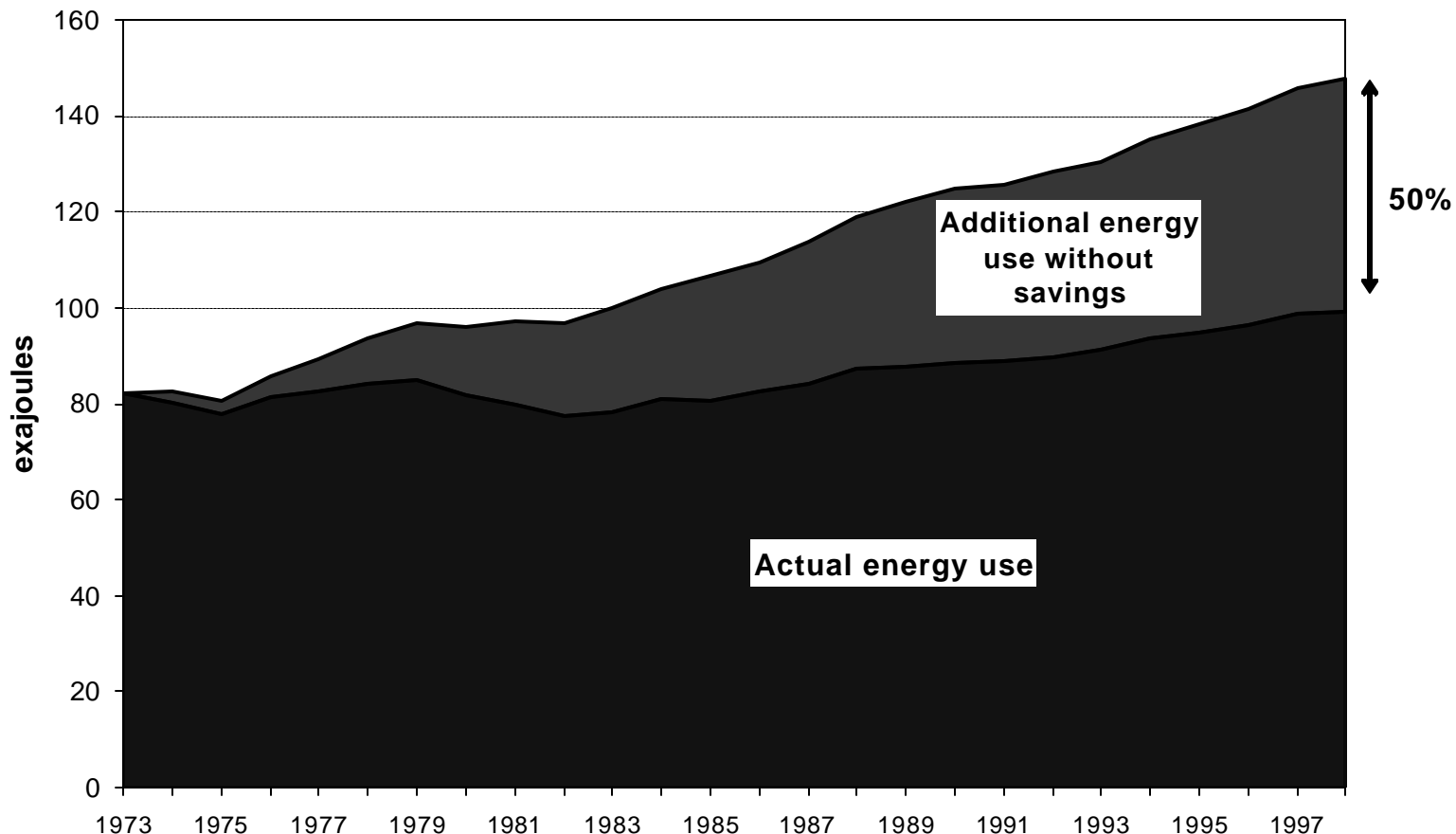


Energy Demand and Savings IEA -11

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Without energy savings achieved since 1973 energy demand in 1998 would have been 50% higher

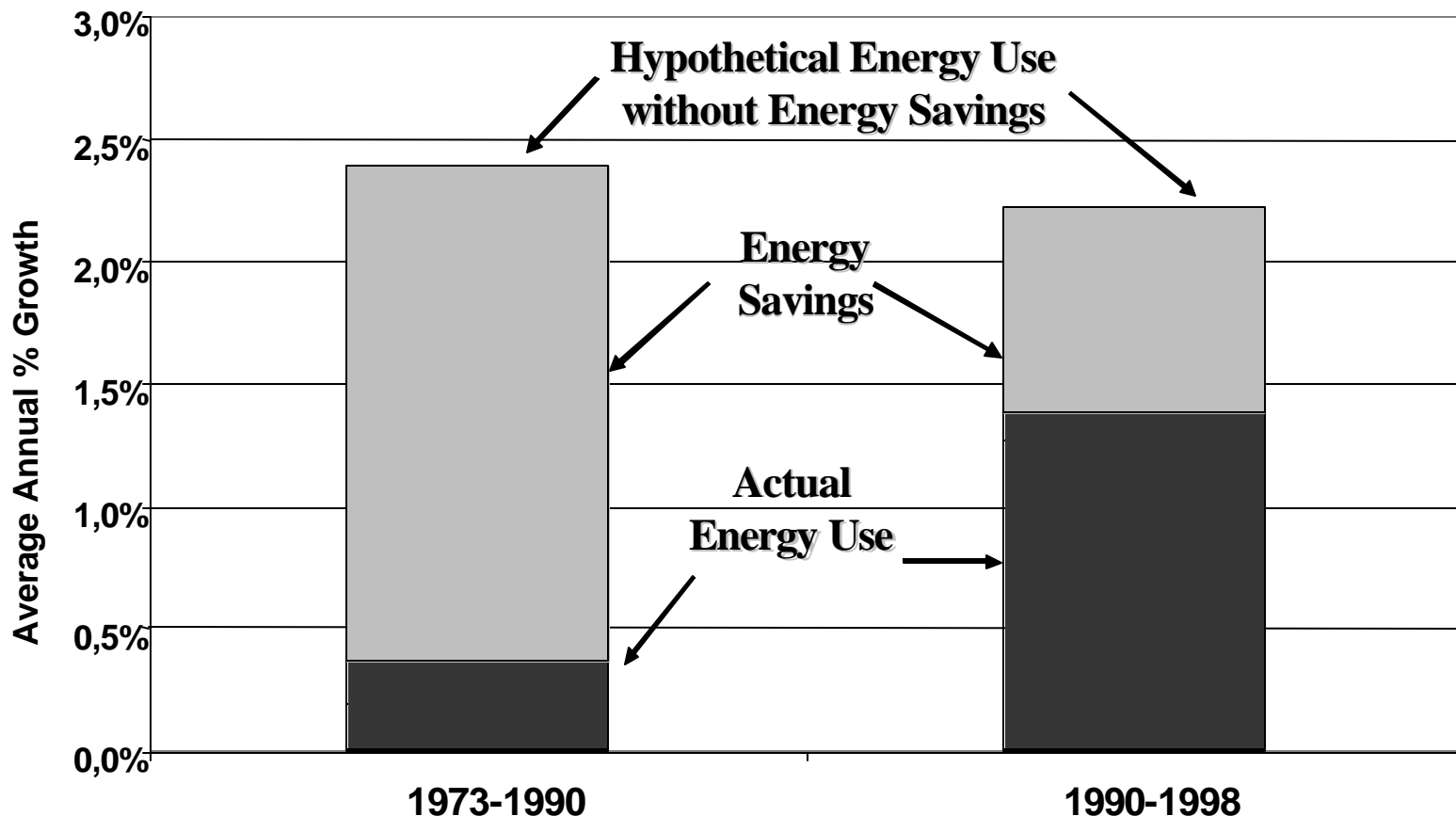


IEA-11 Energy Use Impact of Energy Savings

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Rates of energy savings have slowed significantly after 1990, leading to rapid demand growth

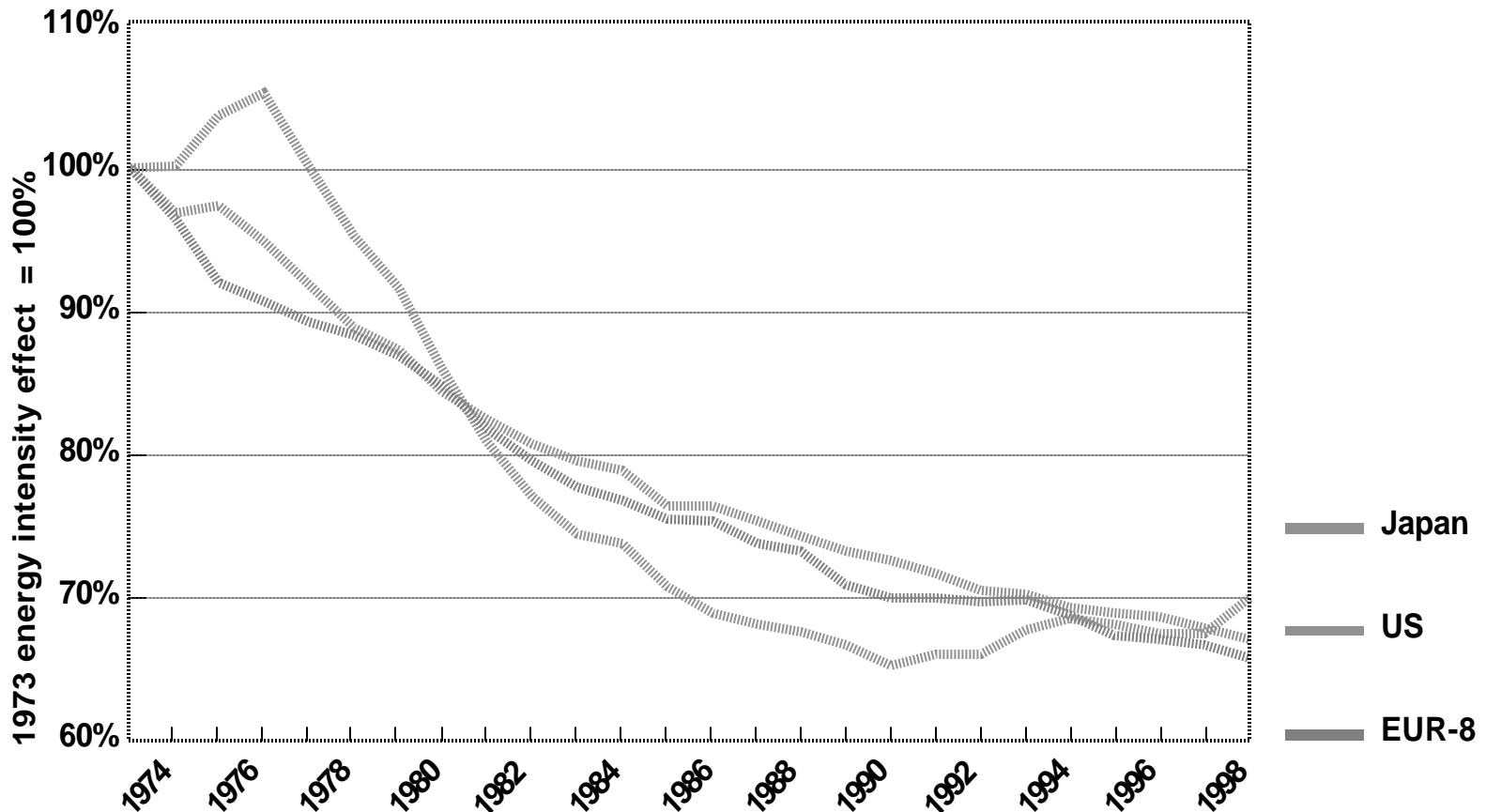


Economy-wide Intensity Effect

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Intensity effect fell by about 30% in all three regions



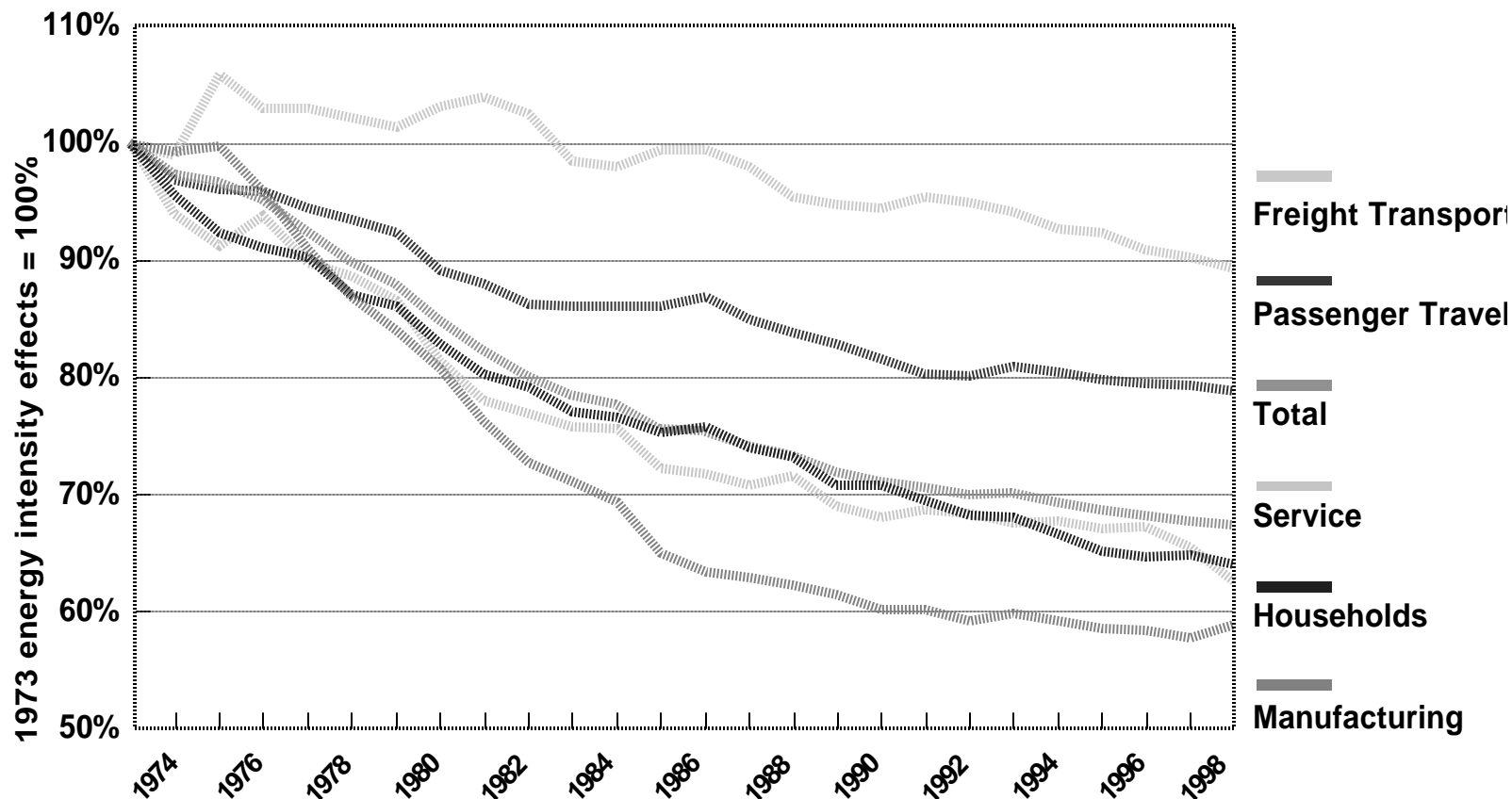
Energy Intensity Effects by Sector

IEA - 11

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Declines in energy intensities have slowed in all sectors since the late 1980s

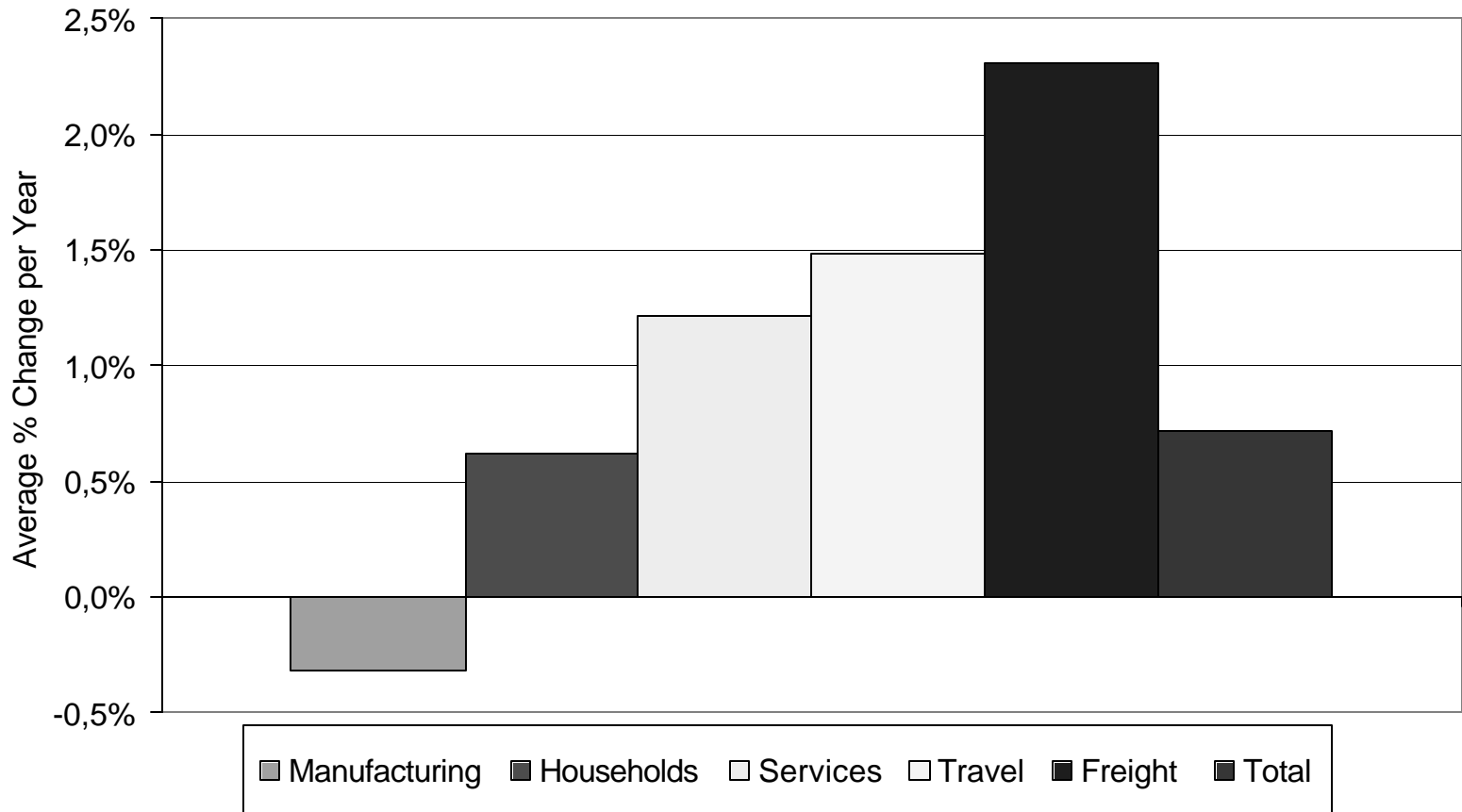


Changes in Final Energy Consumption 1973-1998, IEA-11

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Manufacturing only sector with decline in energy use

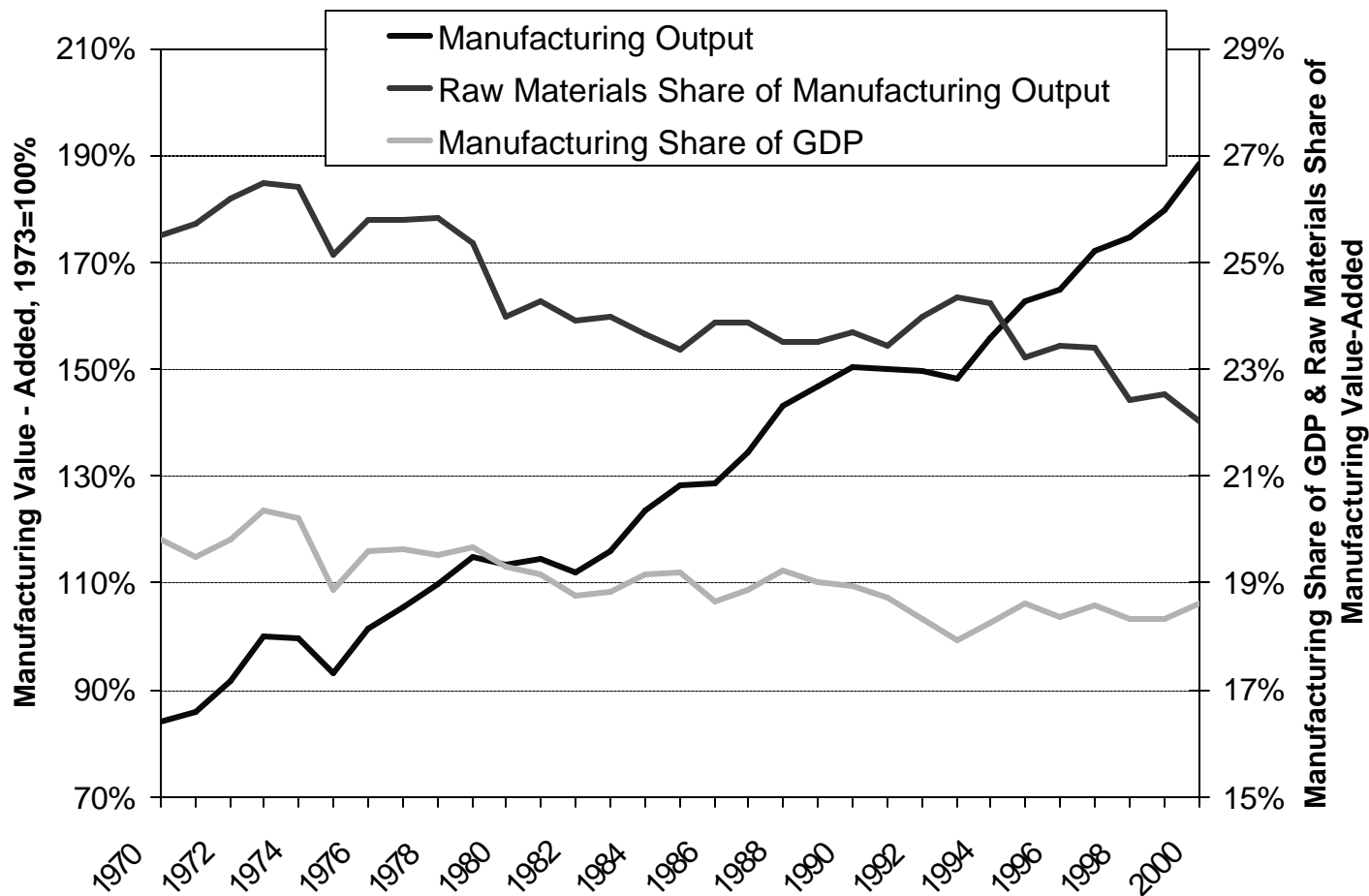


Manufacturing Output IEA-11

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Manufacturing roughly maintains its share of GDP

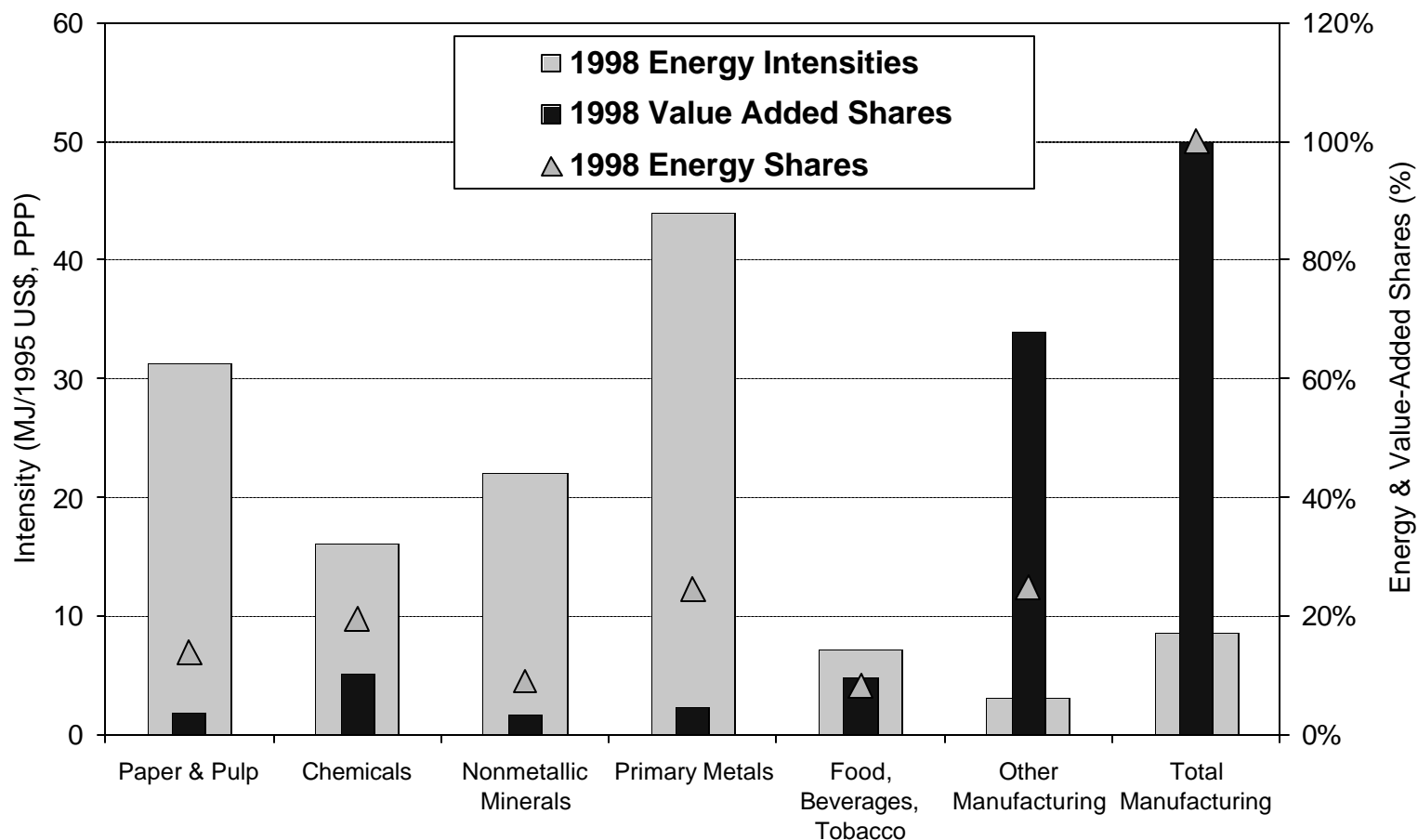


IEA-11 Energy Intensities, Value-Added and Energy Shares

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Energy-intensive industries contribute little to overall output, but has a large share of total energy use



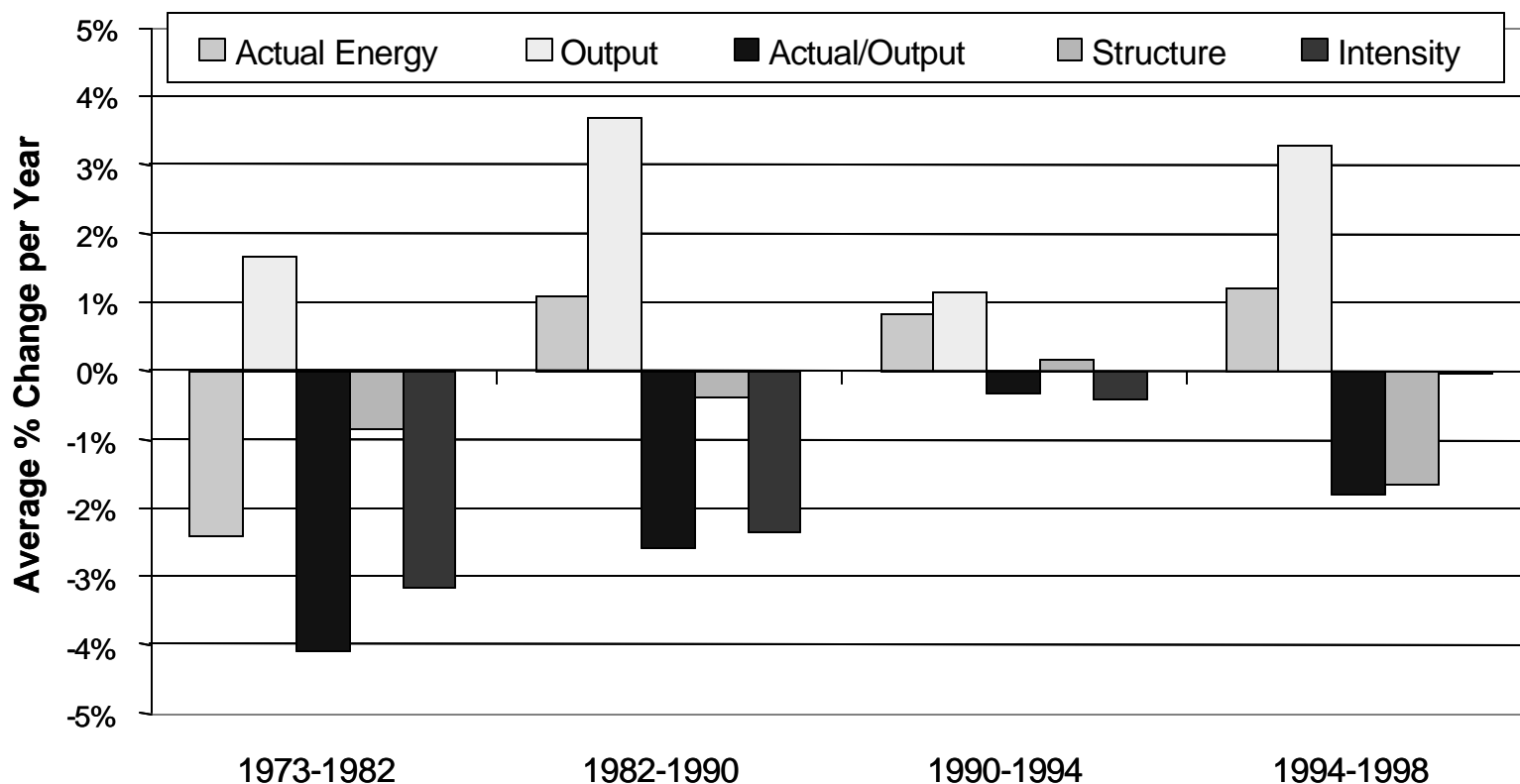
Energy Savings and Structural Change

IEA - 11 Manufacturing

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Recent trends: Slowing decline in intensities, but important impact from structural changes

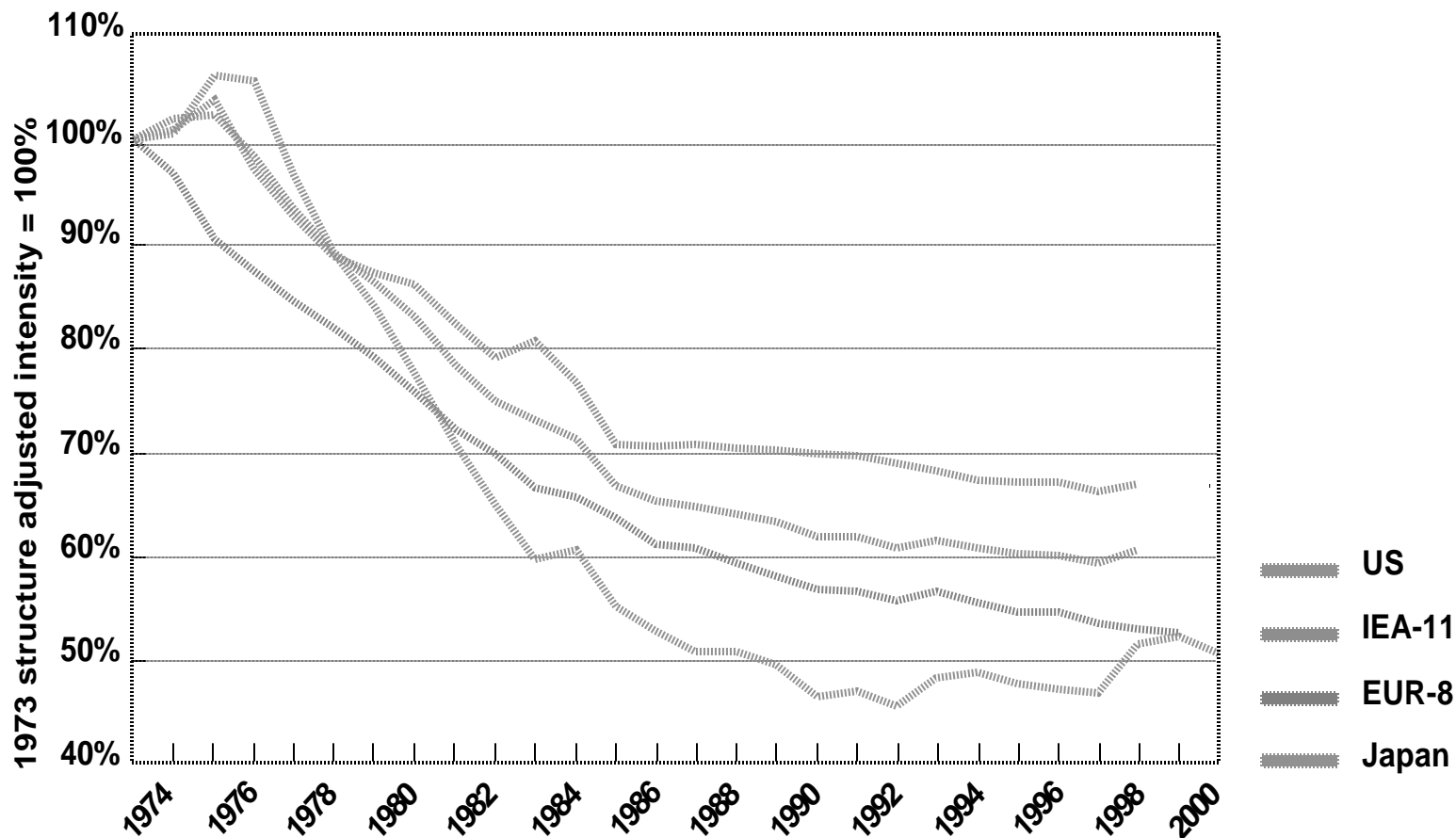


Manufacturing Energy Intensity (Adjusted for Structural Changes)

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***Declines in energy intensities slowed markedly
since late-1980s***



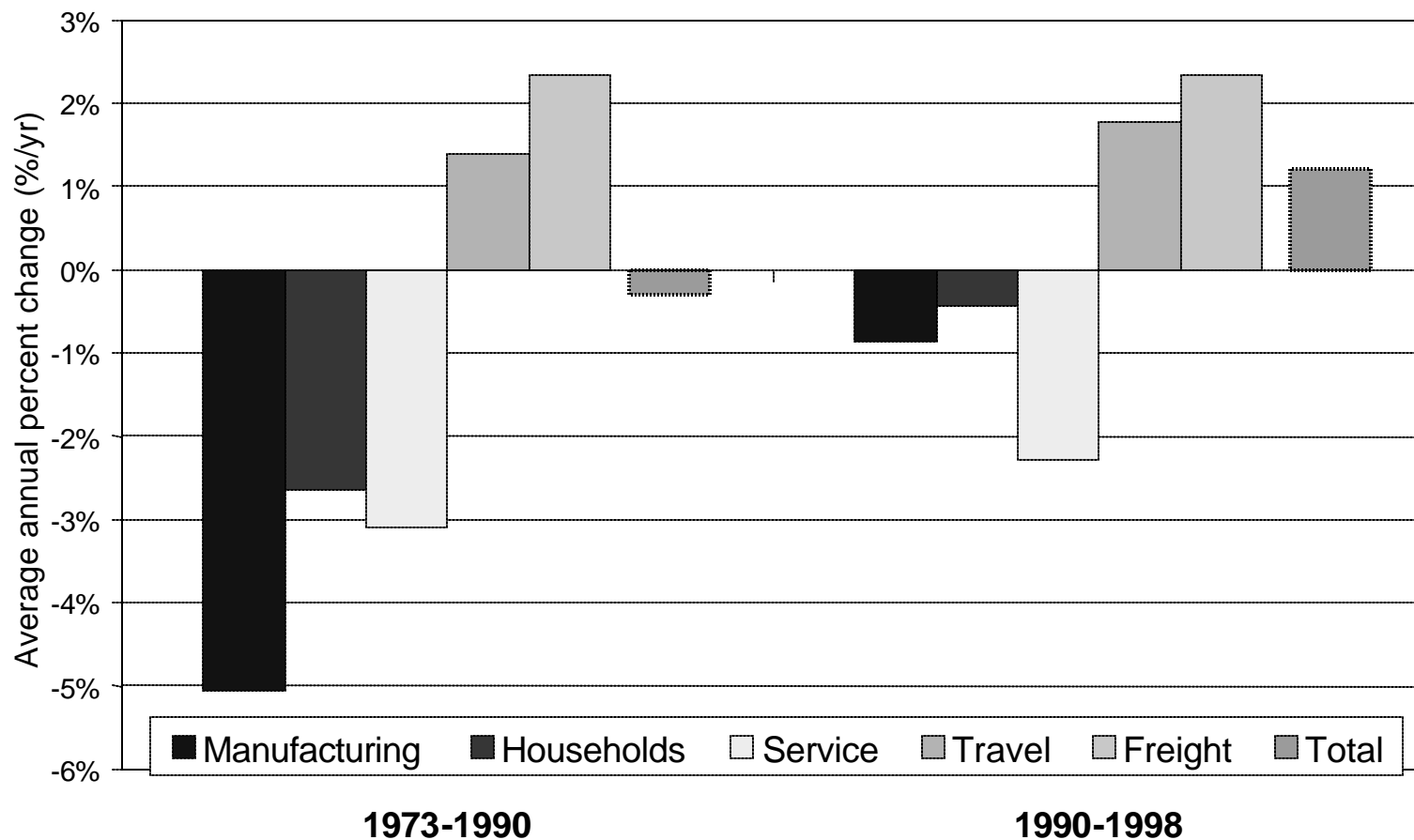
Changes in Oil Demand by Sector

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Growth in transport offset by declines in stationary sectors

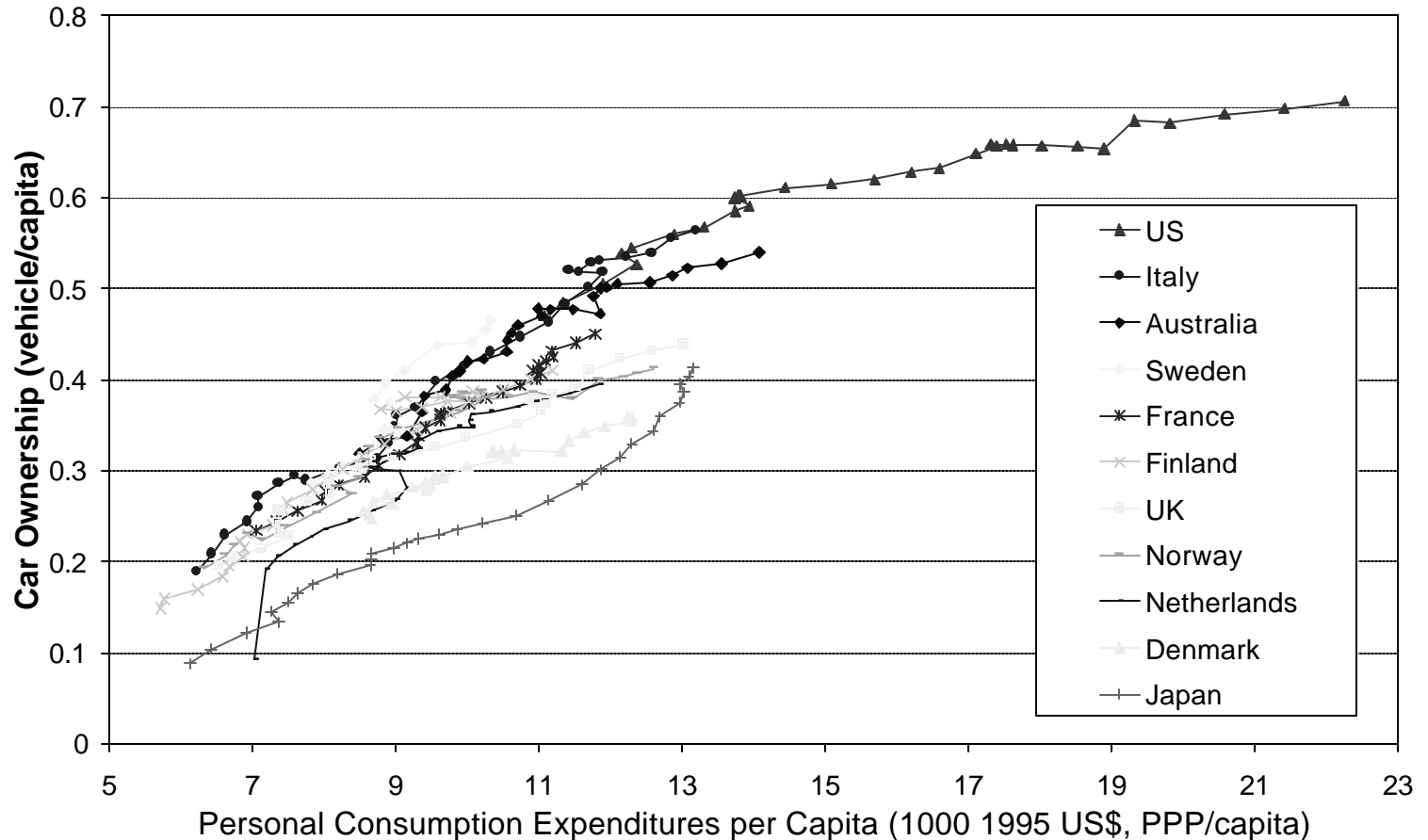


Car Ownership and Income 1970-2000

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Strong growth most places, slowly leveling off in the US



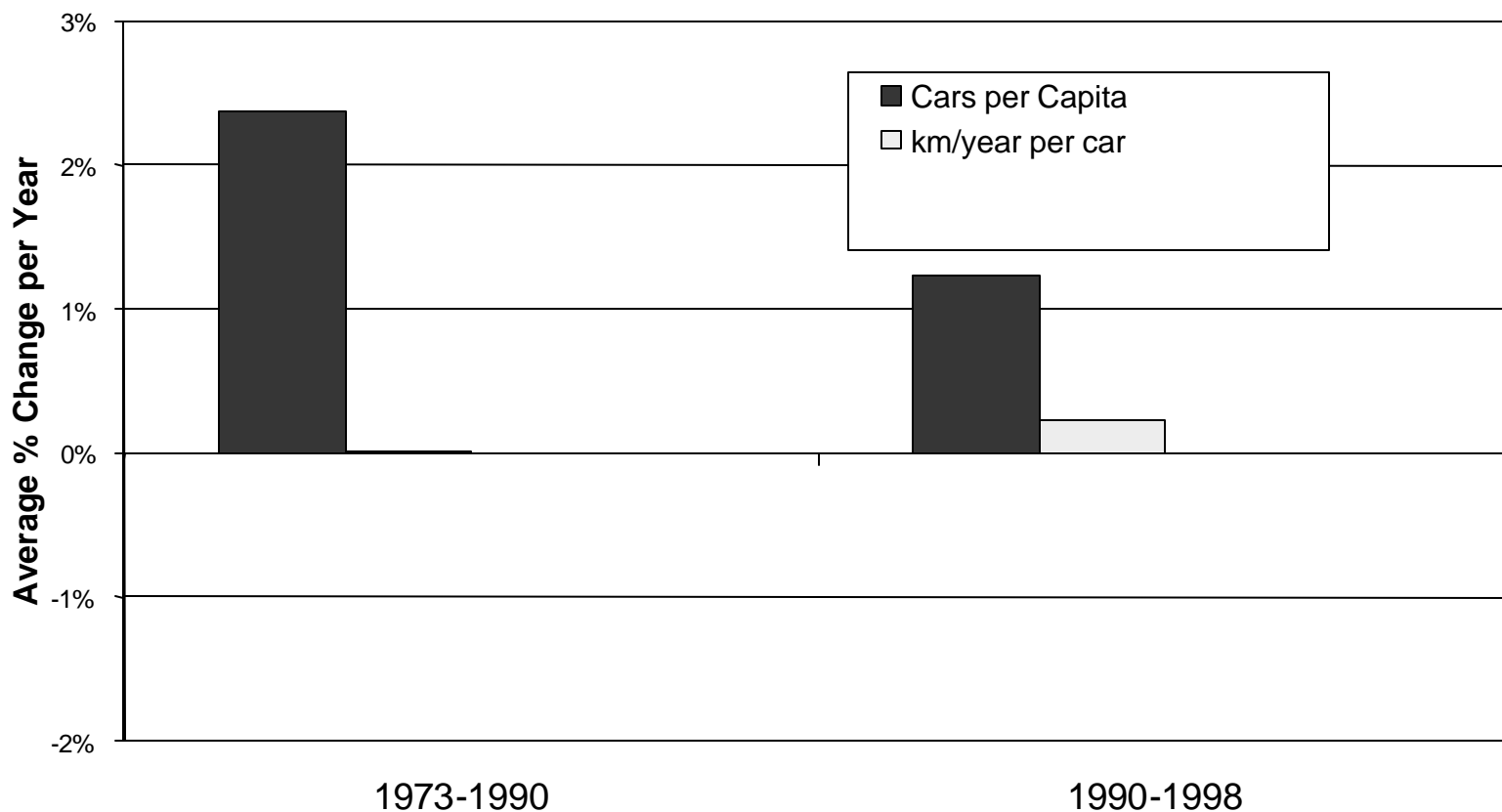
Energy for Cars (IEA-11)

Factors shaping development 1973-1998

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Strong growth in car ownership while the use of each car has changed little



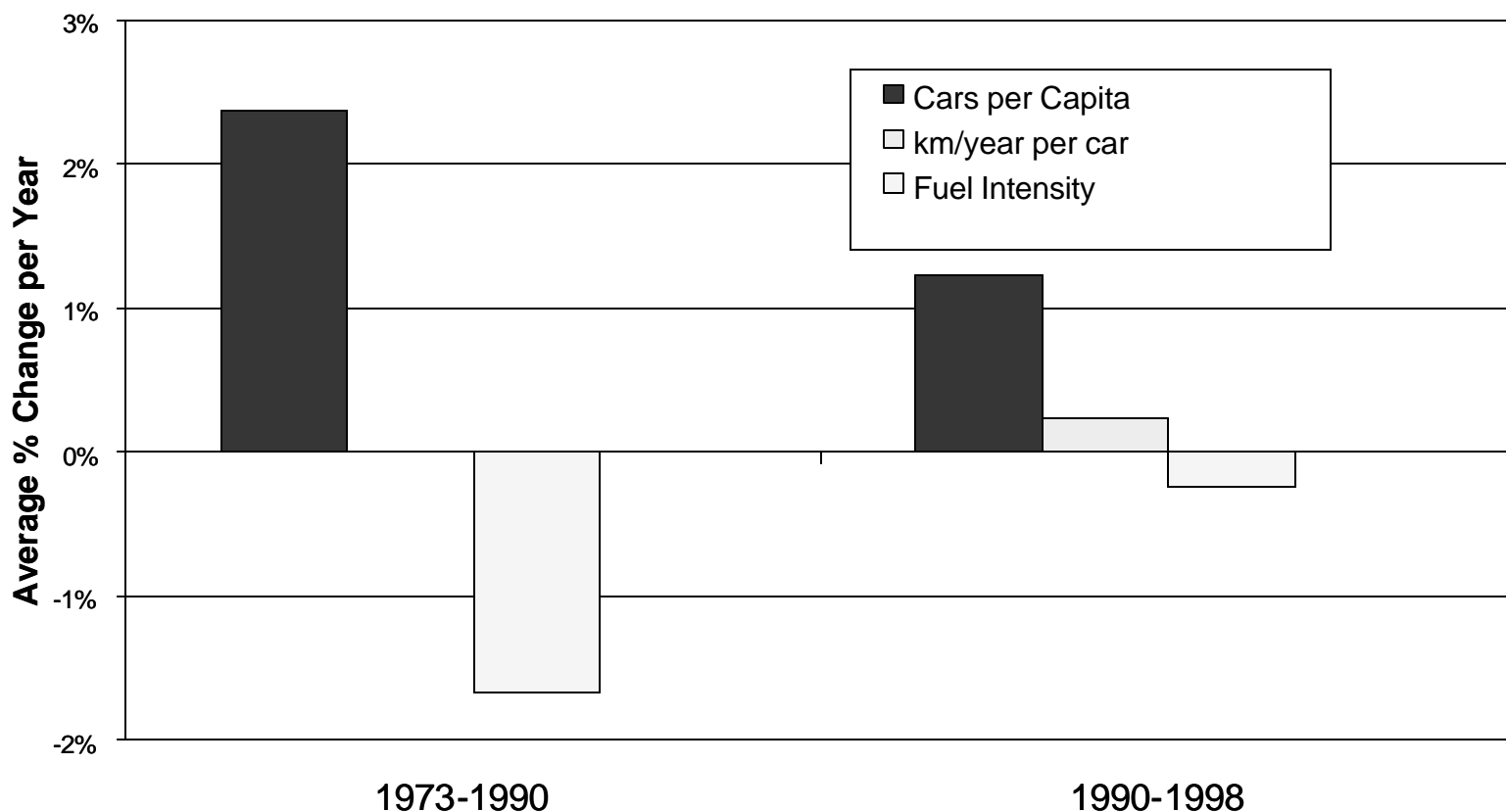
Energy for Cars (IEA-11)

Factors shaping development 1973-1998

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Decline in fuel intensity has slowed....



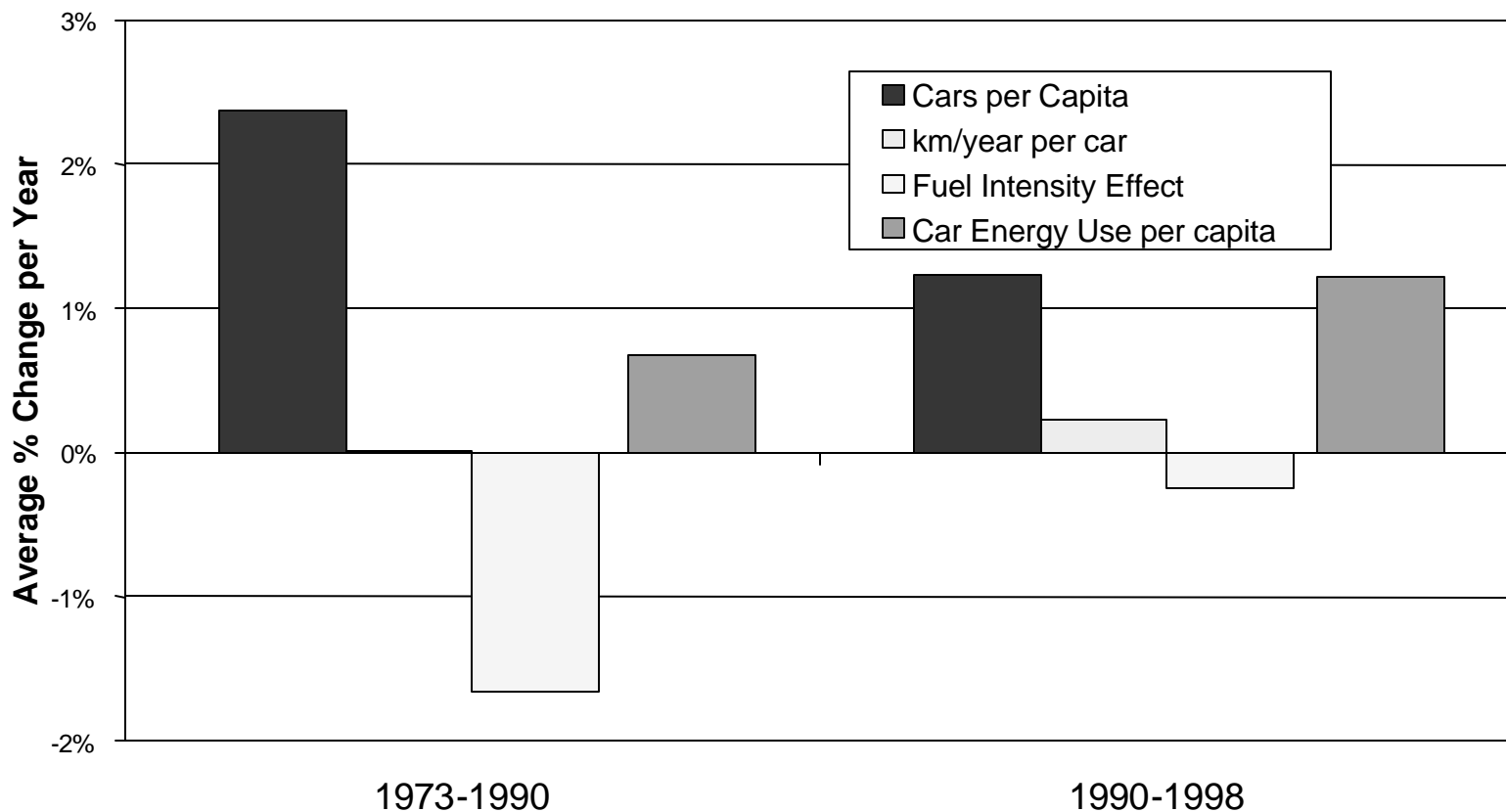
Energy for Cars (IEA-11)

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Net result is more rapid growth in fuel demand after 1990 despite lower growth in car ownership

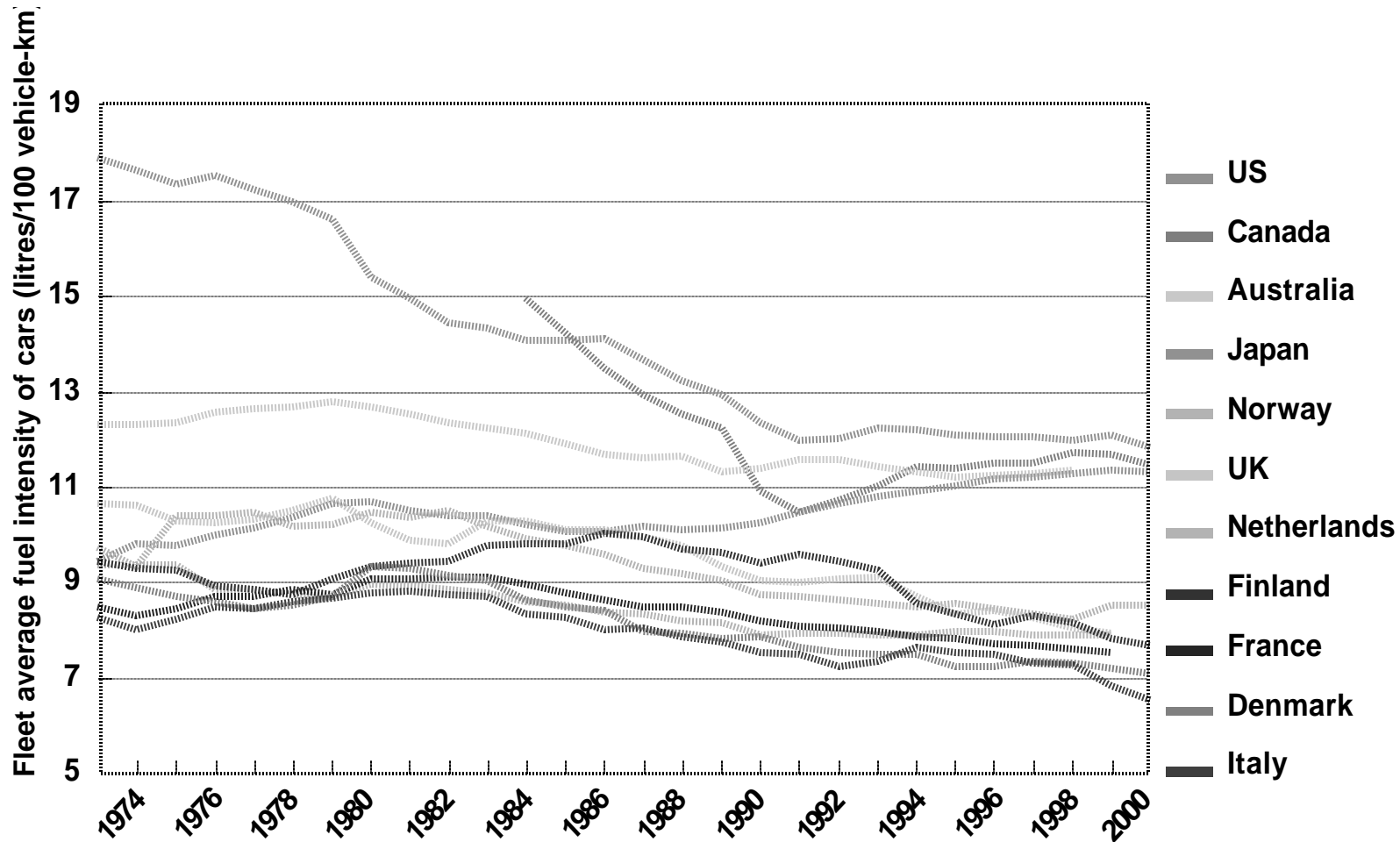


Car Stock-average Fuel Intensity

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Strong decline in the US until 1990, no change since then

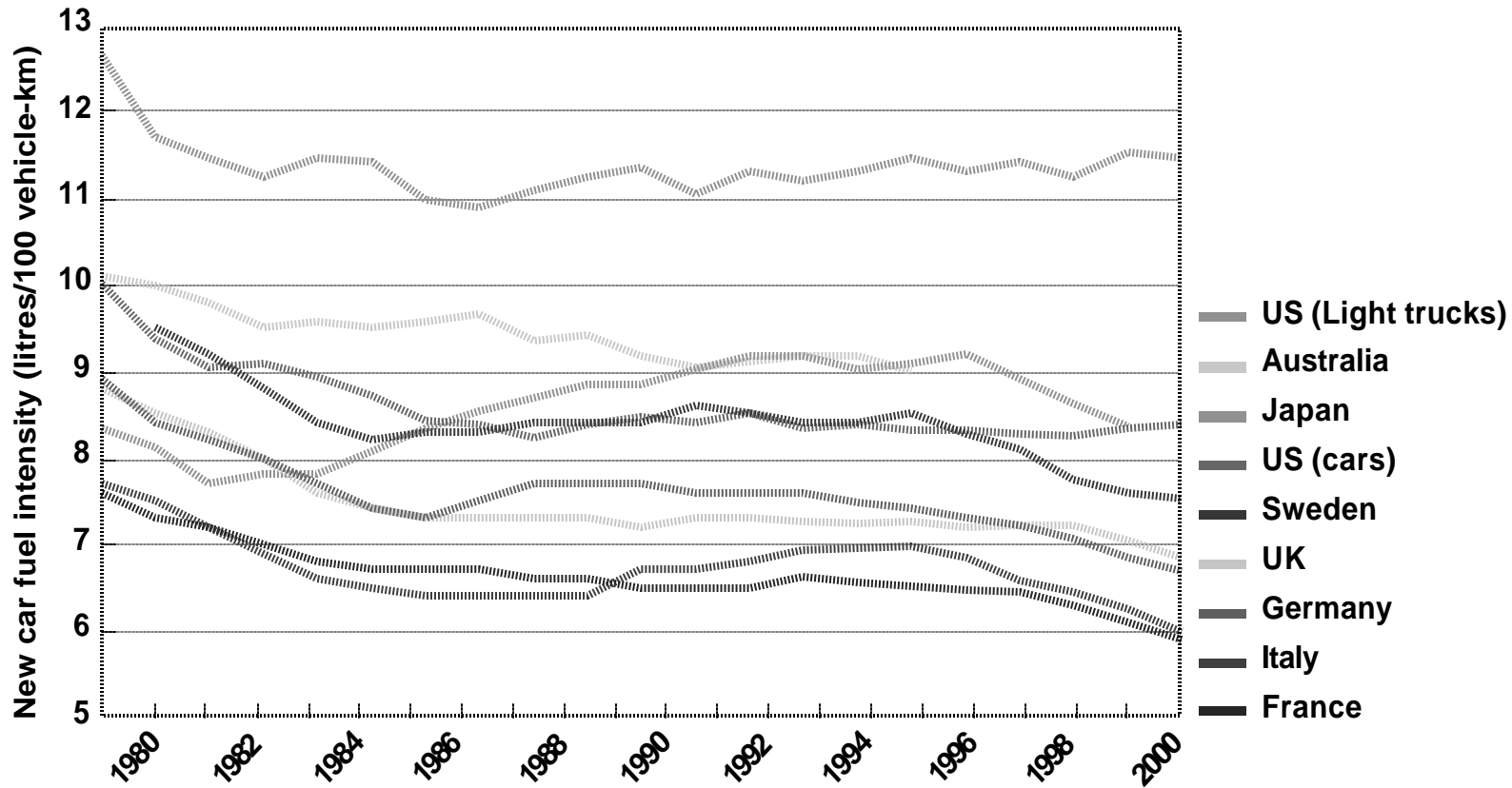


New Car Fuel Intensity

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Small changes since early 1980s, but positive development recently in EU and Japan

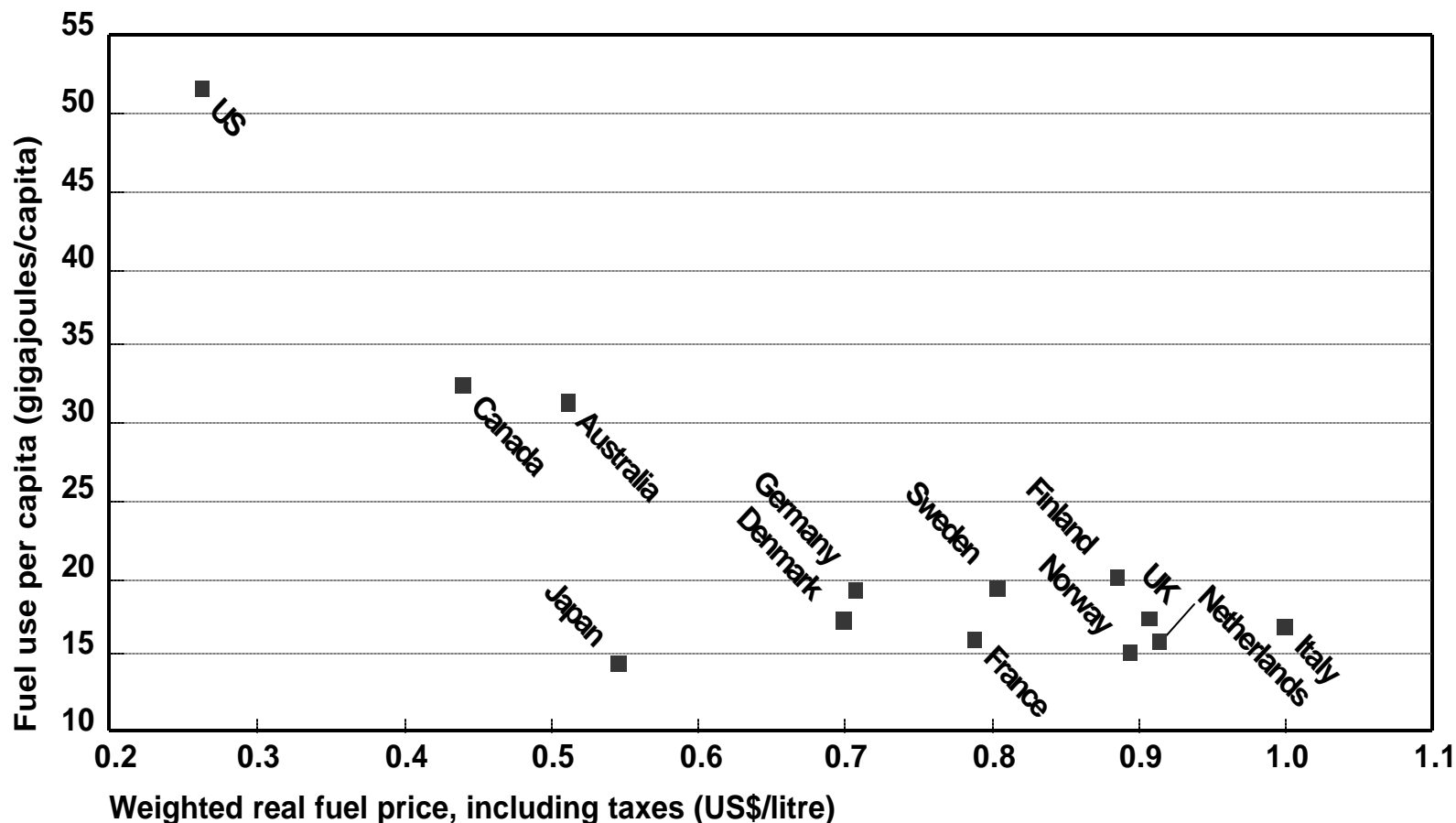


Car Fuel Use per Capita vs. Price, 1998

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Energy use for cars is higher where prices are lower

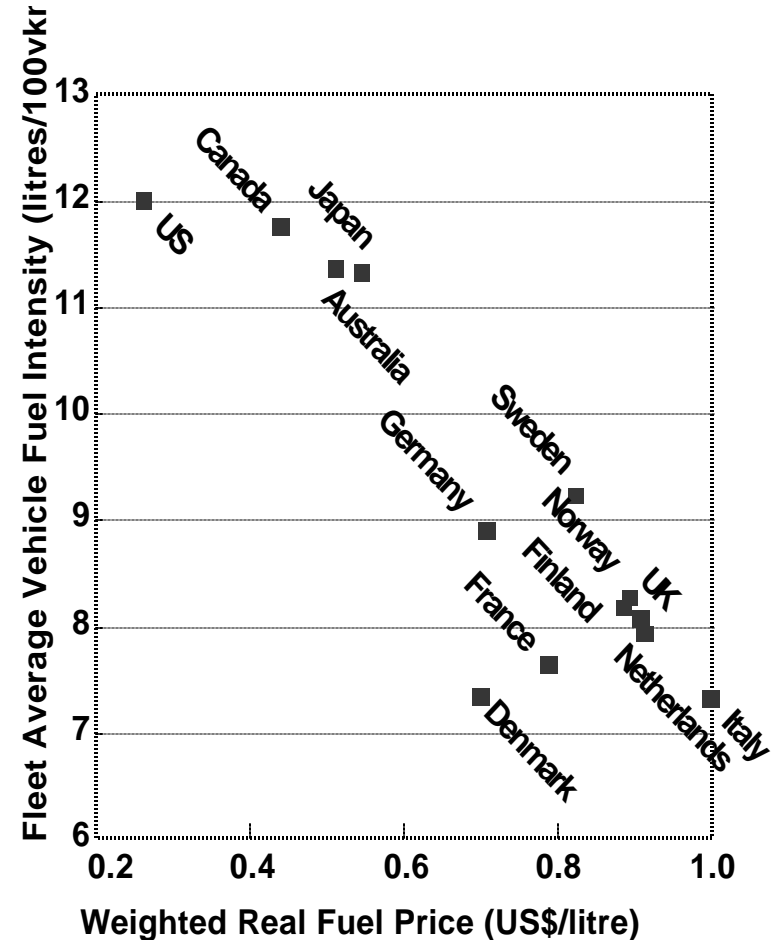
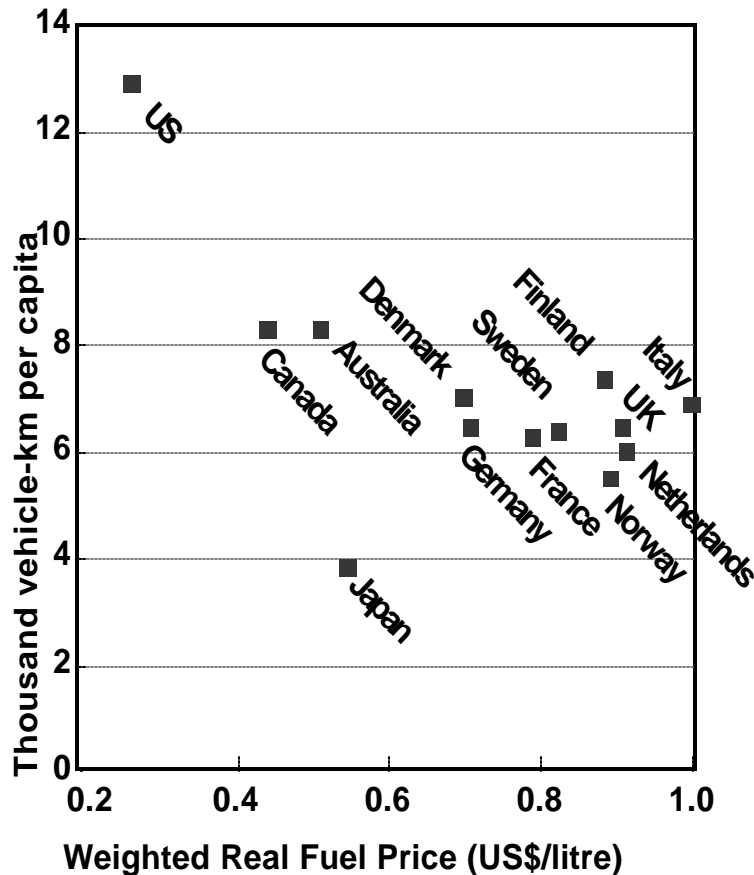


Travel and Intensities vs. Fuel price

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Higher fuel prices correlate with lower fuel intensity

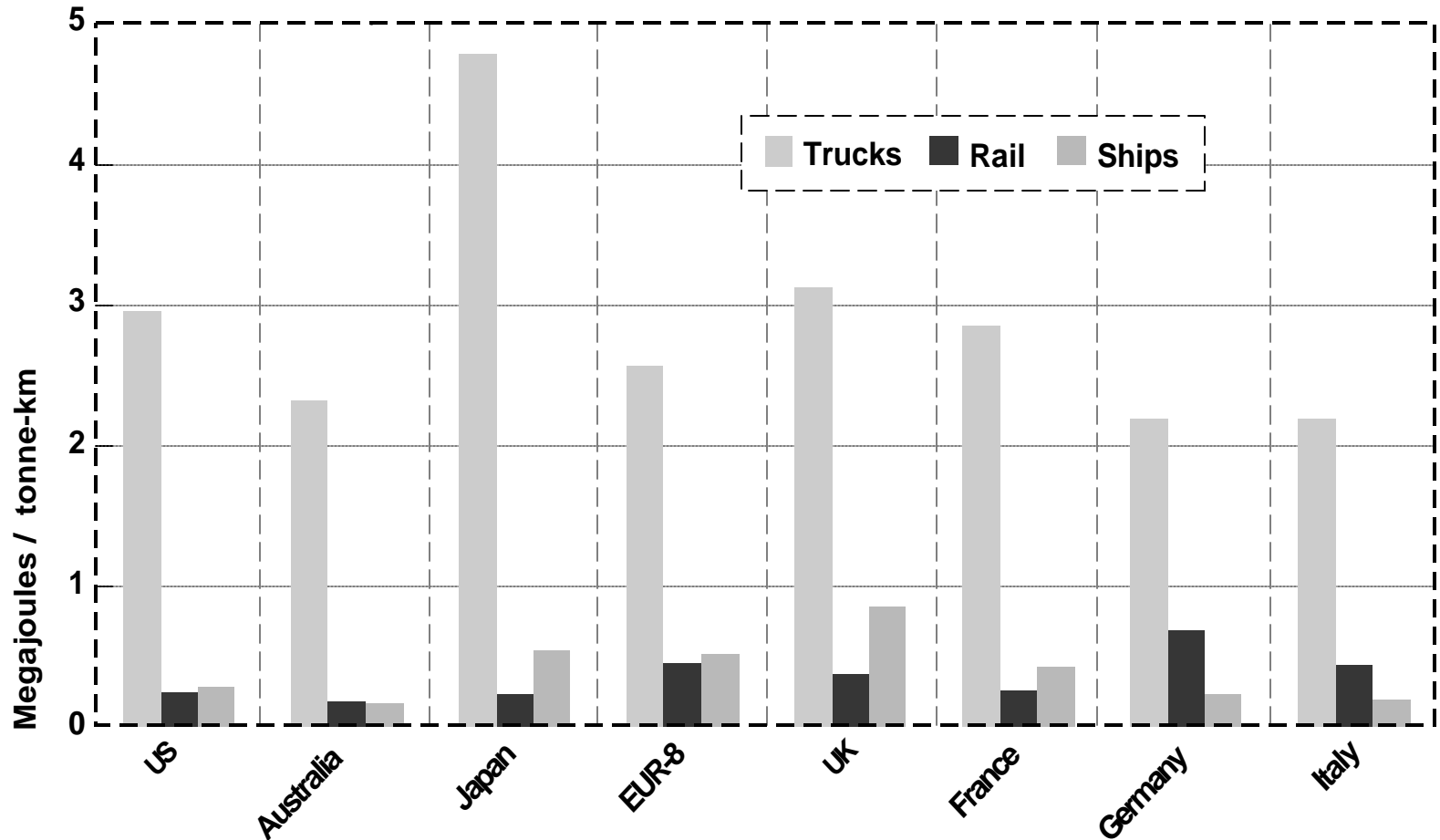


Freight Energy per tonne-km by Mode

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Trucks use far more energy per tonne-km than rail or ships

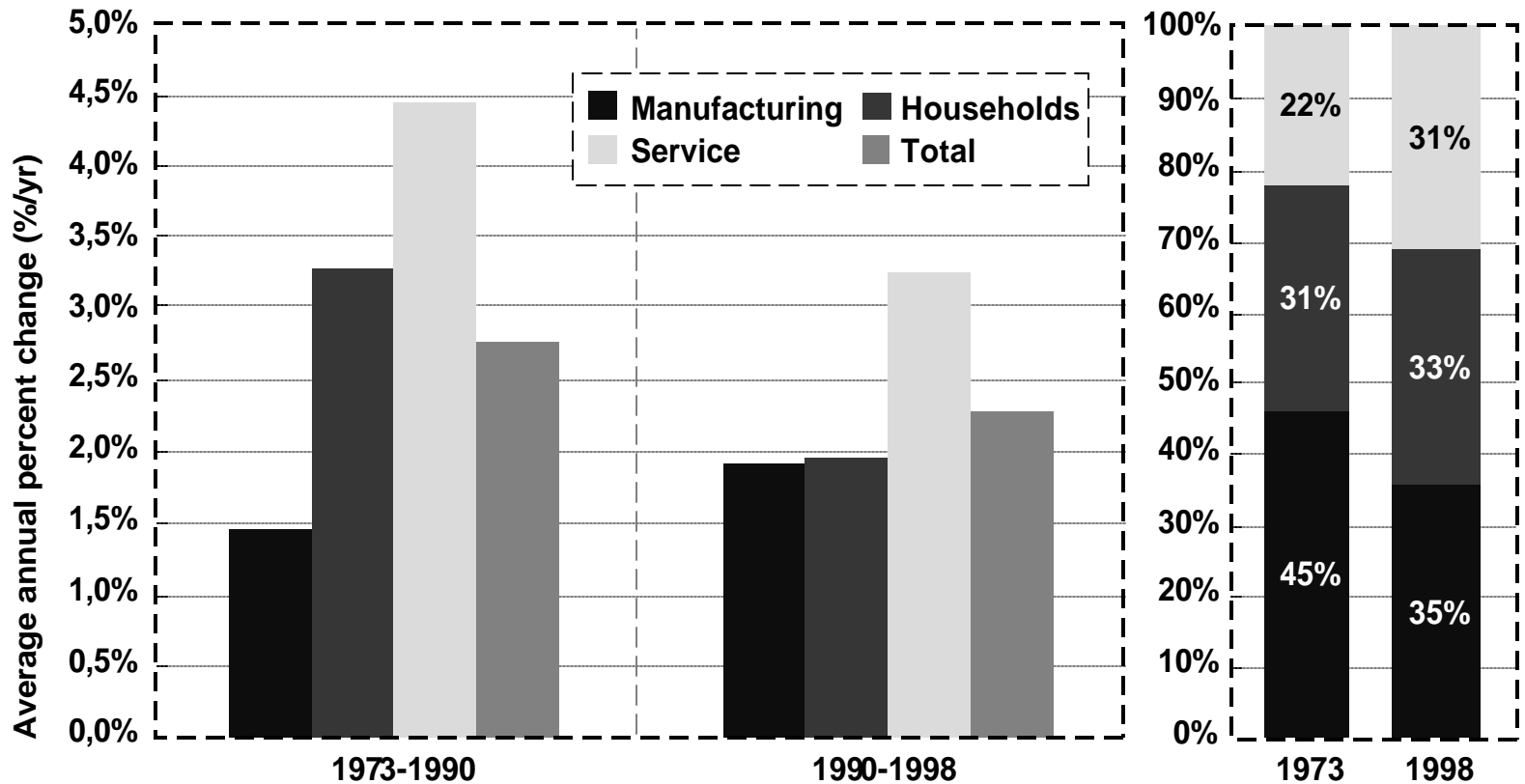


Electricity Demand by Sector, IEA-11

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Strong growth in electricity demand in all stationary sectors

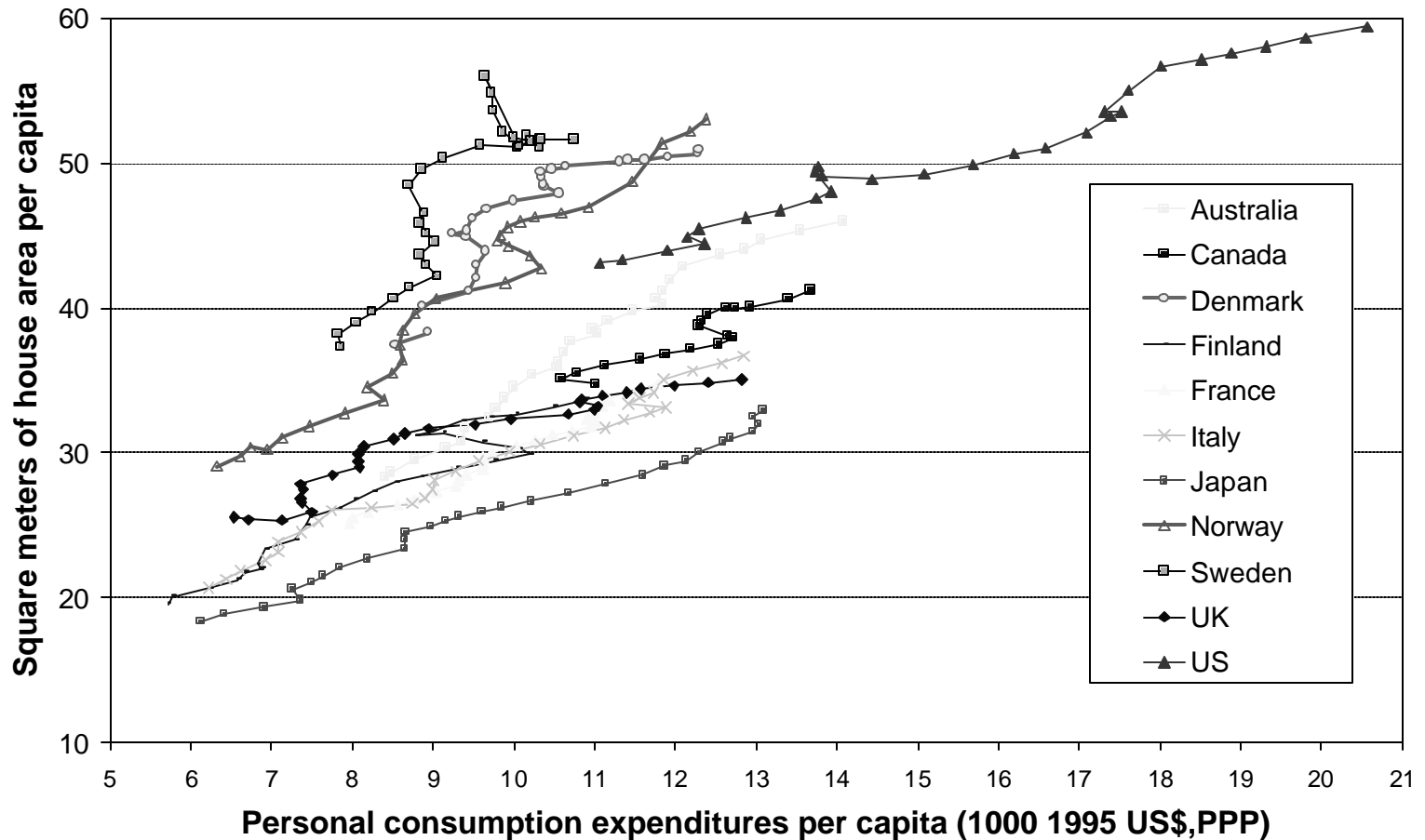


House Area and Income 1970-1998

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Living space gets bigger as we get richer



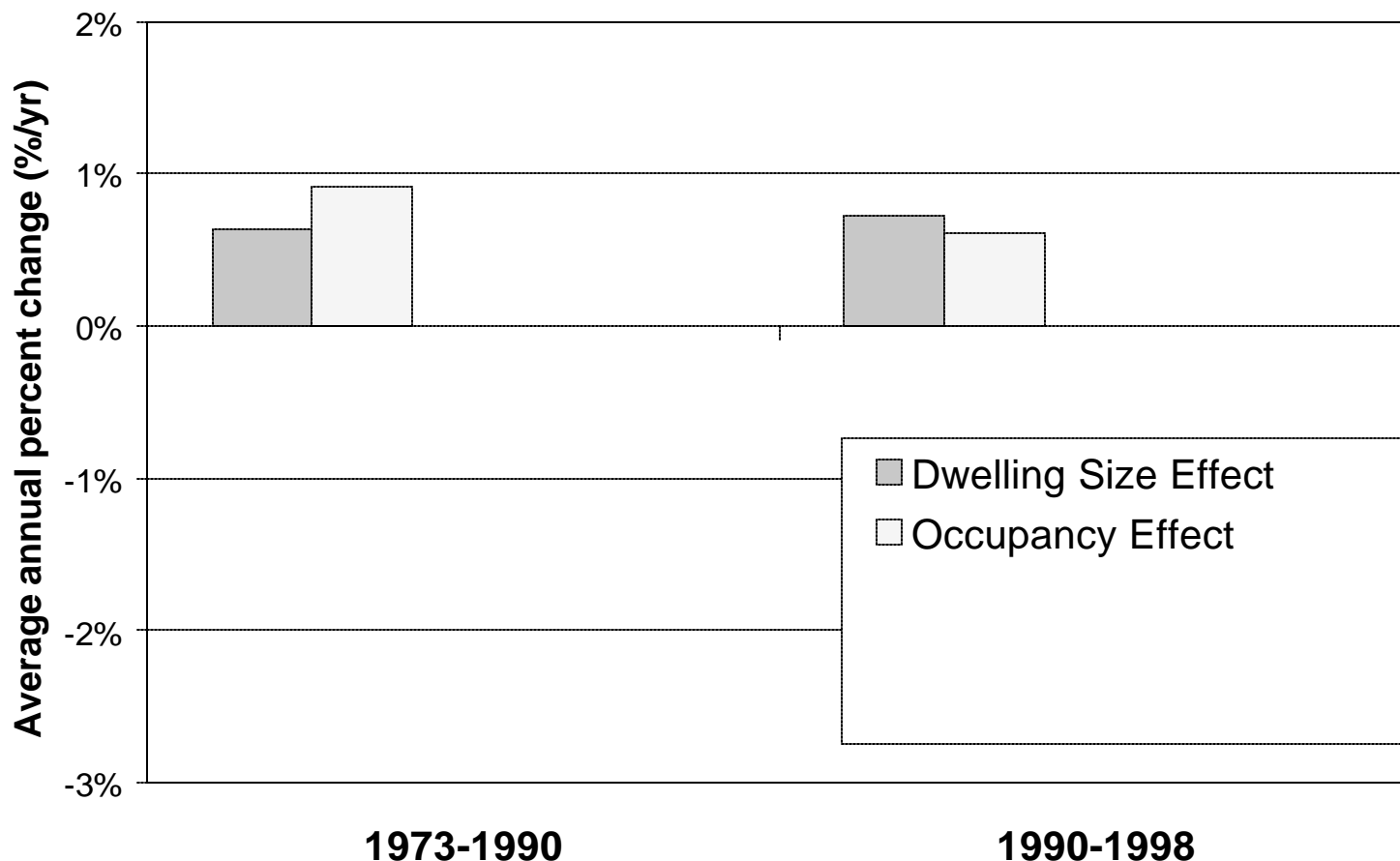
Energy for Space Heating (IEA-11)

Factors shaping development

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Bigger homes and fewer people per home steady drivers of space heating demand



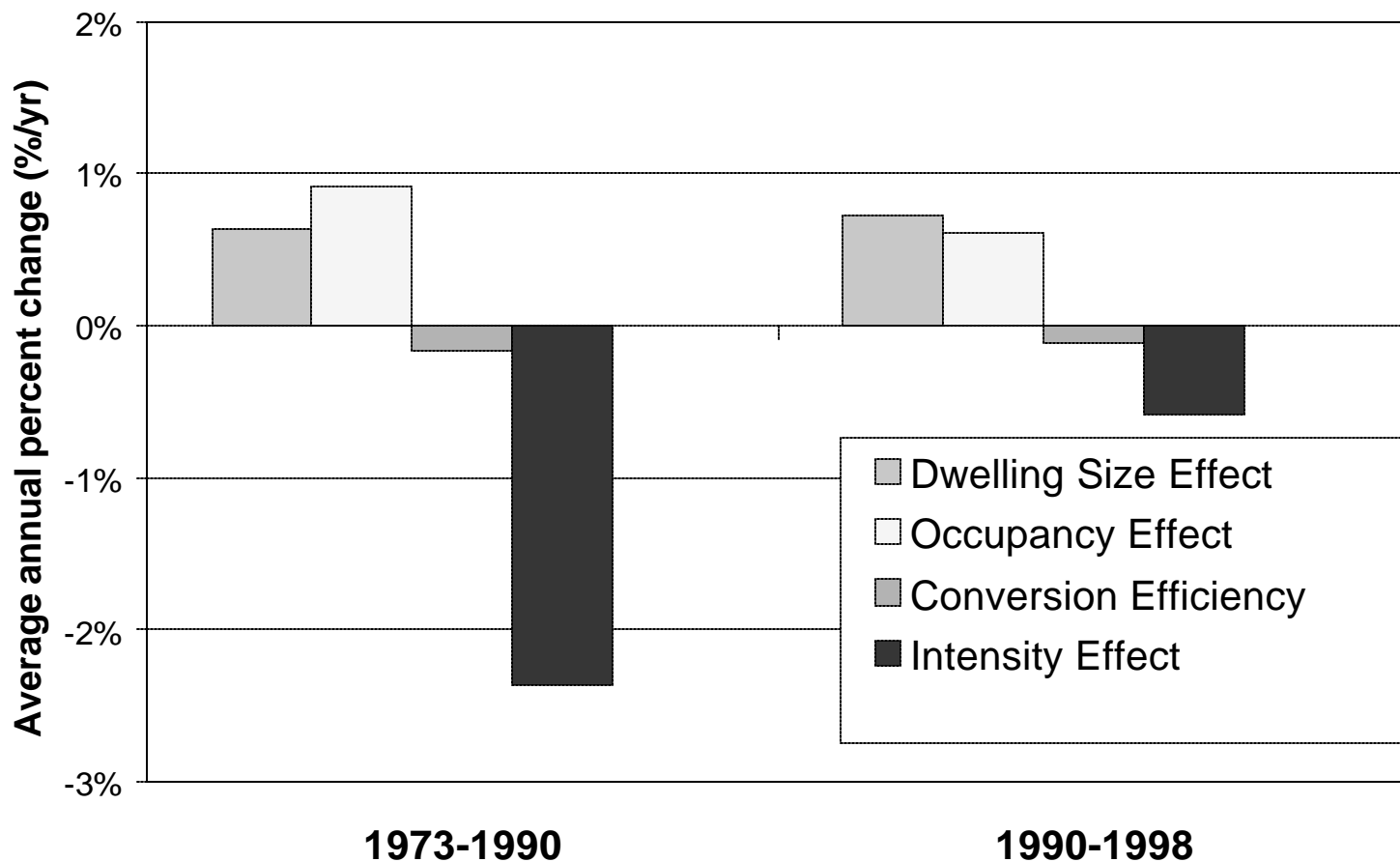
Energy for Space Heating (IEA-11)

Factors shaping development

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Declines in intensities are slowing....



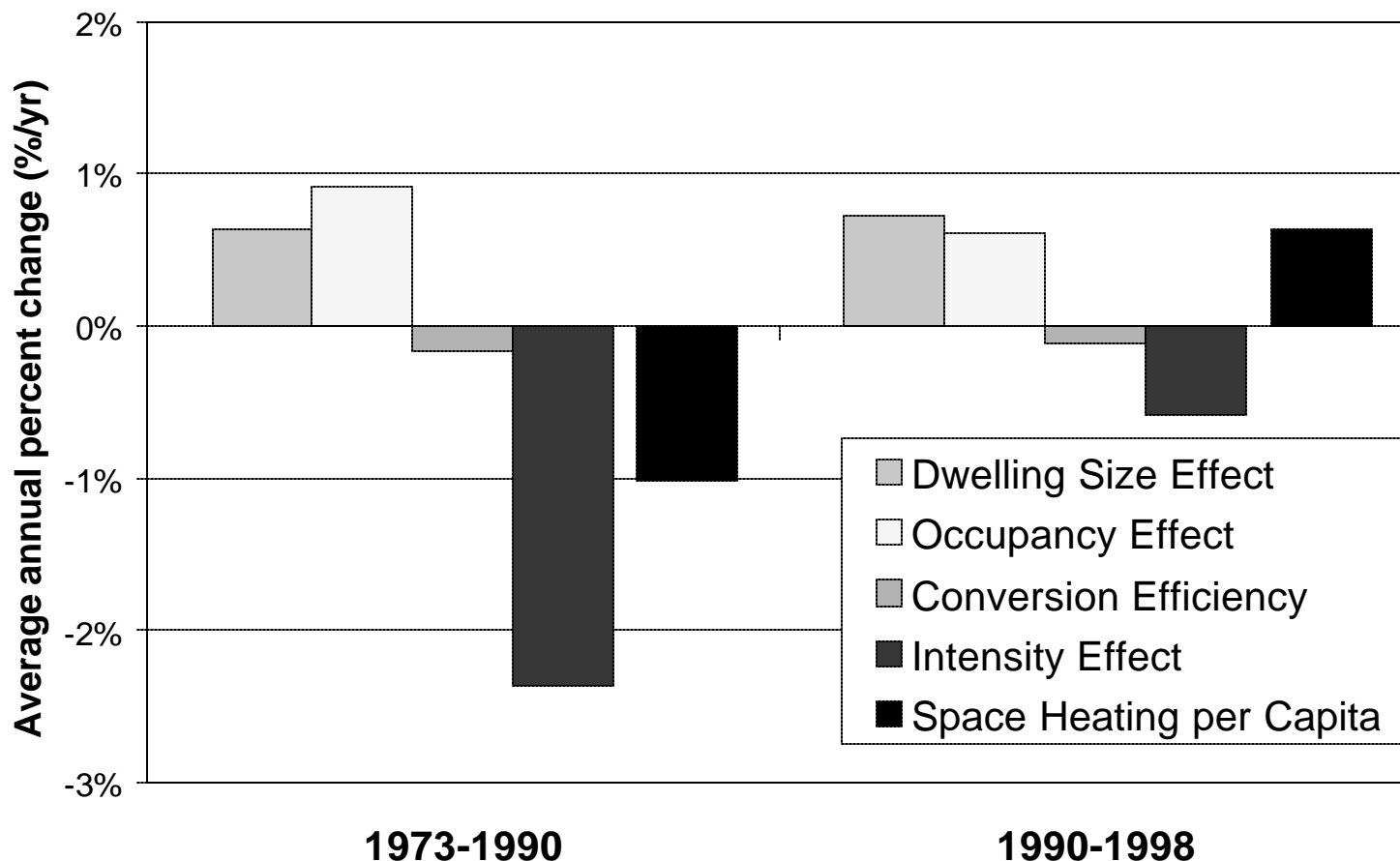
Energy for Space Heating (IEA-11)

Factors shaping development

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Net result is an increase in per capita heating demand after 1990

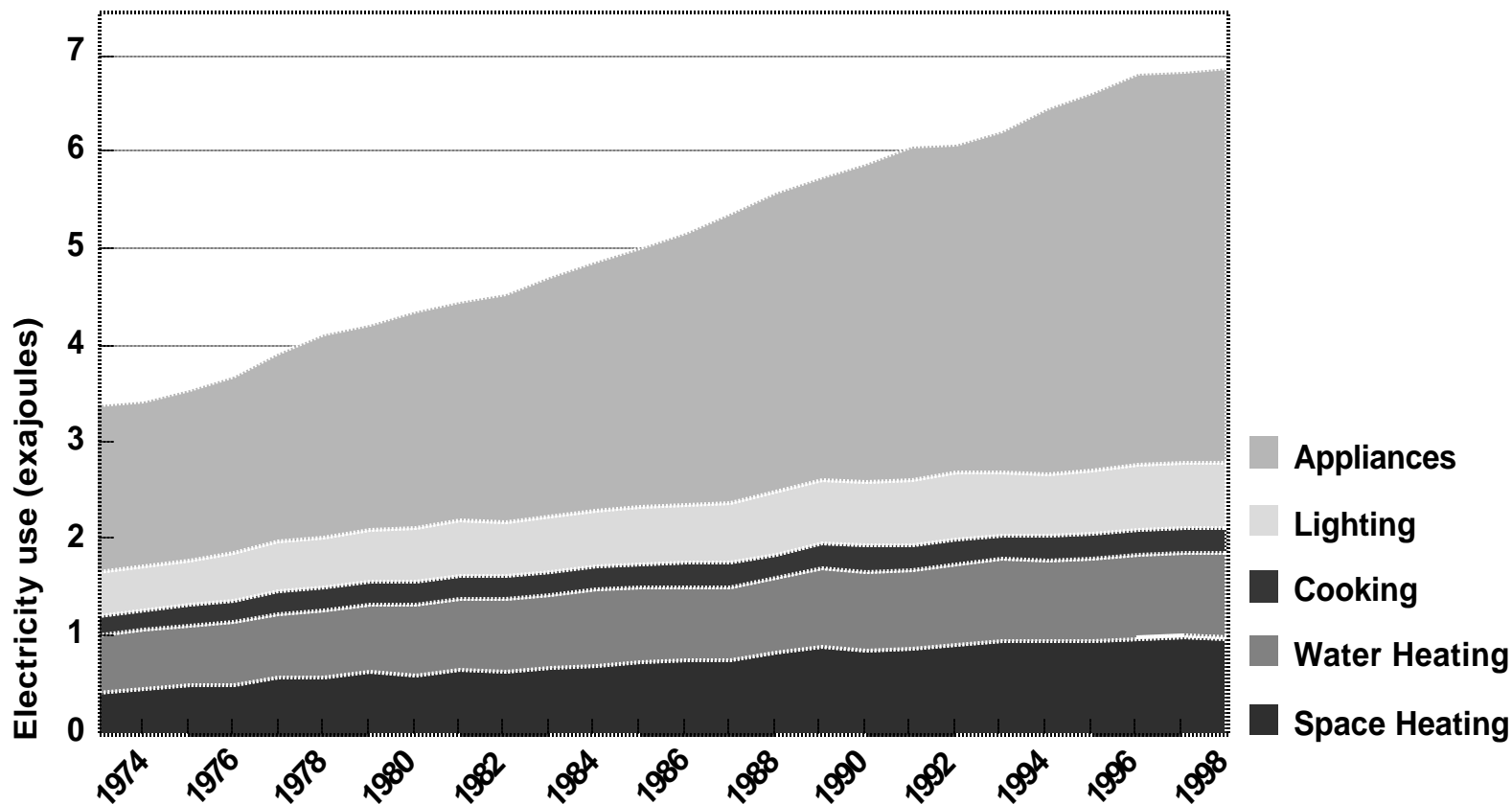


Household Electricity Demand IEA-11

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Appliances key driver of electricity demand



Energy Costs and Savings

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- I Falling prices and successful energy savings have helped reducing energy budgets for industry and private consumers since the early 1980s:**
 - ⌞ Energy's share of production cost in industry fell as much as 50%**
 - ⌞ Energy cost as share of income for private homes fell 20-50%**
 - ⌞ Fuel cost per km for cars fell by 20 to 60%**
- I Can explain less incentive to sustain energy savings after 1990.**

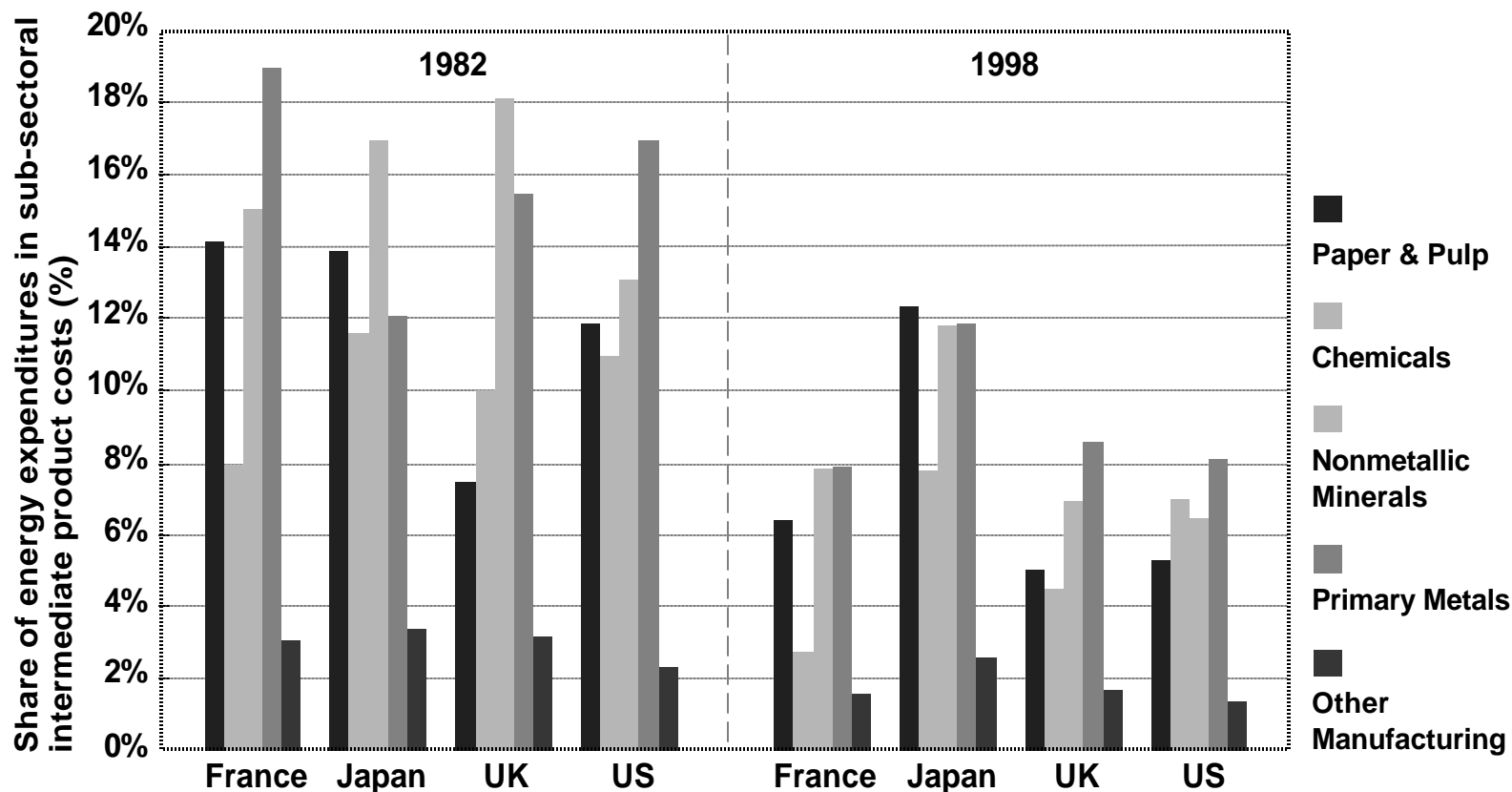


Share of Energy Expenditures in Sub-sector Intermediate Product Costs

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The share of energy in total production costs varies significantly across countries and sub-sectors, but has fallen everywhere



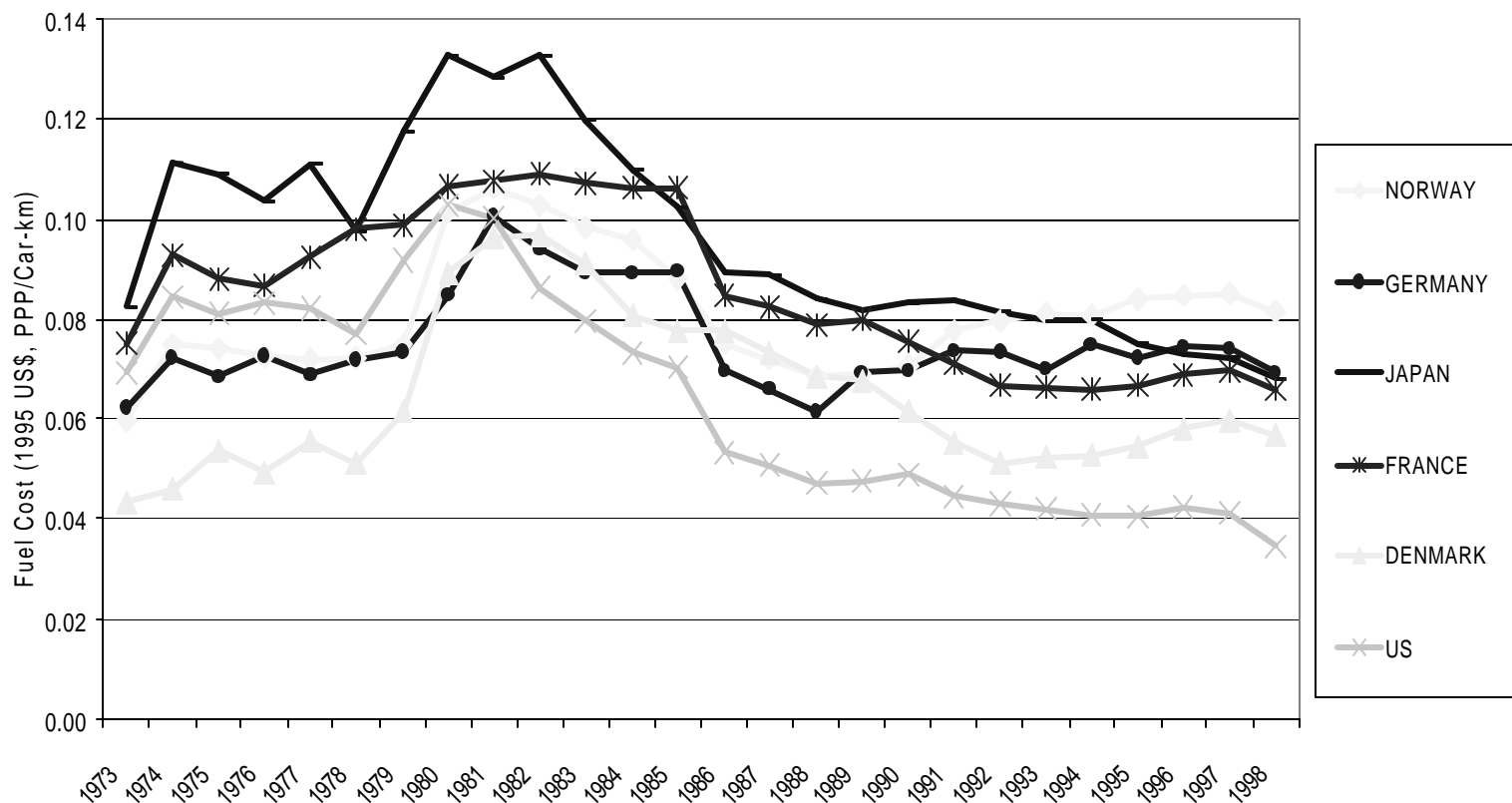
Fuel Cost for Driving Private Cars

US\$ (real terms, including taxes)/car-km

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Fuel cost per km have generally fallen since the early 1980s

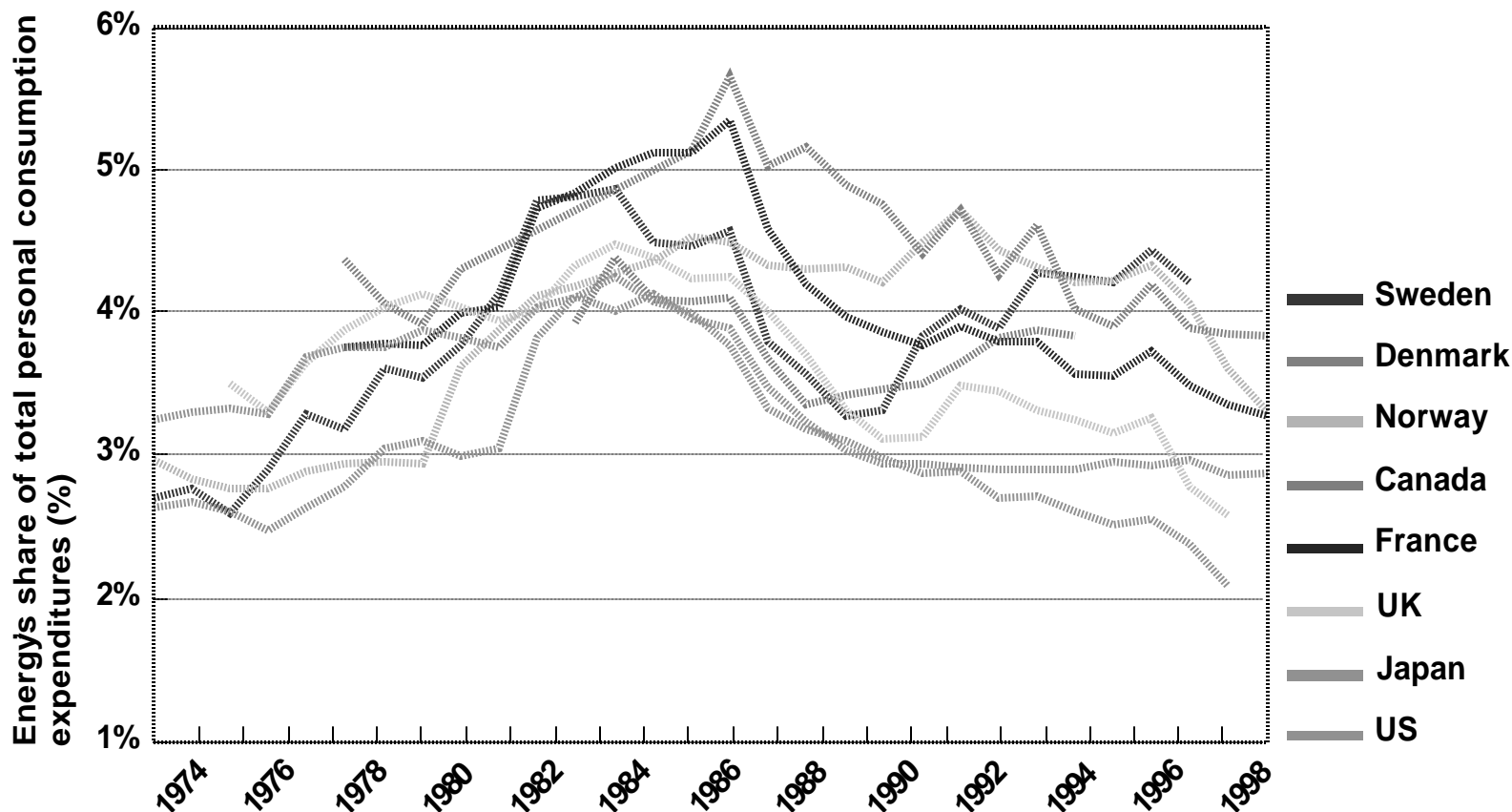


Household Energy Expenditures as Share of Income

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IEA households today spend considerably less of their incomes on energy than in the early 1980s

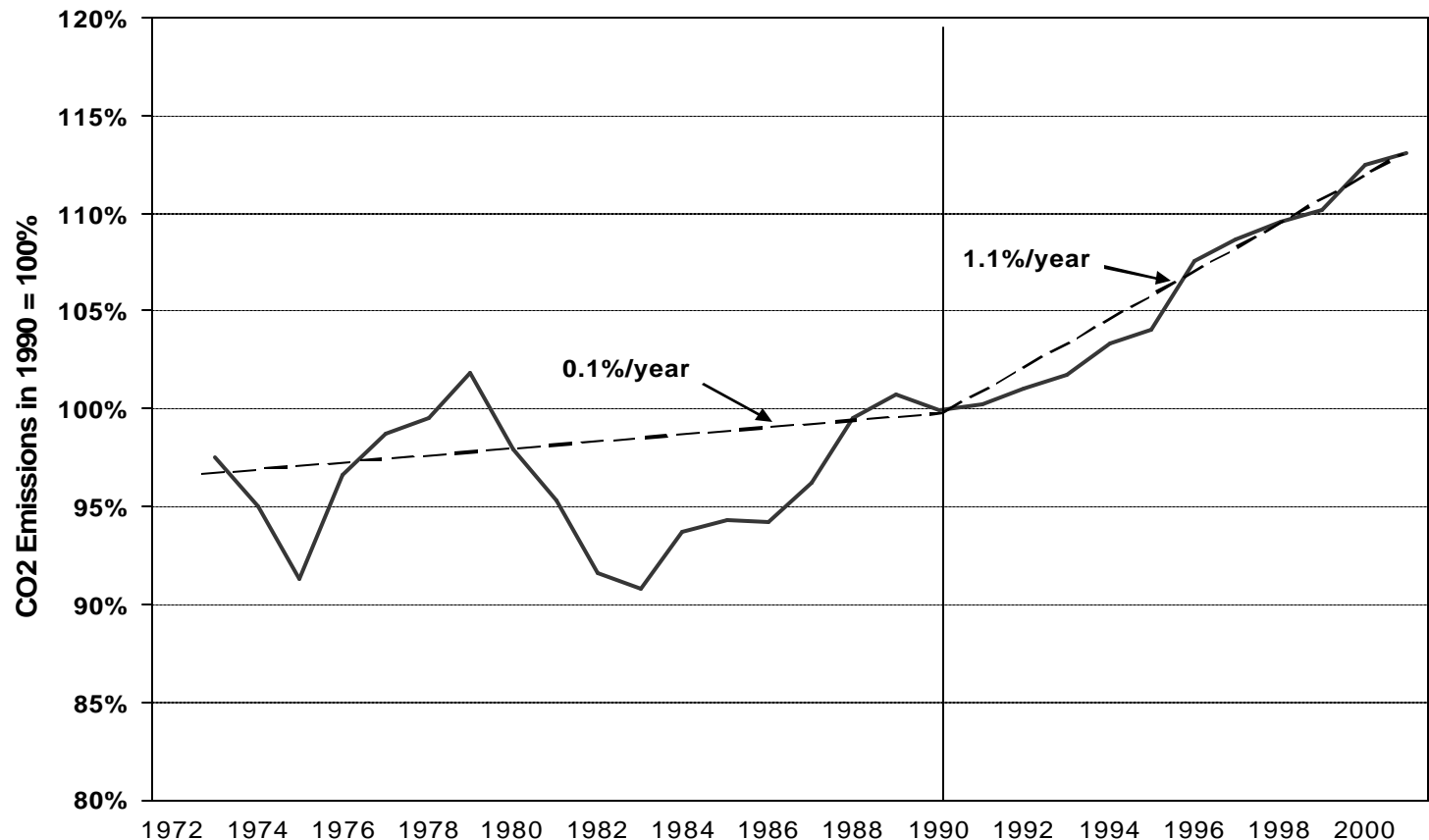


IEA CO₂ Emissions 1973 - 2001

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Recent trends show steady increase

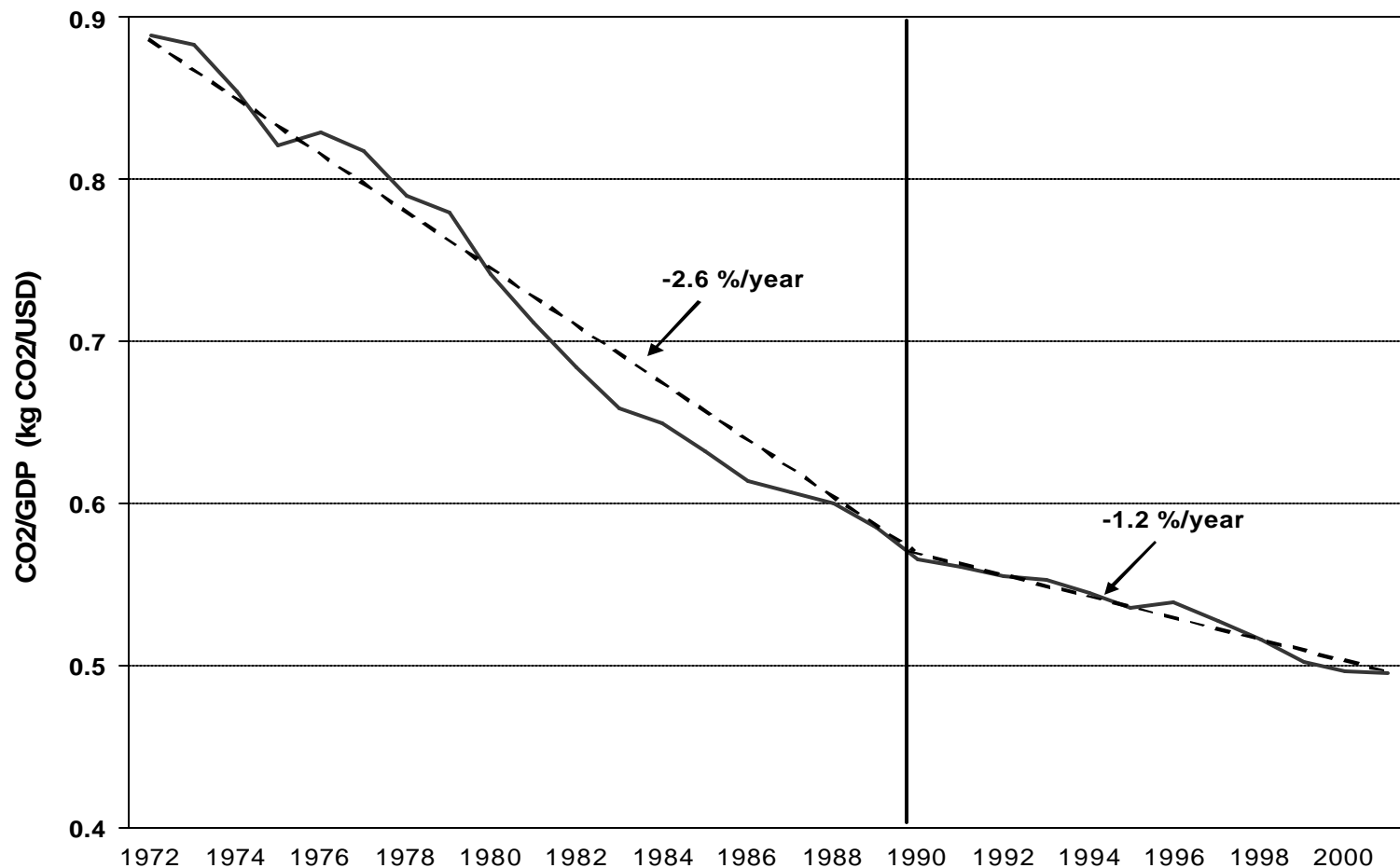


IEA CO₂ Emissions per GDP 1973 - 2001

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Rate of decline has slowed since 1990



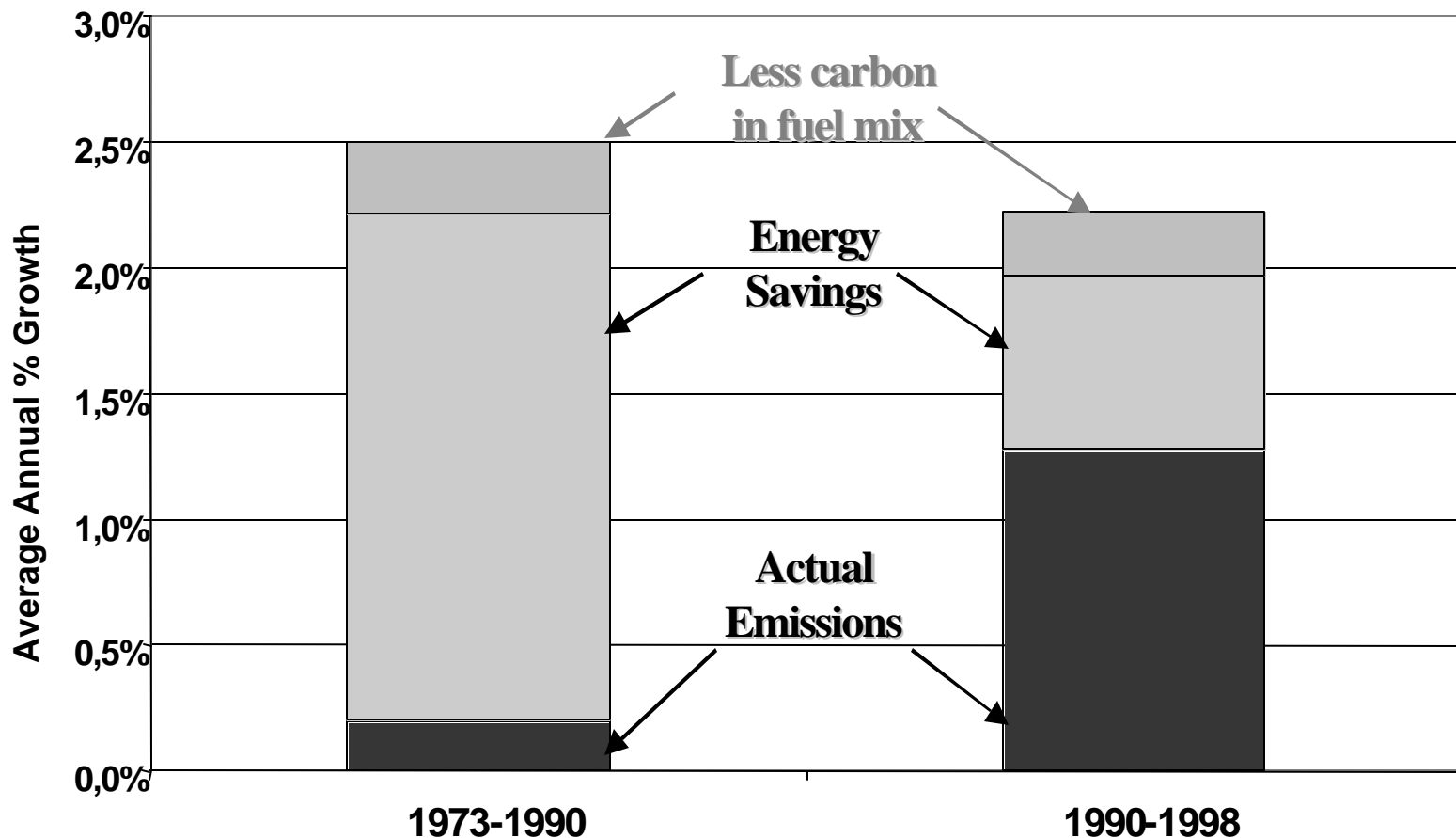
IEA-11 CO₂ Emissions

Impact of Fuel Mix & Energy Savings

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Slowing energy savings rates primary reason for accelerated growth in emissions after 1990

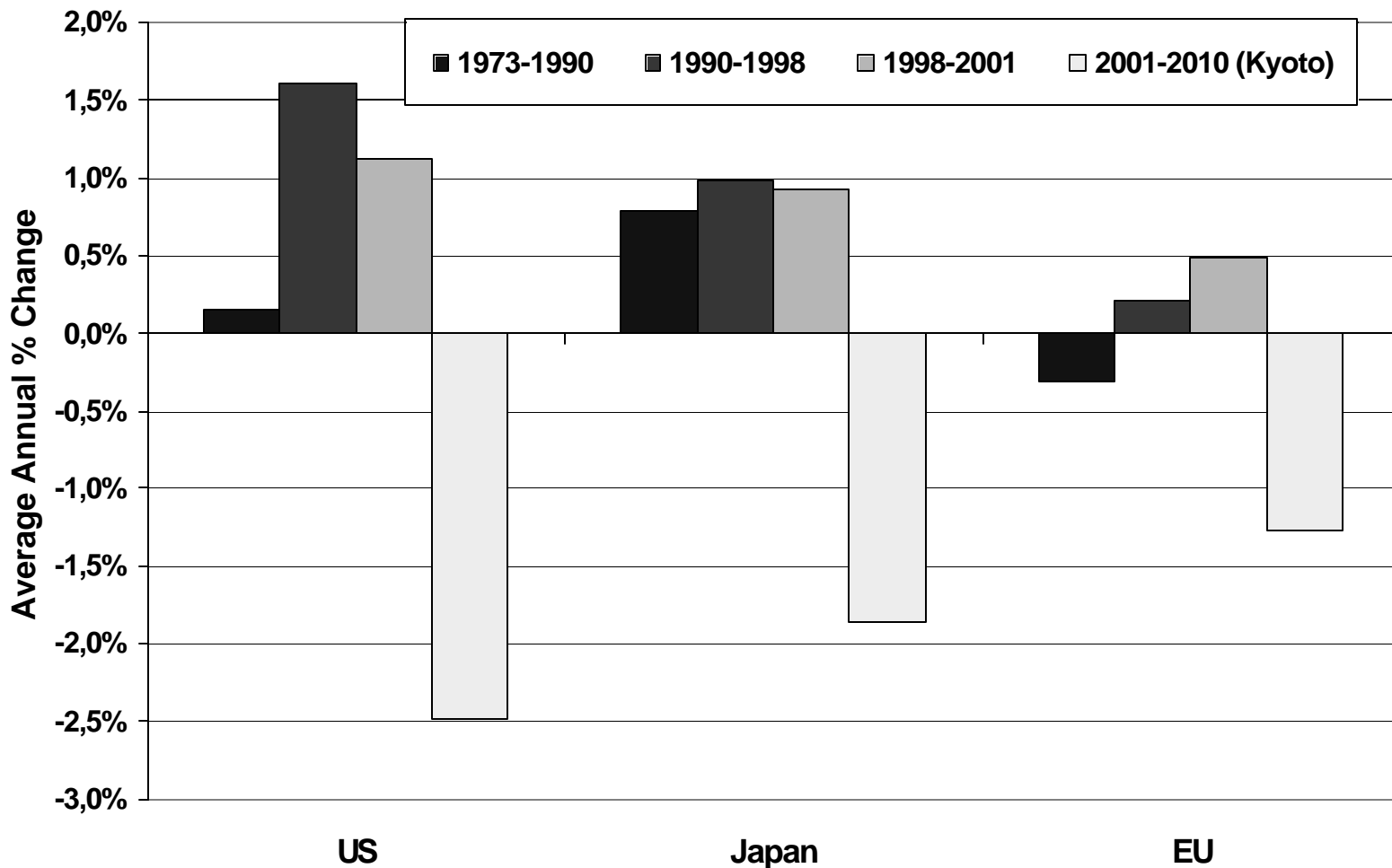


CO2 Emissions and Kyoto US, Japan and EU

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Recent development in stark contrast to what is implied by the Kyoto targets



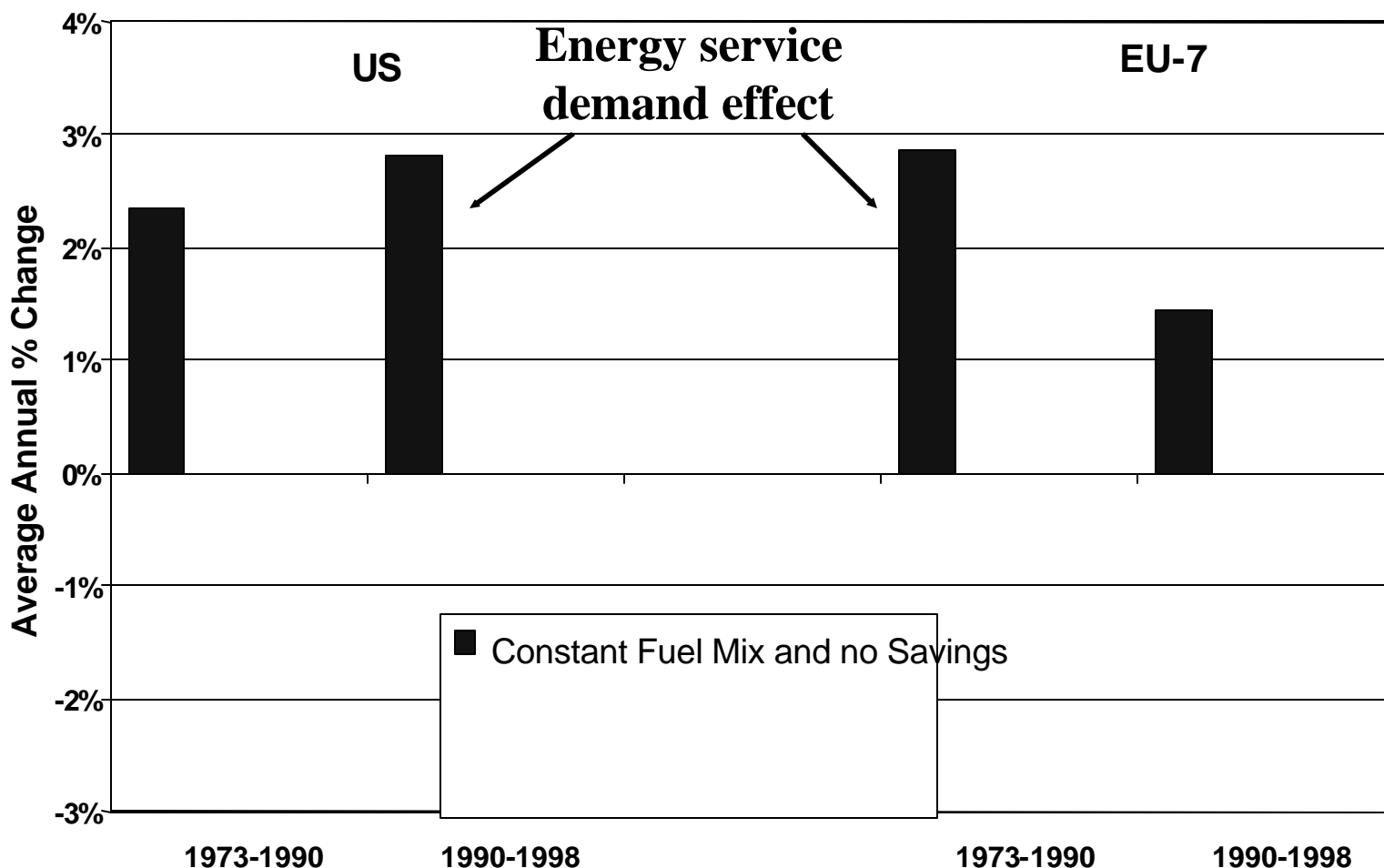
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CO2 Emissions in the US and EU

Impact of Fuel Mix & Energy Savings



Growth in the demand for energy services higher after 1990 in the US, opposite trend in the EU



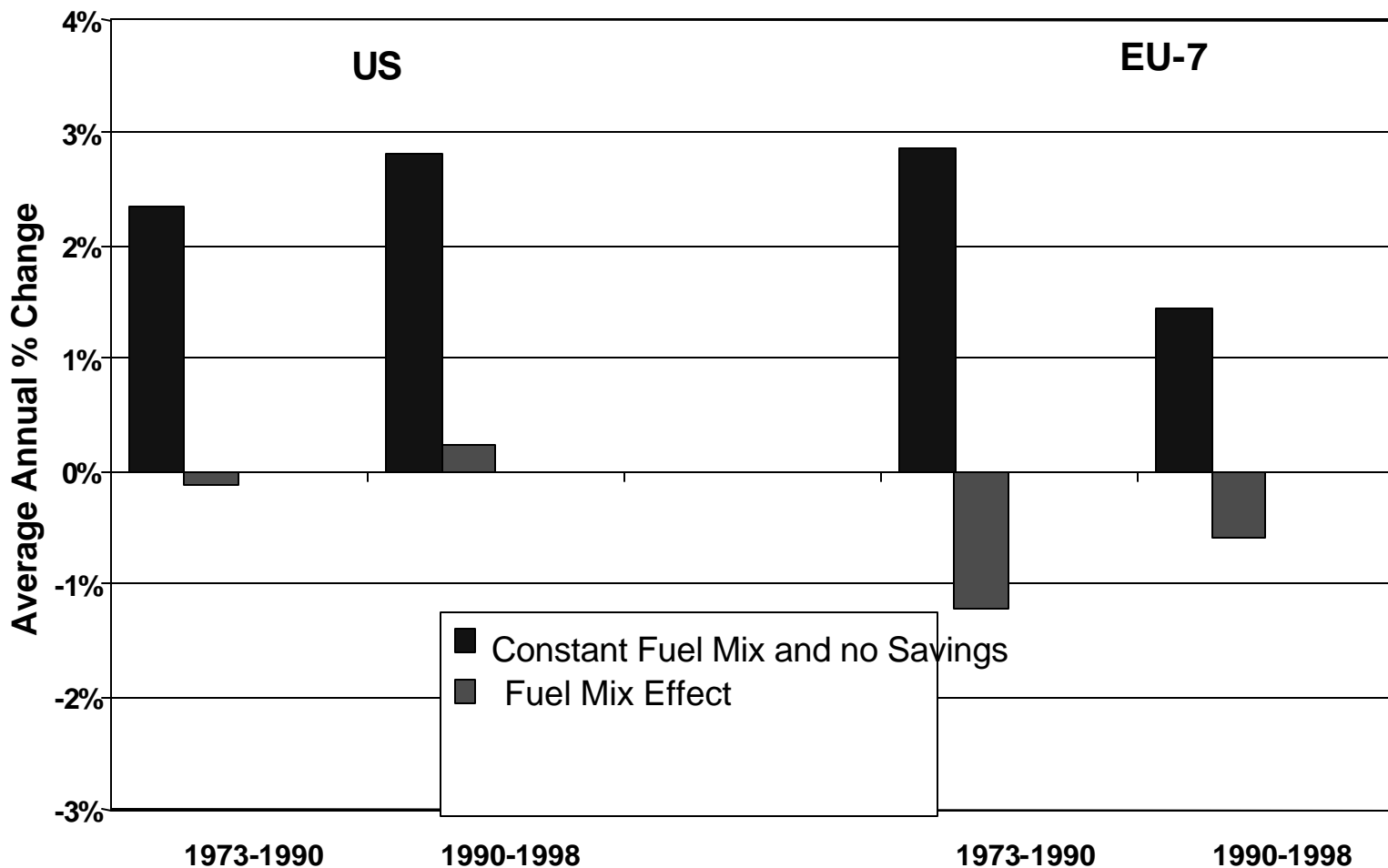
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CO2 Emissions in the US and EU

Impact of Fuel Mix & Energy Savings



Significant reduction of emissions due to a less carbon intensive fuel mix in EU



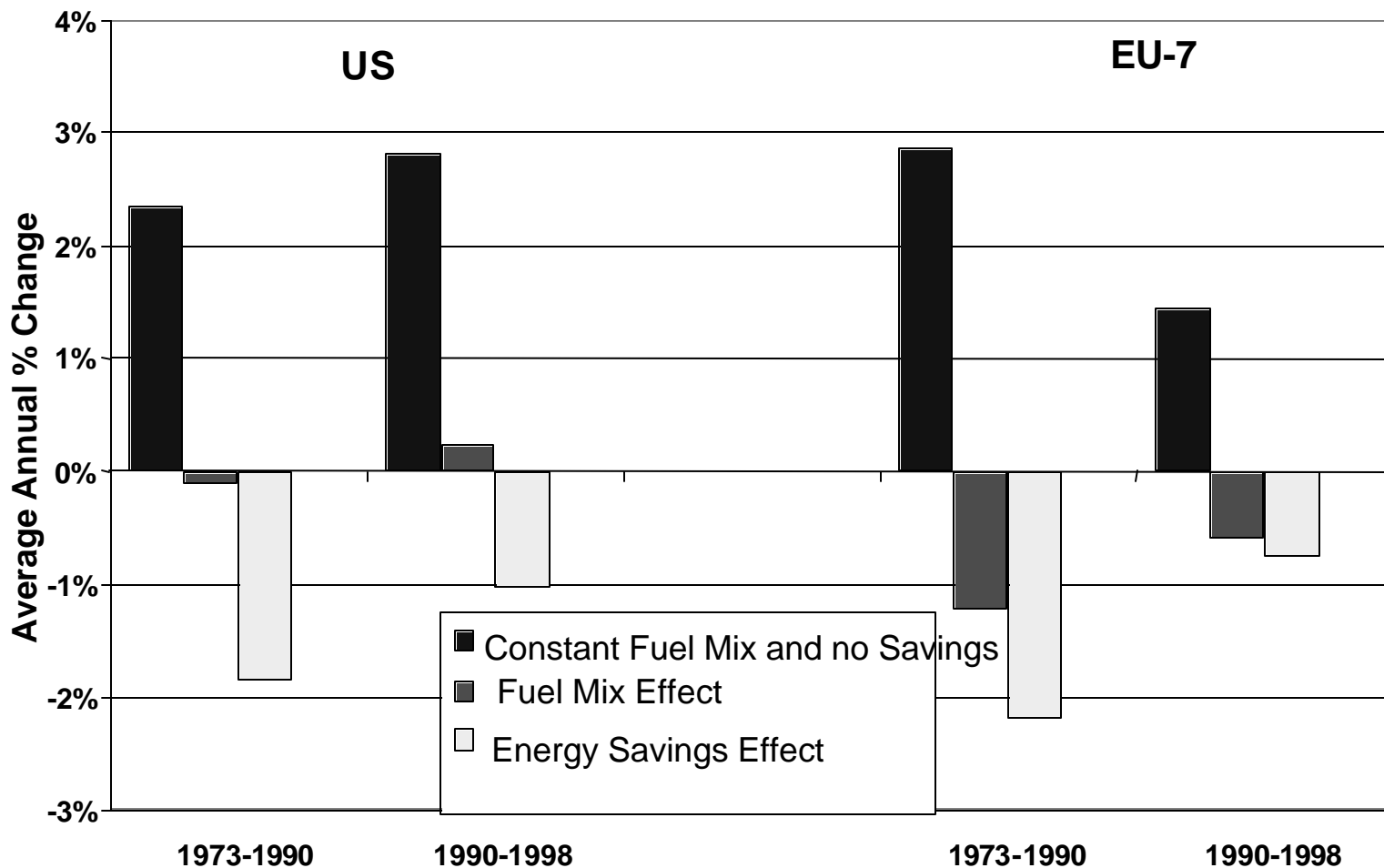
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CO2 Emissions in the US and EU

Impact of Fuel Mix & Energy Savings



Slowing energy savings rates....



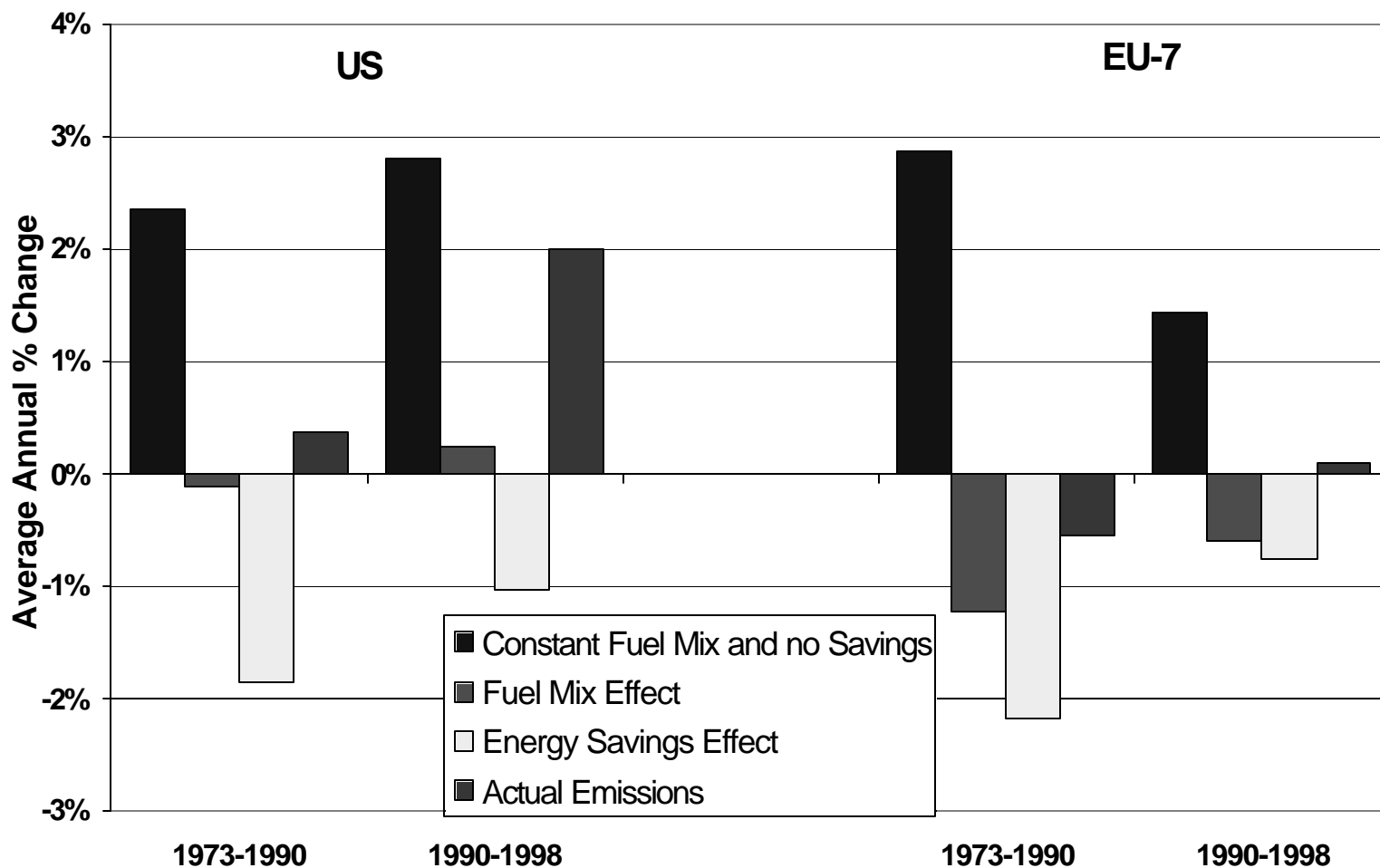
CO2 Emissions in the US and EU

Impact of Fuel Mix & Energy Savings

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***Slowing energy savings rates primary reason
for accelerated growth in emissions after 1990***



IEA End-use Data Modelling Applications

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I World Energy Outlook:

- ⌋ Allows for disaggregated demand side representation in WEM
- ⌋ Allows for estimation of policy impacts in Alternative Scenario

I Energy Technology Perspectives Project

- ⌋ Provides basis for demand side in global MARKAL model
- ⌋ “Energy Model Builder” Linking energy statistics and other data to demand modules by sector