

# ***Introduction to Energy Indicators***

## ***Motivation and Approach***

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Assessing Energy Efficiency Progress:

### ***A call for action from G8 Leaders and IEA Ministers***

- **Gleneagles Plan of Action (G8 Communiqué):**  
*We will [G8 Heads of States]...invite the IEA ...to develop energy indicators to assess efficiency...*
- **Communiqué from IEA Ministers May 2005:**  
*“...instruct the IEA to monitor our efforts to [reinforce our energy efficiency effort]..”*

## **Presentation Overview**

- **Why indicators?**
- **What are they?**
- **Examples**
- **Data needs**

## **Why Indicators?**

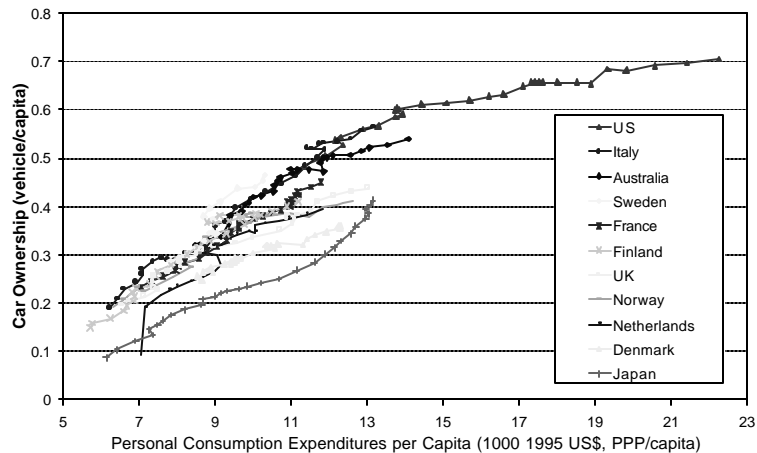
*Indicators can help...*

- **Understand driving forces behind growth in energy demand**
- **Separate factors related to energy efficiency from those that are not**
- **Identify potentials for energy efficiency improvements**
- **Measure progress of energy efficiency measures**

## What is an Energy Indicator?

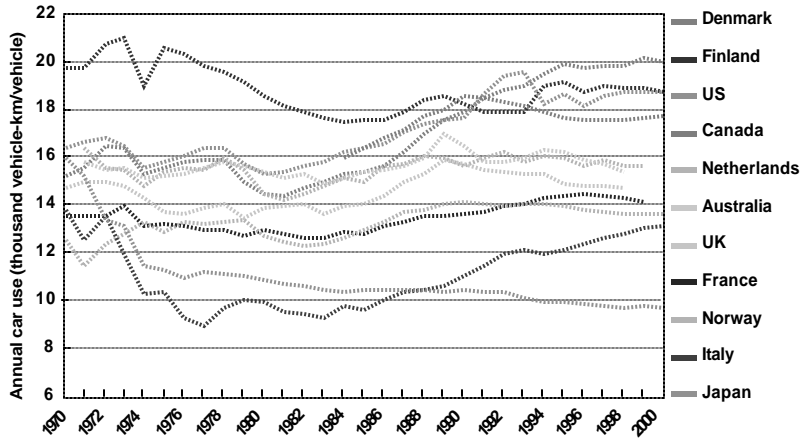
- Relates energy use to activities driving demand for energy services
- Two main types:
  1. Indicators following activities that drive energy use  
(e.g. industrial output, building area, appliance ownership, ton-km, car-ownership and use)
  2. Indicators following energy intensity developments:  
(e.g. energy/passenger-km, energy/value added by industry branch, space heating energy/floor area)

### Example of Driving Force Car Ownership and Income 1970-2000



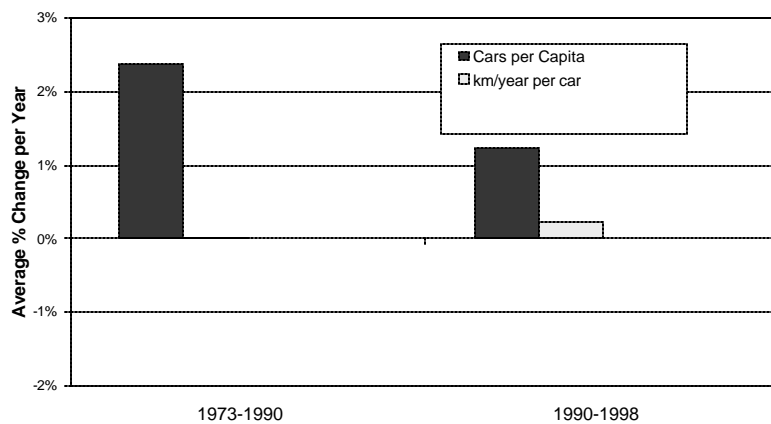
***Strong growth most places, slowly leveling off in the US***

## Example of Driving Force Annual kilometres per Vehicle



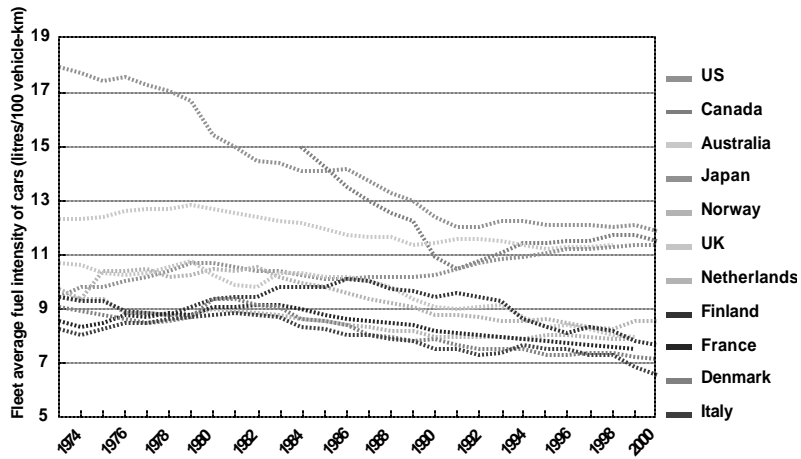
*Travel per vehicle is fairly stable over time*

## Energy for Cars (IEA-11) Factors shaping development 1973-1998



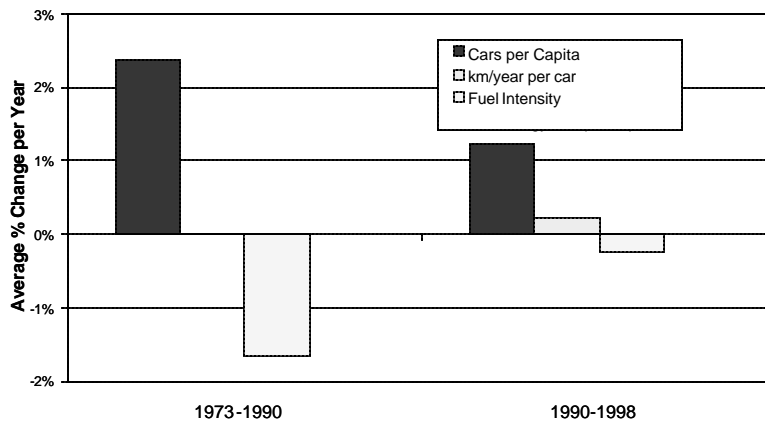
*Strong growth in car ownership while the use of each car has changed little*

## Example of Intensity Indicator Car Stock-average Fuel Intensity



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

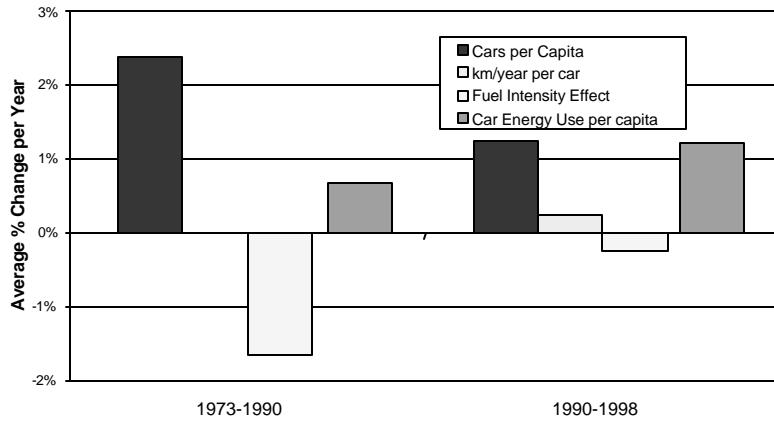
## Energy for Cars (IEA-11) Factors shaping development 1973-1998



**Decline in fuel intensity has slowed....**

## Energy for Cars (IEA-11)

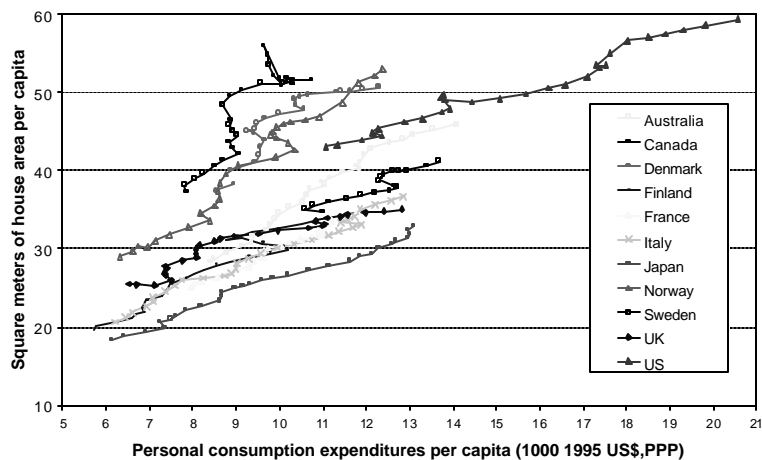
### Factors shaping development 1973-1998



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

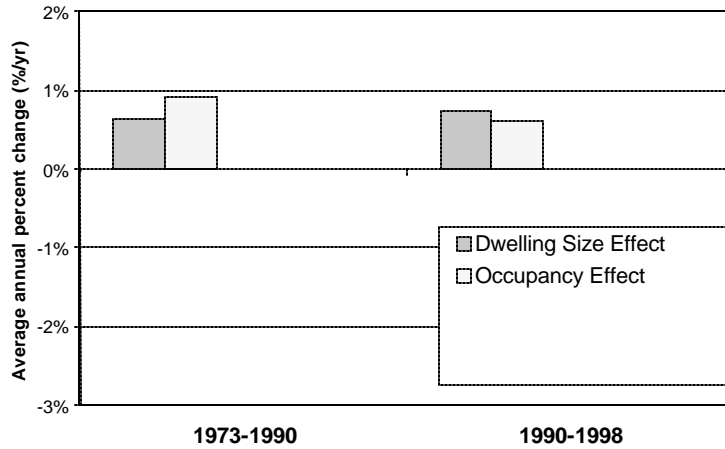
## Example of Driving Force

### House Area vs. Income (1973-1998)



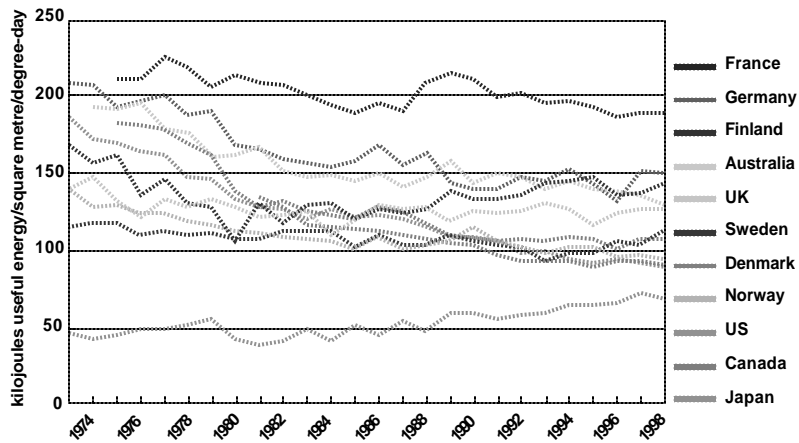
**Living space gets bigger as we get richer**

## Energy for Space Heating (IEA-11) Factors shaping development



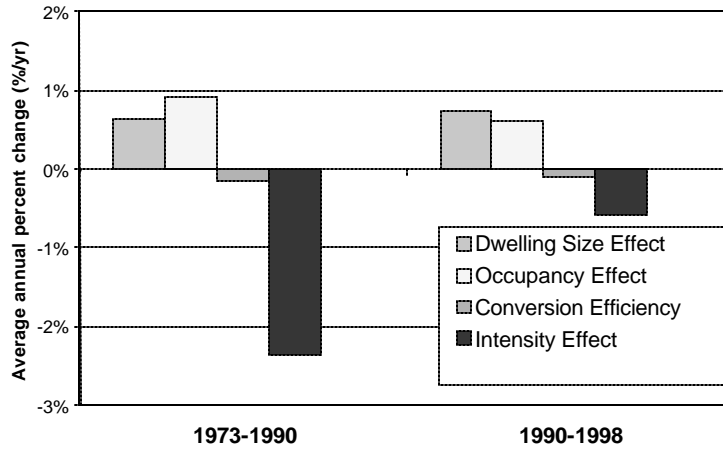
***Bigger homes and fewer people per home steady drivers of space heating demand***

## Example of Intensity Indicator Useful Space Heating Intensity



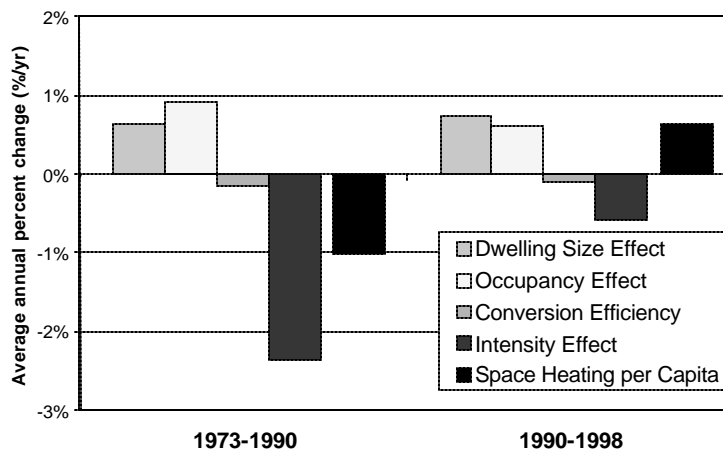
***Space heating intensities have declined, but increased comfort levels offset the savings in some countries***

## Energy for Space Heating (IEA-11) Factors shaping development



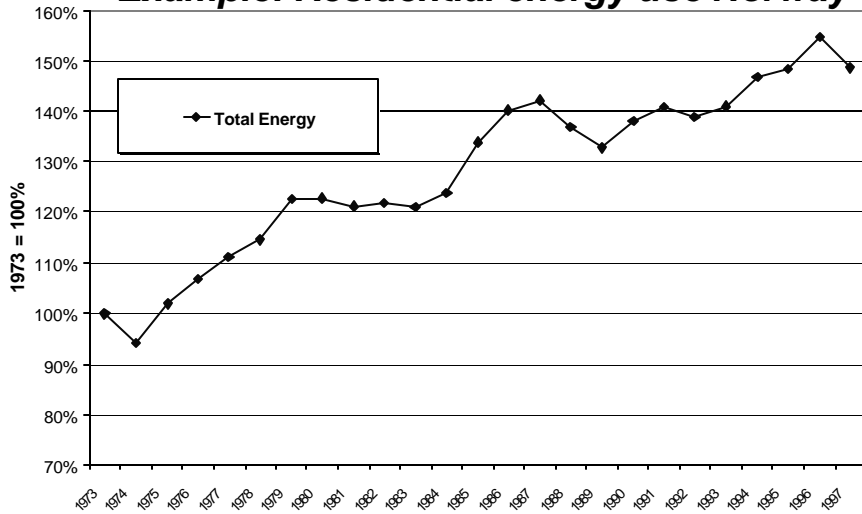
*Declines in intensities are slowing....*

## Energy for Space Heating (IEA-11) Factors shaping development

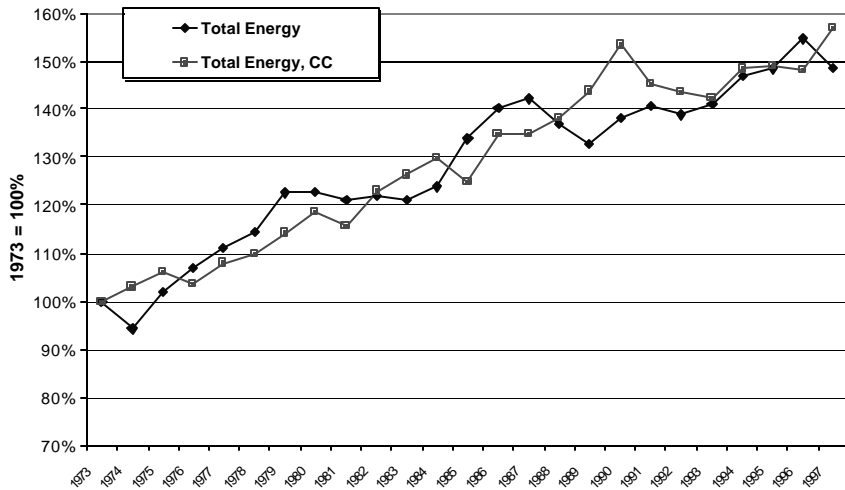


*Net result is an increase in per capita heating demand after 1990*

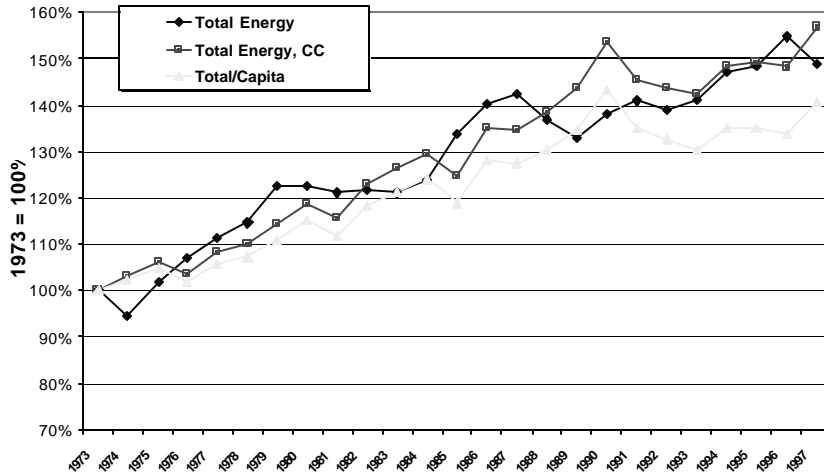
## Indicators following energy developments *Example: Residential energy use Norway*



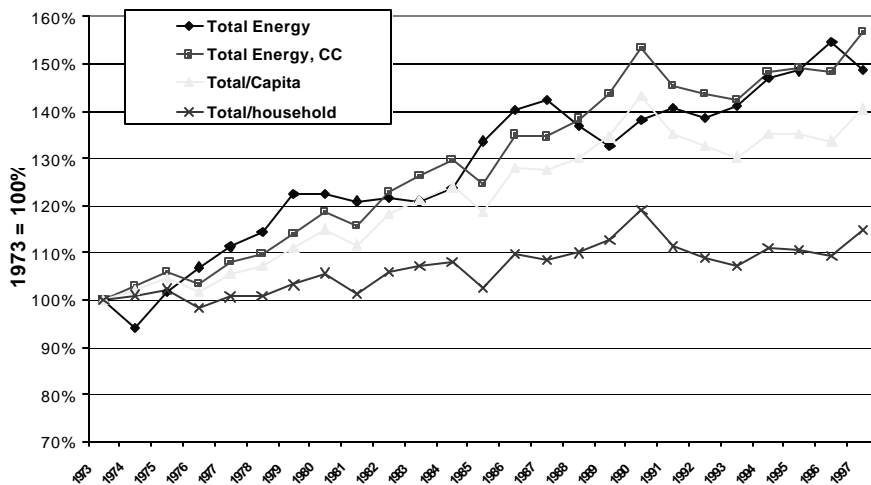
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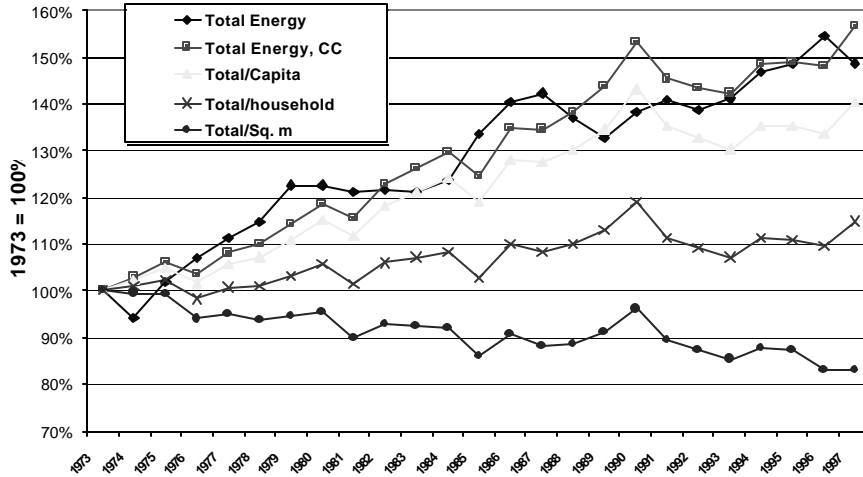
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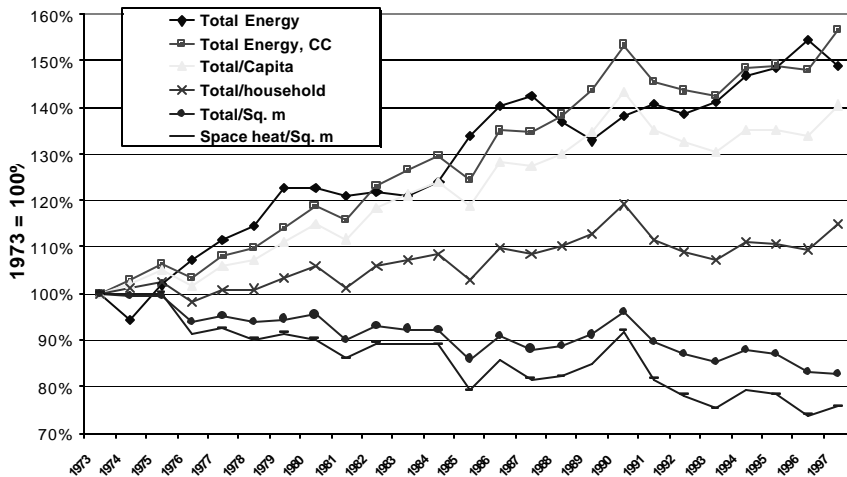
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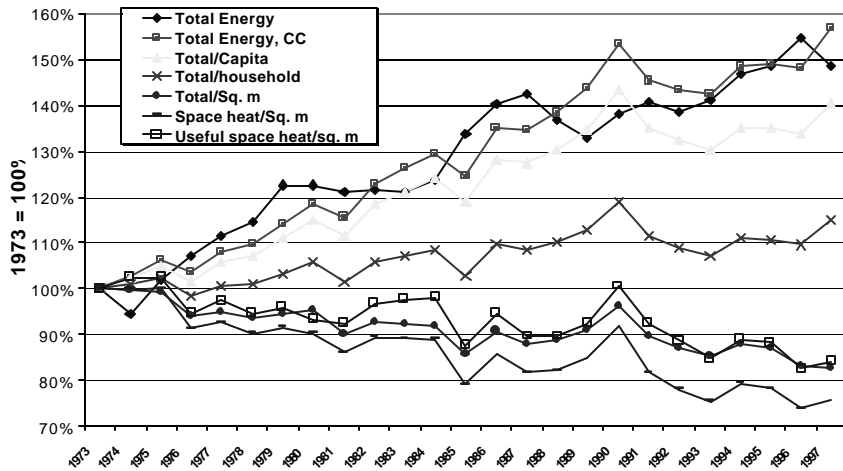
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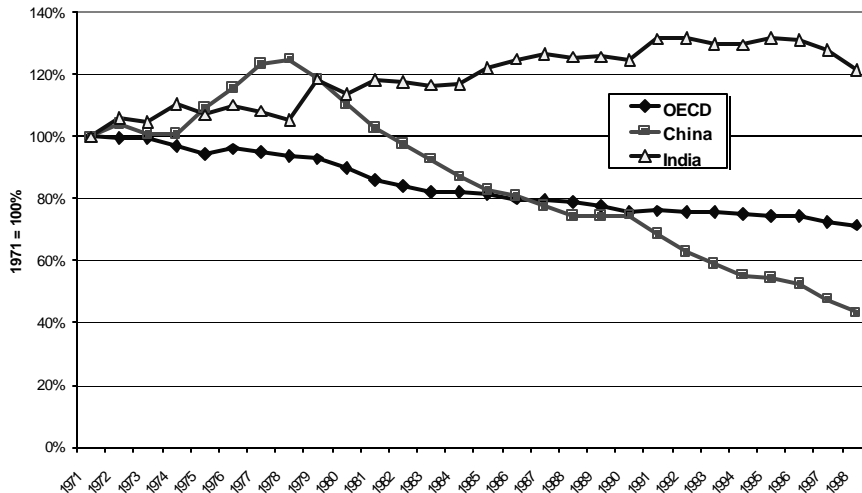


Disaggregated energy indicators are data intensive

*Why not simpler aggregated measures?*

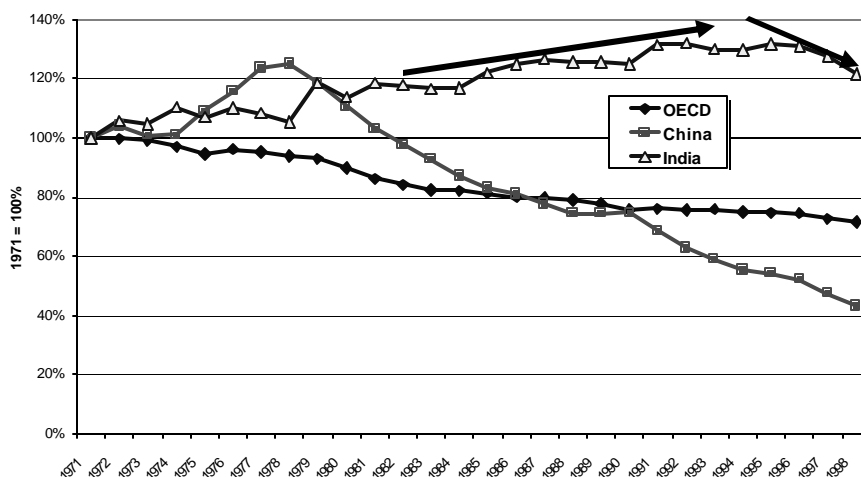
## Example: Energy per GDP India, China and OECD

*Total Primary Supply of commercial energy per unit of GDP*

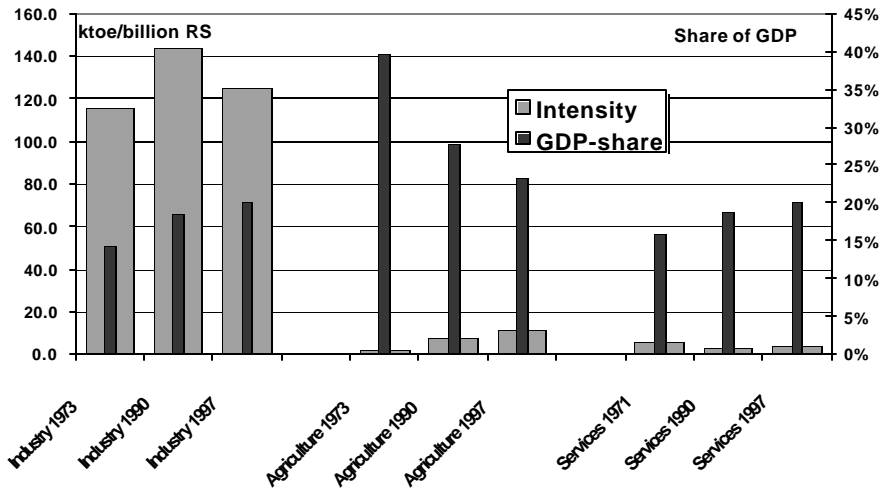


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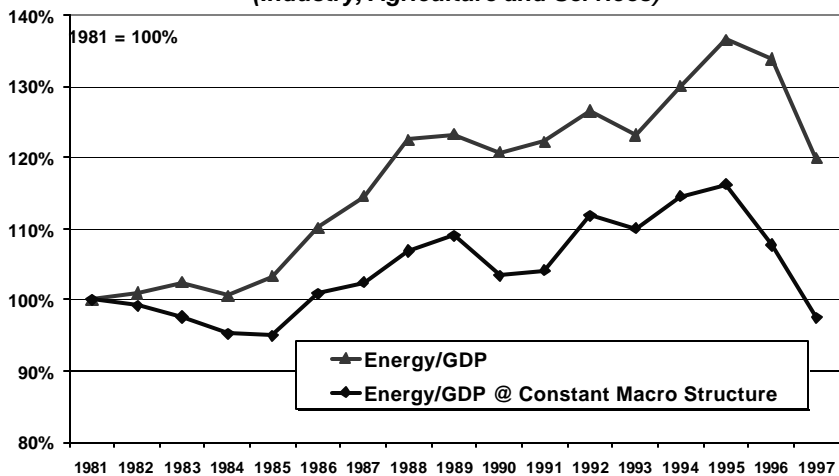


## The beginning of an explanation

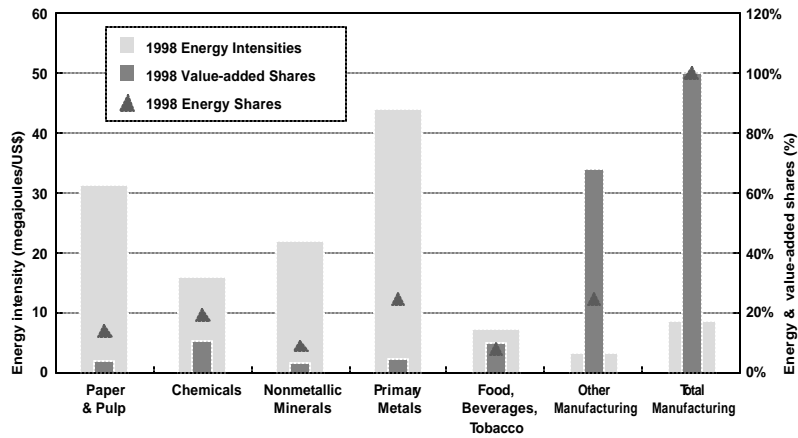


## Impact of Changes in Macro Structure Changes E/GDP vs. Changes in Sector Intensities

(Industry, Agriculture and Services)

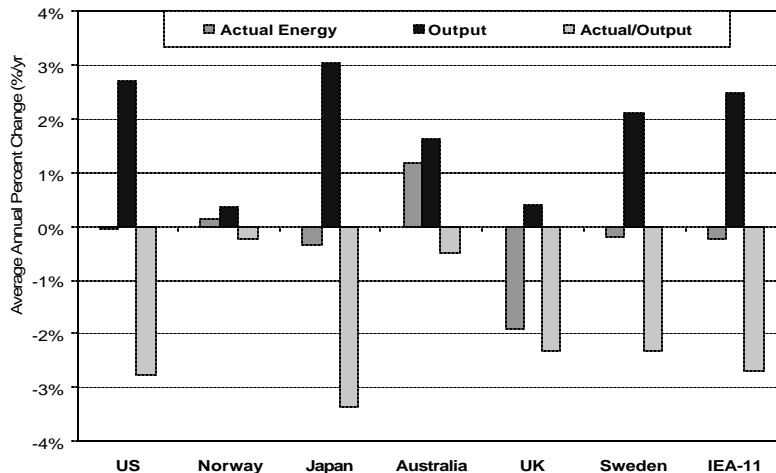


## Sub-sector Energy Intensities, Value-added and Energy Shares, IEA-11



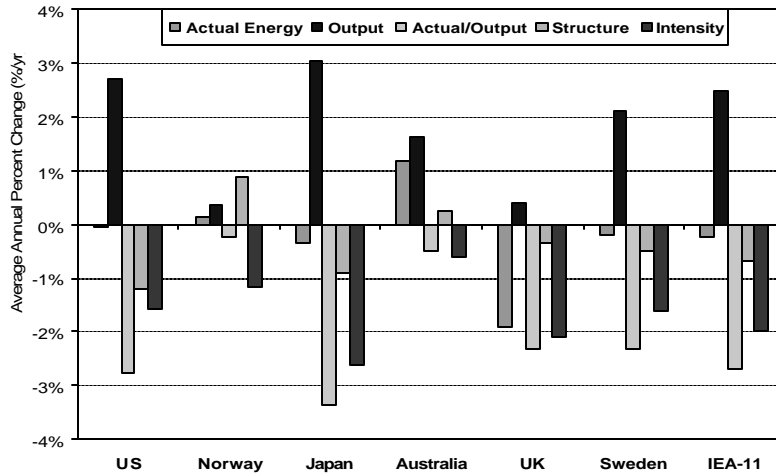
*Energy-intensive sub-sectors contribute little to overall manufacturing output, but account for a large share of energy consumption*

## Energy Savings and Structural Change IEA - 11 Manufacturing, 1973-1998



*Strong reduction in energy per \$ produced almost everywhere*

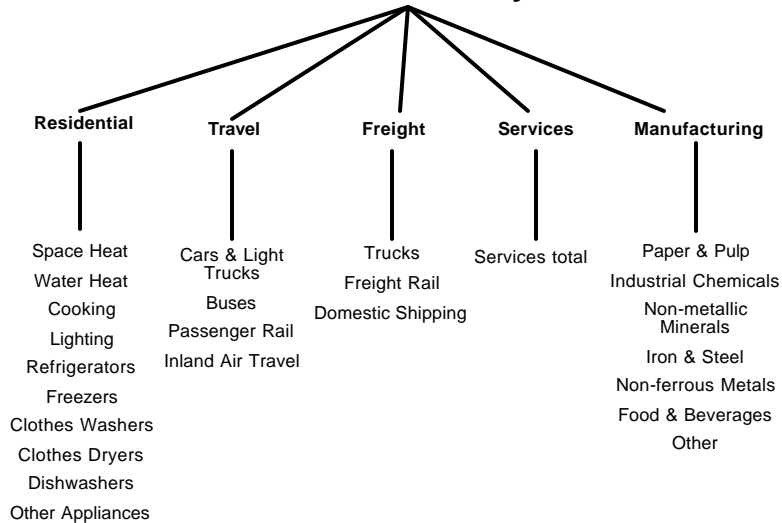
## Energy Savings and Structural Change IEA - 11 Manufacturing, 1973-1998



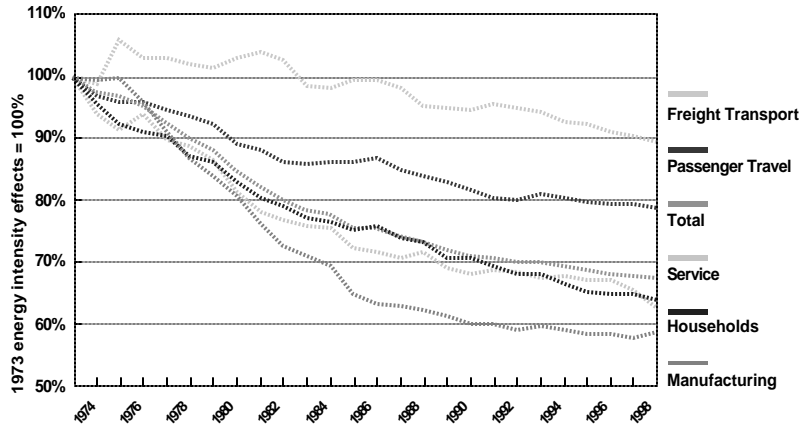
**Structural changes explain some of the country difference in aggregate intensity**

## Sector & End-use Coverage

### Total Economy

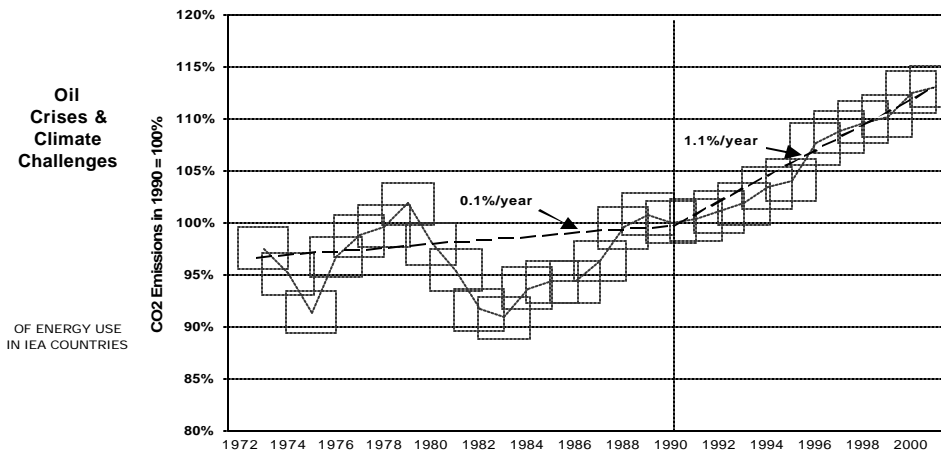


## Energy Intensity Effects by Sector IEA - 11



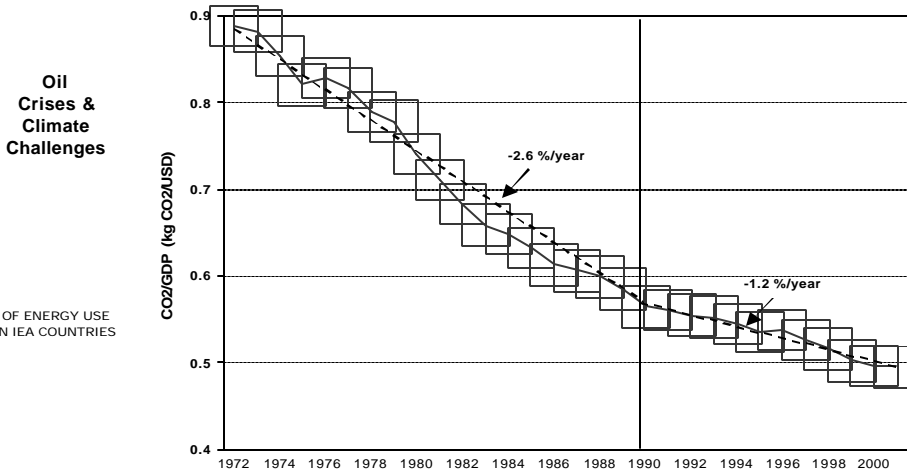
**Strong decline in energy intensities for all sectors since 1973**

## IEA CO<sub>2</sub> Emissions 1973 - 2001



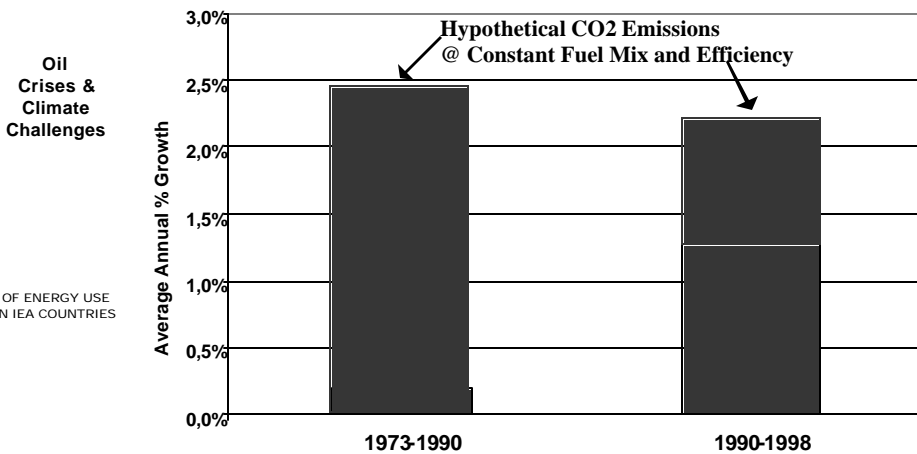
**Recent trends show steady increase**

## IEA CO<sub>2</sub> Emissions per GDP 1973 - 2001



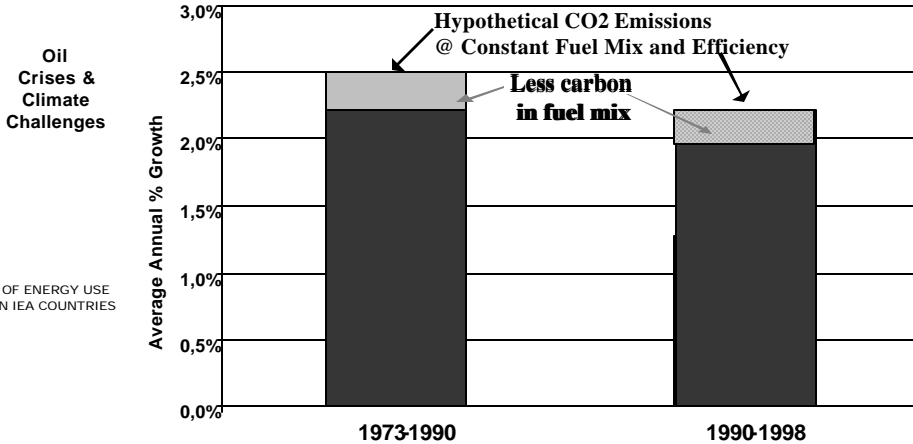
***Rate of decline has slowed since 1990***

## IEA-11 CO<sub>2</sub> Emissions Technology Frozen at 1973-level



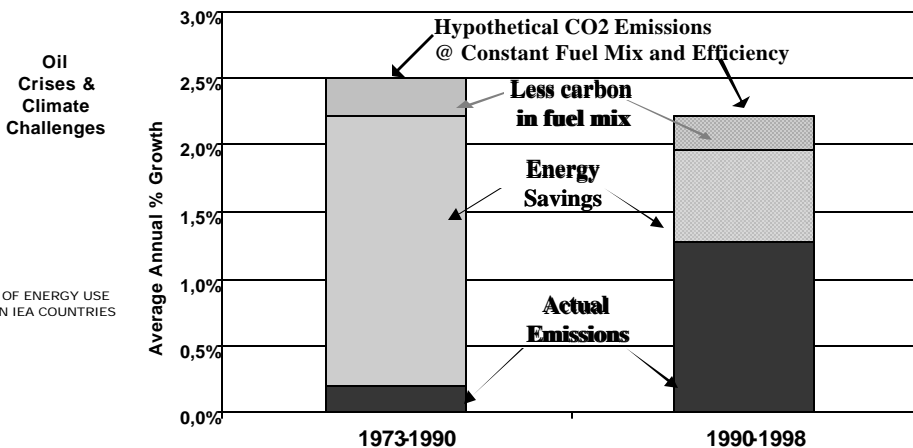
***Without changes in fuel mix and energy efficiency  
emissions would have increased 2.2-2.5%/year***

## IEA-11 CO<sub>2</sub> Emissions Impact of Changes in Fuel Mix

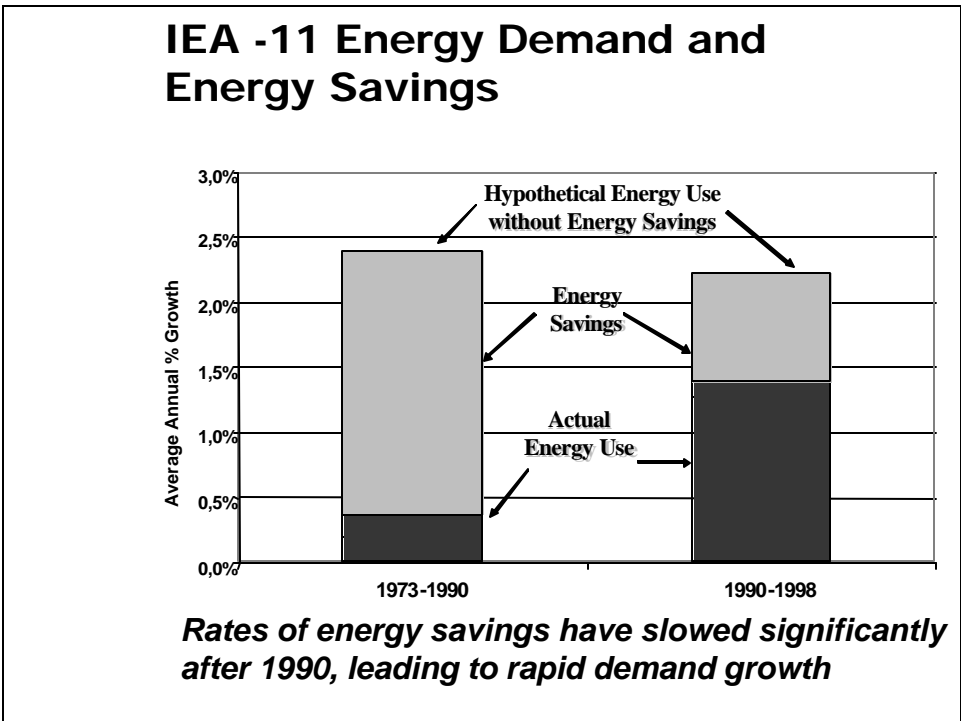
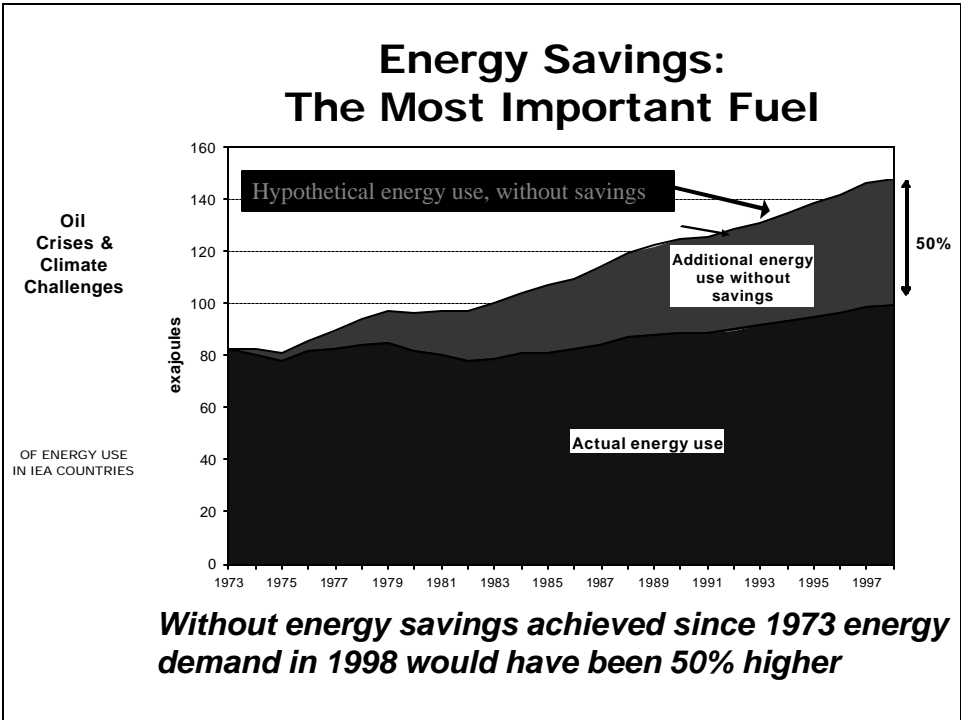


***Changes in supply and end-use fuel mix moderated growth in emissions by 0.5%/year***

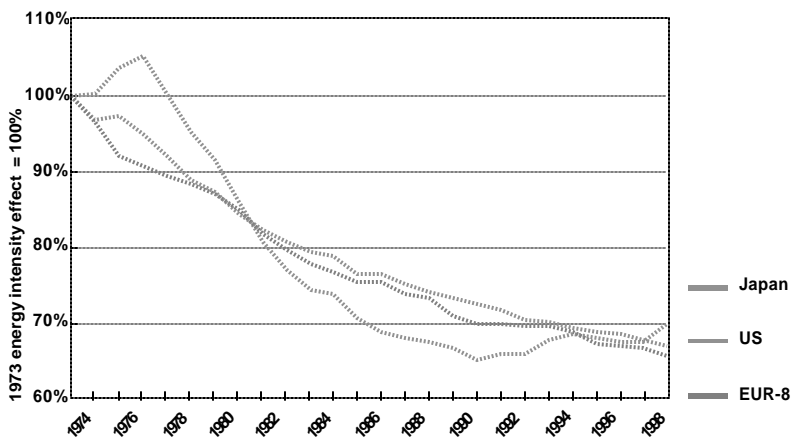
## IEA-11 CO<sub>2</sub> Emissions Impact of Fuel Mix & Energy Savings



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

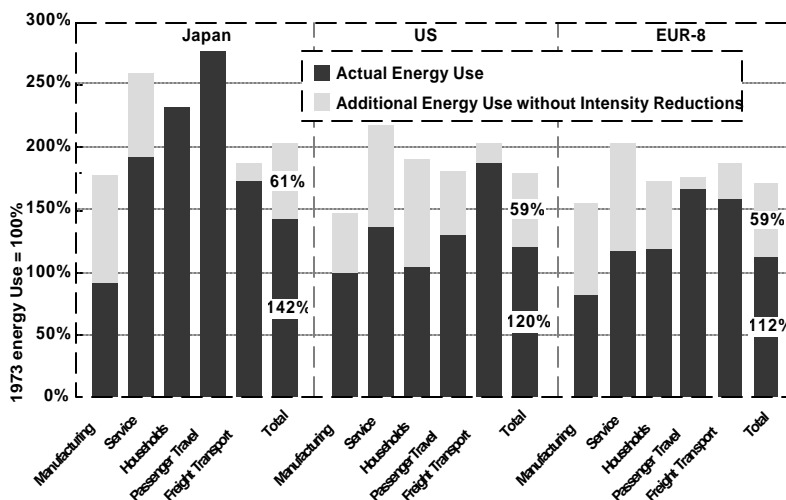


## Economy-wide Intensity Effect



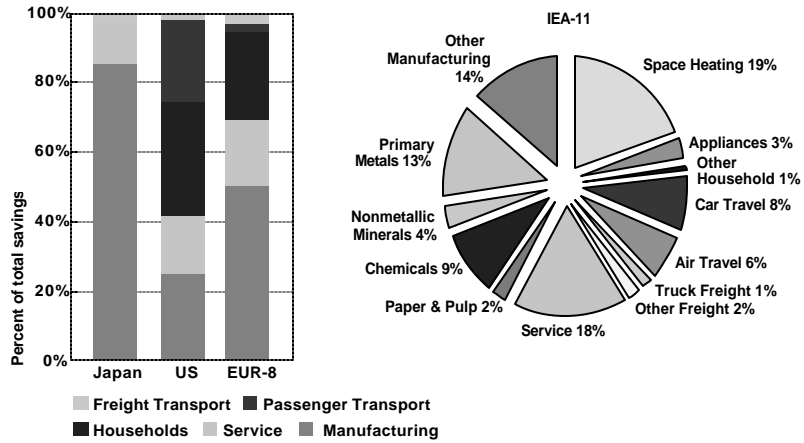
**Intensity effect fell by about 30% in all three regions**

## Actual Energy Use and Energy Savings by Country & Sector



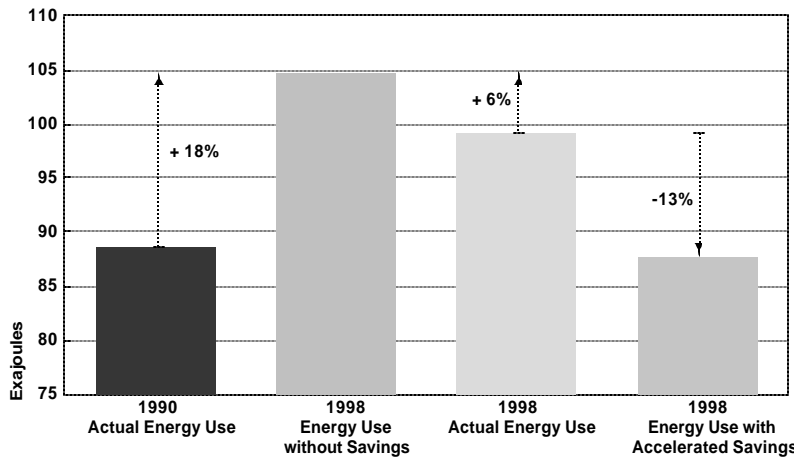
**Total energy savings across the three regions are similar, but there are important differences by sector**

## Contribution to Energy Savings from Sectors and End Uses



*Outside the United States, transport has contributed little to overall savings*

## Actual Energy Use & Two Savings Cases, IEA-11

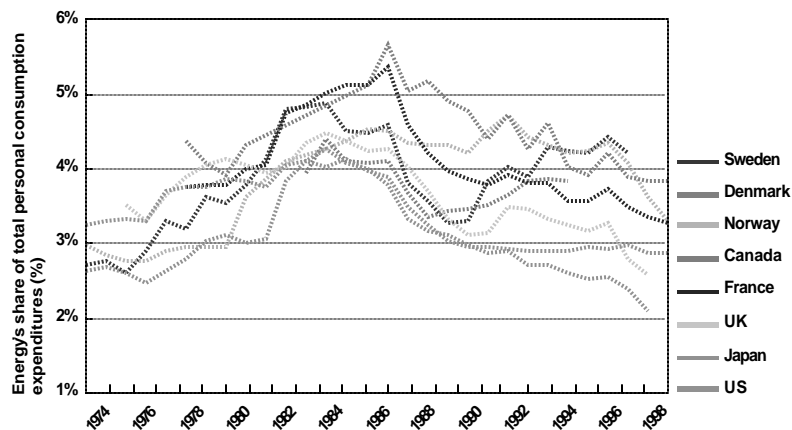


*If savings rates had followed “the second best” IEA-11 could have saved 13% more energy between 1990 and 1998*

## Energy Costs and Savings

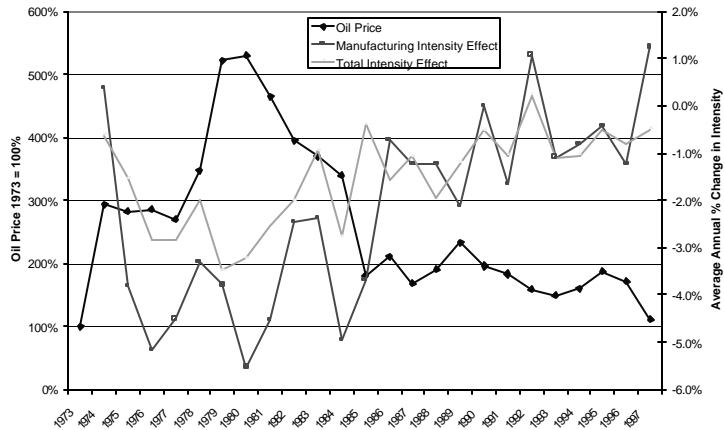
- **Falling prices and successful energy savings have helped reducing energy budgets for industry and private consumers since the early 1980s:**
  - ◆ Energy's share of production cost in industry fell as much as 50%
  - ◆ Energy cost as share of income for private homes fell 20-50%
  - ◆ Fuel cost per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

## Household Energy Expenditures as Share of Income



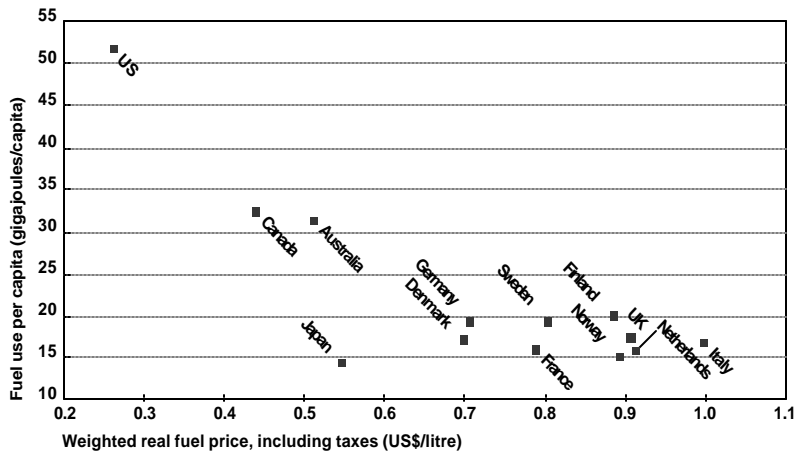
***IEA households today spend considerably less of their incomes on energy than in the early 1980s***

## Real Oil Price and Changes in Energy Intensities



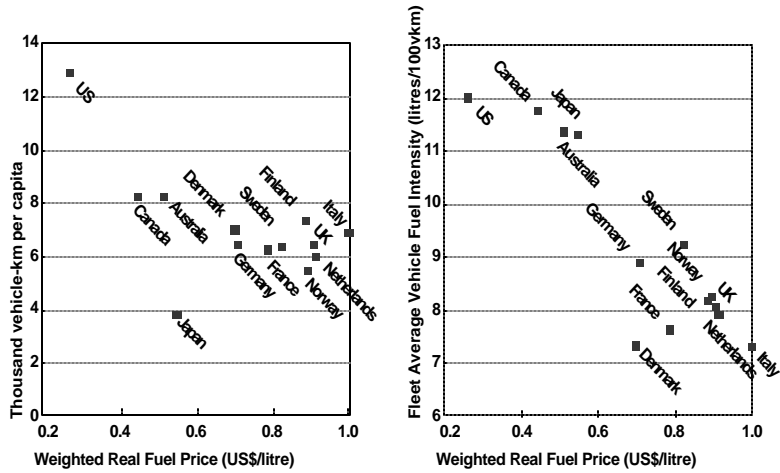
**Correlation between slowing rate of decline in energy intensities and oil price level**

## Car Fuel Use per Capita vs. Price, 1998



**Energy use for cars is higher where prices are lower**

## Travel and Intensities vs. Fuel price

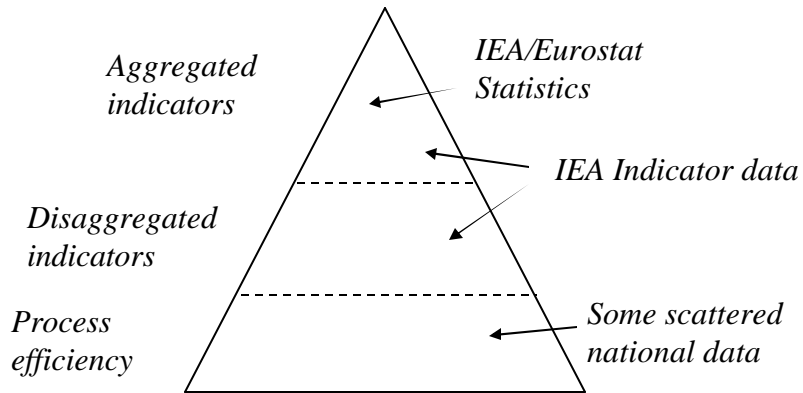


***Higher fuel prices correlate with lower fuel intensity***

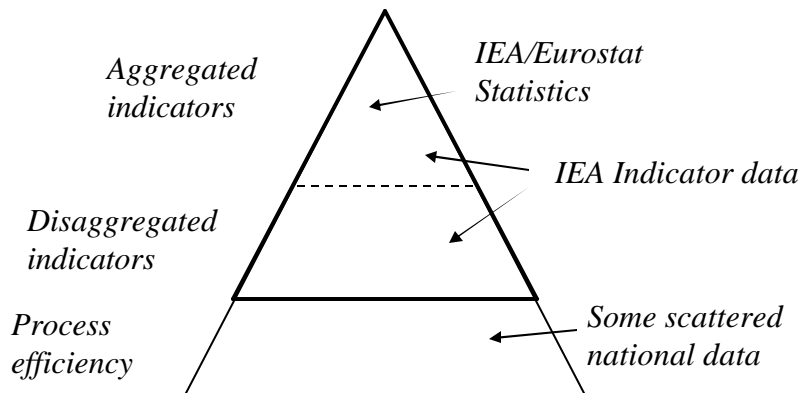
***Data***

***The Painful Necessity***

## Matching Analysis and Data The Indicator Pyramid



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## **Developing Indicators**

### ***Collection of data is the starting point***

- Analysing energy demand developments requires
  - => Disaggregated data
  - => of good quality
  - => consistent over time and
  - => consistent with international standards
- Improving availability and quality of data requires national efforts
- Participation in international efforts adds value but require submission of consistent data

## **IEA Energy Indicator Project: Next Steps**

- **Update:**
  - ◆ IEA Indicator database to most recent year
- **Expand:**
  - ◆ Cover more IEA Countries
  - ◆ Non-OECD Countries
- **Deepen:**
  - ◆ New indicators to improve assessment of energy efficiency progress in all sectors, e.g. for industry:
    - Use physical production, not value added as activity measure
    - More disaggregated to capture production of key energy intensive materials

## **IEA Energy Indicator Project: Deliverables**

- **Continued update of IEA indicator database (next version mid 2006)**
- **Update of IEA's "30 Years" Indicator publication, presenting trends for all sectors through 2001/2002/2003 (planned for 2006)**
- **Expanded indicator database with key non-OECD countries (2007-2008)**
- **Develop more detailed indicators to address the G8 tasks on buildings, transport and industry (2006-2007)**
- **Workshops focused on non-OECD countries and on development of new indicators (2006-2007)**
- **Publication on trends in energy use and efficiency in IEA and key non-OECD countries (Spring 2008)**

## **Taking Indicators Forward** *Issues Discussed at IEA Workshop*

- **Data and methodology go together**
- **Indicators motivate need for data**
- **Indicators a tool for checking data**
- **Help to understand what you don't understand**
- **Short-term analytical needs vs. long-term data collection efforts**
- **What to do when data is missing?**
- **Communication between statisticians, analysts and policy makers needed**

## **Taking Indicators Forward**

*Issues Discussed at IEA Workshop (cont.)*

- **National efforts crucial to feed data to IEA and to help assessing trends**
- **The need for assessing new indicators by sector**
- **Sector specific issues, e.g. household surveys**
- **Expand IEA indicator project to non-OECD countries**
- **Collaboration to improve definitions, e.g. energy efficiency vs. conservation**