ENERGY STATISTICS

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Energy Efficiency and Statistics for Energy Efficiency

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International Energy Agency

Overview

- Why energy efficiency is high on the political agenda, but…
- Energy efficiency: what indicators with what data?
- How the IEA collects its energy efficiency statistics
- Challenges: Current issues with Korean EEI data
- What does the IEA do to help countries and to promote energy efficiency

Why energy efficiency is high on the political agenda, but…

Energy Efficiency: from a hidden fuel…

The IEA Medium Trends and Medium-Term Prospects series

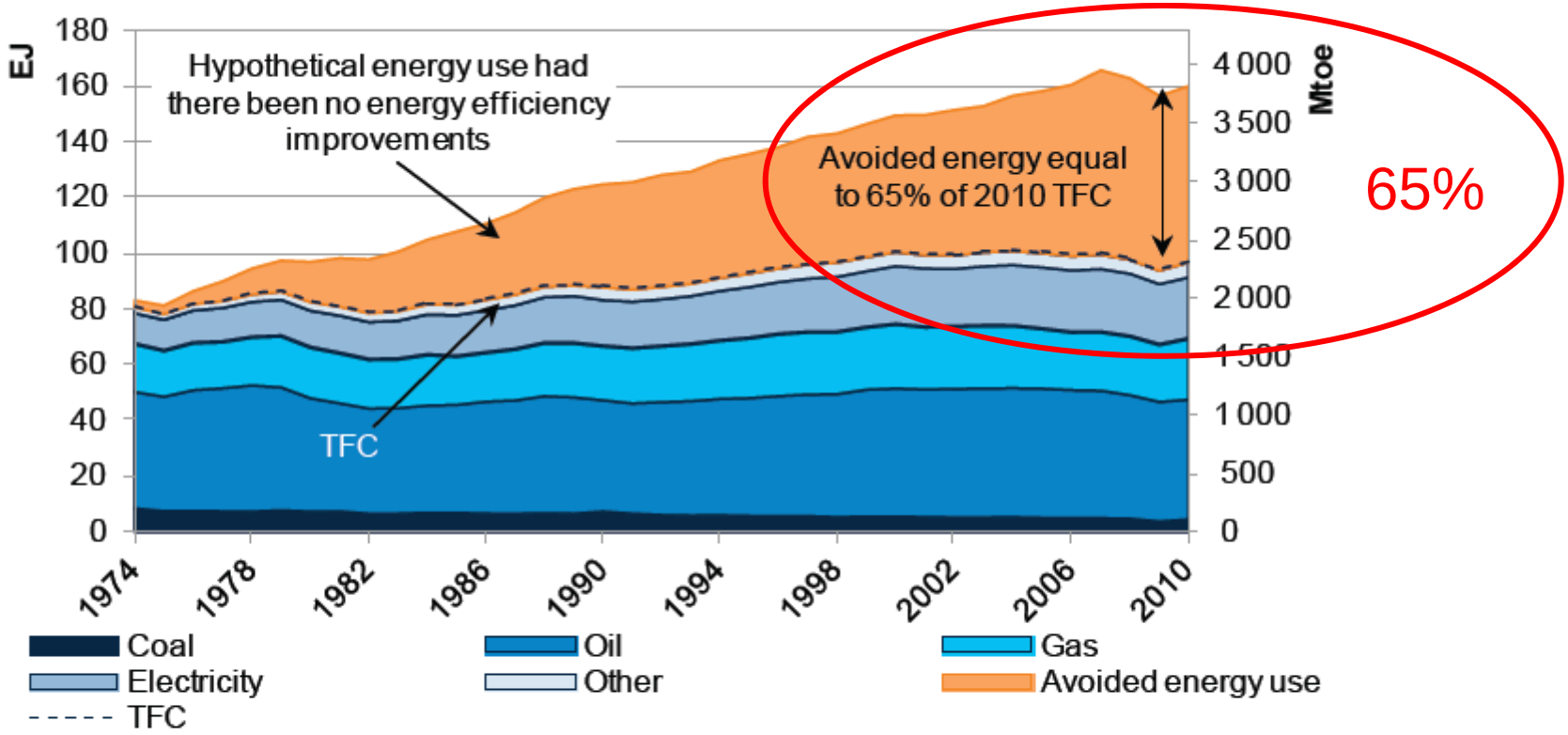
In October 2013, the IEA launched the first annual edition of its *Energy Efficiency Market Report*.

From the Foreword:

The reduced energy demand stemming from energy efficiency over the past decades is larger than any other single supply-side energy source for a significant share of IEA member countries, suggesting it is not so much a hidden fuel but could in fact be **our first fuel.**

Why energy efficiency is the first fuel

Figure ES.2 The "first fuel": avoided energy use from energy efficiency in 11 IEA member countries

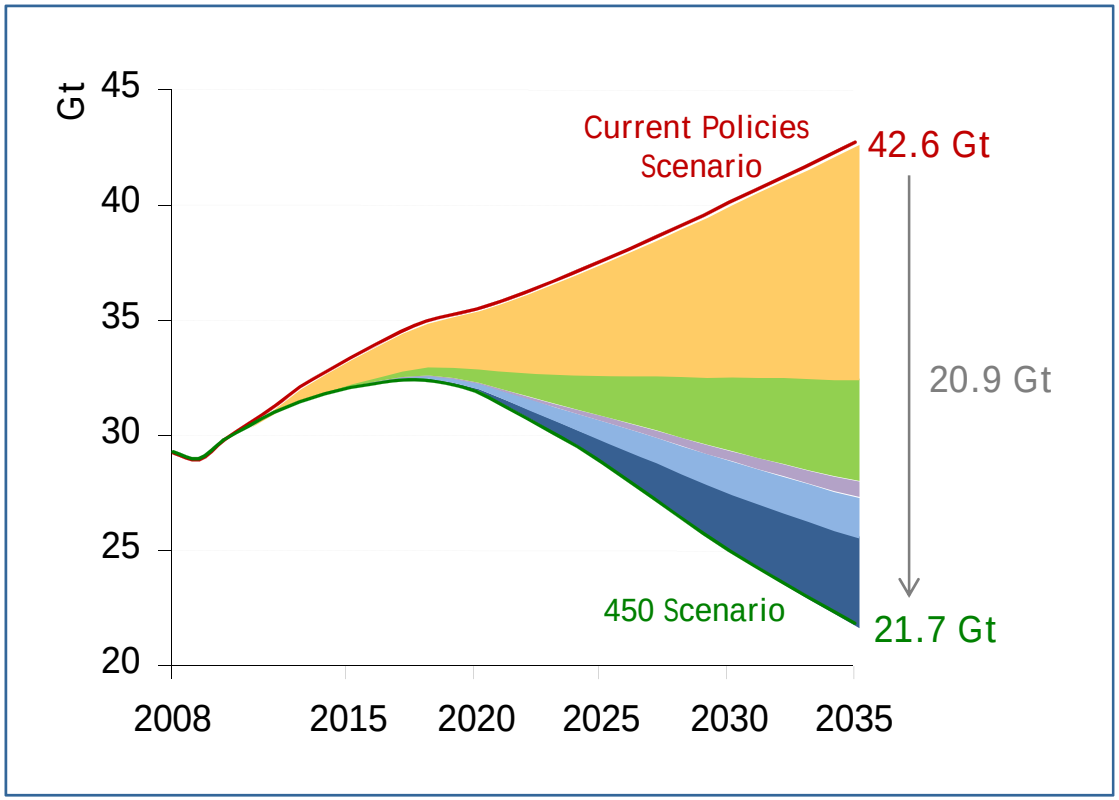


Notes: TFC = total final consumption. The 11 countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States, those for which sufficient data is available to undertake analysis. "Other" includes biofuels plus heat from geothermal, solar, co-generation and district heating. Co-generation refers to the combined production of heat and power.

Source: IEA indicators database.

Energy efficiency is the fuel #1 for tomorrow

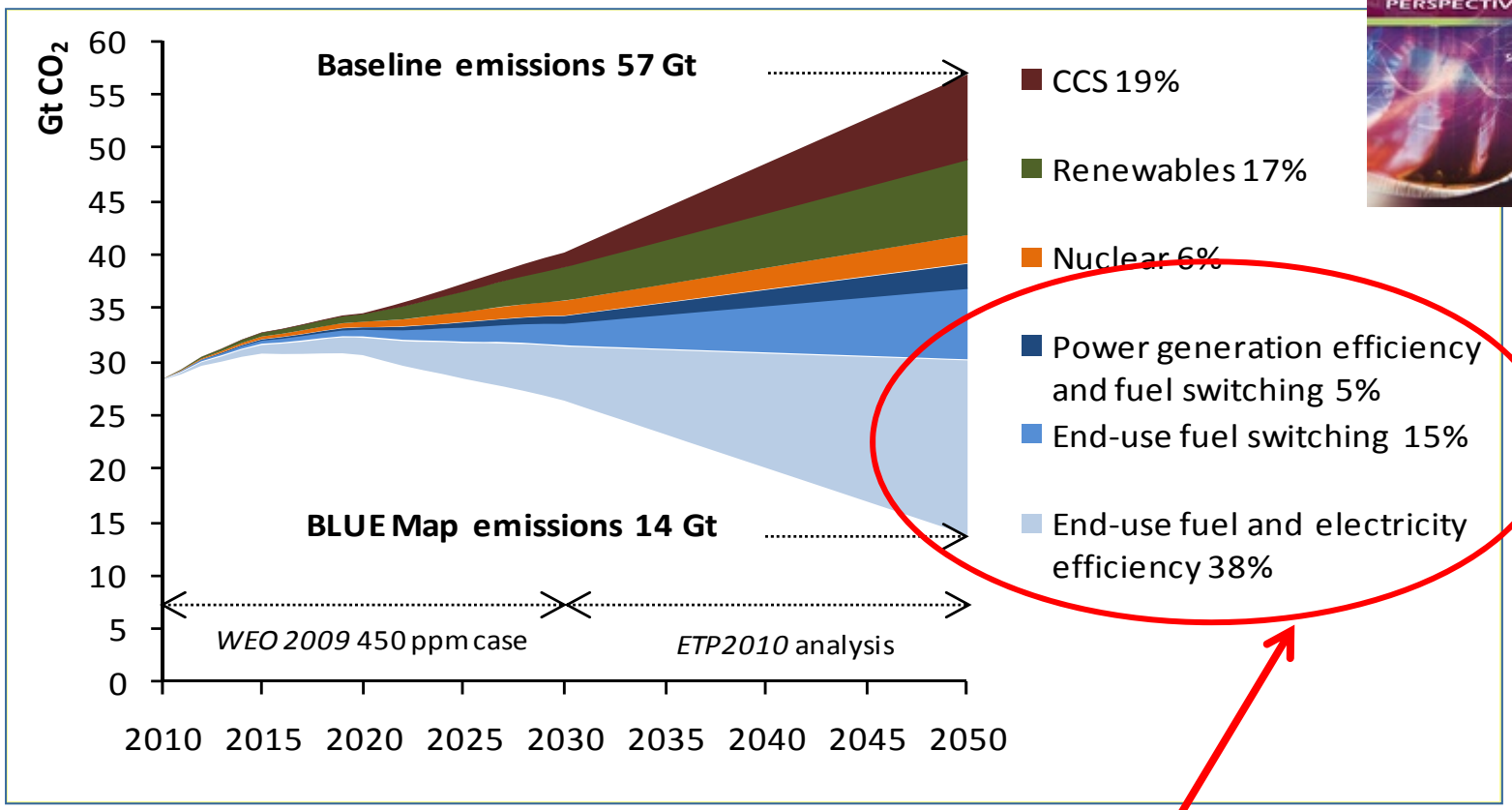
World energy-related CO2 emission savings by technology in the 450 Scenario relative to the Current Policies Scenario

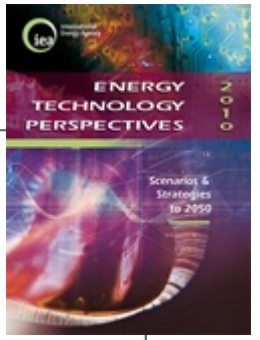


Share of cumulative abatement between 2010-2035	
Efficiency	53%
Renewables	21%
Biofuels	3%
Nuclear	9%
CCS	15%

➔ More than 50% of the reduction of CO_2 emissions should come from energy efficiency

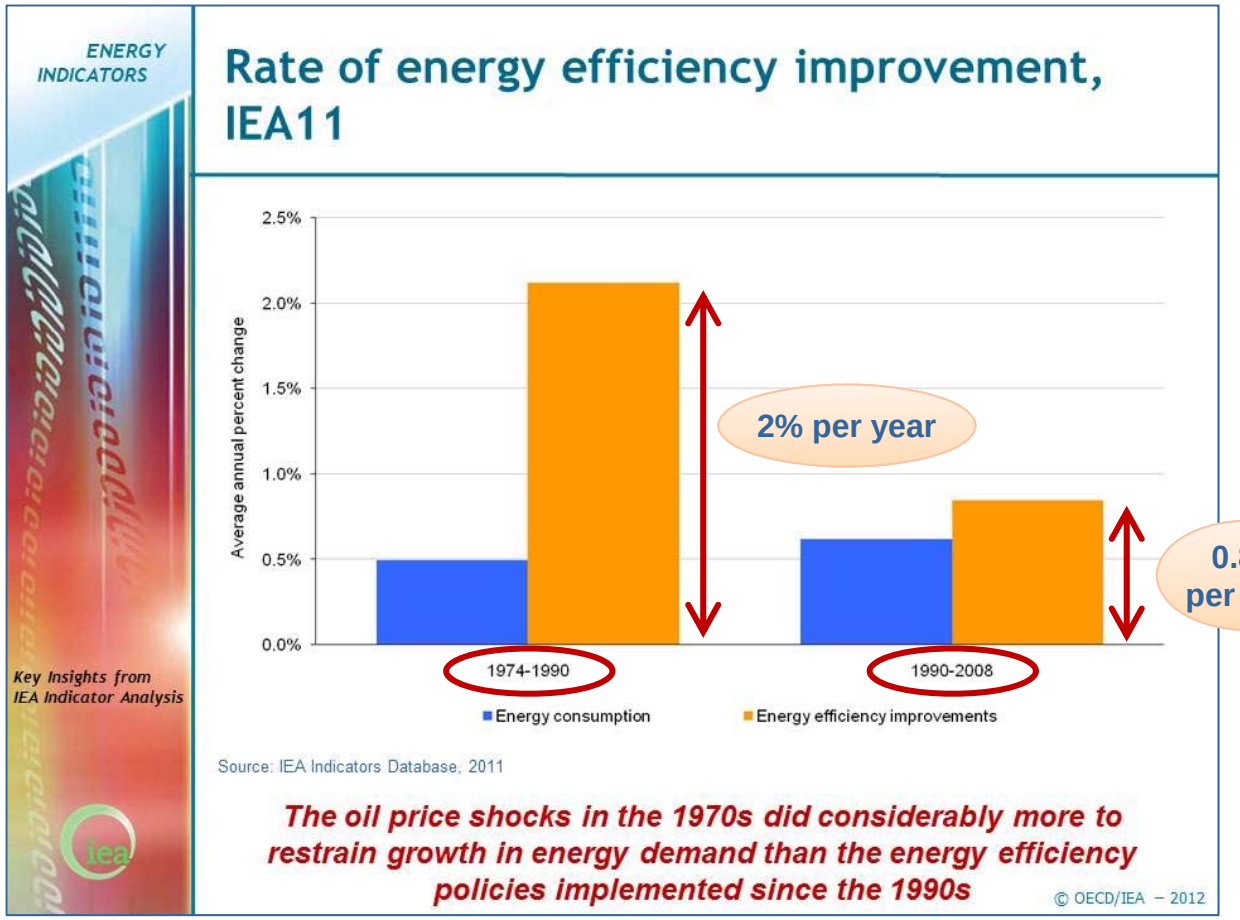
Energy efficiency is the fuel #1 for tomorrow





➔ **Energy efficiency will account for almost half of the reduction**

However, what is the current situation?

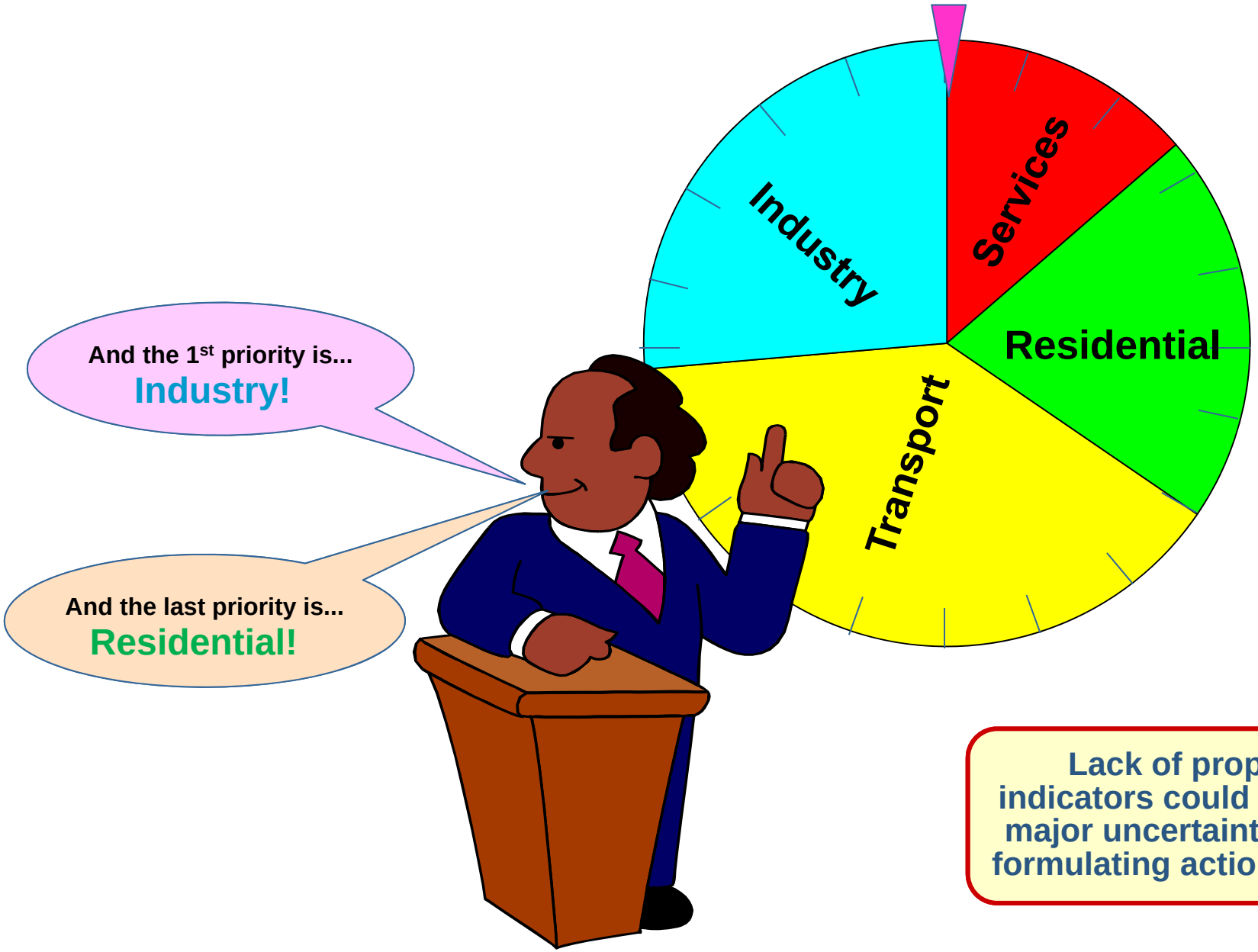


From 1974 to 1990, energy efficiency contributed to 2% per year to maintain growth

From 1990 to 2008 it contributed to less than 1% per year

➔ **So, why so little when much more should be done?**

Part of the answer is in the lack of proper data



Lack of proper indicators could lead to major uncertainties for formulating action plans

However, too many data would not be the solution

… so the need to limit the data collecting to what is necessary. But what is necessary depends on the situation of each country

Energy efficiency:

What indicators with what data?

How to monitor energy efficiency?

WORLD ENERGY BALANCE

2010

What most countries collect on a regular basis is limited to <u>aggregated</u> levels

No breakdown by end use:
- space heating
- water heating
- lighting
- cooking
- air conditioning
- appliances

Need detailed **END-USE** data to monitor energy efficiency!

	Coal & Peat	Crude Oil	Oil Products	Gas	Nuclear	Hydro	Geoth/Solar	Comb. Ren. & Waste	Electricity	Heat	Total
OTHER SECTORS	136.42	0.23	425.87	633.44	-	-	14.37	834.05	820.32	145.22	3036.92
Residential	76.58	-	222.89	418.55	-	-	6.98	805.42	395.81	97.97	2024.19
Comm. & Pub. Services	23.30	-	107.32	173.79	-	-	1.15	16.33	338.31	32.47	692.67
Agriculture/Forestry	9.57	0.02	102.97	5.58	-	-	0.16	7.02	36.20	3.36	164.88
Fishing	0.01	-	5.69	0.02	-	-	0.03	-	0.36	0.06	6.17
Non-specified	26.96	0.21	14.00	35.51	-	-	6.05	5.28	49.64	11.36	149.01

How to monitor energy efficiency?

MOTIE
MINISTRY OF TRADE, INDUSTRY & ENERGY

"In Korea, **Energy demand** has **more than doubled** between 1990 and 2010."

- **Industry**
  - GDP almost tripled
  - Share of manufacturing sector 47% ↑
- **Residential**
  - Population 15% ↑ / Dwellings 86% ↑
  - Winter temp. 15%↓ / Summer temp. 23%↑
  - Size of dwellings 18% ↑
- **Transport**
  - Traffic volume quadrupled

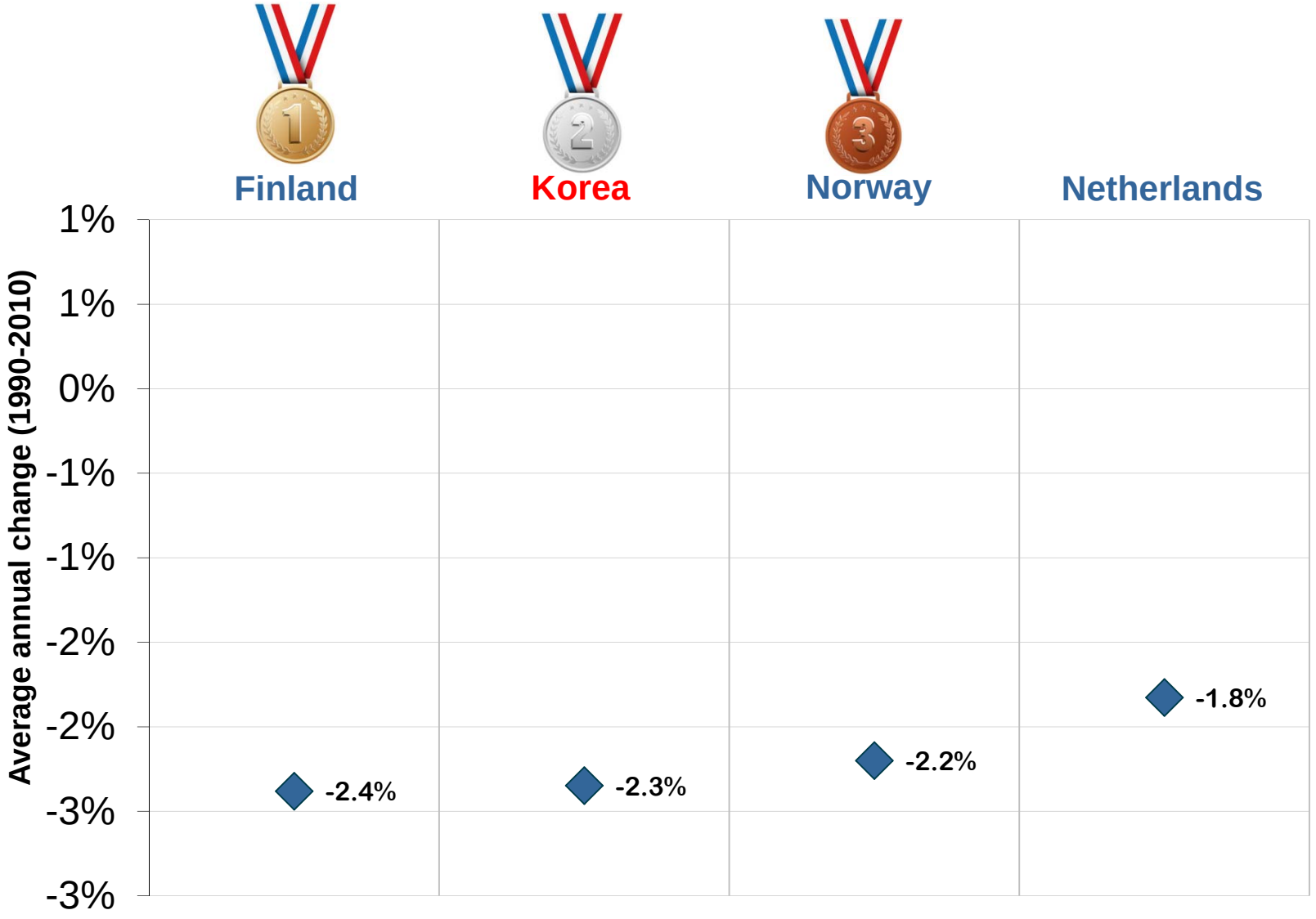
Need **ACTIVITY** data to monitor energy efficiency!

Yes, but is it due to structure effects or efficiency gains?

"**Energy intensity** has decreased by **5%** over the period."

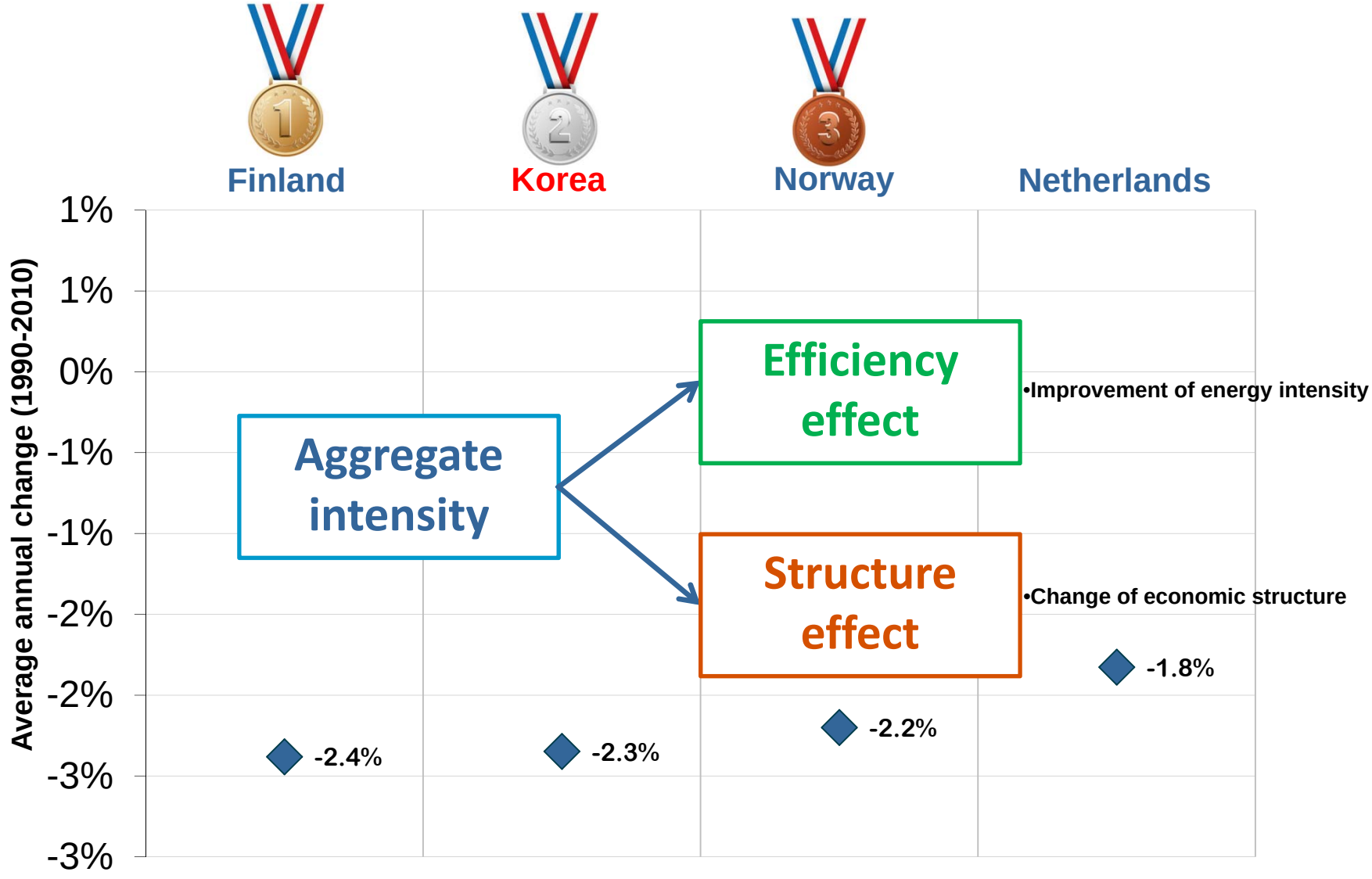
Source: IEA Energy Efficiency Indicators Database

Change in industrial energy intensity (Energy per VA)



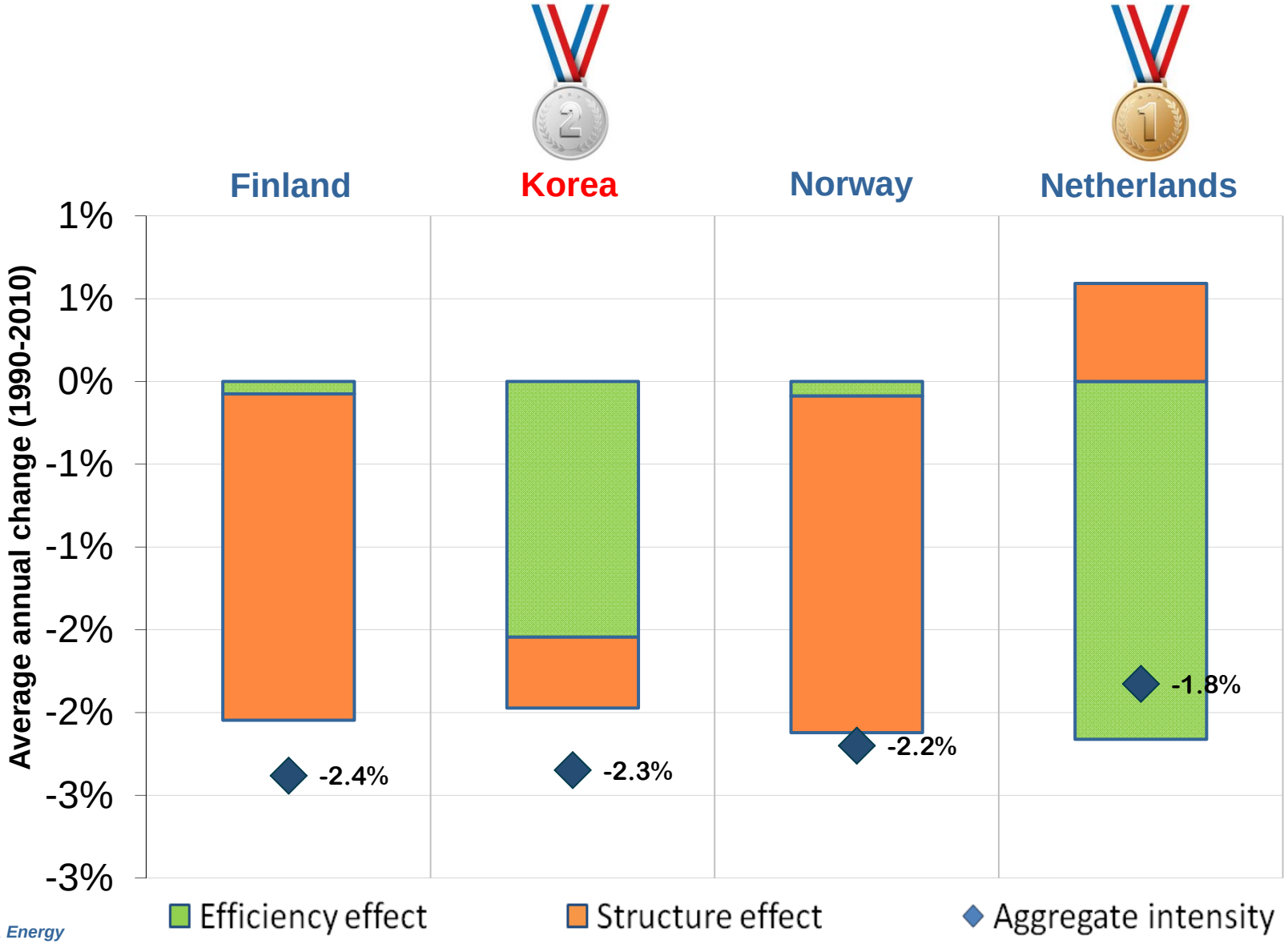
Source: IEA Energy Efficiency Indicators Database

Change in industrial energy intensity (Energy per VA)



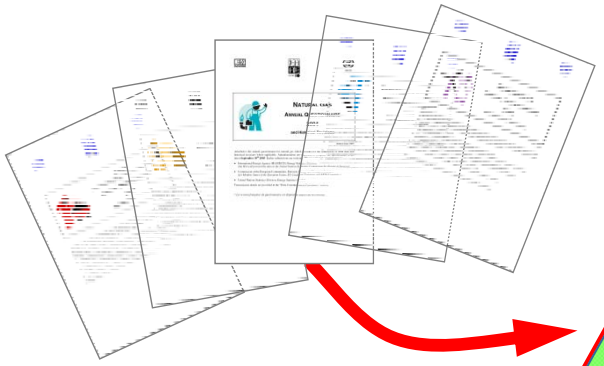
Source: IEA Energy Efficiency Indicators Database

Change in industrial energy intensity (Energy per VA)



Source: IEA Energy Efficiency Indicators Database

The indicators pyramid



TPES/GDP

TPES/Production

Electricity Cons./Population

CO2/GDP PPP

Efficiency Elec. Prod.

Aggregated Indicators

Sectoral Energy Intensity

End-use Energy Intensity

Unit Energy Consumption

Disaggregated Indicators

Energy/ton cement

Heating/sqm

Litres/100km (stock)

Dry process

Process/Appliance Efficiency

Condensing boiler

Litres/100km

data requirement

What are the data needed to build a minimum set of disaggregated indicators?

International Energy Agency

How the IEA collects its energy efficiency statistics

Mandate for the IEA data collection

- Requests from countries to provide guidance on:
  - What indicators for energy efficiency?
  - How to build them?
  - What data are needed?

- The 2009 IEA Ministerial meeting
  - Acknowledged the importance of energy efficiency indicators
  - Committed to annually report data for indicators through the IEA template

IEA energy efficiency indicators template

Energy Efficiency Indicators Template

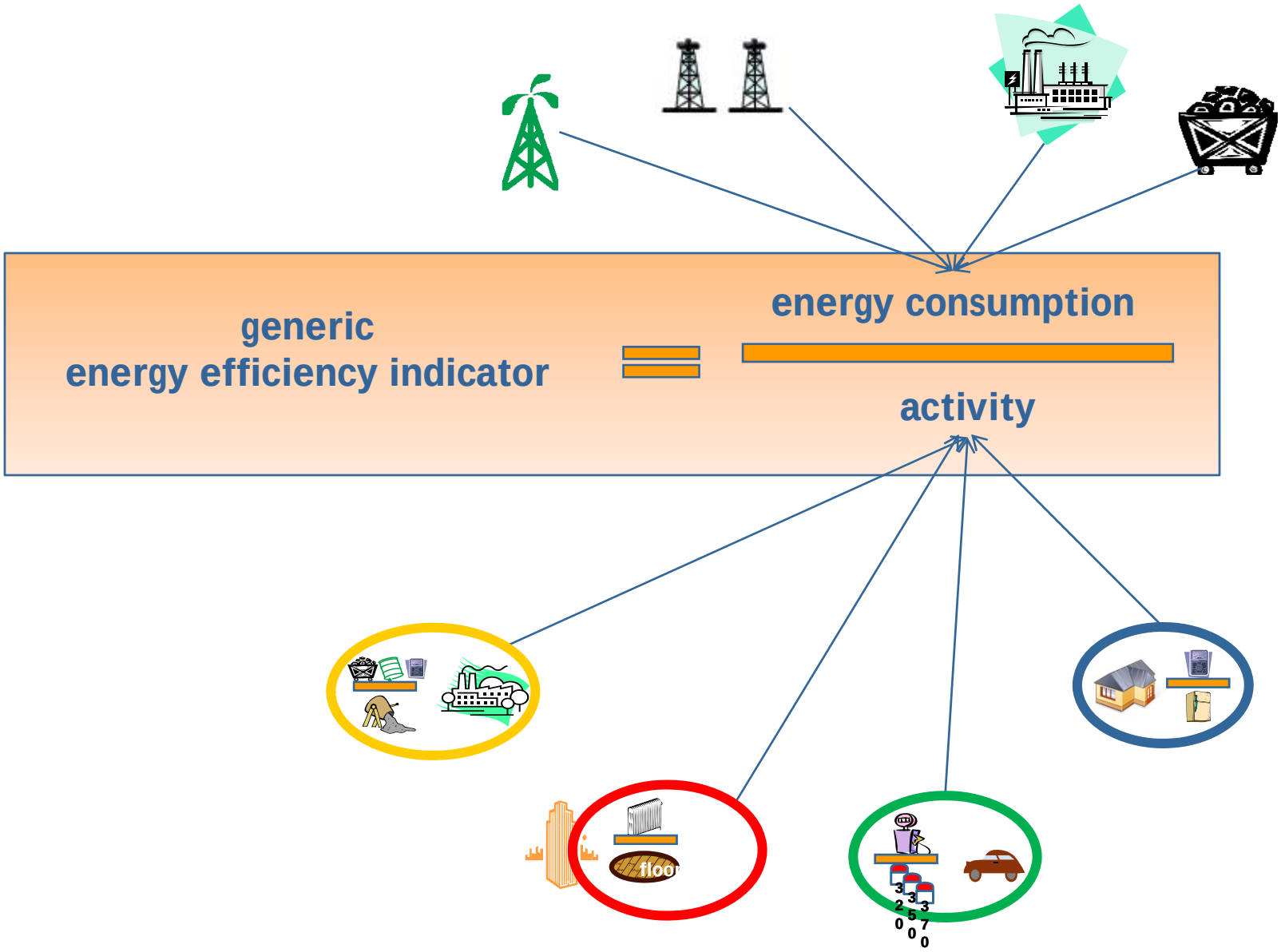
country name

Energy consumption & **Activity** data for:

- INDUSTRY
- SERVICES
- RESIDENTIAL
- TRANSPORT

COUNTRY DATA SECTION (to be re	
MACRO ECONOMIC DATA	
COMMODITIES	
INDUSTRY	
SERVICES	
RESIDENTIAL	ances data
TRANSPORT	
IEA DATA and AGGREGATE INDICA	
ELECTRICITY GENERATION	Electricity generation from combustible fuels and efficiencies
BASIC INDICATORS	Predetermined set of aggregate energy and activity indicators
SUPPORT TOOLS	
USER REMARKS	To incorporate comments associated to the data from the individual sheets
DATA COVERAGE	Generates a graphical summary of data coverage (completed vs. expected)
SINGLE INDICATOR GRAPHS	To generate a graph for one energy indicator
MULTIPLE INDICATORS GRAPHS	To generate a graph comparing trends from multiple indicators
CONSISTENCY CHECKS	To run the integrated consistency checks

Energy efficiency indicators: definition



Indicators for industry

For 19 major ISIC sub-sectors: (by fuel type)

- Food
- Textile
- Wood
- Paper
- Chemical
- Rubber & plastics
- Metals
- Equipment
- …

energy efficiency indicator = **energy** / **production**

Value-Added ($)

physical production (t)

- Paper
- Chemicals
- Other non-metallic mineral
- Basic metals

Indicators for residential

energy efficiency indicator = **energy** / **activity**

# of dwellings

floor area (m²)

For each end-use:

- **Space heating***
- **Space cooling***
- **Water heating**
- **Cooking**
- **Lighting**
- **Appliances (energy use, stock, diffusion)**
  - Refrigerator
  - Freezer
  - Dishwasher
  - Clothes washer
  - Clothes dryer
  - TV
  - Computers

* Climate corrected, using heating degree-days

Indicators for services

For each end-use:

- **Space heating***
- **Space cooling***
- **Lighting**
- **Other building use**
- **Non-building use**

* Climate corrected, using heating degree-days

energy efficiency indicator = $\frac{\text{energy}}{\text{activity}}$

Value-Added ($)

floor area (m²)

# of employees

Indicators for transport

- Transport purposes
  - Passenger / Freight
    - Road
    - Rail
    - Air
    - Water

energy efficiency indicator = $\frac{\text{energy}}{\text{transport activity}}$

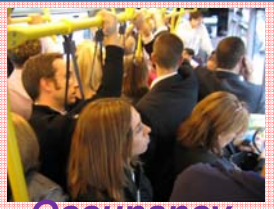
Passenger-km or ***tonne-km***

Vehicle stock

×

Distance travelled

×



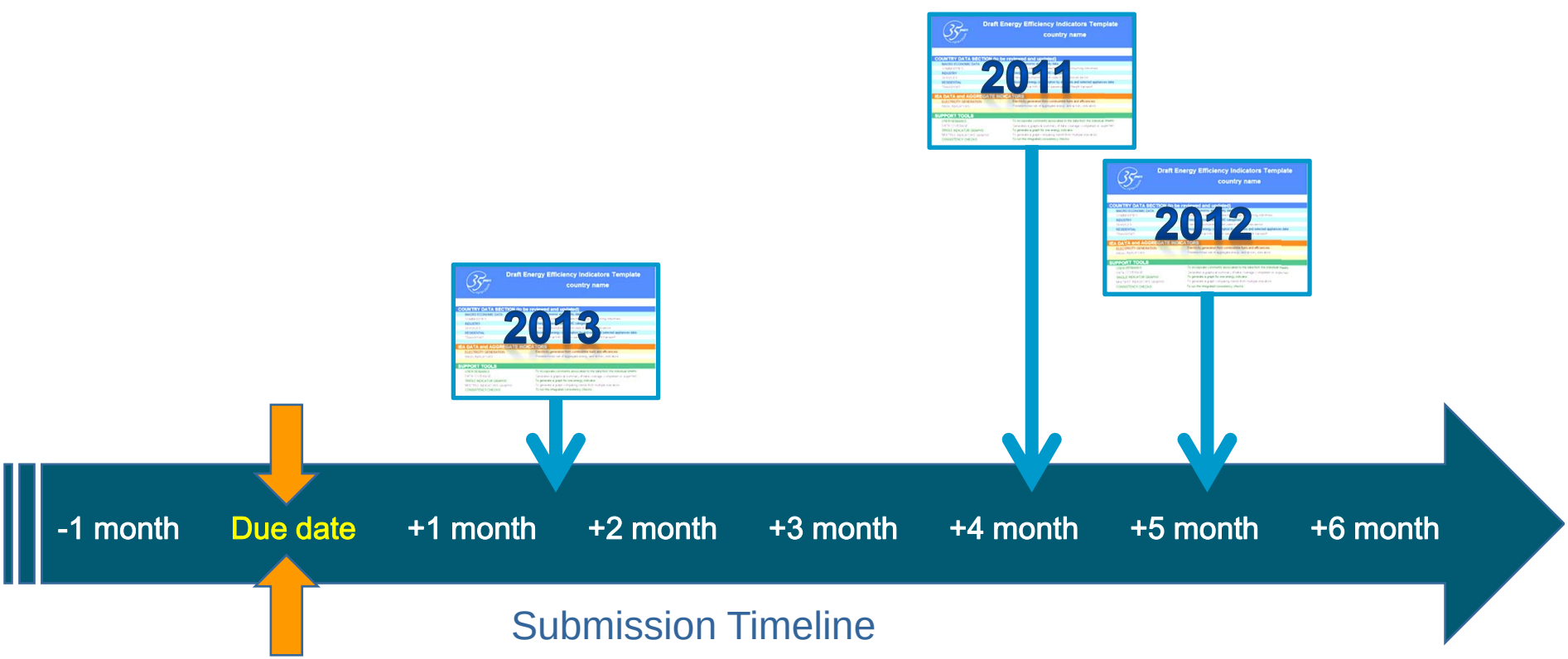
Occupancy

Load factor

Challenges:

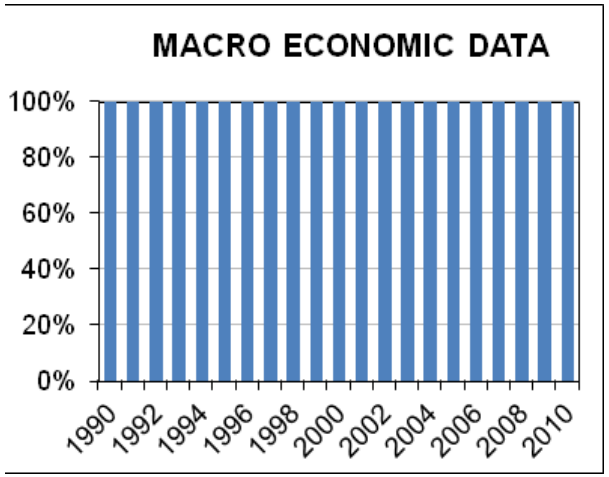
Current issues with Korean EEI data

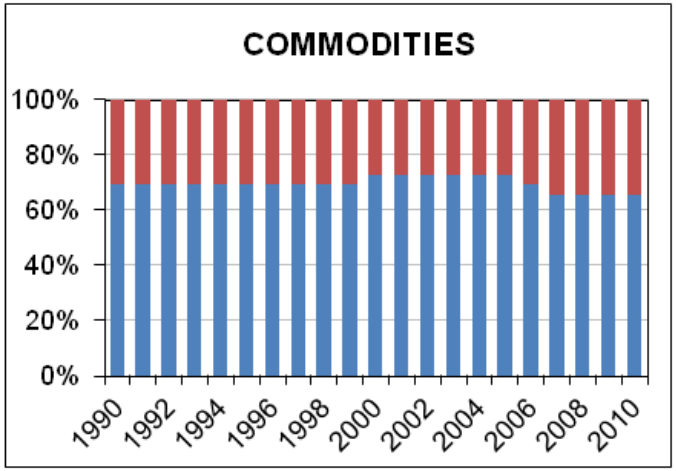
Data assessment: timeliness

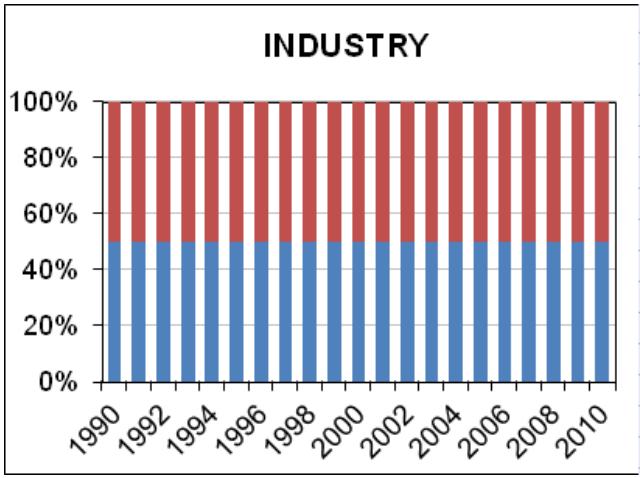


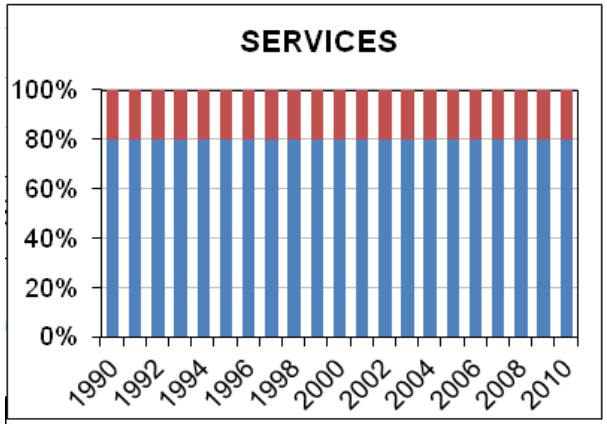
Data assessment: completeness

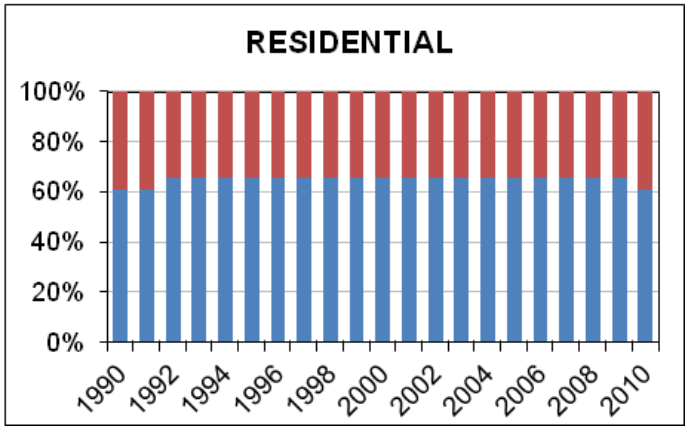
Energy Efficiency Indicators template for 2013 data cycle

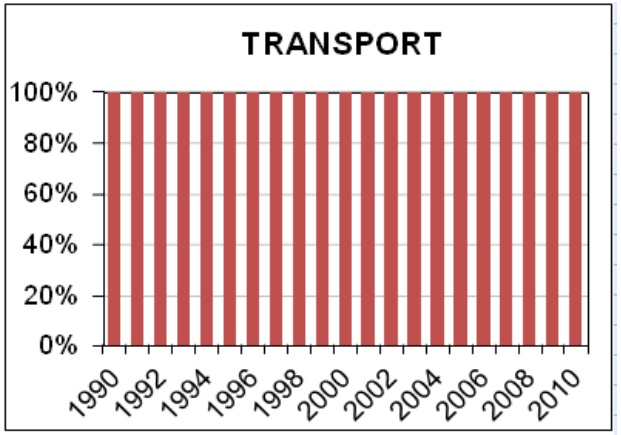












Data currently reported

Additional data needed

Data assessment: quality and coverage

- Minimum quality and coverage for our analysis

	2011	2012	2013	2014
Industry	☺	☺	☺	?
Residential	☹	☹	☹	?
Services	☺	☺	☺	?
Transport	☹	☹	☹	?

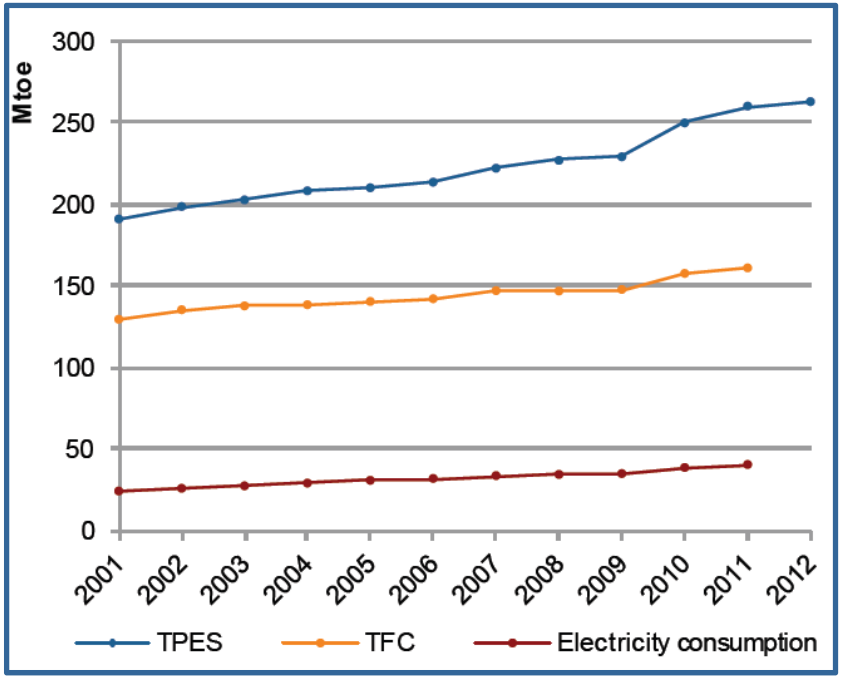
- Only Industry and Services sectors are included in IEA's analysis

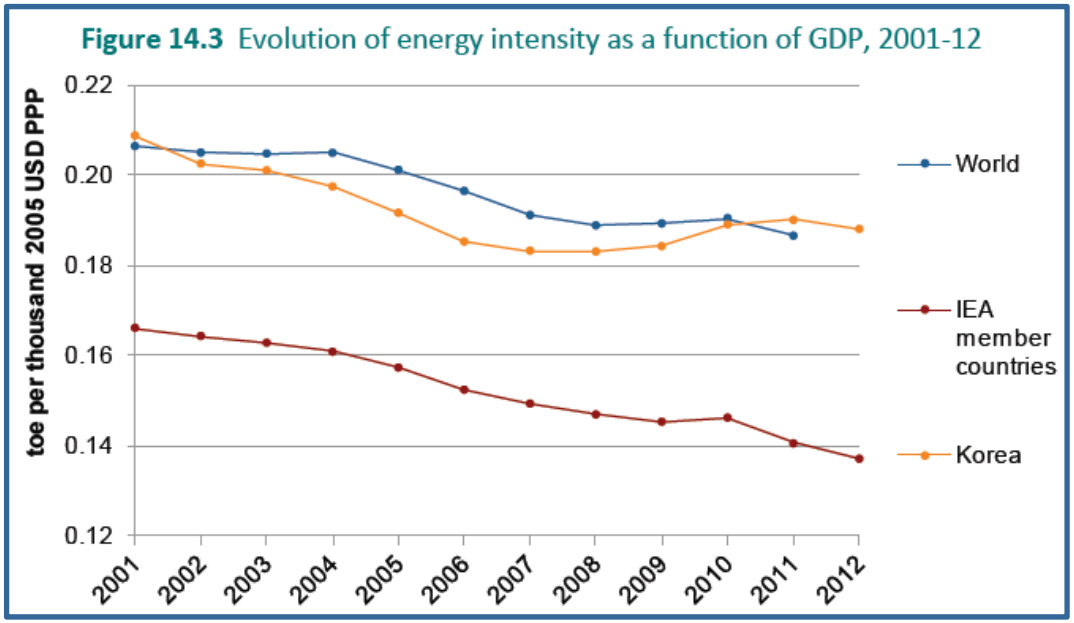
- Improvements will be welcome!
  - Issues tend to persist over different cycles

Consequences

- More data would be needed for comprehensive national analysis
  - Only aggregated indicators are available for analysis

14. KOREA





Source: Energy Efficiency Market Report 2013, pp 177-178

Consequences

More data are needed for comparative analysis

- Lack of comparability

Source: Energy Efficiency Market Report 2013, p 61

Figure 3.10 Changes in aggregate intensities of 15 member IEA countries, decomposed into structure and efficiency effects, 1990-2010

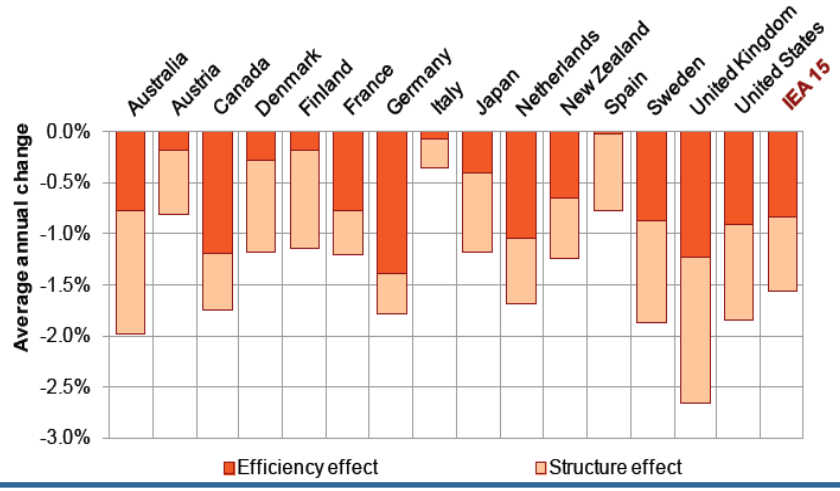
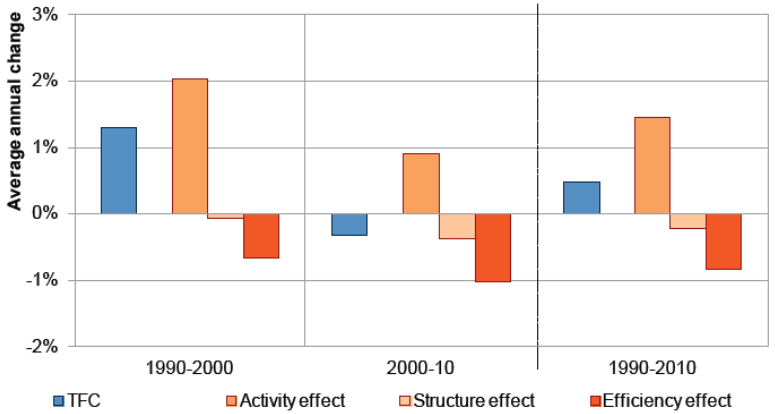


Figure 3.9 Changes in TFC, decomposed into structure, activity and efficiency effects for 15 IEA member countries



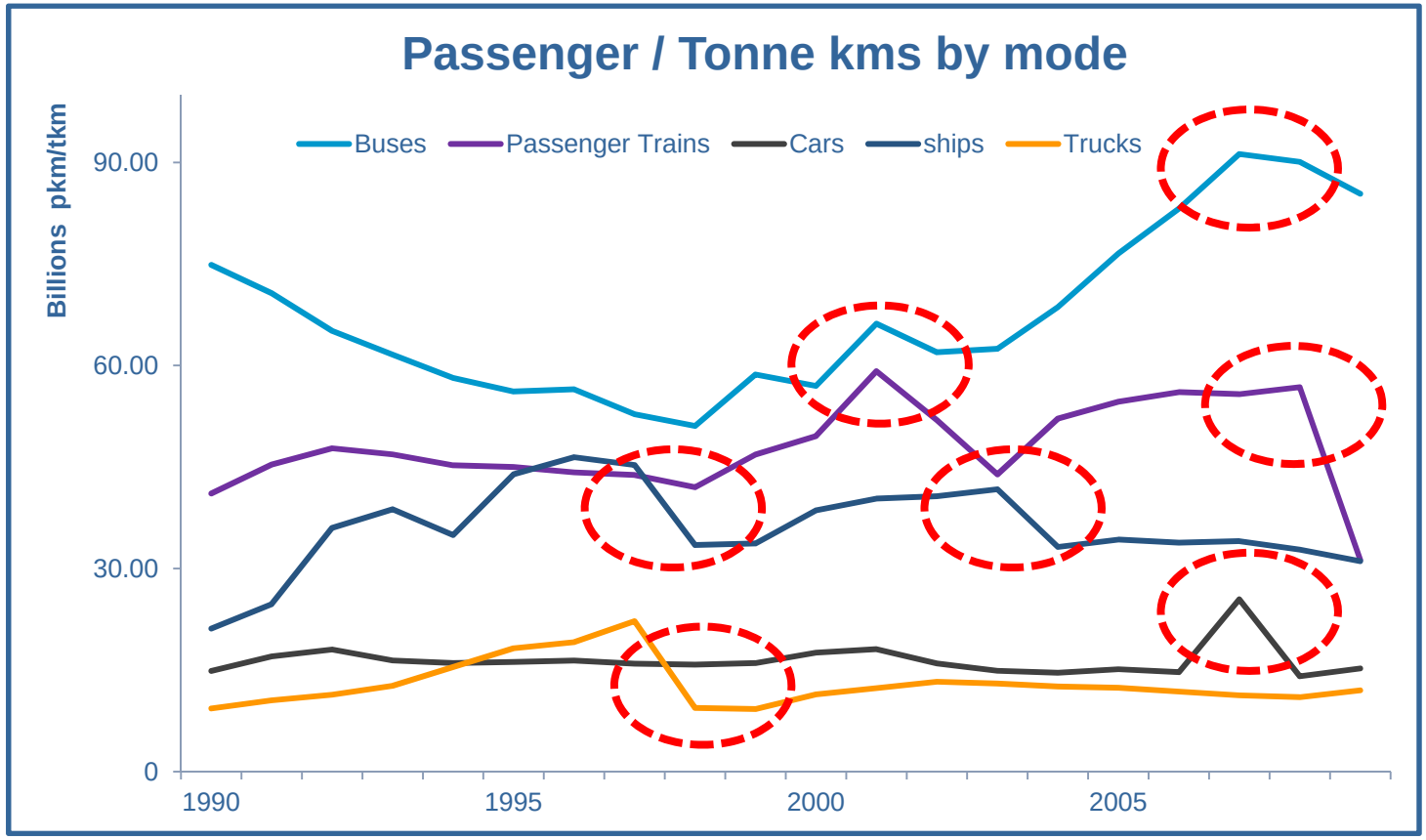
Note: the 15 countries are Australia, Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Spain, Sweden, the United Kingdom and the United States. A discussion of the decomposition analysis methodology is provided in Box 3.1. In IEA indicator analysis, household energy use changes are corrected for yearly climate variations.

Consequences

- **EEI data are being required by more and more research groups:**
  - Energy Technology Perspective
  - Tracking Clean Energy Progress
  - Transition to Sustainable Buildings
  - Buildings Envelope Technology Roadmap
  - Mobility model
  - Etc…

Major issues – Transport

- **No data are submitted**
  - **All data were deleted since last year's data review**
    - **Previously, inconsistent activity data**



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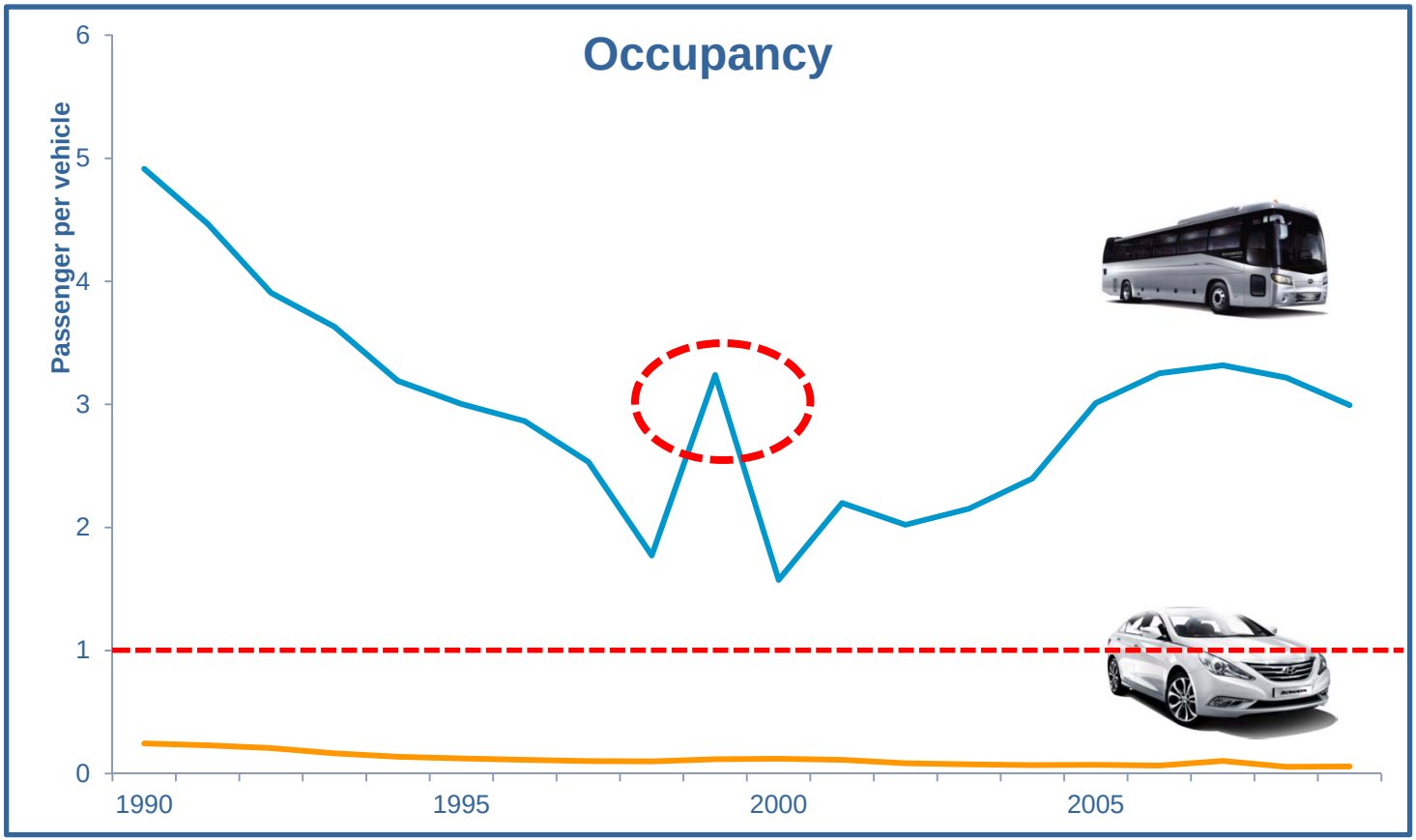
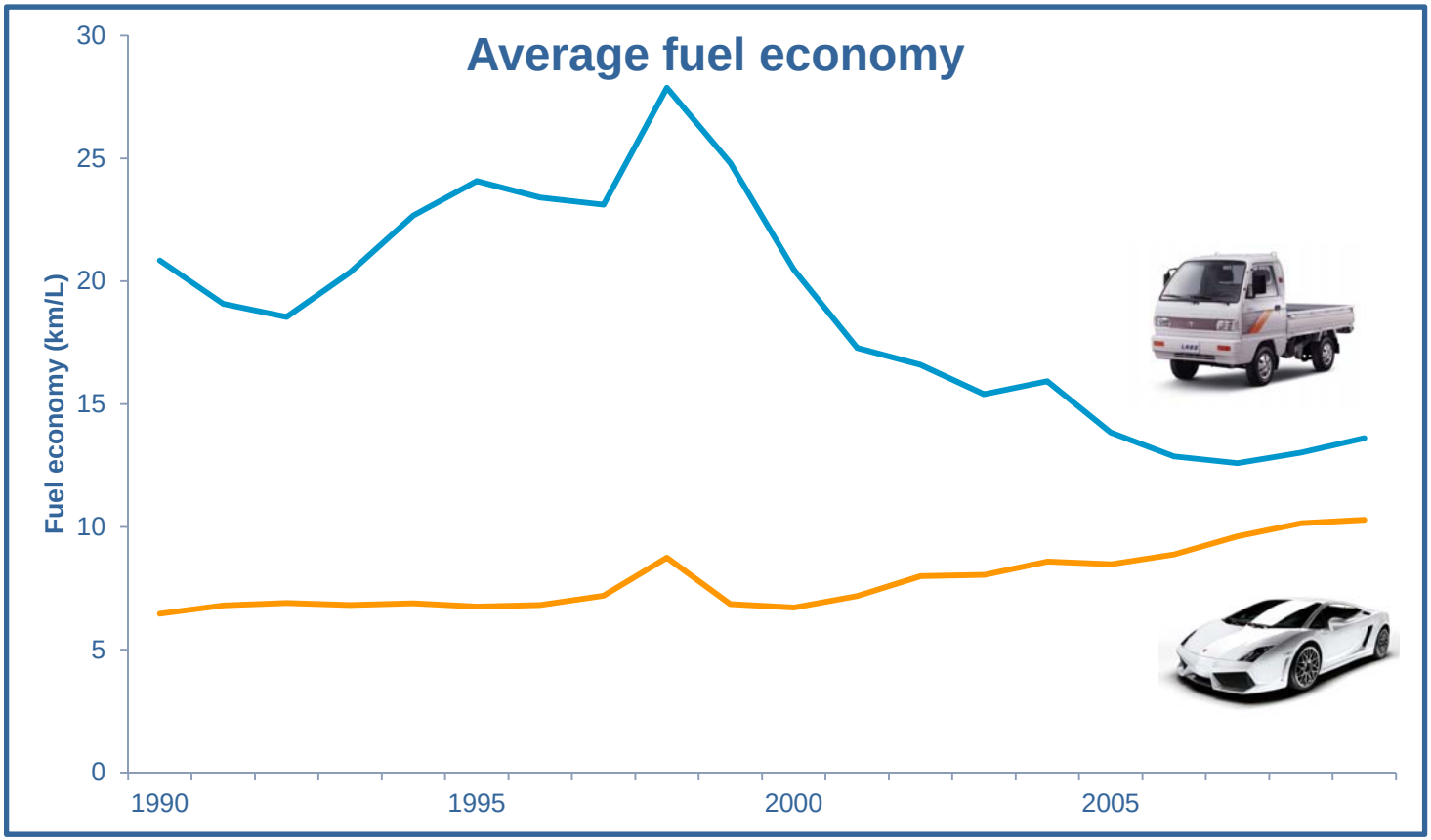


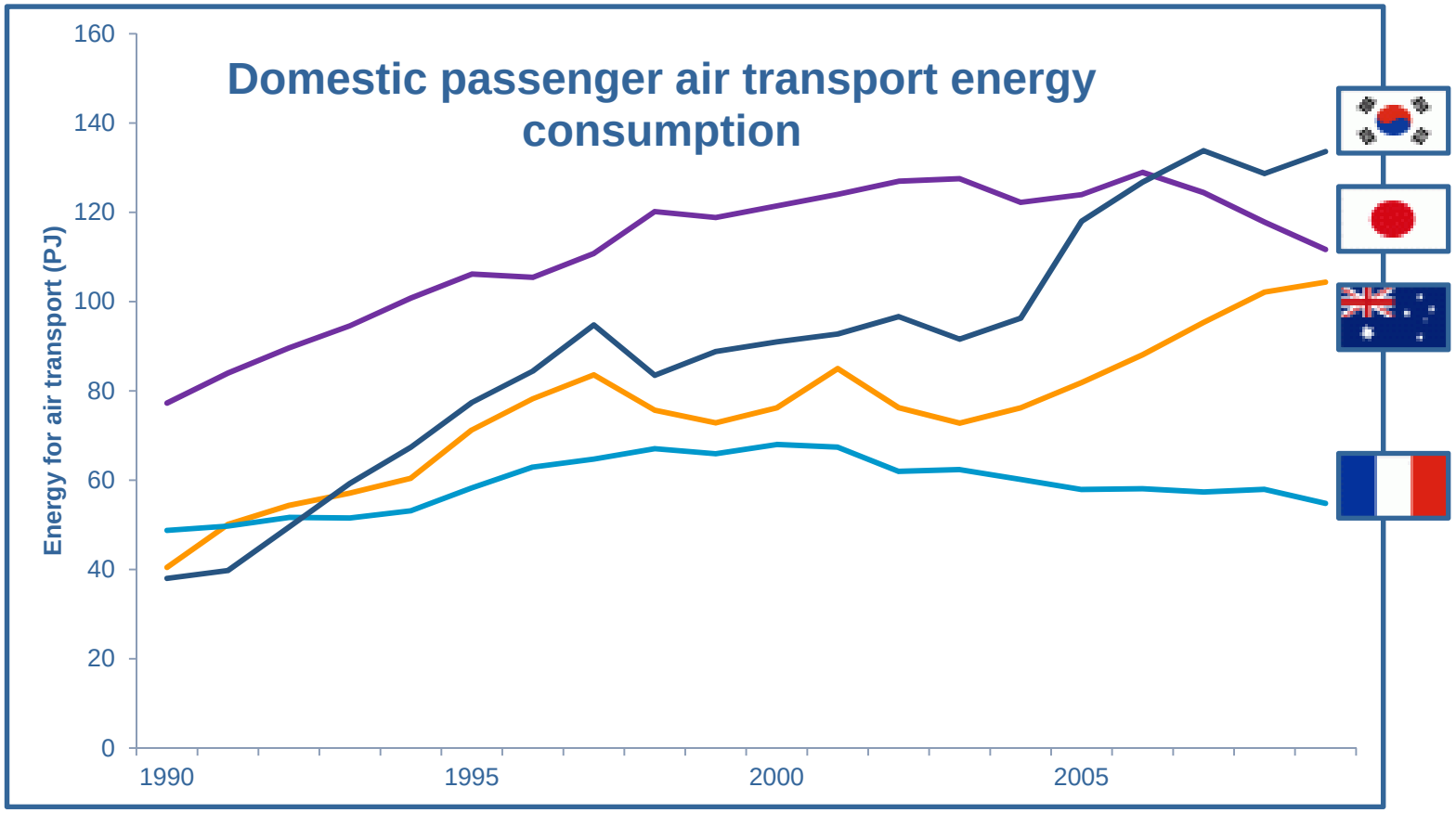
Major issues – Transport

- **No data are submitted**
  - **All data were deleted since last year's data review**
    - **Mismatch between activity and energy data**



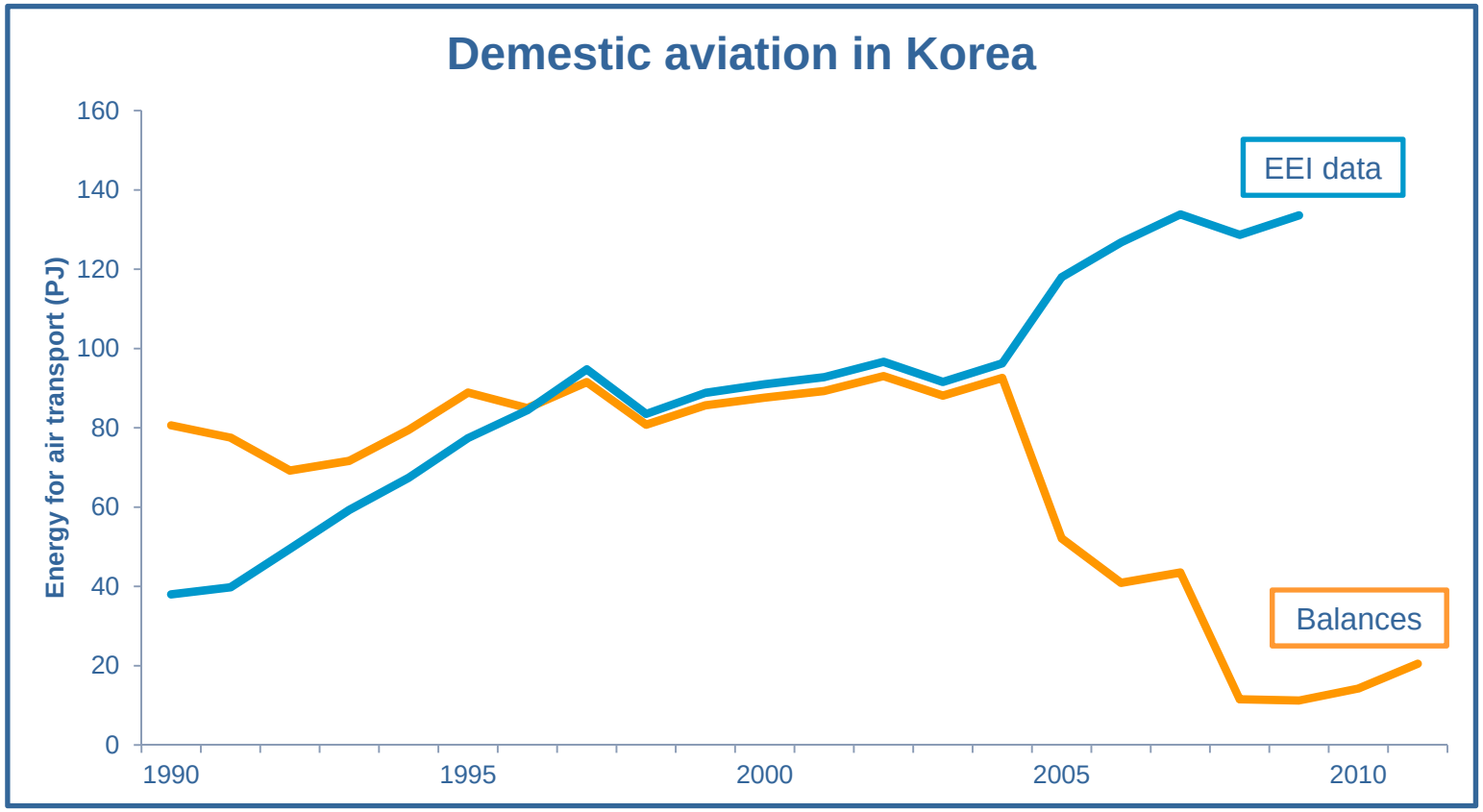
Major issues – Transport

- **No data are submitted**
  - **All data were deleted since last year's data review**
    - **Misallocation**



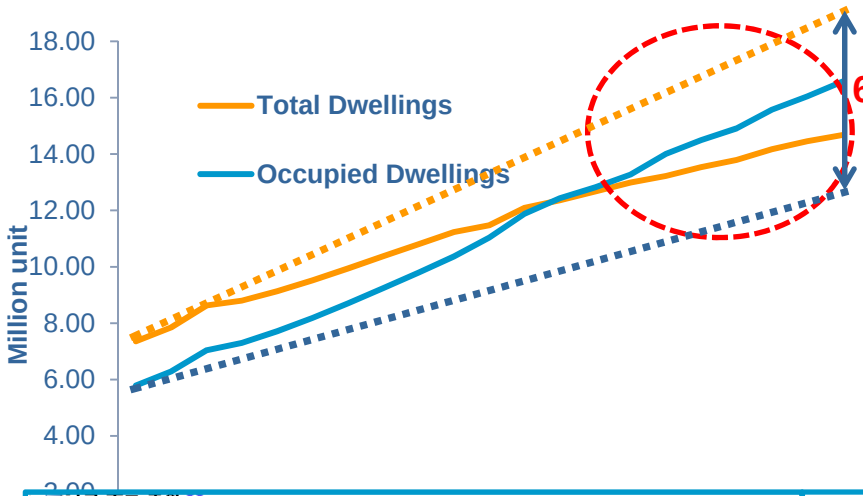
Major issues – Transport

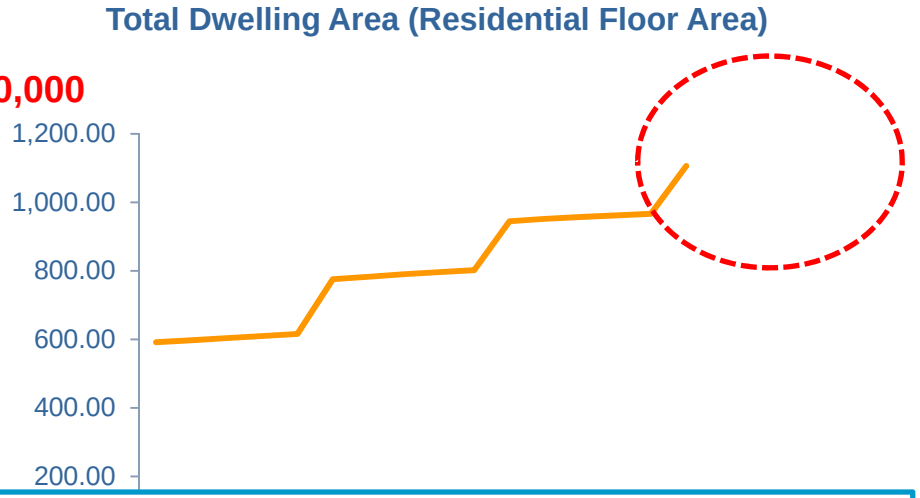
- Energy balances vs. Energy efficiency indicators template
  - Inconsistency between the two submissions



Major issues - Residential

Basic but critical data are missing





주택의 종류, 연면적 및 거주인수별 주택-시군구[1)]

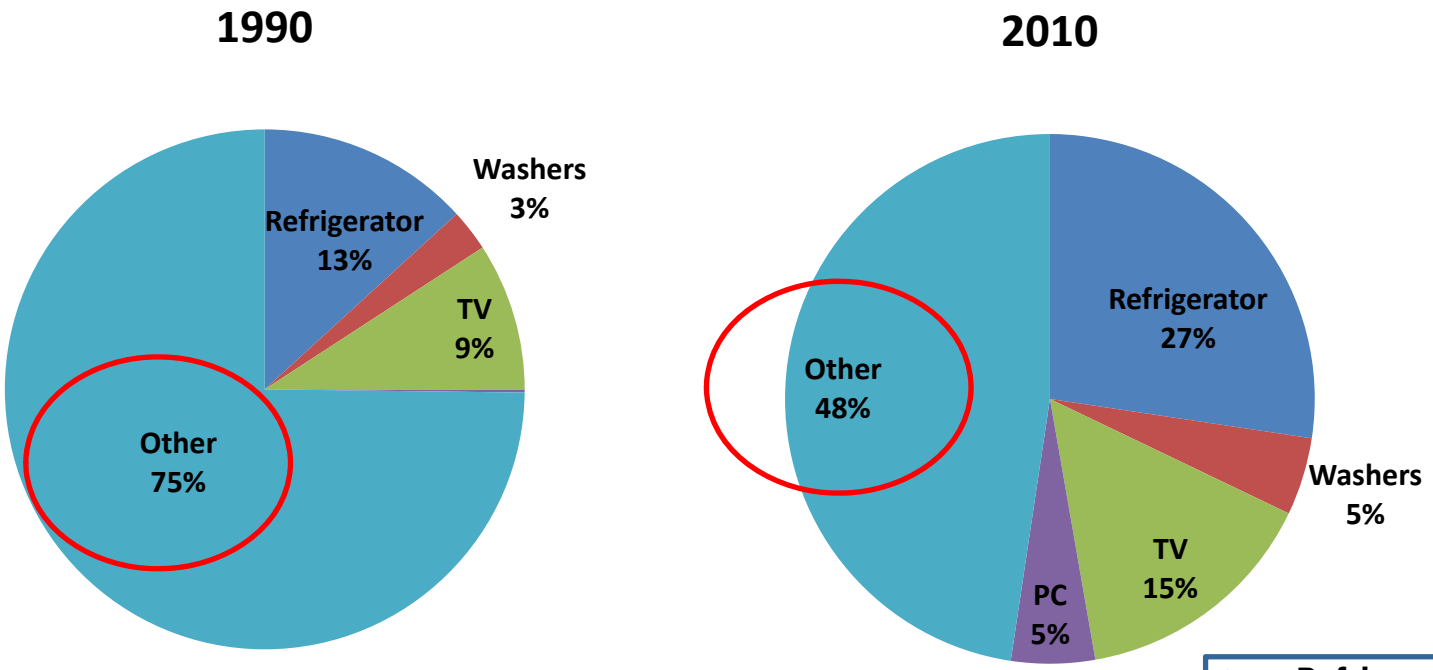
행정구역별	주택의종류별	연면적별	주택 호
전국	계	계	13,883,571
		20m² 이하	26,008
		20m² ~ 40m²	1,241,183
		40m² ~ 60m²	4,080,204
		60m² ~ 85m²	4,881,601
		85m² ~ 100m²	1,018,083
		100m² ~ 130m²	1,204,192
		130m² ~ 165m²	829,434
		165m² ~ 230m²	355,061
		230m² 초과	247,805

출처 : 통계청, 주택총조사 +더보기

주석
1) 주1) 주택을 대상으로 집계. 단, 주택이외의 거처 및 빈집 제외
주2) 연면적은 주거에 이용되는 전용 부분만 포함하며 아파트 등 공동주택은 전용 면적을 기준으로 함

Major issues - Residential

Share of energy (electricity) use by appliance

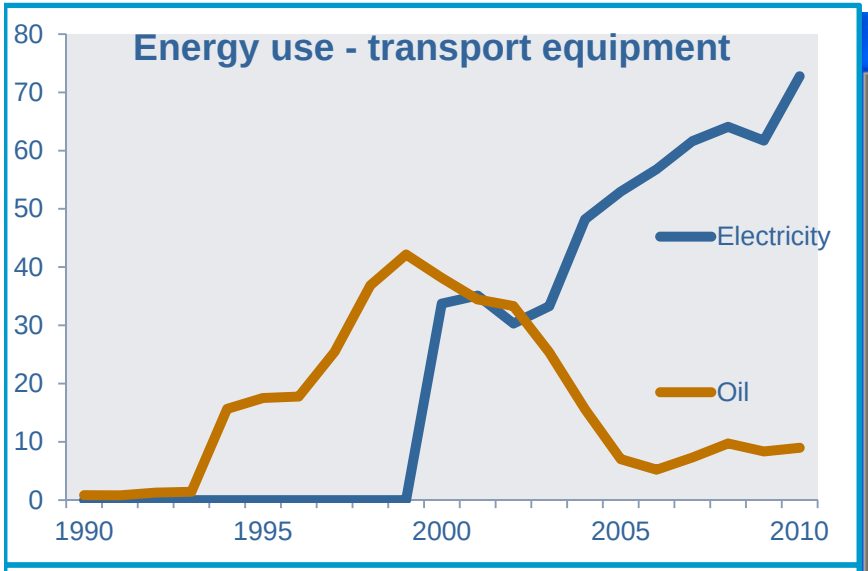


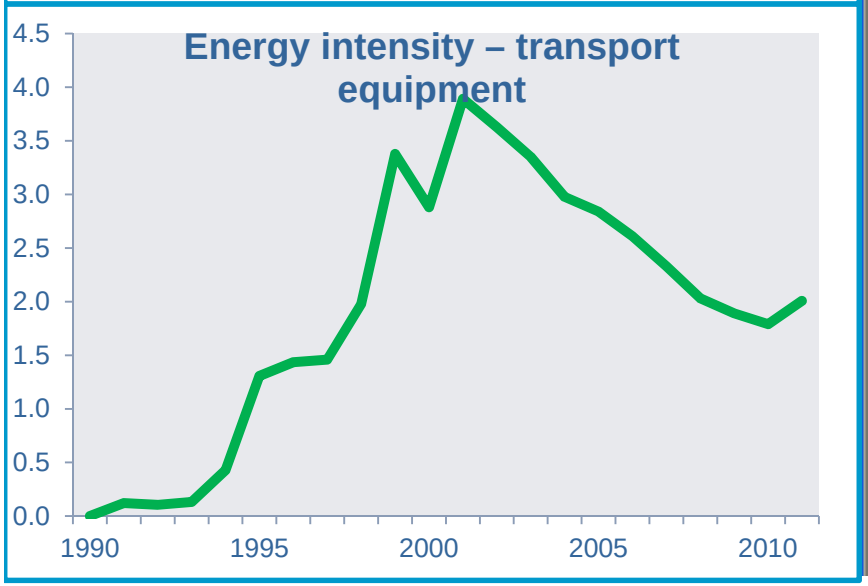
- Refrigerator
- Freezer
- Dishwasher
- Clothes washer
- Clothes dryer
- TV & home entertainment
- Computers & ICT

- What else is included in 'Other'?
  - Maybe misallocated electricity
  - 24,000 GWh in other appliance

    vs. 1,600 GWh in space heating, 0 in water heating

Major issues - Industry



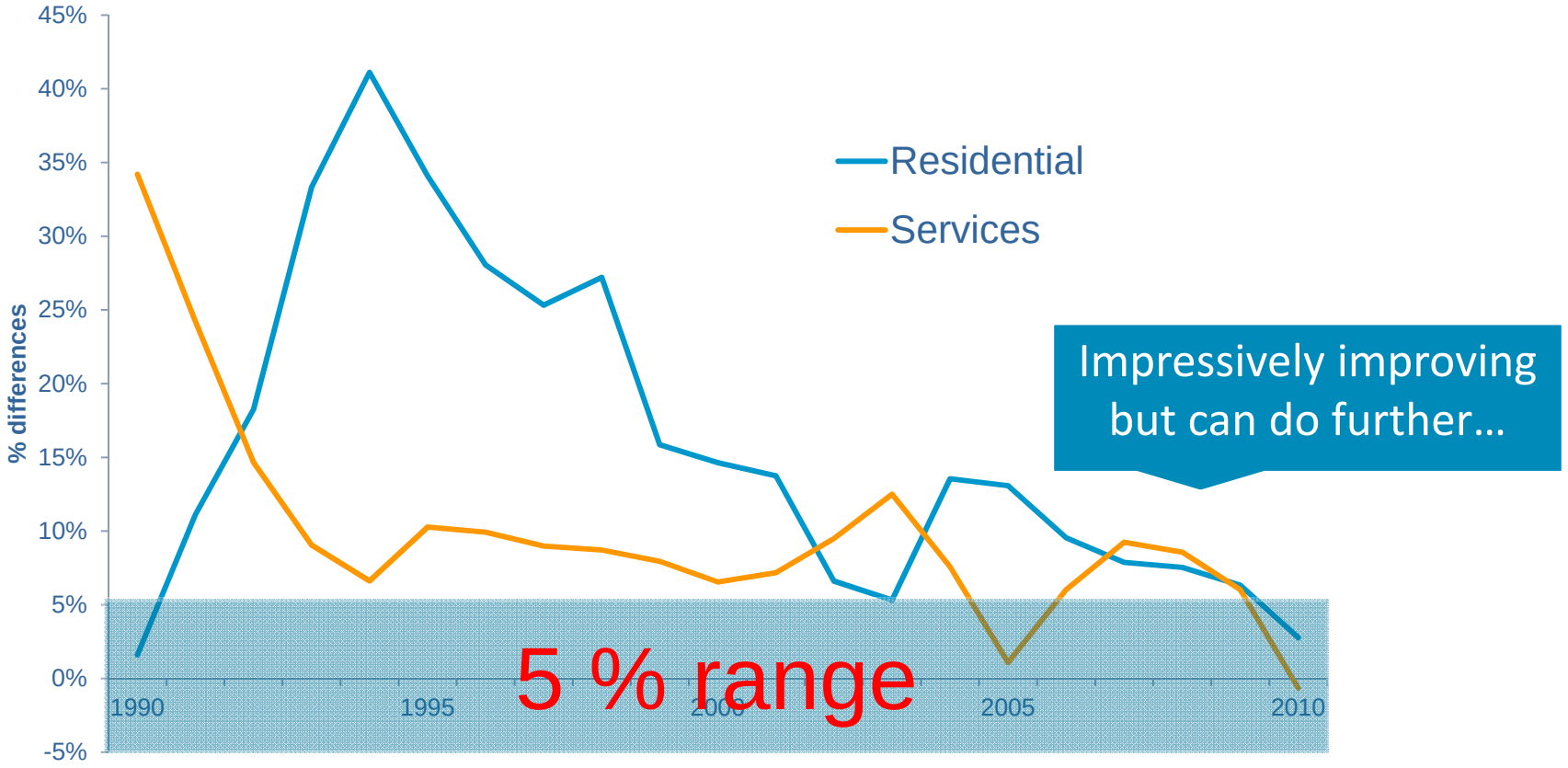


Summary Energy Balances (Read-only)

UNIT: ktoe	COUNTRY: Korea	FLOW: Transport equipment
PRODUCT	Electricity	
TIME		
1990	0	
1991	0	
1992	0	
1993	0	
1994	0	
1995	0	
1996	0	
1997	0	
1998	0	
1999	0	
2000	806	
2001	839	
2002	724	
2003	795	
2004	1,151	
2005	1,265	
2006	1,356	
2007	1,472	
2008	1,531	
2009	1,474	
2010	1,738	
2011	1,914	

Major issues - Discrepancy

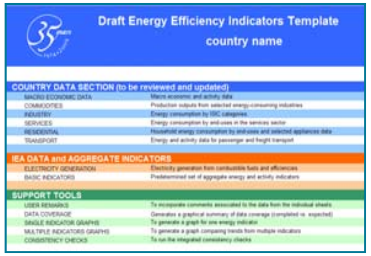
% Differences between IEA balances and EEI data



What does the IEA do to help countries and to promote energy efficiency

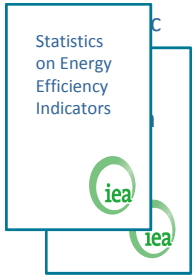
How can the IEA help raising concerns and helping countries collecting proper statistics

Helping countries



Improve clarity and user-friendliness of the template

Strengthen communication with countries



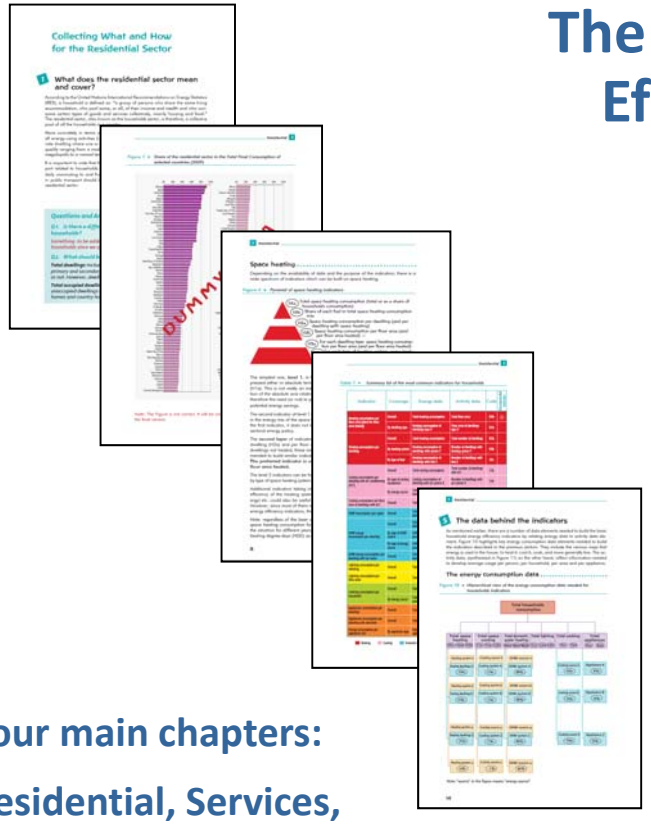
Provide guidance through Manuals

Organise training on statistics for energy efficiency

Where does the IEA stand on Manuals

International Energy Agency

The Statistics for Energy Efficiency Indicators Manual

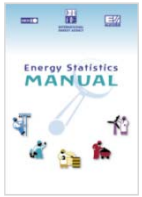


Four main chapters:

Residential, Services,

Transport, Industry.

Same approach as in:



One of the key values of the Manual is in the Annex with 160 data collecting practices

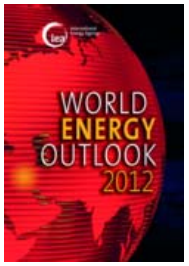
Background	Country	Austria		R/Su/01
	Organisation	Statistics Austria		
	Name of the survey	Household energy consumption survey		
	Survey purpose	• To determine total household energy consumption • To determine household appliances energy consumption • To collect household energy expenditure • To collect dwelling physical characteristics • To collect household occupant characteristics		
Data collection	Sample design	Stratified random sampling approach		
	Sample sources	List of addresses, list of telephone numbers, labour force survey.		
	Collection methods	• Computer assisted personal interview (CAPI) • Computer assisted telephone interview (CATI)		
	Sample/Population size	14 000 / 3 429 720	Response rate	55%
	Frequency	Every two years	Last time surveyed	2010
	Time to complete survey	10 minutes	Mandatory	No
	Incentive	None		
	Survey respondents	Households		
	Elements collected	Dwelling type, dwelling floor area, building age, household occupancy, energy-related renovations, household energy consumption and related expenditures.		
	End-uses collected	Space cooling, space heating, domestic hot water, other: cooking.		
Notes and comments	Main challenges	• Inconsistent responses • Response quality		
	Possible improvements			
	Key best practice	A new approach to data control compared with previous surveys was taken for the first time in 2004 and continued in the follow-up survey runs. Up to and including the 2000 survey, only the individual energy sources themselves were checked for plausibility, any missing data were calculated (quantity-value pairs) and substitutions were made if necessary. Such routines of course continue to be used, with the additional step that the total of the reported energy consumption is then related to a calculated (fictitious) overall consumption. This fictitious overall consumption by the household is calculated from the data for that household, on the one hand (floor space, number of people in household) and pre-set parameters for the individual types of use (space heating, water heating, cooking, other purposes), on the other hand. Calculating the total reported energy consumption per household in this way involves some quite complicated plausibility routines, because one or more alternative quantities have to be calculated if the quantity-value pairs do not match and these alternative quantities then, when variably applied, lead to a number of different calculated overall energy consumption figures. The fictitious standard value is then used to select the quantity-value pairs that appear most probable.		
	Other documentation	Available: Surveying Methodology and Questionnaire		

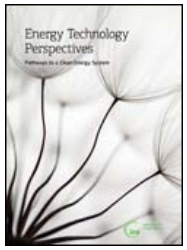
A second Manual to complement the first one:

The ***Manual for Development of Energy Efficiency Indicators*** is aimed at providing energy analysts and policy makers with tools needed to assess what are the priority areas for the development of indicators and how to select and develop the data and indicators which will best support energy efficiency policy.

How can the IEA help raising concerns and helping countries collecting proper statistics

Raising concerns / Raising profile





Energy efficiency is at the centre of IEA flagship publications

The publication of the *Energy Efficiency Market Report* has generated hundreds of articles in the Press

Energy Efficiency at the centre of the Ministerial meeting on 19-20 November 2013

A few words to conclude

- Energy efficiency is high on the political agenda, however actions do not always follow intentions
- Timely and detailed energy statistics are the basis for any sound energy efficiency policy
- Statistics are needed for building proper indicators which will then be used to assess situations, to optimise policies, to define programmes and actions as well as to monitor progress or failures
- The IEA is committed to help member countries and non-OECD countries in developing their statistics and their policy on energy efficiency
- This is why we are delighted to be in Korea for this workshop
- Korea is certainly extremely committed to further developing its statistics and its energy efficiency policy and I would like to commend Korea for that.
- At the end of the day, if Korea is successful, Korea could play a key role in the APEC region to help other countries in building their proper reporting mechanism.

Thank you