Energy Consumption Data for Energy Efficiency Indicators in Korea

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Contents

IEA Energy Efficiency Indicators(EEI)

- Energy Efficiency Indicators has been developed with following objectives :
  - To assess energy efficiency situation
  - To monitor progress of energy-savings or energy efficiency policies
  - To plan future actions to improve energy efficiency
  - To motivate policy-makers to pay attention to the programs/policies
- IEA is collecting the data for EEI from member countries.
  - Excel template file
  - 6 sectors : macroeconomic data, commodities, industry, transport, services, residential
  - Korea $\rightarrow$ since 2008, by KEEI

Questionnaire

- Macroeconomic data
  - Activity & structure indicators : population, employment, dwellings, residential/services floor area, heating degree-days, cooling degree-days
  - GDP, GDP deflator
  - Value-added
- Commodities
  - Production of commodities based on ISIC Rev.3.1 Division
  - Paper, chemicals, other non-metallic mineral products, basic metal
- Industry
  - Energy use by industry

Questionnaire

- Transport
  - Activity & structure indicators : passenger transport [passenger-kilometres], freight transport [tonne-kilometres, tonnes], vehicle kilometres, vehicle stocks (number of vehicles in use)
  - Energy use by mode (10 sub-modes)
- Services
  - Energy use by end-use
  - End-use : space heating, space cooling, lighting, other building energy use, non-building energy use
- Residential
  - Energy use by end-use
  - End-use : space heating, space cooling, water heating, cooking, lighting, appliances, other
  - Appliances : diffusion(unit/dw), stock, unit energy consumption(kWh/unit)

Energy data for EEI-IEA

- Energy balance
  - Data from energy suppliers
  - Insufficient information to specify end-use of energy
- Energy Consumption Survey
  - Major statistics for EEI-IEA
  - Every 3 years from 1981 (based on Energy Act) $\rightarrow$ discontinuity in time series
  - Accomplished by Ministry of Trade, Industry and Energy(MOTIE) & KEEI
  - Survey on energy use in industry, transportation, services and residential sector (by end-use and source)
  - Sample survey (sampling from other official surveys' population)

Activity statistics for EEI-IEA

- Industry
  - National Accounts : value added by industry(Bank of Korea)
  - Output by major products(related associations)
- Transport
  - Statistical Yearbook of MOLIT(Minister of Land, Infrastructure and Transport)
  - Survey on the car mileage(Korea Transportation Safety Authority)
- Services
  - Surveys on Utilization and Dissemination of Lighting Fixtures(KEMCO)
  - Census on Establishments(Statistics Korea)
- Residential
  - Population and Housing Census(Statistics Korea)
  - Survey on Electricity Consumption Characteristics of Home Appliances(KPX)

Industry

- Difference in industrial classification between EEI-IEA and KEB(Korea Energy Balance)
  - EEI-IEA : 20 classifications (ISIC Rev.3.1 Div. 1 45) under the industrial sector
  - Korea Energy Balance : 14 classifications under the industrial sector
  - Difficult to meet EEI-IEA classifications in energy consumption as well as value added
- Difference in industrial classification between Korea energy agencies
  - Difference in each agencys classification reported to KEEI (or published officially)
  - Difference in sub-industries included in a certain next-higher classified industry

Transport

- Difference in transport modes classification between EEI-IEA and KEB
  - EEI/IEA : 10 sub-modes (included in the passenger and the freight modes)
  - Korea Energy Balance : Road, Rail, Air, Marine
- Absence of necessary data
  - 30 kinds of statistics out of a total of 70 necessary statistics
  - Even if available, many of those are unstable series
- Coverage differences in the related data under the same mode : *Example : freight truck*
  - Stock : private freight truck + business freight truck
  - Ton-kilometers : business freight truck
  - Vehicle-kilometers : private freight truck + business freight truck
  - Energy consumption : private freight truck + business freight truck

Services

- Re-estimation and revision
  - 0.5 $\times$ Energy Balance + 0.5 $\times$ Energy Consumption Survey
  - Energy Consumption Survey : re-calculated using linear interpolation from 1990 to 2011 and regressed on Services GDP by end-use
- Accuracy and reliability of the data for end-use consumption
  - End-use consumption is surveyed on-site in services sector. A respondent, the owner or the manager of a shop or a building, have filled out the questionnaire on his own estimation for end-use consumption.
  - Over 20% of other building energy use & 0 non-building energy use

Services

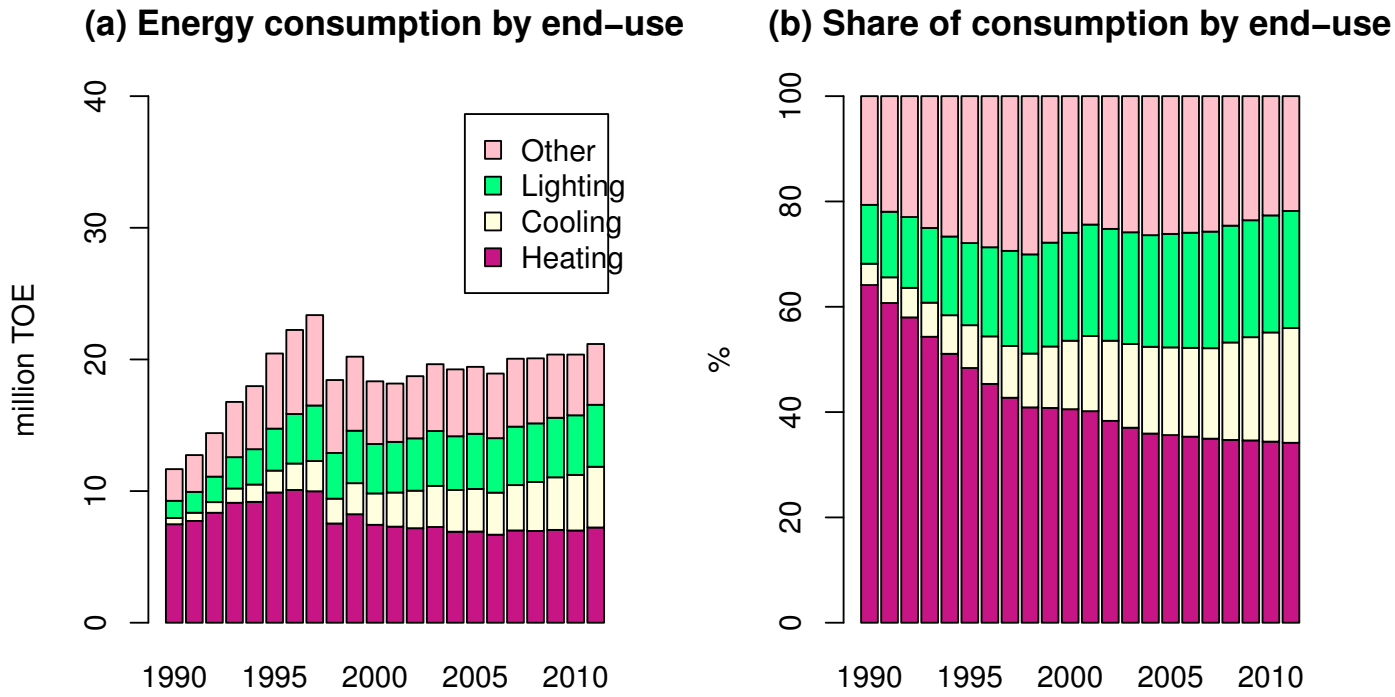

Figure: Energy consumption in services sector

Services

Table: Energy consumption in services sector

	1990	1995	2000	2005	2010	2011
Thousand TOE						
Heating	7,482	9,894	7,436	6,926	7,006	7,235
Cooling	473	1,662	2,385	3,237	4,224	4,612
Lighting	1,304	3,189	3,759	4,189	4,528	4,707
Other	2,409	5,707	4,759	5,085	4,613	4,619
Total	11,667	20,452	18,339	19,436	20,371	21,173
%						
Heating	64.1	48.4	40.5	35.6	34.4	34.2
Cooling	4.1	8.1	13.0	16.7	20.7	21.8
Lighting	11.2	15.6	20.5	21.5	22.2	22.2
Other	20.6	27.9	25.9	26.2	22.6	21.8

Residential

- Re-estimation and revision
  - 0.8 $\times$ Energy Balance + 0.2 $\times$ Energy Consumption Survey
  - Energy Consumption Survey : re-calculated using linear interpolation from 1990 to 2011 and regressed on GDP deflator by energy source
- Accuracy and reliability of the data for end-use consumption
  - Town gas : space heating - Water heating - Cooking
  - District heating : space heating - Water heating
  - Electricity consumption by end-use : Survey on Electricity Consumption Characteristics of Home Appliances(KPX) $\rightarrow$ discontinuity in time series, more detailed data of appliances

Residential

Table: Diffusion of appliances in residential sector(Unit/dw)

		1990	1995	2000	2005	2010	2011
APP	TV	1.16	1.37	1.42	1.46	1.43	1.42
APP	Refri./Freezer Combinations	1.07	1.05	1.07	1.03	1.03	1.02
APP	Kimchi refrigerator	–	0.04	0.14	0.49	0.76	0.82
APP	Clothes washer	0.79	0.94	0.95	0.97	0.99	0.99
IT	PC	0.1	0.58	0.7	0.83	0.94	1.00
IT	Laptop	–	–	0.03	0.07	0.18	0.23
APP	Dish washer	–	–	–	–	–	–
Cooking	Rice cooker	–	–	–	–	–	–
Heating	Electric mat	0.23	0.56	0.39	0.36	0.6	0.65
Heating	Electric heater	0	0.12	0.12	0.07	0.05	0.05
Heating	Electric heater(fan type)	–	–	0	0.02	0.04	0.04
Lighting	Fluorescent light	2.62	3.62	4.43	5.27	6.2	6.79
Lighting	Incandescent bulb	4.87	3.29	2.87	2.63	2.44	2.32
Lighting	Other light	0.23	1.52	0.58	1.1	1.31	1.44
Cooling	Electric fan	1.54	1.35	1.58	1.68	1.69	1.61
Cooling	AC	0.06	0.17	0.29	0.44	0.59	0.61

Industry

- More in-depth classification using the Energy Consumption Survey(ECS)
  - Energy Consumption Survey : 24 industrial classifications based in KSIC(Korean Standard Industrial Classification) → However, surveyed in every 3 years
  - Applying the ratio of the each sub-industrys energy consumption in the ECS to the total energy consumption of industrial sector in the Korea Energy Balance
  - Bridging gap (intervening years of ECS) using interpolation methods
- More strong promotion of the project of the development of NES system
  - Unify and adjust each energy agencys energy classification system to KSIC
  - Change the Korea energy balance format to the IEA balance format
  - Finally, establish the lowest classification level report system (requiring the cooperation of Korea energy agencies)

Transport

- Estimation of absent data (or lack of coverage)
  - Using the relevant assumptions and proxy factors (data)

Example 1: passenger-kilometers for passenger car

passenger cars passenger-kilometers $\approx$ average passengers/passenger car $\times$ average mileage/passenger car $\times$ passenger car stock

Example 2: ton-kilometers for private freight truck

private trucks ton-kilometers $\approx$ average loaded weight/private freight truck $\times$ average mileage/private freight truck $\times$ private freight truck

- Using the mini-survey
  - Carrying out a mini-survey to get the activity data for private bus (Nov.- Dec. in 2013)

Services

- Buildings Energy Consumption Survey (by KEEI)
  - Government(MOTIE) fund for the survey 2013 : about 170,000 US$
  - Survey coverage : commercial and public buildings consuming over 2,000TOE in Seoul Capital Area
  - Increasing the cost per survey unit by minimizing sample number ($n = 200$)
    ◇ Cost per survey unit : 142$ for BECS, 38$ for Energy Consumption Survey (based on Y2010)
  - Detailed survey items to estimate more accurate end-use consumption and to analyze patterns of energy consumption on commercial activities
  - Collection of Para data (Survey process data)
  - Increasing sample size every year (2,000 $\rightarrow$ 6,000)
  - Finally, fixing the sample (panel survey) to chase the change of energy consumption characteristics
- It is expected to improve quality of the survey and to construct qualified energy data for policy analysis in services sector.

Residential

- Household Energy Panel Survey (by MOTIE & KEEI)
  - Started from 2009 : 2009 - 2010 (pilot survey), after 2011 (approved survey)
  - Survey coverage : about 2,500 households all over the country
  - Detailed survey items associated with home appliances $\rightarrow$ replace the KPX's appliance survey
- It is needed to construct an energy efficiency database integrating all the information about household's characteristics, energy use and equipment-profile.
  - Cooperation with government/organizations ; income information from National Tax Service, equipment-profile from KEMCO
  - Smart metering