

A Measurement on Green Economy in Korea: *Green Industry Statistics*

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Abstract

Since 2008, a national Green Growth policy has been underway in Korea to transform the growth paradigm from “quantitative growth” to “qualitative growth with Low-Carbon”. This is a kind of sustainable development policy to promote a Green Economy. In the context of this growth strategy, Statistics Korea (KOSTAT) has been developing indicator sets on Green Growth and Green Life. In addition, as a statistics development project for Green Growth, Korean Green Industry Statistics have been compiled with collected data from the Economic Census of 2010. This paper introduces a conceptual definition of Green Industry, a classification of green products, a survey framework, and the data collection process etc. Also, principal indicators on *Green Production and Green Employment* are analyzed to show how much the Korean economy has been greened.

Key Words: green economy, green industry, green product, green production, green job

1. Introduction

“Green Growth with Low Carbon” was proclaimed to be Korea’s new national vision for economic growth in 2008. This vision was aimed to shift the development paradigm from a quantity-oriented growth dependent on fossil-fuel to a quality-oriented growth driven with low carbon. The green growth strategy is focused on a synergistic relationship between economic growth and environmental protection in order to simultaneously achieve three objectives: the promotion of eco-friendly new growth engines for the national economy, the enhancement of the quality of life for members of the society, and the contribution to international efforts to make progress on climate change. Hence, the Korean green growth strategy might be regarded as a kind of sustainable development policy to help the government promote a Green Economy.

In order to fully support this national growth strategy, Statistics Korea (KOSTAT) has been developing green growth statistics. Development programs on green growth statistics¹ can be categorized in three ways: assessment of government’s green policies, transition to a green lifestyle, and promotion of green production. First, a *Green Growth Indicator Set* has been designed as a measurement framework for the performance of the government’s green growth policies. Second, a *Green Life Indicator Set* has been built to check the current situation in citizens’ Green Lives and then to establish long-term targets for green policies. Data for these indicators has been collected by a nationwide survey on green activities within households. Finally, *Green Industry Statistics* has been compiled as a pilot research project. Actually, Green Production and Green Employment have been estimated with the Economic Census data from 2010.

This paper has been prepared to introduce the Korean Green Industry Statistics as a case study. In section 2, a conceptual definition of Green Industry and a classification of green products will be explained briefly. In section 3, the survey framework and data collection process will be presented. Furthermore, principal indicators from Green Industry Statistics will be introduced to show current figures of the Green Economy. In the last section, remarks concerning implications and limitations of the pilot research project will be summarized.

¹ A Korea measurement framework is suggested in KOSTAT & EUROSTAT (2012).

2. Green Industry and Green Products

Conceptual Definition of Green Industry

A Green Industry is defined as industrial special activities for achieving green growth with low carbon by producing green products which can *enhance efficiencies of energy and resources, minimize environmental pollution, and protect or improve the environment* in economic activities. This conceptual definition is based on the “Low Carbon-Green Growth” Law²” and “Green Technology Certification Act³”. Article 2 in the “Low Carbon-Green Growth” Law describes conceptual definitions of green industry and green goods or services. In the “Green Technology Certification Act”, there is a list of green technologies which can be applied to producing green goods and services.

Classification of Green Products (Goods and Services)

Green products need to be listed systematically according to purposes, functions, or other characteristics in order to easily identify green industry and analyze green production activity. In the Korean project, a classification of green products has 4 categories, 15 groups, and 47 classes as shown in Table 1. In other words, all green goods and services are classified into the 4 following categories: green energy, pollution control, enhancement of energy efficiency, and enhancement of resource efficiency. Moreover, each category has 3 or 4 groups of lower level classification. The first category of *Green energy* covers products related to alternative energies that reduce fossil fuel use. The second category of *Pollution control* includes products to treat, prevent, or control environmental emissions in the air, water or soil. The third category, *Enhancement of Energy Efficiency*, groups energy efficiency products in the context of reduction of fossil fuel use through conservation of energy or minimization of energy loss in economic activities. The last category, *Enhancement of Resource Efficiency*, contains resource efficiency products to preserve and use sustainable natural resources such as water, raw material, land, biodiversity and the ecosystem.

Table 1. Classification of green products

Category	Group	Class
1. Green Energy	11. Renewable Energy	Solar energy, Solar heat, Wind power, Bio energy, Ocean energy, Geothermal heat, Water power, Waste energy, Other renewable energy (9)
	12. New Energy	Fuel cell, Hydrogen energy, Clean fossil energy (3)
	13. Other Green Energy	Nuclear power (1)
2. Pollution Control	21. Air Pollution	CO ₂ treatment, Non-CO ₂ treatment (2)
	22. Waste/Waste Resource	Collecting or Recycling waste/waste resource, Waste/Waste Resource treatment, Other services on Waste (3)
	23. Soil/Water	Wastewater/Excrement treatment, Water purification, Soil purification and eco-friendly detergent, Other purification activity (4)
	24. Other Pollution Control	Eco-friendly agricultural production, Purifying indoor air, Noise/Vibration reduction, Other control activity (4)
3. Enhancement of Energy Efficiency	31. Green Home & Green Commercial	New light source with high-efficiency, Home appliance with high-energy efficiency, Other energy appliance (3)
	32. Green Transportation	Green car, Intelligent transportation system, Other green transportation (3)
	33. Green Architecture	Building with high-energy efficiency (1)
	34. Other Energy Efficiency	IT on Power, Energy storage, Green computing/SW, Other activity with energy efficiency (3)
4. Enhancement of Resource Efficiency	41. Water Resource	Ocean resource, Water reuse, Leakage protection and water saving (3)
	42. Forest Resource	Recycling waste paper/timber, Establishment of Green space, Forest resource management (3)
	43. Mineral Resource	Recycling or Remanufacturing mineral resource (1)
	44. Other Resource Efficiency	Ecosystem protection, Preservation of biological diversity, Natural disaster prevention (3)

² The “Low Carbon-Green Growth” Law was released officially in 2010.

³ The “Green Technology Certification” Act was enacted in 2009 to nurture Green Industry.

3. Survey Framework and Data Collection

Survey Framework

A survey for data on green industry was designed in the Economic Census of 2010. A question on green activity was planned to be inserted into the census questionnaire. In the original questionnaire, there were 3 items as follows: category of green industry the activity belongs to, detailed descriptions of green goods or services, and sales of green products. The census questionnaire with green items was assigned only to establishments for 9 industries (ISIC Rev.4); ‘Agriculture, forestry and fishing (A)’, ‘Mining and quarrying (B)’, ‘Manufacturing (C)’, ‘Electricity, gas, steam, and water supply (D)’, ‘Sewerage, waste management and remediation activities (E)’, ‘Construction (F)’, ‘Information and communication (J)’, ‘Professional, scientific and technical activities (M)’, and ‘Administrative and support service activities (N)’. Also, due to the constraints of survey budget and survey burden caused by the inclusion of small establishments which are expected to have no green activity, establishments with less than 5 workers were not included in the census interview.

Activities in the Green Industry covered almost the same as those in the Environment Goods and Services Sector (EGSS) of EUROSTAT⁴. However, as previously mentioned, the Korean case extended coverage of the enhancement of energy efficiency and resource efficiency.

Data Collection

The survey for data collection was implemented step-by-step in the span of the time schedule. In 2010, a classification of green goods and services and a well-designed questionnaire were prepared. In 2011, data for green activities were collected from establishments for 9 industries through a comprehensive Economic Census of 2010. In 2012, collected data were edited according to rigid rules. Especially, data editing was internally implemented 6 times even during the process of conducting the survey. In addition, data editing was carried out with external information from registered data which was obtained from a number of industry associations and government organizations. A list of green products and a list of establishments with a green technology certificate, which are made by the “Green Technology Certification Act” and “Eco-Energy efficiency Certification Regulation”, were most useful for this editing work in identifying practical green products on borderline. After collecting and editing, code numbers were given to all green goods and services according to the classification system.

Estimation

Green production and green employment were basically calculated with information on sales of green products. Sales of green products as an indicator of green production were calculated directly with data on the sales at the level of establishment. It was then summed up to industry level and recounted by category and group of green products. Green employment should be estimated using a separate method which is based on strong assumptions, because information on green employment was not collected at the green product level in the Economic Census of 2010. For example, if an estimation method has a strong assumption that the sales ratio of green products equals the employment ratio for production of these green products at the establishment level⁵, green jobs in employment of each establishment could be calculated straight from existing survey data. Of course, green jobs may be inferred to be jobs which are allocated for the production of green goods or services. Just now, green jobs could be aggregated to industry level and recounted by category and group of green products like the estimation process for green production.

⁴ EUROSTAT (2009) was published as a data collection handbook on environmental goods and service sector.

⁵ In the Economic Census of 2010, the survey unit was “establishment”.

4. Principal Indicators in Green Industry Statistics

Green Production (Sales of Green Products) by Industry

Sales of green products in 9 industries totaled 92.5 trillion won in 2010. Sales of green products in “Mining and quarrying & Manufacturing industries”, which has the largest share 44.8% among 9 industries, was 41.4 trillion won. Sales within other industries were distributed from 11.0 trillion won to 15.4 trillion won, their shares ranged from 11.9 % to 16.7% as presented in Table 2.

On the other hand, sales ratio indicators in Table 2 showed how much each industry has become green in 2010. The total sales ratio of green products in 9 industries was about 4.5%. The biggest sales ratio was shown to be 90.6% in “Sewerage, waste management and remediation activities”. “Professional, scientific and technical activities” had a ratio more than 10%, while “Electricity, gas, steam, and water supply” had a ratio of less than 10%. The sales ratio in “Mining and quarrying & Manufacturing industries” of Korea in 2010 was 2.9%, which is relatively high compared to 1.3% in the “Manufacturing industry” of the U.S.A. in 2007.

Table 2. Sales of all products and green products by industry

Industry (ISIC Rev. 4)	Sales of all products	Sales of green products (Unit: Billion Won, %)	
		(Share)	Sales ratio
Total (9 industries)	2,077,251	92,501 (100)	4.5
B. Mining and quarrying & C. Manufacturing	1,426,915	41,397 (44.8)	2.9
D. Electricity, gas, steam, and water supply	117,191	11,133 (12.0)	9.5
E. Sewerage, waste management and remediation activities	13,531	12,259 (13.3)	90.6
F. Construction	257,704	15,408 (16.7)	6.0
M. Professional, scientific and technical activities	109,150	10,987 (11.9)	10.1
Other industries (A, N, J)	152,760	1,316 (1.4)	0.9

Table 3 shows sales of green products and their shares by category of green products across industry sectors. In 9 industries, sales of green products for *enhancement of energy efficiency* had the largest portion, 30.5%. The portions of sales on green products were 24.7% for *enhancement of resource efficiency*, 23.3% for *pollution control*, and 21.6% for *green energy*. In particular, green products for *enhancement of resource efficiency* were not observed in “Electricity, gas, steam, and water supply”. Moreover, green products for *enhancement of energy efficiency* were not reported in “Sewerage, waste management and remediation activities”.

A brief explanation might be introduced by industry sectors. First of all, in the “Mining and quarrying & Manufacturing industries”, green products for *enhancement of energy efficiency* accounted for the largest portion, 42.3%. Sales of green products in these industries were caused mostly by solar energy, new light sources with high-efficiency and energy storage, and recycling or remanufacturing of mineral resources. In “Electricity, gas, steam, and water supply”, green products were composed of those for *green energy* and *enhancement of energy efficiency*. Sales of green products in this industry were mostly accrued from nuclear power, water power, and other activities with energy efficiency. In “Sewerage, waste management and remediation activities”, green products were comprised of those for *pollution control* and *enhancement of resource efficiency*. Therefore, sales of green products in this industry belonged to treatment and services related to pollution control and recycling or remanufacturing of mineral resources. In “Construction”, sales of green products were represented in the treatment of wastewater and excrement, establishment of green space, and ecosystem protection. Finally, in “Professional, scientific and technical activities”, green computing / software and other activities with energy efficiency contributed to sales of green products.

Table 3. Sales and its share of green production by industry and category

(Unit: Billion Won, %)

Industry (ISIC Rev. 4)	Sub-total	Category of green products			
		Green energy	Pollution control	Energy efficiency	Resource efficiency
Sales totaled in 9 industries (Billion Won)	92,501	19,943	21,557	28,167	22,834
B. Mining and quarrying & C. Manufacturing	41,397	8,504	7,033	17,501	8,360
D. Electricity, gas, steam, and water supply	11,133	7,101	10	4,022	-
E. Sewerage, waste management and remediation activities	12,259	23	6,874	-	5,362
F. Construction	15,408	2,442	4,946	302	7,718
M. Professional, scientific and technical activities	10,987	1,854	2,573	6,085	476
Other Industries (A, N, J)	1,316	18	121	257	919
Shares by category in 9 industries (%)	100.0	21.6	23.3	30.5	24.7
B. Mining and quarrying & C. Manufacturing	100.0	20.5	17.0	42.3	20.2
D. Electricity, gas, steam, and water supply	100.0	63.8	0.1	36.1	-
E. Sewerage, waste management and remediation activities	100.0	0.2	56.1	-	43.7
F. Construction	100.0	15.9	32.1	2.0	50.1
M. Professional, scientific and technical activities	100.0	16.9	23.4	55.4	4.3
Other Industries (A, N, J)	100.0	1.4	9.2	19.6	69.9

Green Jobs by Industry

The number of green jobs in 9 industries was estimated to be 322.8 thousand persons in 2010 as shown in Table 4. In the “Mining and quarrying & Manufacturing industries”, 105.2 thousand workers were employed for the production process of green products. The share of green jobs in these industries was 32.6%. “Construction”, “Sewerage, waste management and remediation activities”, and “Professional, scientific and technical activities” contributed 79.9, 59.2, and 56.0 thousand green jobs, respectively. Corresponding shares of green jobs in these industries became 24.7%, 18.3%, and 17.4%, respectively.

On the other hand, jobs ratio indicators⁶ in Table 2 showed how many persons have worked to produce green products in 2010. The jobs ratio in 9 industries was about 5.4%. The biggest jobs ratio was shown to be 92.8% in “Sewerage, waste management and remediation activities”. “Electricity, gas, steam, water supply” and “Professional, scientific and technical activities” had a 17.0% jobs ratio and 8.6% jobs ratio, respectively.

Table 4. Estimated green jobs by industry

(Unit: Thousand person, %)

Industry (ISIC Rev. 4)	Whole employment	Green jobs	
		(Share)	jobs ratio
Total (9 industries)	6,033.5	322.8 (100)	5.4
B. Mining and quarrying & C. Manufacturing	2,980.5	105.2 (32.6)	3.5
D. Electricity, gas, steam, water supply	65.0	11.1 (3.4)	17.0
E. Sewerage, waste management and remediation activities	63.8	59.2 (18.3)	92.8
F. Construction	1,066.7	79.9 (24.7)	7.5
M. Professional, scientific and technical activities	648.0	56.0 (17.4)	8.6
Other Industries (A, N, J)	1,209.5	11.5 (3.6)	1.0

⁶ A jobs ratio is not the same as a sales ratio of green products. For example, in “Mining and quarrying & Manufacturing industries”, a 3.5% jobs ratio is bigger than a sales ratio of 2.9%. This is because green employment was estimated not at industry level but at the establishment level.

5. Remark

A pilot research project on green industry statistics in Korea is expected to contribute greatly to the valuable efforts for the measurement of the Green Economy. In fact, sizes of green production and green employment were first obtained through the Economic Census of 2010. This project, however, does not cover all industry sectors (i.e., whole establishments in the domestic economy). Furthermore, Adapted Goods⁷, which are included within green products in terms of conceptual definition, were not fully counted in these green industry statistics because of practical identification problems. The editing procedures of survey data could identify only adapted goods which have green labels⁸ or were produced by green technology⁹. Due to these limitations, green industry statistics were disseminated with a list of green products and a description of the scope of industry sectors covered within the study.

In our work to develop indicator sets and survey statistics related to green growth, a decoupling indicator between the environment and economy or an environmental productivity indicator showed the level of “greened” activities in production and consumption as well. These “greened” indicators might have good statistical quality in terms of comparability and consistency since they could be derived mainly from theoretical and systematic statistics such as SEEA. On the other hand, the terminology “green” in green production or investment was very difficult to define in practice. A definition of “green” activity in green production and investment tends to be subject to temporal and spatial shifts according to differential technological progress or policy priorities. In particular, international or regional comparisons of estimates of green growth indicators or measurements on the green economy should be careful since such estimates may have different meanings across countries and time.

The international statistical community should play an important role in preparing and distributing some kinds of *lists on green items* needed for compiling corresponding green statistics in fields of Patents, R&D, Finance, TAX, Budget, ODA, etc. This work would be expected to become a critical starting point to develop and compile internationally comparable "green" indicators and statistics.

6. Reference

KOSTAT & EUROSTAT (2012), *Green Growth Measurement Frameworks in the Republic of Korea and in the European Union*, 4th OECD World Forum.

Korea Ministry of Environment (2010), *Low carbon- Green growth Law*.

U.S.A. Department of Commerce (2010), *Measuring the Green Economy*.

UNEP (2011), *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*.

OECD (2011), *Towards Green Growth*, Ministerial Council Meeting.

EUROSTAT (2009), *Handbook: environmental goods and services sector*.

⁷ As mentioned in EUROSTAT (2009), adapted goods are less polluting or more resource-efficient than equivalent normal goods even though they provide similar utilities, because the primary purpose of normal goods is not an environment protection or resource management.

⁸ Administrative organizations have a list of green label products made from “Eco friendly label Regulation” and “Energy efficiency label Regulation”.

⁹ It includes all technologies described by “Green technology certification Act”.