

Structure of Renewable Energy Input-Output Table in Korea and its implication

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Overview

The Input-Output table contains micro information about industry's flow of production and technology. The Renewable Energy Input-Output table focuses on renewable energy flows in and out of industry. And this table contains production technology of renewable energy equipment manufacturing industry. Because climate change becomes a big issue, because demand of emerging country increases rapidly, and because developed countries find new growth force, renewable energy is one of the major topics nowadays. Renewable energy (RE) is considered as an option to substitute other imported energy sources and to mitigate greenhouse gas emissions in Korea. In case of Korea, energy dependency on overseas is 96.5% in 2011, and Korea is the world's 7th country in GHG emissions.

The Korean government introduced the *Alternative Energy Development Promotion Act* in 1987 to promote alternative energy. The 2nd *Basic Plan* of 2003 aimed to raise the production share of renewable energy system (RES) in TPES to 5% by 2011 and to 9% by 2015. The 3rd *Basic Plan for Development, Usage and Deployment of RE technology of 2008* revised the targets of the 2nd Basic Plan for the production share of RES to 4.3% in TPES by 2015 and 11% in TPES by 2030. Korea introduced the feed-in-tariffs (FIT) and R&D fund to accelerate deployment of RES in 2002. The amount of R&D, deployment, and FIT are 1,142 Billion Won, 1,929 Billion Won and 769 Billion Won respectively during 2003-2010. The R&D budgetary supports for RES increased by 6.8 times in this period.

The question is how to evaluate a quantities effect of such deployment policy in renewable energy in Korea. Data availability for RE or energy flow of industry is one of issues in empirical analysis. Only macro data of RE is published because RE has small share in TPES compared with other conventional energy sources. However, each industry has different production technology and energy input-output structure. In addition technology progress happens along the time. The Input-Output table contains RE flows, assisting to proceed comparison analysis among industries.

ESRI (2007) surveyed input and output structure of renewable energy industries such as photovoltaic, hybrid car, bio fuel, Carbon Capture Storage (CCS), and forest management, and presented its input coefficient. MOE of Japan (2008) analyzed induced effects from Government promotion in renewable energy based on Japanese Input-Output table 2000. In this analysis, target renewable sources are photovoltaic, wind, small hydro power, geothermal, biomass, etc. McEvoy and Longhurst (2000) analyzed induced employment from investment of RE industry in UK using Input-Output table. Ragwitz et al. (2009) estimated total value added and employment from RES development in EU using Input-Output table. Kim (2012) composed Photovoltaic Input-Output table 2009 of Korea based on press release for RE industry survey of Korea published by MKE (2012) and input coefficient of photovoltaic published by ESRI (2007), and analyzed induced production of photovoltaic in Korea. KEEI (2012) made Renewable Energy Input-Output table 2008, which contains renewable energy sources such as photovoltaic, wind, bio diesel, fuel cell and so forth.

This paper generates methodology for Renewable Energy Input-Output table in Korea and shows segmentation of RE from conventional industry. It also shows its application. There are a few previous studies mentioned how to make Renewable Energy Input-Output table clearly except ESRI (2007) and Kim (2012). Kim (2012) used survey results of ESRI (2007) to build up Photovoltaic Input-Output table of Korea. However it is not clear that photovoltaic industry of Korea has same input structure with that of Japan. This research explains the process of how to build Renewable Input-Output table in Korea.

The remainder of this paper is organized as follows: the second section introduces raw data and methodology used to build Input-Output table up; and the third section discusses the effectiveness of Renewable energy Input-Output table, followed by the containing implication of Renewable energy Input-Output table.

Methods

Bank of Korea (BOK) uses financial statements and survey for buying and selling of each company and industry when they make Input-Output Table. Methodology of BOK is one of reliable method to build Renewable Input-Output table. Financial statements, which show material flows of each company, are most significant and reliable information in building of table. Financial statements of representative company in each RE source provide micro information for wages, surplus, taxes, sales, and input structure in production.

At the first stage to make Renewable Energy Input-Output Table, representative company must be pointed in each RE source. This representative company produces neither co-product nor by-product of RE source but one product of RE source. This

company also publishes its financial statements regularly in public. At the second stage, financial statements of each company must be collected in same fiscal year. At the third stage, thermal power sector of Input-Output table will be divided RE sector and Non-RE sector. After this, it is arrangement process that Renewable Energy Input-Output table is to be balanced in total input and total output.

In Korea, RE companies are small and they did not publish financial statements in public. Therefore, other data published by the Government sectors are used. MKE publishes "Survey of Renewable Energy Industry" in every year from 2009. This survey contains sales, employment, import, export, and investment of each renewable energy source such as photovoltaic, wind, geothermal, etc. Input-Output table of Korea has also energy sector. Based on Input-Output table of Korea, distribution of electricity and heat produced by RE among economic sectors will be researched. In addition "Annual Energy statistics", "Energy balance table" are used as raw data.

Induced analysis both production and employment for investment or deployment policy in RE will be estimated with Renewable Energy Input-Output table. This induced analysis looks like typical Input-Output analysis.

Results

Renewable Energy Input-Output table expands research target to indirect effect of investment in RE sector and helps to evaluate relative priority among Government budget. RE has small share in TPES in Korea. Therefore published Input-Output table may not need to contain RE sector. This study builds a Renewable Energy Input-Output table based on financial statements of representative company in RE source, "Survey of Renewable Energy Industry", "Energy statistics", and energy sector data from "Input-Output table". Data from financial statements of representative company provides more accurate information when Renewable Energy Input-Output table is made.

The Korean Government install a couple of policy to increase RE share in TPES and the amount of R&D budgetary supports for RE increased rapidly. Renewable Energy Input-Output table have a chance to evaluate this Government expenditure. In addition, Renewable Energy Input-Output table allows evaluating amount of induced effect in production and employment from growing of renewable energy industry.

Empirical analysis shows that induced production from additional final demand in RE industry is not so small in Korea. Major related industry is iron and steel industry. RE industry stimulate other industry which Korea has relative priority. RE industry has potential to grow in industry sector like electricity industry, vehicle industry, construction and civil engineering industry, etc. For example, additional demand in photovoltaic power equipment induced 1.932 times of production in Korea. In aspect of induced employment from additional final demand in RE industry is not huge. RE industry is not a labour intensively industry but a capital intensively industry. It has small positive effect on new employment in labour market. And labour force moves from conventional generation sector to RE generation sector.

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