

# The Current Status of Research and Development in Electrical Engineering of Korea

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## 1. Introduction of National R&D Plan

As the UR negotiation was settled in December, 1993, the new age of globalization with competition and cooperation has begun and all market fields have been opened. Now Korea is confronted with the unlimited competition era. In this situation, the survival strategy which adapts our country to the new world of reformation and competition is the only way to sustain our technological power by enhancing the base of science and technique. Therefore in order to rise up to the technical level of G7 countries into the beginning of the 21th century, Korean government established the technical development plan for five years in the beginning of 1993, which aimed to promote the technical power of major industries and core techniques of special fields to the level of G7 countries until the year of 2001.

By this plan, since 1992 Korean government has been consistently promoting the G7 project in order to get the pioneering techniques, and has been exclusively focusing on space science, nuclear science, future complex technology and life engineering which will lead the creation of new businesses.

Meanwhile, Korean government has created the organizations for the private research development, has increased the support in taxes and funds, and has promoted the simplification of administrative structure and the removal of unnecessary restriction for the settlement of the private enterprise-centered technical reformation system.

The investment of the research and development of Korea was 2.17% of GNP and the number of researchers was 89,000 in 1992. Korean government will expand the investment of research and development by 3-4% of GNP

until 1998 and reinforce the number of researchers by 140,000.

For the timely supply of the technical information, which is expected to be a major industry base in the year 2000, Korean government has already started to invest and continuously increased key projects, which are focused on the database architectures, information distribution systems, and organizations for the information dissemination.

## 2. The Status of Electrical Technology

### 2.1 Electric Power Business

The first Korean electric power business was established in 1898 by Hansung Electric Power Company. But the electric power business had been under the control of Japan for 36 years since 1908. After the Second World War and Korean War, Korean government adopted the Korea Electric Company Act in 1961 and formed the Korea Electric Company. Since then Korea have steadily developed the electric power business in company with economic growth. So now we are able to meet the domestic demand, and even try to export the electric power technology. As a result we made a contract with China for Kwangdong nuclear power plant in 1993.

Concerning the details of the current driving plan on the electric power, Korean government has planned to enlarge the investment in the field of the energy demand management to balance supply and demand of energy. Korean government has also planned to promote the investment for the purpose of supplying the equipment of high efficiency and improving the efficiency of the energy equipment. For the reduction of the power transmission loss, Korean government also has a long-term plan, such

as developing power transmission line and transformer with high capacity and low-loss of power. In addition, Korean government has raised the first distribution voltage from 6.6kV to 22.9kV in Seoul and Cheju-island and the second distribution voltage from 110V to 220V. Korean government hope that the loss in the low voltage line and in-line could be reduced as the result of this plan. Moreover, in order to introduce the competing system into the electric power business, Korean government has allowed the commercial enterprises to generate the electrical power, on condition that those generated electric power should be sold to the Korea Electric Power Cooperation(KEPCO).

Meanwhile, in the prospect of the electric power demand, total electric power is estimated to be expanded by 8.7% during 5 years from 1994 to 1998 that is from 127,734 GWh of 1993 to 194,043 GWh of 1998.

The electric power demand of the housing is expected to be steadily increased as the supply of house electric machinery expands. It is estimated to be increased by 10.6% from 23,916 GWh of 1993 to 39,531 GWh of 1998. So the component ratio of the total demand is expected to be 20.4% in 1998, compared to 18.7% in 1993.

The commercial demand is also expected to be increased resulted as the high-rise buildings, the expansion of subway and high-speed rail system, the elevation of the standard of life and the development of the leisure industry. Therefore, it is expected to reach the year average rate 10.3% from 27,293 GWh of 1993 to 44,490 GWh of 1998. So the component ratio of total demand is expected to lead to 22.9% in 1998.

Finally, the industrial demand will cause the total electric power demand expansion with the steady growth in the field of the manufacturing industry. It is estimated to be increased to the year average rate 7.5% from 76,225 GWh of 1993 to 110,022 GWh of 1998. So the component ratio of total demand is expected to lead to 56.7% in 1998 from 59.5% in 1993.

## 2.2 Electric Industries

In 1960s, the first economic-development-plan-for-5-years had laid the cornerstone of the infrastructure of Korean electric industries, especially of the heavy electric machinery industries including electric generating equipments.

In 1970s, Korean electric industries began to be developed in earnest with the influence of investment and financing policy of government, which was boosted to rearing policy of heavy chemical engineering, export rive policy and long

-term rearing policy of mechanical technology. So the Korean electric industry was reorganized from the technology of home machine, electricity-supply machine and small transformer to the technology of heavy electric machinery.

In 1980s, while heavy chemical industries went through the period of the hardship of the control of investment, the electric industries in Korea formed the basis of growing up as the 12th country of the world in electric engineering industry. In the mean time, testing equipment for supervoltage of international scale was completed and started to be operated in the heavy electric machinery fields. And as Korean electric industries came to be able to execute most of the performance evaluation for electric machinery, they became to make 500MVA transformers and 900MW generators as well as 170kV, 362kV breakers.

In 1990s, however, the interior and exterior environment of the world economy changed rapidly. As electric machinery manufacturers became large-scaled in the developed country, technical barrier came to be higher. In addition, the trade war came to be so severe that the demand for market opening, the development competition of new product with up-to-date technique and the restriction on the use of pollution generating products for the preservation of environment supplemented the hardship of Korean electric industries.

In order to cope with this situation, Korean government is now putting spur on the technical development of electric machinery such as 765 kV breaker and transformer and large capacitance induction motor. As a result, now the large capacitance induction motor in rotating machinery came to be very competitive in the world market and the development of large capacitance synchronous motor and AC operating motor for electric car has been accomplished. But generally speaking, the level of design technique of Korean electric industry is relatively low and some parts of design technique depend on foreign country such as USA, Germany and Japan.

## 2.3 Electronic Industries

With over 20% average growth rate, Korean electronic industry became to be the most important field of export in the late 1980's. In 1993 it recorded the export amounts of exceeding 24 million dollars and now it has taken the prominent strategic role in both manufacturing and export fields.

But Korean electronic industry is now confronted with some difficulties. While the developed countries entrench

technologies and trades, the developing countries are led by low wages. And what is worse are the domestic problems such as few well-trained engineers and high wages. These problems cause Korean electronic industries to fall behind in the world market place. It is very difficult to keep up with the developed countries in the fields such as computational methods, experimental analysis technology, new electric materials, optical applications, and AI which determine the quality of the products. That is to say, Korean electronic industries have found nowhere between advanced technology of the developed country and hot sales strategy of the developing country. In addition, they are faced with some critical domestic conflicts -high interest rate and inflating payments- which let the industries be at stake losing its own advantages in the market place.

It is urgently necessary for Korean electronic industries to improve R&D and productivity, and transfer into highly advanced industrial structure. Otherwise, there is no its own profit anywhere. Therefore, through the industry-institute complex research system, we are trying to pave the way for the brains in institutes to collaborate with the industry in R&D. Seeing the world market trends, the industrial

Division	Type	Date	Papers
Robotics & Automation	Workshop	4th Mar	25
Power System	Academic Announcement	3th Jun	29
Computer & AI	Academic Announcement	20th May	56
High Voltage Applications	Academic Announcement	22th Apr	14
Power Electronics	Academic Announcement	14th May	21
Electric Machinery	Symposium	6th Jun	11
Electric Materials & Solid State	Academic Announcement	14th May	24
Control & Measurement	Academic Announcement	21th May	32

electronics of the integrated technology has been focused on. And it is a typical instance for advanced technology and value added product manufacturing. But reflecting on the structure of Korean electronic industry, the industrial electronics occupy at most 22% in total amount. Hence, Korean government has determined to improve and domesticate the electronic industry on following highly advanced technologies -mini and large computer manufacturing, mobile and satellite communication, LCD, etc.- cooperating with industrial enterprises. Recognizing the importance of the roles of medium enterprises, the electronic industries have been reorganized into the proper structures based on 'var-

ious products but small quantity' fundamentals. The large enterprises lay emphasis on R&D instead of simple assembling procedures, while the medium enterprises lay emphasis on manufacturing, by which flexible price, compatibility in the market, and immediate decisions are available.

### 3. The Academic Activities of KIEE

The academic activities of KIEE can be classified by those of 11 major divisions. They exchange the source of academic information and promote the fellowship among the members of KIEE at the conference. Until 1988 all divisions had held the academic conferences respectively, but since 1989, they have shared conferences two times in a year, summer and fall meeting.

The following table shows the activities, the number of papers, and the formation of the divisions in 1994.

KIEE publishes two kinds of journals. The one is 'the Proceedings of the KIEE' which covers general information and activity news, and the other is 'the Transactions of KIEE' which deals with specific academic papers on each field. The Transactions of KIEE covered 240 papers in 1994, increased by roughly 15.8% in comparison with 1993. The following table is the classified papers issued in "the Transactions of the KIEE" in 1994.

Fields	Papers	Fields	Papers
Power System	74	Electric Machinery	77
Power Electronics	125	Electric Material & Solid State	92
Control & Measurement	55	Robotics & Automation	30
High Voltage Applications	48	Circuit & Systems	24
Computer & AI	15	Wave & Quantum Electronics	4

\* 본고는 일본전기학회 95년도 전국대회(95. 3.28 -3.30 北海道大學)의 특별강연회에서 본 학회 대표단장으로 참가한 박상희 부회장의 특별강연 내용이다.