I. Background

Currently improvement of engineering education and the system related to qualification of engineers is causing much controversy in Japan. We are now living in an age of "globalization" in which people, goods, capitals, services, information, etc., move not only domestically but also on a world scale. We should establish a system to achieve international equality and integration in engineering education programs provided by higher educational institutions such as universities, and in qualification for engineers in the real world.

In order for Japan, with comparatively scarce natural resources, to achieve economic prosperity and stable living standards in the 21st century, it is necessary to continuously live as a science/technology-oriented country under an international system where equal and free competition may be carried out. However, many accidents involving scientific technology have occurred recently in Japan, and people's trust in science and technology is lessened. Indeed, it is necessary to review what the social duties of researchers and engineers engaged in science and technology are. Moreover, the population of young people who are called "indifferent to science" is drastically increasing today, and it is pointed out that the level of educational foundation of students studying science and technology is declining.

Under such circumstances, engineering education at universities and the qualification of engineers as well as systems for Continuing Professional Development (CPD) are being improved.

II. Establishment of an Engineering Education System

1. Inauguration of Japan Accreditation Board for Engineering Education (JABEE)

Conventionally, the academic idea that universities are a place to study and educate people was long dominant in Japan. However, Western nations' idea that universities should provide education to develop the total capability of a student required to be an independent engineer -- i.e., engineering education -- has been stressed recently.

Based on such an idea, a system to provide education based on programs of international equality (including not only curriculums but also educational staff, related facilities, etc.) is to be adopted in engineering education at higher education institutions such as universities. For this purpose, the Japan Accreditation Board of Engineering Education (JABEE) was established in November 1999 to authorize engineering education programs in Japan.

JABEE is going to establish the standard for accrediting educational programs (in common to all fields or in each field) and other standards to define the methods for authorizing them. The process of establishing these standards began in 2000. Standards for educational programs and concrete

* "Nogyo-Doboku" in Japan is an applied science including Agricultural Engineering and the following fields: irrigation, drainage, reclamation, land-consolidation, land-conservation, rural infrastructure and rural environment.

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methods to examine programs in each field are to be worked out by related associations in the corresponding field. Thus JABEE and associations in each field will cooperate with each other to proceed the work. JABEE is planning to participate in the Washington Accord, a worldwide organization, when such an educational program authorizing system is in place. Only after JABEE becomes a member of the Washington Accord can international equality and integrity in engineering education at higher education institutes such as universities in Japan be guaranteed.

2. Action taken by the Japanese Society of Irrigation, Drainage and Reclamation Engineering (Japanese Society of Nogyo-Doboku)

The Japanese Society of Irrigation, Drainage and Reclamation Engineering (JSIDRE) established a study committee for engineering education certification (JABEE committee) in September 1999. The society also participated in the establishment of JABEE as the representative of agricultural associations. Now it is positively joining the JABEE’s activities.

In conjunction with other agricultural engineering associations, JSIDRE has prepared the standard in each field of Agricultural Engineering (V1.0 draft) and registered it at JABEE, which was done in line with the establishment of the Nogyo-Doboku educational program standard. In that standard draft, three poles of an Agricultural Engineering program are presented: 1) Nogyo-Doboku (the three fields of soil, water and infrastructure or soil, water and environment), 2) Agricultural Machinery and 3) Agricultural Environment Engineering. Moreover, the JABEE committee of JSIDRE is studying about the concrete curriculums for Nogyo-Doboku programs of the standard in each field. Since 2000, the committee also has been conducting the first trial work of examination to authorize Nogyo-Doboku programs along with programs in other engineering fields.

III. Improvement of Engineering Qualification System

1. Present situation of engineering qualification system

There are many engineering qualifications authorized by the nation in Japan. Of them, the most universal and prestigious qualification is “Professional Engineer” (PE). PE is the national qualification defined by the Professional Engineer Law established in 1957. PE is not a qualification to work such as MD or Architectural Engineer, but people can obtain the title of PE.

At present, PE consists of 19 fields (84 subjects) such as Construction, Electricity and Electronics, Machinery, Agriculture, etc. During the 40 years since this qualification was established (until 1998) about 45,000 people passed the examination to obtain this qualification (average examination pass rate against the number of applicants: 13%; average age of those who passed the examination: 43). Of 45,000 people who succeeded in the examination, 39,000 are registered as PE. Nogyo-Doboku or Rural Environment is one of the subjects in the Agricultural field, and the numbers of people who passed the examination for the two subjects were 1,400 and 100 respectively.

There is another qualification, called Assistant Professional Engineer. So far 12,000 people have passed the examination to get this title (average examination pass rate: 17%; average age: 28) and 6,000 of them are registered as Assistant PE.

2. Revision of PE system

A part of PE Law (established in 1957) was revised in April 2000.

(1) The background of the revision was as follows:

1) A PE is required to have a high level of occupational ethics as well as capability of service.
2) To deal with the rapid embodiment of mutual authorization of international engineer qualifications such as APEAC, international integrity of major requirements for PE is to be secured.
3) Japan, which aims to be a science/technology-oriented country, should nurture and secure a sufficient number of PEs of high quality.
(2) The revised points were as follows:

1) Clarification of duties (occupational ethics) to the society: A PE shall observe the occupational ethics to secure public safety, environmental maintenance and other public interests.

2) Improvement of PE authorization examination: The present system shall be revised drastically to be structured in line with international equality. (Those who pass the first examination will be master engineers, who can apply for secondary examination after acquiring a certain length of practical experience. Only those who pass the secondary examination shall be called PE.)

3) Introduction of CPD: For those who obtain the qualification of PE, CPD shall be provided to keep and improve their capabilities. Also measures such as regular registration of the performance of CPD shall be studied.

4) Introduction of authorization system for those who have foreign engineer qualifications: Measures shall be taken so that those who have foreign engineer qualifications with equality can be PE in Japan.

IV. Systemization of APEC (Asia-Pacific Economic Cooperation) Engineers (APEC Engineer Qualification Mutual Authorization Project)

1. History

In Western countries, mutual authorization of engineer qualification and engineer equality is promoted in order to achieve international interchange of engineers. A registration committee was established in FEANI (European Federation of National Engineering Associations) as a European engineer registration system. In America, an engineer mutual authorization system was established in 1995 by NAFTA (North America Free Trade Agreement).

APEC nations also need such a mutual engineer authorization system. For this purpose, an APEC Engineer qualification mutual authorization project was approved in 1998 and inaugurated in November 2000.

2. Outline of project

The outline of APEC Engineer qualification mutual authorization project is as follows:

(1) Concept of APEC Engineers - 5 necessary requirements

1) complete an accredited or recognised engineering program, or assessed recognised equivalent;
2) be assessed within their own economy as eligible for independent practice;
3) gain a minimum of seven years practical experience since graduation; and
4) spend at least two years in responsible charge of significant engineering work; and
5) maintain their continuing professional development at a satisfactory level.

In addition, all practitioners seeking registration as APEC Engineers must also agree to be:

- bound by the codes of professional conduct established and enforced by their home jurisdiction and by any other jurisdiction within which they practice; and
- held individually accountable for their actions, both through requirements imposed by the licensing or registering body in the jurisdictions in which they work and through legal processes.

(2) Framework of mutual authorization mechanism

1) A Monitoring Committee is to be established in each country to register APEC Engineers.
2) APEC Engineer Coordinating Committee is to be established to coordinate the activities of each nation’s Monitoring Committee.

(3) Fields at present

The applicable fields shall be 9 in total: Civil, Structural, Geotechnical, Environment, Mechanical, Electrical, Industrial, Mining and Chemical. Each country shall register in one or more field at least.
3. Japan’s reaction

Japan has positively participated in the promotion of this project and worked out its framework as a major country of APEC. In January 1999, Japan established cross-departmental communication committee (secretariat: Science and Technology Agency) to deal with this project properly as well as a Monitoring Committee (General affairs: Japan Professional Engineering Association) at the request of governmental departments.

Japan is going to participate in the two fields of Civil and Structural engineering for the time being. In these 2 fields, PEs and 1st-class Architectural Engineer shall be targeted for registration.

V. Conclusion

Japan views engineering education at universities, engineer qualification to be granted in the real world, and CPD of engineers with consistency, as a unified system. This is based on awareness of the need to secure the international integrity of engineers and improve the social position of engineers as well as to position this project as life-long education of engineers.

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Book

Advanced Paddy Field Engineering

“Advanced Paddy Field Engineering” is to present the available information relating to the engineering aspects of recent paddy field development and management in Japan in comprehensive manner.

This book is useful to scientists, engineers and graduate students in rice producing countries for planning the future research and development activities as related to paddy fields.

In spite of the importance of paddy cultivation in most of countries in Asia, not much emphasis has been evident in improving the paddy field system. It may not possible nor necessary to replicate exactly what has been done in Japan, but it is possible to make several improvements to the paddy field systems in most of the countries.

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