

A Study on a Legal Framework of Smart Water Grid

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Abstract

It is high time that state, local government, public institution, company and people should establish a new paradigm in order to overcome water shortage due to global population growth, urbanization and climate change etc. This means that we should establish strategies for water management in a dimension of securing state competitiveness of a dynamic force for new growth as well as prevention of disaster through integrated smart water management, turning away from passive defense strategy to water crisis. Smart Water Management that refers to implement intelligent water information systems by IT convergence is considered a new paradigm. Smart Water Grid (hereinafter “SWG”) is the core of this water management policy. In this paper, we try to study the Smart Water policy, especially SWG, and legislation development trends in major advanced countries such as U.S.A., EU, Singapore, Australia and Japan etc. In the conclusion, we suggest a proposal for structuring a legal framework of SWG in an era of climate change.

Keywords: *Climate Change, Water Management, Water Shortage, Smart Water Grid, Smart Water Management, Integrated Water Management, Multiplex Source of Water, Human Right to Water, Water Management Governance, a legal framework of Smart Water Grid*

1. Introduction

The crisis due to water shortage *etc.*, is, nowadays, the world-wide permanent crisis which all the states in the world. Therefore, one of the most important responsibilities of states and local government is to protect people’s lives, health and properties safe from the hazards derived from water or water disaster. Furthermore, the government must establish a strategy to prevent and protect the water crisis and water problems, which makes the perfect water management.

On the basis of results from the comparative analysis with Smart Grid in power sector, we evaluate legal, economic and technological feasibility related with the Smart Water Grid (hereafter ‘SWG’). Into the bargain, we try to suggest a proposal for structuring a legal framework of SWG in this paper.

It is necessary that related ministries such as Ministry of Environment and Ministry of Land and Transportation *etc.*, local government, public institution, civic organization, company and people should establish a new water management system in which governance system works well based on a bond of sympathy to smart water management.

Concerning other countries abroad, there are various systems for water management. There are countries such as U.S.A. and Japan which maintain several systems for the water management and there are countries such as Great Britain, Germany, France and Singapore which pursue only one system for the water management. We need to make a framework which fits to our circumstance well, with bearing in mind of other countries, among them “Basic Law on Water Circulation of 2014” of Japan.

Why is legislation important in water management? It is because of several reasons as follows: the paradigm of water management has been changed, therefore (i) it is necessary for us to provide water management stably and to secure human rights to water, (ii) it is necessary for us to help global water industry grow well, (iii) it is necessary for us to take a legal measure to prepare for threat against security because of the character of the Smart Grid, (iv) it is necessary for us to prepare for the necessity of the mediation surrounding interest-conflicts of water management, (v) it is not enough to cover these issues, with only the development of the technology or the adjustment of administration or budget, (vi) it is high time for us to prepare for a mechanism of mediation and integration focusing on law.

Concretely, it is necessary for us to revise existing provisions of Acts on Water Management or to make new provisions of Acts on Water Management. These kinds of effort could not be perfect measures for preparing for water shortage due to climate change. Therefore, it is necessary for us to make new and integrated “Smart Water Grid Act”, likewise the “Smart Electricity Web Act”.

The main problem is that tasks of water management are divided into various departments of government such as Ministry of Land, Infrastructure and Transport and Ministry of Environment. Accordingly, there could be contradictions and conflicts between management of water quantity and management of water quality. Also, in the overall view, it is so difficult to coordinate between governmental departments. It is not efficient in that where investment is really required, sufficient investment is not made. For this reason, in the dimension of national government, an establishment of the new SWG system and legislative efforts to support the SWG system are desperately required.

In this paper, we will cover, at first, the concept, background and expectation of the SWG. And then, we will look into water management policies of major countries and current trends of legislation on water management of them. We will cover the establishment of governance collaboration and integration oriented SWG, the framework of Smart Water management, and current situations and problems of existing provisions on Water Management Acts. In the end, we will draw necessity to legislate an integrated Act on SWG to cope with climate crisis.

2. The Concept, Background and Expectation of the Smart Water Grid

2.1. Concept of Smart Water Grid

“Smart Water Grid (SWG)” means the next generation total water management system which combines the state-of-the-art science technology engaged in water production, distribution, management and consumption processes with the information and communications technology, to make the real-time smart integrated water management and share relative information possible, so that it makes the water supply chain stable and efficient [1].

In a nutshell, SWG is a water management system which combines the existing water management system with the information and communication technology, to make it overcome the existing limits. Therefore, it distributes, manages and transports the various sources of water efficiently, so that it can solve the imbalance situations of water resources [2].

2.2. Background of Smart Water Grid

2.2.1. The Action against Climate Change and the Appearance of New Strategy for Integrated Water Resource Management: SWG is very useful to cope with Climate Change and one of Integrated Water Resources Management strategies. Especially, pivotal concept of SWG system is multi water source system. Multi water source system means a

circular water loop system which can take advantage of usable water resources getting out of existing single source of water. This SWG developed into an intelligent multi water source system which uses multi water source based on real-time monitoring. Integrated Water Resources Management means to manage water resources in integrated way which concerns the quantity and the quality of water and the ecosystem and the culture around the zone of the waters for maximizing the efficiency [3].

2.2.2. Pioneering World Water Market through Information and Communications Technology Convergence Technology: SWG is also very useful to pioneer world water market through ICT (information and communications technology) convergence technology. One of the backgrounds to carry SWG is that the ICT fusion technology can be used in the area of the water resources management. Nowadays, between the water manufacturer and the water consumer, the real time management capacity based on ICT is expanding on and on. Also, the consensus to the requirement to pioneer the world water market with the development with SWG gets intensified.

2.3. Expected Effect of Smart Water Grid

SWG is highlighted to the Water Resources Management System for the next generation which overcomes the limitations of the former Water Resources Management System. It is because SWG suggests the new paradigm. At first, it is quite difficult to manage water resources successfully, but there are many strengths of SWG: (i) it is possible to establish a new paradigm in order to overcome water shortage due to global population growth, urbanization and climate change etc. with the introduction of SWG; (ii) it is possible to establish strategies for water management in a dimension of securing state competitiveness of a dynamic force for new growth as well as prevention of disaster with the introduction of SWG; (iii) it is possible to enhance efficiency in production of water and processing of water with the introduction of SWG; and (iv) it is possible to manage water-related facility systematically and preventively with the introduction of SWG [4].

If we should combine top level technology of domestic information and communication with water management technology together, we can create brand value to compete with the world [5].

3. Water Management Policies of Major Countries and their Current Trends of Legislation

3.1. The Policies and Directions of Legislations of Major Countries

The major countries maintain variable water resources management system to take an effective action against the climate change. Countries such as U.S.A. and Japan maintain plural systems for water management. However, it seems not to manage dividedly the tasks on the quantity of water and the tasks on the quality of water. On the other hand, countries such as Netherlands and Singapore pursue one integrated system for water management. Except for the Department of the Environment and Water Resources in Singapore, there is no case which perform the tasks of water resources management in one department.

Each major countries hastes to develop and merchandize the SWG technology and proceeds to construct the integrated and smart water resources management system with the SWG technology. Also, for transforming the society into SWG system and for the smooth and quick market release of the new technology, products and services, the major countries intend to reform the related statutes.

3.2. Current Trends of Legislation of Major Countries

There are current trends of legislation of major countries. Among them, bill on establishment of water resources committee for 21st century was made in 2009 in U.S.A. There are also many state regulations on reuse of water in U.S.A [6]. Basic act on water was made in 2009 in Netherland. This act is an integrated act of eight water-related acts. It is noteworthy that Ministry of Infrastructure and the environment was made in 2010 in Netherlands. Recently, Basic Act on Circulation of Water was made in Japan in 2014. This Act is a kind of an integrated management of water resources.

The legislature of United States of America made task forces for water resources management and the activating research and study in 2009 [7]. In the European Union, the United Kingdom and the Netherlands are remarkable. The UK suggests the Five-Technologies which will be the core of the Water Resources Management in the future. The Netherlands is in progress of legislation for the water resources management and the maneuver against climate change. The typical country in lack of water, Singapore aggressively made strategy for securing of water resources to overcome crisis of water lack [8]. Australia introduced SWG to solve water lack problems in many provinces.

4. Cooperative Structuring of Integration-oriented Smart Water Grid and Governance

4.1. The Integration of the Separated Water Resources Management Function and the Comprehensive Water Resources Management

It is very important to integrate separated water-management function and to make comprehensive water-management. Five major ministries of Korea are in charge of water-management. Ministry of Environment is related to Quality of Water; Ministry of Land and Transportation is related to Quantity of Water. It is very necessary to install an institution to coordinate these conflicting functions in view of comprehensive water-management. It is needed to a make country-wide water management comprehensive maneuver system for preventing the climate change.

4.2. The Formation of the Water Resources Management Governance for the Co-work and Adjustment

The more stakeholders in resource distribution process, the more consensus of the people with participations and information communications in major decisions are needed. Of course, the Government is also one of the stakeholders, and therefore it takes important responsibility to adjust the interests of the participators for governance [9].

5. Necessity for Introducing Legal System of Smart Water Management and Current Laws on Smart Water Grid and its Problems

5.1. Necessity for Introducing Legal System of Smart Water Management

5.1.1. Enhanced Necessity for Stable water Management and Guaranteeing of Water Human Right: For solution of conflicts and co-work on the technology and industry around water resources management, it is necessary that the legislatures which activated by the administrative and political pursuit with the integrated and systemic regulations and adjustments. In July 28th, 2010, the Resolution on ‘the right to water’ in UN General

Assembly is adopted [10]. Therefore, the right to water is accepted as “the indispensable human right to enjoyment of the human life and all the human rights.”

5.1.2. Development on Global Water Industry and Paradigm Shift in Water Management: Due to innovation of water management technology with new fusion technology, demand for new locomotive to growth is rising.

Actually, there is no standard or adoption of the standard in the lower statutes is quite unreasonable when people try to certificate the new fusion technology, instruments, products and services for the smart water resources management system technology, instruments, products and services. Therefore, we need to reform legal framework for successful performance on the SWG.

5.1.3. Enhanced Threat to Security Due to Properties of Smart Water Grid: The increase in usage of bilateral communication technology, the hardware and software, nodes, interconnection between the Smart Grid devices and the Smart Grid instruments dispersed in wide area causes and enhances the threats to security. Smart Water Resources Management is also alike with the Smart Grid. Therefore, the maneuver in the legislative way to collect, use and secure the information.

5.1.4. Enhanced Necessity for Coordination Surrounding Water: The international organizations such as OECD say that the water crisis which many of countries undergo is the “Crisis of Governance,” not only the natural phenomenon, climate change. As far as the legislations on SWG are concerned, those factors should be considered enough.

5.2. Current Laws on Smart Water Grid and its Problems

In a nutshell, there is no current law on smart water grid. Problems of current laws on water management grid are separated legal system in view of ministry and its function. Details of Korean acts on water resources management are in following Table 1.

Table 1. Table of Korean Acts on Water Resources Management

Fields	Name of Act	Functions	Department in charge
Management on quantity of water	「River Act」	To increase profits by using rivers	Ministry of Land, Infrastructure and Transport
	「The Act on construction of Dams and Assistance etc. to Neighborhood Area」	To construct dams, manage them, utilize the construct costs	Ministry of Land, Infrastructure and Transport
	「Ground Water Act」	To develop and utilize ground water adequately	Ministry of Land, Infrastructure and Transport

	「Water Supply and Waterworks Installation Act」	To regulate standards for installing and managing water pipe	Ministry of Land, Infrastructure and Transport, Ministry of Environment
	「Drinking Water Management Act」	To develop drinking water	Ministry of Environment
	「Promotion of and Support for Water Reuse Act」	To reuse the sewages into pure water	Ministry of Environment
	「Rearrangement of Agricultural and Fishing Villages Act」	To develop water for agricultural and fishing villages	Ministry of Agriculture, Food and Rural Affairs
	「Small River Maintenance Act」	To maintain and manage small rivers	Ministry of Security and Public administration
Management on quantity and environment of water	「Framework Act on Environmental Policy」	To stipulate rights and duties on maintaining environment of people	Ministry of Environment
	「Water Quality and Aquatic Ecosystem Conservation Act」	To prevent foreseeing damage on people's health and environment by water contamination	Ministry of Environment
	「Water Quality Conservation Act」	To certify standard of water quality	Ministry of Environment
	「Water Supply and Waterworks Installation Act」	To construct and manage the water supply in wide-area	Ministry of Land, Infrastructure and Transport, Ministry of Environment
	「Drinking Water Management Act」	To set a standard of drinking water	Ministry of Environment
	「Promotion of and Support for Water Reuse Act」	To reuse the sewages into pure water	Ministry of Environment
	「Sewerage Act」	To install and manage the terminal disposal plant of sewage	Ministry of Environment

	「Enforcement Decree of the Act on the Disposal of Sewage, Excreta and Livestock Wastewater」	To manage sewage in suburban	Ministry of Environment
	「Sewerage Act」	To regulate standards for installing and managing sewage pipe	Ministry of Environment
	「Promotion of and Support for Water Reuse Act」	To reuse the sewages into pure water	Ministry of Environment
Prevention against disaster	「Countermeasures against Natural Disasters Act」	To protect people infrastructures and from the natural disasters	Ministry of Security and Public administration
	「Act on the Prevention of and Countermeasures against Agricultural and Fishery Disasters」	To prevent disasters to Agricultural and fishery village	Ministry of Agriculture, Food and Rural Affairs
	「Small River Maintenance Act」	To maintain and manage small rivers	Ministry of Security and Public administration

5.3. Problem of Legislation Related to Water Management and Necessity of Revision

Problem of legislation related to water management are, in view of the lack of fusion legislations, maintenance of departmental and functional separated legal framework.

In this legal framework, it is too difficult to make consistent water management policies, and, therefore, it does not fit under Smart Integrated Water Resources Management, the new circumstance to manage water.

At present, it reaches the limit to secure water resource using traditional water resource such as dam or river. Accordingly, every country tries to find sustainable means to replace it. Among sustainable means, there is wastewater reuse, use of underground water, seawater desalination and direct potable reuse .It is necessary to revise water management related laws to reflect these means.

5.4. Current Laws on Smart Water Grid and its Problems

Concerning with all the former factors, the areas should be divided into two parts: (i) one for the government; (ii) and the other for the private. Hence, the governmental road map [11] including long-term funding plans and improvement of the legal framework should follow the road map.

6. Necessity for Making an Integrated Law on Smart Water Grid and its Direction

6.1. Necessity for Making an Integrated Law on Smart Water Grid

The government should make new provisions of Acts on Water Management. But there are limits in these kinds of revisions. Therefore, it is necessary for us to make a new and integrated “Smart Water Grid Act.”

It is because there is no ground regulations on the SWG, as well as current individual regulations are not legislated in view of the Smart Integrated Water Resources Management, but in view of the stake holding departments. Therefore, it can be meaningless by improving all the individual regulations only in part, not in whole.

Furthermore, for systemic confirmation of the governance system and the co-work on the businesses around SWG, the legislation is indispensable.

6.2. Direction of an Integrated Law on Smart Water Grid

An integrated smart water grid law should refer to existing water-related laws including “Smart Electricity Web Act” but it should also contain water-management properties. An integrated smart water grid law should also contain basic principles on water management, clarification of the right of use of water, pioneering of multiple water resources.

7. Conclusion

There are many water-related problems which relate to water shortage etc. because of climate change. Therefore, “water” has become indispensable to a human being in the international society, in view of the resolution on human right to water of UN.

There is emerging a smart water management system which increases efficiency of water resources utilization as a result of development of Information and Communication Technology. That is SWG, which is the Smart Grid strategy on water management field. SWG can solve the problems derived from water scarcity, water crisis and climate change and, also, develop industry on water which can pioneer a new water market.

One of the major features of SWG is an integrated Smart water management, by which integrate dispersed functions of water management. In addition, SWG is based on the water management governance which integrates all the subjects in the water management. Especially, with appearance of “water loop system based on multi water resources,” which is the most important feature of SWG, not only one department of a local government or a government but also many other major agents can utilize multiple water resources to constitute a circulative water loop system.

Though, considering Korea’s present conditions, there are many water management agents, – such as Ministry of Environment, Ministry of Land, Infrastructure and Transport, lots of local governments, the Water Resources Corporation, the stake- holders, many private companies and people – a lot of related tasks are dispersed. Accordingly, efficiency of water management and its connectivity seem to be quite poor.

For the one more thing, when it comes to entering full-scale integrated water management, it seems that value of water will increase, therefore, problems between inter-local, inter-personal and state-company-private person on water rights will occur even more frequently.

Therefore, the government should develop the SWG system to efficient water utilization and solve conflicts around water. It is high time to revise existing individual Acts or to make a new Act for better water management. Furthermore, the legislature should take it into

account to enact a new integrated act on SWG as a center. Especially, in the overview, it should be legislated that the framework which enhances efficiency of water management and adjusts some rights around the water resources in an anticipated way.

One of the most important things is to establish a new law and to supplement to existing laws on SWG for solving foreseeing or existing problems which have occurring around new technologies on SWG in the administrative and financial view. Also, there are many main agents who are involved in developing of SWG technology; accordingly, it is necessary to prepare for long-term road map so as to coordinate entangled interests with one another. Considering these things, it is necessary to make an integrated legislation on SWG.

“Act on Rivers,” “Act on Underground Water,” “Act on the Water Supplement” and “the Act for the limitation on the Taxation Privilege” stipulate the water management clauses relating SWG. Nonetheless, the legislation should make those acts more effective and related one other, with bearing in mind of essence of SWG and direction of development of SWG.

When it comes to making new integrated law for Smart Water Grid, we should include following considerations, that is, excavation of multiple water resources and its systematic cooperation and management, solution of conflicts on water management including water rights, basic principles and major legal means and solutions for establishing a new governance, promotion of water industry through new fusion technology on water management. That is to say, with enacting an effective and basic law for an integrated Smart Water Grid, it is necessary to revise exiting laws on water management in accord with an integrated Smart Water Grid.

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