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[USING LAND READJUSTMENT  
(LR) TO PROTECT LANDS  
AGAINST URBAN SPRAWL: THE  
CASE OF TWENTIETH-CENTURY  
JAPAN]

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## **Using Land Readjustment (LR) to protect lands against urban sprawl: the case of twentieth-century Japan**

### **SECTION 1: INTRODUCTION**

Finding the optimum relationship between density of population and landscape is a key concept in urban architecture. The consequences of a faulty relationship between these two elements are enormous pressures on people's quality of life, the inefficient use of social resources and a negative impact on the welfare of future generations. The relationship of humans to their living spaces can be compared to with animals' living spaces. For instance, we could use the correlation between fish and a tank as a parable, the question being whether it is possible to put many fish in a normal size tank without regard to the size of the fish and the size of the tank.

Some research shows that by 2075 the global population will reach 9.22 billion people (United Nations, 2004). This puts pressure on the scientific community and politicians to find a balance between density and landscape. It is obvious that in terms of population and urban landscape it can be difficult for people to live without any well-organized design scale in urban design. As a matter of fact, sprawling is a possible consequence of growth without organization in the landscape. Sprawl is the phenomenon of unrestrained development in the landscape that leapfrogs development and is low density. This phenomenon is harmful for a city as developers choose to build structures on less expensive land, far away from metropolitan and urban areas, meaning that the city does not develop harmoniously (Cahn, 2003, p5; Holcombe, 1999, p3).

In terms of sprawling and leapfrogging development, recent research shows that the economic cost of development without well-organized growth and with low density is much higher than the cost of cautious planning with high density. This is due to the fact that low density on the one hand can affect the cost of public transportation and on the other hand, can take up unreasonable amounts of land (Peiser, 1989).

This paper is based on the concept of Land Readjustment (LR) as developed in Japan in the twentieth century with regard to analysis of sprawl. The LR concept can help to find ways to ameliorate sprawl. In addition, LR forces a group of land proprietors to develop or redevelop land and change the irregular plots of agricultural land into urban plots (Sorensen, 1999a).

In the middle of the nineteenth century Western planning ideas based on garden cities had an influence on Japan's concept of LR (Sorensen, 2002). In Britain, Sir Ebenezer Howard published a work on the garden city and urban reform of the countryside in 1902, which heavily influenced the Japanese concept of land reform (Sorensen, 2002, p137). At the beginning of twentieth century Japan began working on a significant method of urban design called LR. Although nowadays this method is relatively unknown, LR has been used in urban design up until the present day. This technique is one of a few significant ideas about urban planning in Japan, connected to the idea of *Toshi Keikaku no Haha* - 'The Mother of City Planning'. Today, this method is used in countries such as Germany, Sweden, Taiwan and Korea (Sorensen, 2002). Consequently, this research has two sections. The first section will focus on the history of LR in Japan and how it works in the urban landscape, and the second section will analyse the Fujisawa sustainable Smart Town as an important example of LR in Japan.

## SECTION 2: HISTORICAL ANALYSIS OF LAND READJUSTMENT

### SECTION 2.1: CONCEPT OF LAND READJUSTMENT

In the case of sprawl in urban design, the LR phenomenon needs to be managed in different ways. It can provide one way of managing sprawl, because managing the agricultural landscape has an impact on the fringe of a growing city. In terms of the fringe in land development, Japan provides a utilitarian perspective for controlling an urban fringe which is far away from the city. For instance, the archetypal application of LR is to organize the new urban land which is far away from the city. LR is a beneficial method that groups together land owners and forces them to develop land in a well-designed plan (Sorensen, 1999a). The LR technique is a successful method in Japan; approximately one-third of all

urban areas are managed using this approach. At the end of the 1960s, 3000ha of land per year was being developed using the LR method and this process continued until 1994 when it covered 3032km<sup>2</sup> of land in Japan. For this reason, this successful method has also been transferred to many Asian countries (Suprianta, 2011; Turk, 2007, p53).

## SECTION 2.2: LR IN JAPAN

LR in Japan is closely connected to the influence of Western ideas on urban design in the nineteenth century. From 1871 to 1873, some Western planning ideas were introduced to Japan. Japanese urban designers were affected by foreign ideas from neighbouring colonial states and Japanese planners' experiences of living in Western countries. For example, Japanese urban designers learned of the transformation of France's capital from being a dirty medieval environment with small streets to a modern urban city with tree-lined boulevards (Fieve and Waley, 2003). In 1935, LR came to light and became well-known through Japan's main architecture magazine which published an article titled '*Kukaku seiri wa toshi kei tochi kaihatsu no kagi*' (LR is the mother of city planning and the main point of land development) (Fieve and Waley, 2003).

Japan started to use the LR method in landscape design in the early twentieth century, due to two catastrophes; the first one being a massive earthquake in 1923 and the second one being the devastation of the Japanese cities after World War Two (Larsson, 1997). Another reason for the increase in its popularity can be found in the population growth which dramatically increased by more than 40% from 1955 and 1965 (Guller, 2005). LR became law in 1954 and was used as the urban design process for the post-war reconstruction (Guller, 2005).

## SECTION 2.3: ORIGINAL IDEA

At the beginning of the twentieth century, Germany used LR as a legal requirement in urban development plans. Franz Adickes, the Lord Mayor of the city of Frankfurt am Main, introduced the law in 1902, making LR a legal requirement in Germany, which was then amended and called '*Lex Adickes*' (Muller – Jokel, 2004).

Since the late nineteenth century, two main arguments have dominated around discussions on landscape in urban design. Firstly, Raymond Unwin (1863-1940) introduced the need for managing new urban areas to achieve good urban design and to create a high quality urban environment. The second argument was presented by Sir Ebenezer Howard (1850-1928) and Augustus Andrewes Uthwatt (1879-1949) who focused on intervening in land ownership. According to the second argument the value of land should not accrue solely to land owners or developers, but by government intervention via urban planning. This intervention would support the community and create public places by introducing some beneficial plans for residents, such as parks, roads or schools by new developers (Sorensen, 1999a). The next section will explain in more detail the effect of the Uthwatt Report in LR.

#### SECTION 2.4: UTHWATT REPORT AND LR

The Uthwatt Report (1942) takes the name of Augustus Andrewes Uthwatt (1879-1949), who was the chairman of the government Committee on Compensation and Betterment set up in Britain. This committee had the aim of setting the principles for the rebuilding of the cities destroyed in the Second World War. The report introduced the planning of the land development and use of the urban fringe. To do this, the report brought two key concepts: shifting land value and floating land value in urban design (Moore, 2005, p3; Monson, Monson, 1949, p176). The idea of shifting value comes from the area of planning control when modifying the land use in one area. After redistribution of the land the value of some land increases whilst the value of other land decreases. Therefore, there is a need to balance the differential value that occurs with development. For this reason the land authority uses a system of compensations for restrictions on development in other areas. The idea of floating value is based on the potential value of land without considering the effect of development in the surrounding land or in other areas. The value of the land is based on the expectation of future development only (Moore, 2005, p3).

#### SECTION 3: HISTORY OF THE GARDEN CITY MOVEMENT IN JAPAN

Sir Ebenezer Howard, founder of the garden city movement in Britain, published the book *Garden Cities of Tomorrow* in 1902. In this book he introduced a new method of urban design by utilizing surrounding rural areas to restrict urban growth. This also prevented sprawling and other problems of city development. The garden city movement took the above idea in an attempt to relieve the congestion of big cities, focusing on the reconstruction of suburban areas to prevent rural retreat. The movement also sought to integrate the above ideas as a foundation for a better urban life (Howard, 1946, p35; Yokohari, Takeuchi, Watanabe, Yokota, 2000, p170). In 1907 the translation of Howard's books into Japanese promoted wild debate amongst those who were interested in managing urban design in Japanese society. The translation of Howard's book was called *Den en Toshi* which means 'Garden City'. The garden city concept in Britain influenced the Japanese garden city, but despite having similar names, the two garden city concepts were slightly different. The basic idea of garden city is independent of the development of the metropolis and is connected to creating a better environment for the people in the city. For instance, the concept is applied to community ownership of land as the protective green belt would allow affordable housing and improvements in social welfare. However, *Den en Toshi* in Japan is based on the concept of LR instead (Sorensen, 2002, p137).

### SECTION 3.1: THE GARDEN CITY MOVEMENT AND LR

One of the main differences between the garden city movement and LR comes from the idea of using agricultural land. The garden city movement prevents sprawling by using the 'green belt' concept, surrounding the city to control the urban size. Therefore, the garden city uses a method of development of urban areas by restricting the use of agricultural land. However, this method although it reduces sprawling, it does not impede it. LR, however, is quite different from the concept of the garden city in that with LR the best way of preventing sprawling is to manage and divide agricultural land into well-organized urban plots. LR could be an effective complementary method used to prevent sprawling.

### SECTION 4: LAND READJUSTMENT AND TECHNICAL ISSUES

The description of the method of LR needs to consider its meaning in the urban design context. LR means forcing a group of land owners to develop or redevelop land and changing the irregular plots of agricultural land into urban plots (Sorensen 1999a). The process forces and encourages each land owner to provide a proportion of their previous land holding, approximately 30% of the total land, to be used in a practical way, e.g., building roads, rail networks, parks and other public places. This action means land use is planned in a different way, while also being beneficial for each land owner. In addition, because there is less leftover land than there would have been before this planning, the value of the remaining land increases dramatically through this process. After exploiting the provided land, the owners of the LR project can sell the remaining parts of the unused land at the end of the scheme; the income of the sales can also be used to pay for the cost of planning and construction of the project. The above is illustrated in Figure 1 (Sorensen 1999b).

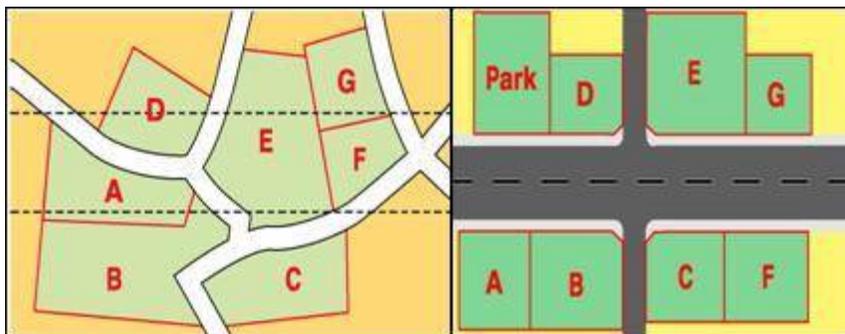


Figure 1. Practical action of LR showing how it can be used to divide land into a well-organized site plan. (Photograph by the official site of Town and Country Planning Department, Peninsular Malaysia, 2006)

As can be seen in Figure 2, LR is used to restructure an urban landscape to provide the community with high density connecting public roads.

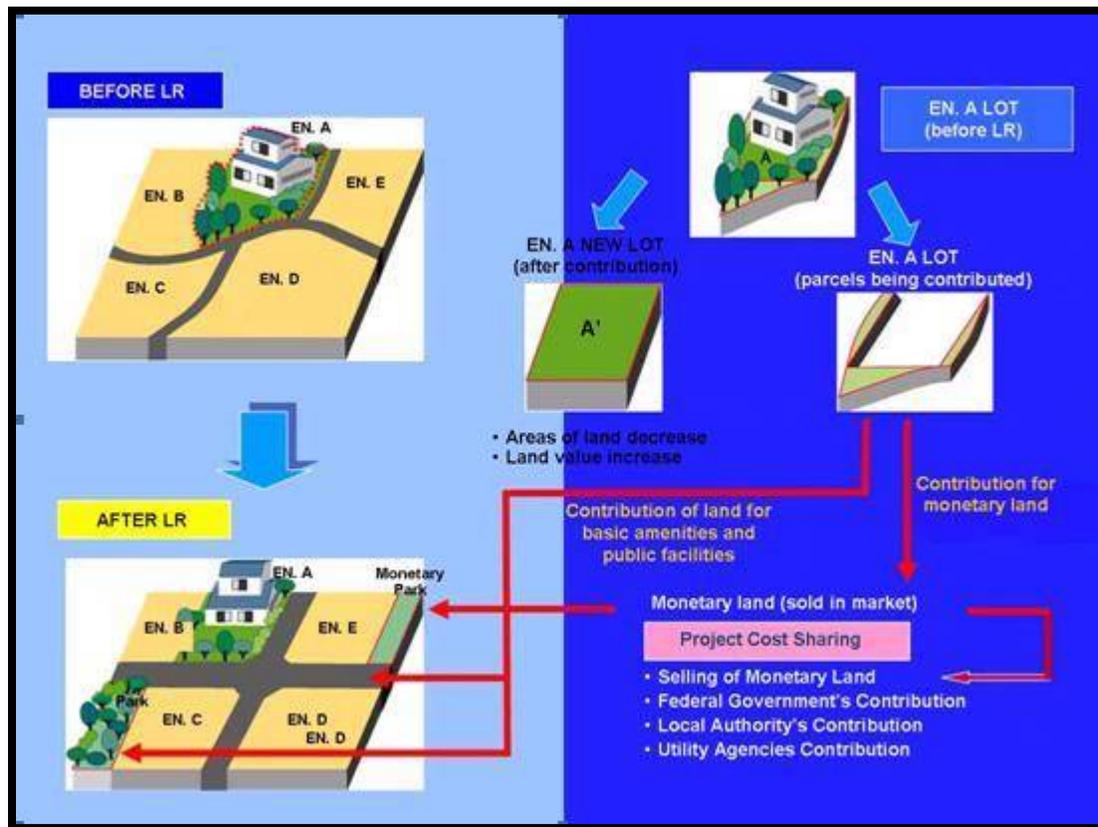


Figure 2. An example of using LR for modelling a site plan. The figure shows practical ways of using the LR technique to plan roads, parks and monetary land. Monetary land refers to the newly divided plots of land that acquire market value due to LR, in this way LR can achieve a balance of benefits for the owners and developers at the end of the project (poster by Supriatna, 2011)

#### SECTION 4.1: CHARACTERISTICS OF LAND READJUSTMENT

LR has five main characteristics. The first is LR is a comprehensive tool to design and execute urban development. For example, it allows the construction of urban facilities in residential areas, such as parks, utilities and infrastructure, and permits dividing land into lots in a scheme zone. Also, LR can provide a flexible method to grade and size land (Balla, 2005).

Secondly, LR allows a fair allocation of the benefits and costs of the project. LR can play a significant role in urban design as a safe financing tool for each land owner. As each land owner can access the urban facility in the same way, the benefits are also fairly distributed among them (Balla, 2005).

Thirdly, LR preserves the land titles during and after the project. The new plots of lands are divided among their owners - consent is given as an alternative to expropriation or sale. LR is therefore a win-win situation (Supriatna, 2011).

Fourthly, an LR scheme is a democratic system that reflects the division of land in a logical way (Balla, 2005).

Fifthly, LR ensures transparency in the project. For example, general meetings of property owners are undertaken. In the implementation, an advisory council of representatives of land owners is constituted in the local administration in order to follow the procedures (Supriatna, 2011). The above is illustrated in Figure 3.

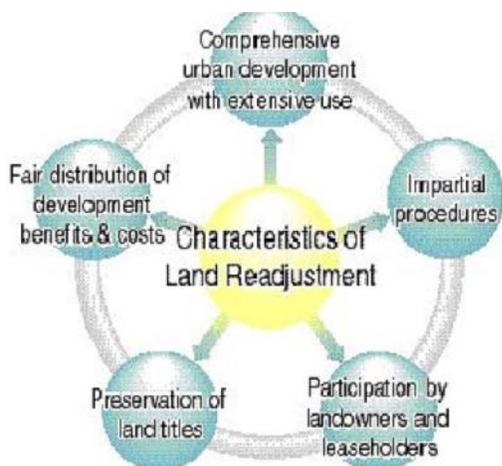


Figure 3. Characteristics of land readjustment. (Photograph by Japan Ministry of Construction, 1997)

#### SECTION 4.2: REDUCED CO2 WITH LAND READJUSTMENT AT HYOGO DISTRICT IN JAPAN

Hyogo district in Japan is one of the most important examples of how urban design and LR in particular has been used successfully to reduce CO2 emissions. Hyogo district is located in the eastern part of the Saga region in Japan. This district was completely redeveloped using LR in 1988. That redevelopment covered 4100 residents and the investment plan totalled 11.2 billion Yen (approximately £86 million) to develop 66.7 hectares (Jian,Jiang,Hokao, 2003, p705) (Figure 4).

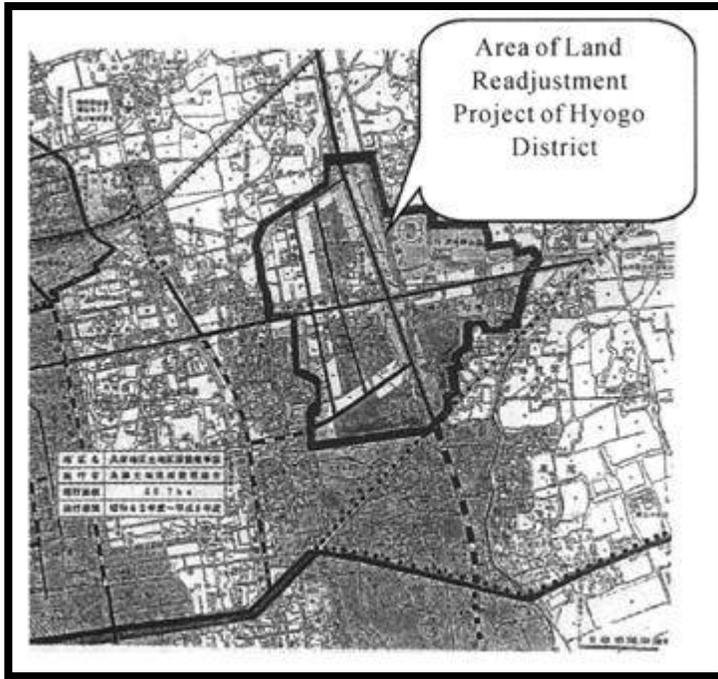


Figure 4. LR and the location of the Hyogo district. Photograph by (Jian,Jiang,Hokao, 2003)

Research on the Hyogo district between 1988 and 1999 shows that LR has increased the open green spaces to 33000 m<sup>2</sup>. LR has created four district parks and two neighbourhood parks with 516 newly planted trees (Jian,Jiang,Hokao, 2003, p708). The absorption of CO<sub>2</sub> by these trees has been calculated to be 11138 t-c during the 12 years. In addition, the development reduced an extra 21.6% CO<sub>2</sub> over this period of time. This shows that LR can not only play a role as a tool for reorganizing urban areas, but can also assist in reducing the size of the carbon footprints of cities (Figure 5) (Jian,Jiang,Hokao, 2003, p708).

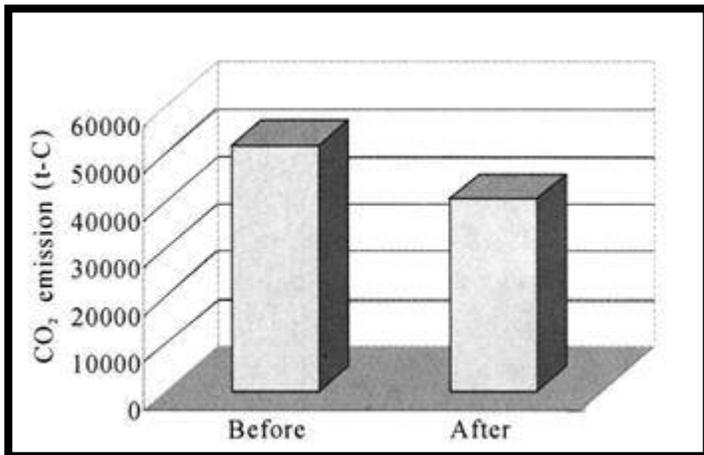


Figure 5: Hyogo district and carbon ambition over 12 years. Table by (Jian,Jiang,Hokao, 2003)

## SECTION 5: KEY EXAMPLE IN JAPAN (FUJISAWA-2014)

After the 2011 Fukushima nuclear disaster (Japan, March, 2011) (Brook, 2011), Japanese urban developers have tried to use ecological systems to introduce future technology, such as renewable energy, into urban design (Michler, 2011). This is the case with the Fujisawa project 50km west of Tokyo. It is proposed to use Panasonic's "entire solutions" technology. This is a method to increase urban residences, making them more energy independent than in present urban towns. This development uses the LR approach as an important part of the design - called the Fujisawa Sustainable Smart Town. The Smart Town is an urban development that is sustainable. The idea of sustainability in the Fujisawa project comes from the analyses of energy consumption of individual structures in urban design. According to Umeda (professor of the Department of Mechanical Engineering at Osaka University)<sup>1</sup> constructions consume around 40 percent of the world's energy and by helping to reduce the energy consumption of each building in the urban design project, the overall effect is that the idea of sustainability becomes an area in urban design (Umeda, 2012,p4).

### SECTION5.1: ORGANIZATION, ROLES AND RESPONSIBILITIES OF DIFFERENT COMPANIES IN THE FUJISAWA SUSTAINABLE SMART TOWN

According to Panasonic's official website as the owner of the Fujisawa Sustainable Smart Town, this project brings together the cooperation of other eight private Japanese companies, Accenture, Mitsui & Co., Ltd, Mitsui Fudosan Co., Ltd. / Mitsui Fudosan Residential Co., Ltd, Nihon Sekkei, Inc, Orix Corporation, PanaHome Corporation, Sumitomo Trust & Banking Co., Ltd and Tokyo Gas Co., Ltd. Each company has a different role in this project (Panasonic, 2011) (Figure 6).

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<sup>1</sup> Professor Umeda has written the first academic book on Panasonic's project in Fujisawa.

Partner company	Responsibility
<b>Accenture</b>	<p>Designs and promotes the service model.</p> <p>This includes the creation of the concept of Smart Town in the project.</p> <p>Provides marketing and the overseas expansion.</p>
<b>Mitsui &amp; Co., Ltd.</b>	<p>Develops the city block and builds structures with a global perspective.</p> <p>Designs energy management services for the project.</p>
<b>Mitsui Fudosan Co., Ltd. / Mitsui Fudosan Residential Co., Ltd.</b>	<p>Develops the infrastructure of the project using the Land Readjustment method.</p> <p>Deals with the sales of residential home lots.</p> <p>Modernizes the plan, the design and the roles of buildings.</p> <p>Builds up the frameworks for the operation and maintenance of the town.</p>
<b>Nihon Sekkei, Inc.</b>	<p>Creates the plan for new energy devices and the corresponding space design.</p> <p>Proposes a landscape design.</p> <p>Formulates town guidelines.</p>
<b>Orix Corporation</b>	<p>Considers the value of the town with the provision of an eco-conscious, and safe lifestyle programme.</p>

	<p>Invents a low carbon footprint city through mobility sharing. For example, using the next generation car concept for the community.</p>
<p><b>PanaHome Corporation</b></p>	<p>Develops the infrastructure using the Land Readjustment method.</p> <p>Deals with the sales of residential home lots.</p> <p>Formulates the planning and the design of the buildings.</p> <p>Creates a framework for the service business.</p>
<p><b>Sumitomo Trust &amp; Banking Co., Ltd.</b></p>	<p>— Designs the Smart Town’s evaluation indicators.</p> <p>Designs and plans for an environmentally conscious site plan.</p> <p>Manages and supports an eco-conscious, comfortable environment for the inhabitants.</p> <p>Handles financing programmes such as leasing.</p>
<p><b>Tokyo Gas Co., Ltd.</b></p>	<p>Brings a household fuel cell system to project.</p>

	<p>Deals with the idea of “ecologically- sound” and comfortable living space.</p> <p>Promotes energy networks.</p>
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Figure 6. Details of the responsibilities of different companies in the Fujisawa Sustainable Smart Town (extract from Panasonic Report 2011 with the author’s adaptations)

**SECTION 5.2: DETAILS AND LOCATION OF THE PROJECT**

The scheme will be constructed on a former Panasonic plant site in the Fujisawa region located 45km south of Tokyo (Umeda, 2012,p2). The project contains 1,000 residences and represents one of the world’s biggest eco-conscious initiatives. The investment plan is 60 billion Yen (approximately £466 million) to develop 190,000m<sup>2</sup> of land (Kimura and Sato, 2011; Umeda, 2012,p3). It will be completed for Panasonic’s one hundredth anniversary in 2018 (Nusca, 2011; Umeda, 2012,p3). Fujisawa is based on two concepts: the first is the LR method with emphasis on an ecological and green lifestyle. The second is the ecological concept of using solar energy power as eco-technology for a new living environment. The city is to be replicable across the globe, employing consolidated power technologies on a colossal scale (Michler, 2011). The Fujisawa plan uses LR as a practical technique to divide the 19 hectares of land for the project (Figure 7).



Figure 7. Urban fabric and site plan of Fujisawa (2014). (Photograph by Michler, 2011)

The Fujisawa plan also combines LR with the purpose of inspiring an eco-friendly green ideology. This can be appreciated in Figure 8 as the streets of the plan lead to a green central area for the community.



Figure 8. Combination of a green line concept with the LR method as a new idea of living environments in the city. (Photograph by Michler, 2011)

In the plan the LR method is used to divide the land into a logical scale size with a parallel line street design. This is to provide easy access for vehicles and people, as illustrated in Figure 9.



Figure 9. Spacious streets in between houses provide access for vehicles and people. (Photograph by Yoneda, 2011)

### SECTION 5.3: GREEN INNOVATION MOVEMENT AND ENERGY SOLUTION

The Fujisawa Sustainable Smart project brought the idea of green innovation (called the 'green plan') as the individual buildings included several practical energy conservation initiatives such as CO<sub>2</sub> reduction, resources recycling, saving water, reducing the effect of chemical substances and protecting biodiversity (Umeda, 2012, p1) (Figure10). Figure 10 shows the green plan initiative in more detail. The use of solar panels is one example of eco-technology in this project that has a direct effect on CO<sub>2</sub> emissions. However, the use of eco-technology has an aesthetic purpose too, that is to make the buildings look in harmony with one another. For example, Figure 11 shows solar panels on the roofs of all buildings. They are integrated as a potential space with aesthetic value.

In the site plan, the residences use roof solar panels, cutting CO2 emissions by 70%. The 1990 baseline of the project also aims to decrease household water consumption by 30%. It also creates energy by harnessing wind power which is integrated with all other alternative forms of renewal energy into a green network (Michler, 2011).

<b>CO2 Reduction</b>	<b>Reduce net CO2 emissions peak</b>
<b>Resources recycling</b>	<b>Follow recycling-oriented manufacturing to make a best use of resources.</b>
<b>Saving water</b>	<b>Minimize the amount of net water used in each construction.</b>
<b>Reduce the effects of chemical substances</b>	<b>Minimize environmental impact caused by chemical substances.</b>
<b>Protect biodiversity</b>	<b>Identify impact of biodiversity and contribute to preservation</b>

Figure 10. Concept of 'green plan' and aims of the Fujisawa Sustainable Smart project. (Extract from Umeda 2012 with the author's adaptations)



Figure 11. Solar panels on the roofs of all buildings. (Photograph by Yoneda, 2011)



Figure 12. Overview of the Fujisawa project showing a sustainable ecological town. (Photograph by Yoneda, 2011)

In the project, LR is used as a tool to create the Fujisawa Sustainable Smart Town and also as a tool to create a green landscape. LR is therefore used to achieve a Utopian concept of an ecological city (Figure 12). The Fujisawa Sustainable Smart Town shows a diversity of ideas. This can be appreciated by the different layers of conceptual intellection, reflected in the urban design project. For example, on the one hand, it combines a network of information with a smart energy gateway (SEG) as illustrated in Figure 13. This is the first layer. On the other hand, it also combines a network of energy with the SEG in the layer below the intermediate layer in Figure 13, then integrates two layers to present one project, embodying the aspirations of a future city.

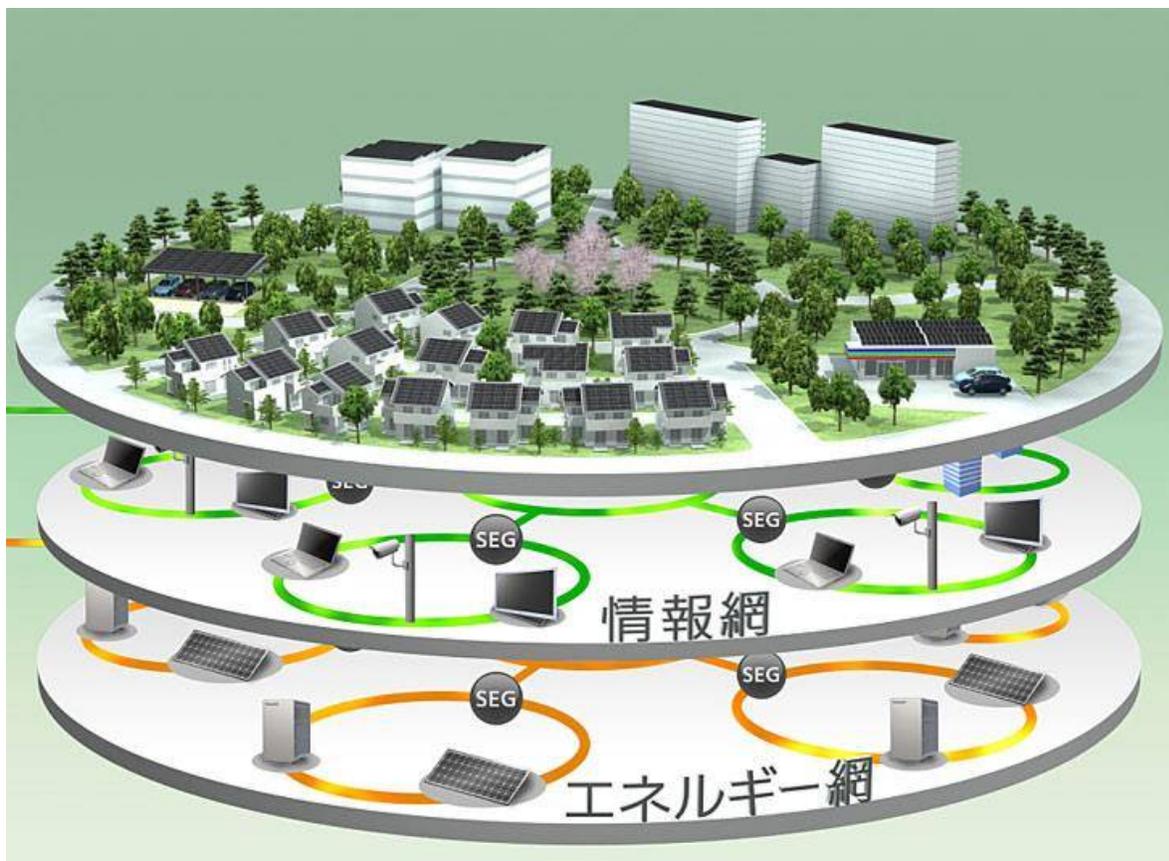


Figure 13. The three layers of the Fujisawa project. The vertical layers form the main concept of the project. (Photograph by Yoneda, 2011)

## SECTION 6: CONCLUSION

Preventing urban sprawl is one of the most important aims of contemporary urban design as preserving the countryside is significant for future generations. In terms of population growth, designing the land in advance can help to prevent sprawling in the future. LR is one of the most successful methods used to help cities avoid sprawling and this phenomenon can also reduce CO2 emissions over the long-term. For this reason, LR is an urban design tool that can be used for modern ecological purposes as illustrated by the Fujisawa project in Japan. The project demonstrates that LR can be used not only for dividing and reorganizing land, but also for high technology in urban areas, as well as in implementing green policies.

LR is an urban design tool which creates a useful method for urban planning and preventing sprawl. For this reason it can be concluded that precision in LR is always vital. The best course of action should be to achieve a balance amid the necessities of LR on the one hand and liveable space entitlements on the other.

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