MATERIAL CYCLES and WASTE MANAGEMENT RESEARCH

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Abstracts

【Special Issues: Regional Circular and Ecological Sphere and Material Cycles】

1. Policy Development in the Regional Circular and Ecological Sphere (Regional-CES)

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Abstract

The Ministry of the Environment, Japan (MOEJ) is promoting the creation of the Regional Circular and Ecological Sphere (Regional-CES). The concept behind the Regional-CES is that of a sustainable, independent, and decentralized society as articulated in the 5th Basic Environmental Plan, which the Cabinet committed to in 2018. The Regional-CES works like a business or public utility, whereby each region utilizes the local resources available to it directly on the ground in order to improve the environment, economy, and society at large. The Regional-CES concept is incorporated into all aspects of the social system. For example, cities and rural areas will form intricate networks that support one another by utilizing their own independent resources, ultimately making the most of each region's specific individuality. This paper is an overview of policies related to Regional-CES: It presents the basic concepts surrounding Regional-CES, possible approaches based on the SDGs concept such as collaboration and backcasting, efforts of the MOEJ to establish Regional-CES, and also includes an introduction of measures being taken by MOEJ to achieve Regional-CES.

Keywords: Regional Circular and Ecological Sphere (Regional-CES), carbon free society, circular economy, SDGs, Regional revitalization

2. Efforts by Odawara City to Realize a Zero Carbon Society and Regional Circular and Ecological Sphere (Regional-CES)

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Abstract

Odawara City, in Japan, is making efforts to realize a zero-carbon society by promoting the use of renewable energy, which is one of its local resources. One such effort includes an initiative by local companies in Odawara to build a system for supplying locally-produced electricity. In order to enable the mass introduction of renewable energy in the future, Odawara is working toward more sophisticated, area-based energy management that combines a variety of storage batteries. The city is also cooperating with a project to establish technology that separates and recovers carbon dioxide emitted from a cleaning plant to produce methane. This is currently being demonstrated on a commercial scale.

Consistently emphasizing public-private partnerships, with a sense of independence and speed, Odawara is expanding collaborations between advanced technologies outside the region and companies within the region. Local production for local consumption of energy not only improves the economic cycle in the region, but also builds a mechanism that leads to the circulation of funds. This can then contribute to other regional activities and development. Lastly, energy management can contribute to the construction of Regional Circular and Ecological Sphere (Regional-CES) by also strengthening regional transportation and resilience.

Keywords: Distributed Energy Resources (DER), Energy Management System (EMS), Electric Vehicles (EV), regional economic cycle, Carbon dioxide Capture, Utilization and Storage (CCUS)

3. Towards the Development of a Regional CES within a Virtuous Regional Economic Cycle

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Abstract

In response to the announcement of a net-zero emissions target by 2050, decarbonization efforts have been widely accelerated through industrial and socioeconomic activities. In order to achieve this goal and simultaneously realize a resilient and sustainable society without hampering socioeconomic activities, Japan's Ministry of the Environment has proposed its Integrated Improvements on Environment, Economy and Society (II2ES) approach, along with the creation of the Regional Circular and Ecological Sphere (Regional CES). The concept of Regional CES emphasizes the importance of creating a virtuous regional economic cyclec which is consistent with the government's regional revitalization strategy. If it is appropriately managed by local firms utilizing local capital, human resources, and natural resources, the introduction of renewable energy can be an effective means of supporting the establishment of a Regional CES and achieving II2ES. In this paper, the regional initiative to achieve II2ES is also introduced, which covers health care business from the profits in local renewable energy business.

Keywords: regional economic cycle analysis, Regional Circular and Ecological Sphere (Regional CES), Zero Carbon City

4. Circulation Technology Supporting a Regional Circular and Ecological Sphere: The Efforts of Saga City

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Abstract

Saga City was certified as a biomass industry city in 2014 (Heisei 26). The future vision it aims for is to establish a town where waste circulates while creating value as energy and resources. Saga City Sewage Purification Centre provides such services as: power generation from digestion gas, fertilizer production from sludge, discharge of treated water with adjusted nitrogen content, separation and recovery of carbon dioxide from fermented biogas. Saga City Waste Incineration Plant conducts such operations as: utilization of waste heat from incineration, power generation by steam turbine, fuel refining from waste cooking oil, separation and recovery of carbon dioxide from exhaust gas. By treating the waste discharged from each facility as a resource, we carry out what is called “Saga City Whole Resource Recycling”, which focuses on the promotion of a recycling society in which the economy and the environment are compatible in a non-wasteful, more natural manner.

Keywords: Saga City, Regional Circular and Ecological Sphere, biomass industrial city, carbon dioxide, resource recycling

5. Development of Heat Transport Technology using Chemical Heat Storage Leading up to Creation of a Regional Circular and Ecological Sphere

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Abstract

We are developing a technology for heat transport using chemical heat storage. With this technology, we aim to contribute to the reduction of CO_2 emissions throughout the entire region by enabling utilization of heat for this area. For materials, we are searching for additives that will improve the reaction rate and reduce the heat storage reaction temperature. They should also be able to evaluate durability and whether the shape matches the system when mounted as a molded body. With regard to the reaction system, each target was evaluated based on the results of verification tests, while reaction conditions for achieving the reaction rate target were also closely examined.

Key words: carbon neutral, chemical heat storage, heat transport, waste incinerator exhaust heat

6. Development of Regional Circular and Ecological Sphere with Material Cycle and Waste Management

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Abstract

Past research has been reviewed, mainly on eco-town projects and circulation of regional resources to design a new concept for the development of Regional Circular and Ecological Sphere (R-CES) from the point of material cycle and waste management. Regions where the movement has been accelerating since the 2020's will require an integrated approach for creating action plans and goals, together with scenario setting addressing zero carbon cities. In order to realize a R-CES, effective regional activities and technologies for cyclical use of community resources must first be determined. Following this, the effects, with the determined critical indexes such as GHG emissions and economic balance of the region, must be determined. An agriculture, forestry, and fisheries linkage model is seen to be a possible core approach for its application in many areas of Japan. Methane fermentation and composting are important core processes in such a model. Referencing good case studies on bio-based material cycles, these concepts are expected to be adopted in each community that aims for R-CES. This article details a case study in the Kyoto region.

Keywords: material cycles, Regional Circular and Ecological Sphere, zero carbon city, bio-gasification, Kyoto region