PROCEEDINGS OF THE
INTERNATIONAL CARBON NEUTRALITY TRAINEESHIP PROGRAM
Volume.01, Number.1, 2023, **134-139**

Digital Technology Helps EU Eco-city Conduction The Eco-city Conduction Achieves Carbon Neutrality

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Abstract

Digital technology can digitally collect and store, deeply integrate and mine, dynamically monitor and process, and comprehensively transmit and distribute various kinds of information about the city's geographical environment, infrastructure, natural resources, ecological environment, population distribution, cultural landscape, social and economic status, etc. (Liao, 2011).

Integrate the digital technology into the construction of ecological city, and facilitate the urban resource and energy subsystem, the ecological settlement environment subsystem, and the ecological industry subsystem to be designed more scientifically and greenly. Meanwhile, utilize the digital technology to construct urban model and basic information platform, and build professional application model base, rule base and corresponding application systems suitable for different functional departments of the city. It will assist the government in making macro-decision and ensuring the allocation and daily supervision of the energy and resources, and then contribute to a carbon neutral city finally.

Keywords: digital technology; Eco-city; carbon neutrality.

1. Introduction

Since the beginning of 2020, the European Union has successively released a number of strategic planning documents aimed at promoting "digital transformation". These include "Shaping Europe's Digital Future", "The White Paper on Artificial Intelligence" and "A European Strategy for Data" in February 2020, "A New Industrial Strategy for Europe" in March 2020, "Digital Sovereignty for Europe report" in July 2020, and "2030 Digital Compass plan" launched in 2021. How to seize the opportunity to complete the two core motions, which was put forward by the new European Commission headed by Ursula von der Leyen-"Digital Transformation" and "Green Transformation" is an important issue that the European Union is facing at present (Cai & Zhang, 2022; European Commission, 2020).

Eco-city, is a city that tends to minimize the demand for energy, water, food and other necessities, as well as the emission of waste heat, greenhouse gases (carbon dioxide, methane, etc.), and wastewater (UNESCO, 1966). The ultimate goal of carbon neutrality is to realize the harmonious coexistence between man and nature, and its realization should also be implemented to build ecological cities. As early as 2005, the EU put forward the "Eco-city Plan", and

it has been in a leading position in the world in the construction of eco-cities. Making full use of digital technology will greatly help the EU to improve the eco-city construction and achieve carbon neutrality.

The eco-city system can be divided into three parts: resource and energy subsystem, ecological settlement environment subsystem and ecological industry subsystem. From the above three aspects, this paper puts forward the following suggestions on how the EU can use digital technology to build ecological cities to help carbon neutrality.

2. Suggestion

2.1. The resource and energy subsystem

A city's resource and energy subsystem is the lifeblood of urban development. It provides the necessary elements for the city, regulates its development speed, scale and direction, and plays a "supporter" role to the maximum extent. Urban resource and energy subsystem construction mainly includes three aspects: green energy system construction, green transportation system construction and water system construction (Wen, 2013, p.2). Against the backdrop of the EU's vigorous development of clean energy for electricity, using digital technology to accelerate the structural adjustment of power grids and improve utilization efficiency in the EU will play an important role in the socio-economic and urban ecological environment development of cities. Therefore, this paper will put forward the following suggestions from the three aspects: water resources, electric power and green traffic.

(1) Water Resources. Based on the Internet, digital earth, virtual reality, and mobile internet technology, develop intelligent water resources management systems, enrich and improve the business application of water resources, and realize the optimal allocation, efficient utilization, and scientific protection of water resources. The intelligent water resources management system needs to do the following:

a) Pollution monitoring and accurate measurement. Implement online monitoring of water quality and quantity at urban pollution monitoring sites, and implement accurate measurement of water resources at water consumption units within the region, and transmit the collected data to the water supply resource monitoring center through signal lines for computer control and management.

b) Automatic control. It will give local or remote alarm when water quality, water level, water pressure and other data exceed the limit. At the same time, through GPRS positioning function, the location of alarm points will be accurately displayed on the map and related information will be displayed. Operators or automatic system itself can utilize the operating system platform to remotely and wirelessly control the on-off of the power supply and the electric valve of the on-site metering equipment.

c) Information visualization. Make use of professional software functions to display the data in statistics and charts, so as to intuitively reflect the situation of water resources in the basin, the real-time measurement of each monitoring point, historical data, statements, etc. And reserve interfaces for the upcoming digitalization, networking and sharing data construction of smart cities.

d) Daily management and optimization decision-making. Making water demand forecast, water supply capacity analysis, water resources supply and demand balance analysis, etc. on the data provided by the monitoring terminal, establish water resources supply and demand model. Base on that, the intelligent water resources management system can generate a series of feasible plans for water allocation, and regional comprehensive development and macro-management of water resources for the government.

e) Convenience services. Customize the special water rights trading and delivery platform software to provide people with management functions such as water conservancy information interaction, disaster warning and rescue.

(2) Electric Power. Accelerate the construction and optimization of UHV power grids in Europe. Using digital technology to establish energy internet, realize the energy interconnection of "source-network-load-storage", and make the power grid have intelligent decision-making functions, so that the power grids can intelligently regulate and control electricity resources, which promote the power system a safer and stabler one, and strengthen the energy storage of power grid.

(3) Green transportation system. Use digital technology to ensure the daily management level of transportation infrastructure, improve the quality and experience of citizens' green travel, and promote citizens' willingness to travel

green.

a) Build the Transportation Internet. In proximity travel, cities can use digital technology to connect subway, bus, online car-hailing, bike-sharing and other modes of travel, and present vehicle information (such as bus route number, station, arrival time, etc.) in the form of app and electronic platform; in long-distance travel, cities can set up a transportation organization service platform to strengthen the information sharing of transportation routes, shifts, passenger load factors among passenger transport enterprises. Besides, related institutions can strongly promote online ticket purchase and through AI intelligently calculate the optimal combined ticket under limited conditions. So that the convenience of green travel will be well improved, and the no-load rate of passenger transport will be reduced.

b) Digital Technology Helps Daily Maintenance of Transportation Public Facilities. Many residents don't choose low-carbon travel is not because there is no intention of low-carbon travel, but because the city has not created good conditions for low-carbon travel. In order to promote residents' green travel, cities can build weather-free and barrier-free cycling corridors for commuting, through digital technology to realize the public transport facilities' management, such as parking regulation, the daily supervision of shared cars, road surface, the charging station system's safety of new energy vehicles, and etc., which provides favorable conditions for residents' green travel.

c) Use AI, big data, cloud computing, Internet of Things and other means to optimize traffic construction and operation schemes, improve traffic flow and reduce energy waste.

Case: " the Big Data Platform for Public Transport Travel "-jointly created by Tencent and Research Institute of Highway Ministry of Transport of China.

It integrates Tencent's big data with the data of public transport industry, establishes a multi-dimensional evaluation system of traffic network based on the characteristics of cities, and uses advanced technologies such as machine learning and cloud computing by combining the temporal and spatial laws of urban population, to conduct overall analysis, management and optimization evaluation of urban network. The platform gives full play to the advantages of multiple data sources to provide technical support to local transportation administrations, bus companies, MaaS service providers, etc., promotes the principle of "travel as a service", improves the operational efficiency and service level of public transportation, and helps urban transportation become more intelligent, green, and convenient. (Zhang, Liu & Liu, 2021, p.372).

2.2. The ecological settlement environment subsystem

The construction of the ecological settlement environment system is mainly to build a multi-dimensional ecological network in the urban complex ecosystem by using the principles of landscape ecology. Its function is not only to provide visual aesthetic effects or simply create a place for urban residents to have a rest and have fun, but also to participate in the material circulation and energy flow of the whole urban social and economic complex ecosystem (Wen, 2013, p.3). Therefore, in ecological settlement subsystem, this paper will make the following recommendations in terms of UPD (Urban Planning and Design) and the regulatory accounting system for carbon emissions.

(1) Urban Planning and Design. The industrialization of EU countries started early and the urbanization level was high, so most of their city models were fixed. Therefore, satellite image recognition, remote sensing, geographic information and other technologies can be used to construct an intelligent platform for urban green design optimization. Calculate the carbon emission and carbon sink balance of the design scheme in real time, and scientifically assist to optimize the design of ecological layout of carbon-neutral cities.

Case: City intelligence Mapping Alliance (CiMA)-Global Scientist Program

On the basis of 13,861 cities in the world, a three-dimensional map of global cities with cross-city communication and multi-agent participation is established. The CiMA 1.0 technical standards include five elements: architecture, roads, topography, water system and green space, and the data accuracy is below meters. Through the integrated calculation of city data such as hydrogeology, climate environment, construction projects, municipal engineering, etc., the carbon balance path of urban development can be deduced intelligently, and the dynamic allocation of single construction project level in local areas can be realized, urban design can be optimized, and scientific decision-making of urban planning, construction and management can be assisted.

(2) Carbon emission control accounting.

a) Use digital technology to improve the carbon emission accounting system.
b) Use online monitoring technology to improve the carbon emission regulatory system. On the basis of unified carbon emission accounting system, monitor the carbon emissions such as urban sewage collection and treatment system in real time by adopting online sensing technologies including infrared gas analyzer and microelectrode sensor, which helps the central government to establish MRV mechanism.
c) Use the blockchain technology to transform the enterprise wastewater and exhaust emission monitoring system. Based on the decentralized nature of blockchain technology and the difficulty of data tampering, the enterprise sewage and exhaust gas emission monitoring system can be modified to achieve carbon emission transparency in the process of goods production and transportation to a certain extent. In addition, based on carbon emission information, the carbon trading market completes fast transactions and payments without third-party intermediaries.
d) Make use of digital technology to improve environmental rule of law. As early as March, 2004, the Council of the European Union issued the Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage, which unified the criteria for environmental damage determination. On this basis, we can use digital technology to build an environmental damage data sharing platform, objectively quantify the amount of environmental damage compensation through the powerful vocabulary capture, common categorization and unique algorithmic logic of artificial intelligence, limit the "arbitrariness" of discretionary power, and improve the effectiveness and quality of environmental rule of law (Li & Liu, 2022).

Case: the "Smart Green Energy Cloud" platform designed by Hebei Province in China

Relying on the "Smart Green Energy Cloud" platform (provincial energy data center), Hebei Province, China, refines and filters the electricity consumption of the whole society, establishes mathematical correlation between electricity consumption and energy data such as coal, oil and gas according to the production process and operation characteristics of various enterprises, and realizes the monitoring of certain time dimensions (annual, quarterly, monthly, daily and real-time). The energy consumption of enterprises can be converted into carbon dioxide emissions. In terms of carbon sink, it collects and collates meteorological and ecological environment data, such as ocean, forest, grassland, lake, forest coverage, background value of environmental quality, and level of CCUS technology development, etc., and analyzes the level of carbon sink in Hebei Province based on these data. Then, the platform can conduct a comprehensive comparison and analysis of carbon emission and carbon sink in Hebei Province, which can scientifically assess the real-time carbon emission level of the whole society and carry out trend prediction, so that the government and relevant departments can know the carbon emission situation of each region and industry, and grasp the whole society's "carbon peak and carbon neutral" process in a timely manner (Lu et. al., 2021).

2.3. The ecological industrial subsystem

Economic system is the lifeblood of a city. The construction of ecological industrial system in eco-cities construction focuses on optimizing industrial layout, adjusting industrial structure, encouraging the establishment of industrial parks, and forming a complete ecological industrial system (Wen, 2013, p.3). Therefore, with the establishment of ecological park as the core, this paper puts forward the following suggestions.

a) Deepen industrial intelligent manufacturing and automation of processing flow.
b) Promote the construction of eco-industrial parks and build virtual industrial parks. Different enterprises can rely on the Internet platform to exchange raw materials, by-products, capital, talents and other resources and share information, just like the "producer-consumer-decomposer" cycle, seeking to close the loop of materials, multi-level energy utilization and information feedback, so as to achieve zero or low emissions and promote circular economy.
c) Reduce process pollution. Companies can use digital technology combined with real-time data of their own product production to design carbon emission analysis and process optimization tools based on LCB (Life Cycle Assessment), EPD (Environmental Product Declaration).

Case: Research Triangle Park in North Carolina, the USA

The Research Triangle Park in North Carolina, USA, in its vast area (about 7770km2, including Raleigh, Durham, Chapel Hill and other areas), has built a virtual industrial symbiosis network to break through the traditional

fixed geographical boundaries and complete the exchange of talents, technology, capital, by-products and other resources. As of 2013, a total of 1382 enterprises have participated in the virtual network, and 1249 different materials have been exchanged. (Wen, 2013, p.119).

3. Summary

Digital technology can digitally collect and store, deeply integrate and mine, dynamically monitor and process, and comprehensively transmit and distribute various kinds of information about the city's geographical environment, infrastructure, natural resources, ecological environment, population distribution, cultural landscape, social and economic status, etc. (Liao, 2011).

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While digital technologies have the potential to build eco-cities and contribute to carbon neutrality for the EU, to achieve the above expectations, the EU still needs to face the following problems:

a) The production level of key digital equipment and the construction of digital infrastructure in the EU are relatively lagging behind.
   Accelerate the deployment of IPV6 infrastructure construction.
b) The relevant technicians are short of layers.
   Introduce high-tech talents.
   Vigorously develop education.
c) The construction and maintenance of data centers also consume a lot of energy.
   Use renewable energy power generation.
   Minimize data center site.
   Use heat pump, indirect evaporation and other technologies to recover heat.
d) The internal political forces of different member countries are complicated, and the status quo and interest need of digitalization are different, which makes it difficult to realize the digitalization policy and improve the level.
e) There are differences in digital standards among member countries and market segmentation.

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