Defining the aspects of the local urban sustainability: Eco-cities as a model

Zainab Khalid¹, Zaynab Radi Abaas²
¹,²Department of Architecture, College of Engineering, University of Baghdad
Email: zainab.khalid@coeng.uobaghdad.edu.iq

Abstract: The absence of ecological perception in the local urbanization resulted in the lack of a clear conception of achieving sustainability in its simplest form in the urban reality and in the city of Baghdad in particular. The research assumes the possibility of achieving urban sustainability in Iraqi cities by applying the cities for the most effective methods to implemented ecological solutions and introducing appropriate urban planning tools and improve the living environment. The research focuses on the ability to define some aspects to achieve a sustainable local urban identity from global experiences. This was performed by proposing a scheduled theoretical framework, through which the features of sustainability can be extrapolated from the experiences of countries like the UK, China, Spain, Finland, Germany, and the US, which are considered leaders in the field of environmental conservation. The goal is to reach healthy urbanism preserved from emissions, with developed systems, take into account the environment and social life to establish ecological cities as part of its contributions to low carbon development with the aim of mitigating climate changes and contributing to the promotion of the sustainable identity of the city.

Keywords: Ecology; ecosystem; urban sustainability; ecological design; eco-cities; greening; natural resources; low carbon.

Methodology
The research is defining the essential aspects of Eco-cities, exploring the indicators of the aspects, and identifying the most proper aspects and indicators suit the Iraqi cities.

1. Introduction
The term "Eco-city" has emerged as a comprehensive term for a variety of new urban development paradigms. Research related to identifying, designing, developing, managing and measuring the performance of eco-cities and sustainable cities has experienced tremendous growth in recent years[1]. In 2019 (Sibiu-Romania), heads of several municipalities and local governments met to motive the heads of state and government in member states to impose the European Union and all European institutions to a long-term climate strategy to define the future of Europe with a view to reaching zero net emissions by 2050[2]. This is based on the increases heat waves, and the phenomena of excessive rains, due to the increase pollution rate that caused many climate changes and an increase in the concentration of carbon by 50%, an increase in the concentration of methane witnessed in the twenty-first century compared to the levels 300 years ago. It is expected to increase the average degrees of Global temperature is between 1.1 °C and 6.4 °C by the year 2100 (compared to 1990), which will result in a sea level rise of 4-6 meters over a period of hundreds of years, which leads to the flooding many coastal cities[4][3].

The United Nations Development Program (UNDP) defines an Eco-city as ‘a city that provides an adequate standard of living for its population without exhausting the ecosystems and the resources that
depend on it'. Another definition has defined the Eco-city as an environmentally healthy city. The ecological city is defined by a vision of a sustainable city that is implemented as a short-distance city, i.e. compact and high-density. It is in fact a healthy human ecological process that leads to sustainable development within the absorptive capacity of local ecosystems through changes in production pattern, consumption behavior, decision-making tools based on environmental economics and systems engineering[5]. More examples have emerged at the level of environmental regulation according to several categories and features. On the urban side, for example, activating the scope of local environmental regulation and not relying on national governments. At the detailed design level, green buildings set one example of this. Dozens of jurisdictions impose various levels of “greenness” of buildings (public and/or private). To make cities competitive in a global environment and to encourage investment. New urban growth systems have become based on the relationship between society and nature. The fields, the waterfronts, the marketing nature, and pollution regulation are being redeveloped, while preserving and trying to improve the existing infrastructure[6]. This relationship between society and nature leaves room for civil participation and even resistance by city dwellers to advance their cities ecologically and improve the living environment and reduce the waste of resources resulting from the failure to adopt a sustainable approach as a lifestyle[5].

Predominantly, the development of Eco-cities is linked the three basic dimensions of sustainability with the environmental goals, and several types of mechanisms and applications have emerged. First, on the technical side; industrial urban metabolism, life-cycle production, conservation of resources, use of renewable energy, etc. have been applied. Either on the urban side; the built environment, open spaces, and connectivity, and maximizing accessibility, while reducing resource use and urban problems have been emerged. And third, on the sociocultural aspect; understanding the balance between man and nature, and understanding environmental ethics to enhance people's contribution to maintaining a high-quality urban ecosystem[6]. It has also been suggested that priority should be given to preserving aspects of environmental value or aspects of environmental and economic value, as auxiliary or managed ecosystems can remain a valuable alternative to cities[7]. Another classification for categories in general, ecological architecture can be understood as being characterized by; implementing the symbolism of nature to create relationships between architecture and its cultural context, integrating architecture in landscapes, integrating or linking the object with the garden area or the natural environment of the urban context, using environmental technology that creates an architectural basis sustainable and environmentally responsible, distant urban and urban planning ideas that allow imagination to the future, based on a general social perspective of the changes that may affect building art and environmental policy, and all models that direct how to build more wisely, smarter, economically and more environmentally[8]. It is noted that society forms the primary axis in ecological design, as the environmental impact of human habitation has been reduced by building compact, dense, and walkable societies. These urban societies have assumed efficacy in terms of energy resources and high independence based on local food and energy[9]. As a result, achieving balance and harmony with nature leads to the urban health and better living.

On the other hand, energy consumption in developed countries has become a big issue, as 25% of the world's population consumes 80% of energy reserves. Hence, the concept of ecological design has gradually become the direction that architects are moving towards sustainable development, especially with the acceleration of the urbanization process, an increase in density, height, the expansion of buildings and the complexity of jobs, contemporary buildings seek through the use of new technologies, new materials and advanced scientific methods to solve environmental problems such as improving energy efficiency, reducing the consumption of non-renewable resources, and making full use of clean energy and a low carbon life, where an ideal living environment is created[10]. Therefore, the ecological design of buildings represents the combination of "technology and ecology" an inevitable trend of urban development, and ecological design is a necessity as a new form of humanity[11]. Low carbon terms and zero carbon technologies are a relative term, therefore; clean energy is the energy that markedly reduces total greenhouse gas emissions compared to the usual energy alternative. For example, practically clean energy technologies are all those technologies that reduce fossil fuels, combustion, and greenhouse gas emissions, utilizing renewable energy sources, including hydro, solar, wind, geothermal, and bioenergy except for the energies that cause a lot of
carbon emissions. Heat is wasted. The overall carbon reduction is required to be clearly positive[12]. Besides clean energy, green buildings and green urban infrastructure services, there is a frequent reference to the need to integrate the two previous concepts and the actual integration of nature, gardens, public green spaces, urban agriculture, green roofs, green facades in urban fabrics; this is important because it provides the ability to absorb water and carbon dioxide, and helps purify the air[5]. Many European and American cities and China are trying to create environmentally friendly cities as part of their contributions to low carbon development with the aim of mitigating climate change. Among these mechanisms is the European Union’s support for low-carbon housing and urban and rural development[12]. Finally, ecological design methods have defined as the design and construction methods in an attempt to mimic the persistent characteristics of nature[9]. The term "bionic" refers to the biological simulation of the use of high technology and materials to improve performance and organizational development continuously, to obtain high-efficiency and low-energy consumption, with a conscious response, physical and environmental safety, to provide the building some "environmental characteristics”[11]. Taking advantage of some natural properties like higher resistance, higher rigidity, easier maintenance, and lower costs, turning to biotechnology and continuous construction is its appropriate solution to the problem of architectural originality. Therefore, by studying the most relative standards around the world and as noted in the International Eco-cities Initiative [1] as seen in Table 1 bring the idea of the association of ecological design with the sustainable and green initiatives and confirms the importance of this study.

Table 1. The most important sustainable – ecological standards initiative across the world [1]

| The organizer | Initiative name | Aspects |
|---------------|----------------|---------|
| BRE UK/Global | BREEAM Communities | Multistage assessment scheme and certification designed for urban master planning. It covers six areas of urban sustainability (energy, governance, innovation, land use, social and economic development, and transport). |
| DGNB NSQ      | German Sustainable Building Council | The certification system for new neighbourhoods, including 50 indicators across six quality dimensions (environmental, economic, sociocultural, technical, practical, on-site) allows resiliency across urban contexts. |
| Chinese Society for Urban Studies | Eco-city Development Index System | The proposed national indicators framework is organized into five categories and 28 indicators. Specific targets for the majority of indicators, with eight indicators identified with greater flexibility in terms of innovative terms and methods |
| Singapore and Chinese governments | Tianjin Binhai Ecocity | 26 key performance indicators program is designed specifically to focus on resource efficiency, and the integration of national standards of China-Singapore. |
| Enterprise Community Partners, Inc. | Enterprise Green Communities, USA | A non-profit credit program to support sustainability initiatives for affordable (low-income) neighbourhoods. The free online chart-indicator tool includes mandatory and optional criteria |
| US Environment Protection Agency | Green Communities | Opening "Utilities" to guide community-led sustainability action plans. A multi-stage process, including guidance on selecting, |
It is clear from the foregoing table 1 there are several basic aspects of ecological design that can be adopted: Urban aspects- Judgment and decision-making policies, design and the technological aspects, services and transportation and intelligence aspects, natural features and preservation aspects, society and its relationship to urban and natural structure. These features overlap within all the social -
economic - environmental - technological -and political dimensions, to form the integrated ecological city. These features and aspects will be the subject to search in some global experiences of ecological cities to prove their existence and find out some other aspects.

2. Ecocity experiences

Geddes and Kiesler both mentioned integrating civic life and culture as part of a larger ecosystem of forces responsible for design. Geddes claimed that there was homogeneity between nature and the city and considered both cities and natural places ecosystems involving the flow of energy, matter and human and non-human beings[9]. The city represents a reciprocal interactive relationship between human behaviour and location data in a way that integrates human activities, space formation and the natural environment within the correct urban design and planning to achieve high levels of comfort and safety. It is an adaptive and creative process of the influences of the natural environment and the available natural resources to promote the appropriate urban environment [13].

In light of this, the term (Ecocity) was a start calling for the expansion of natural elements like green spaces; now, the concept of ecological cities focuses on issues with constructive development characteristics, like developing environmentally friendly economic activities and creating environmentally friendly infrastructure. The level of urban planning rises to ecological success. If the city can provide fresh air, fresh water and green spaces, energy storage designs, a waste management system, conservation and reduced resource consumption as well as incentives for sustainable economic activities[14]. There are many practices, dialogues and transfer of experiences between the European Union and the countries of America, Asia and other countries. In addition, there is a list of many ecological regions that are considered one of the pleasantest liveable places, depending on the ecological approach. The researchers termed sustainability ambassadors to some of the cities under study, such as BedZED in England, Freiburg in Germany, Portland in America and Dongtan in China, because of the quality environmental features of these cities' plans [15].

2.1. England Eco-city experience

BRE UK/Global relies on BREEAM Communities as the basis for multi-stage evaluation and certification for urban design and planning. It defends six areas of urban sustainability (energy, governance, innovation, land use, social and economic development, and transportation)[1]. An effective monitoring conducted in 2003 found that some pilot projects reduced greenhouse gas emissions by using clean energy 88% fewer than the heating requirements; hot water consumption is 57% less than electrical energy used, 11% of this is produced by solar panels. The 2010 development review also drew positive conclusions on the social level, as residents and neighbours were happy, with the mileage of residents' cars reduced by 65%. There are ten ecological principles adopted in the UK for sustainable urban growth that respect urban culture and contexts which have been widely adopted for transformations in European Union cities[5]. Additionally, there is an intense focus on the topics of building materials, pedestrians, public transportation and high-density communities; those are:

- The environment and the earth must be respected: the buildings should be unobtrusive and must fit the landscape they occupy.
- Architecture is a language: contemporary designs must adhere to pre-existing structures to prevent repulsion.
- Scale: Recent buildings must respect the human scale and the surrounding buildings.
- Harmony: Richness in the urban landscape comes from diversity, but the buildings must be in harmony with their neighbours.
- Create well designed social environments: the enclosed spaces are more visually satisfying and encourage roaming.
- Materials: The materials must be natural and local, considering traditional local building methods.
- Banners, lights and facilities. Traffic control is preferred through road planning to slow drivers.
- Pedestrians should represent the centre of the design process: restore the streets from the car.
- Density: The intensification of activities should not contradict with some traditional architectural styles, like balconies.
10. Flexibility: Prevent rigorous traditional planning in favour of flexible schemes[12]. An example of these principles is the Beddington Zero Energy Development (BedZED) Environmentally friendly housing project in Hackbridge, London, designed to create zero carbon emissions, and was the first large-scale carbon-neutral community to support a more sustainable lifestyle and environmental protection. The ecological and the carbon footprint were used to define criteria (sustainable lifestyles) in a high-density residential project that accommodates a mix of income groups and combines homes and workplaces. Significantly reduce CO2 emissions per person from home and encourage and support other aspects of sustainable lifestyle including reducing water use and reducing the use of private cars[15].

It is the first construction project in which the local authority carried out an encouragement session, selling lands less than the market value to encourage investment and making sustainable economic development viable. The homes were constructed in 2000-2002 and were of a high standard of finishing quality to engage urban professionals. Where the design of the building is integrated with the elements intended for power generation with other support functions[16]. For example, wind turbines are located on the roof used to produce energy, to enhance ventilation and internal and external air exchange. Take into consideration the direction of homes to the south to take advantage of the solar energy gains. There are 777 square meters of solar panels and the use of triple glass, materials with high thermal insulation and low impact on the environment. Building materials were selected from renewable or recycled sources located 56 km from site to reduce the energy required for transportation. Tree waste feeds the cogeneration plant to provide central heating and electricity. Biomass heaters were carried out with solar heating. The tubes used to distribute hot water pass near the windows to remain them warm even using sunlight. Rainwater is recovered and used for irrigation and water tanks. A portion of the water used for irrigation is purified by phytol-treatment and returned to the reservoir. Most of the rainfall is collected and reused on site. The choice of devices to be water-saving and use recycled water as much as possible[15]. To preserve the concept of low emissions and promote an environmentally friendly alternative; the project promotes public transportation, cycling and walking, and reduces the possibility of using cars by limiting the area of parking areas; there is also bus and railway stops in the vicinity. The project works in partnership with the City Car Club, and residents are encouraged to use environmentally-friendly vehicles that are powered by electricity and liquefied gas - petroleum gas cars have priority over cars that burn gasoline and diesel[17]. So, the main aspects related to the indicators extracted from the sources are seen in Table 2.

| Main aspects                      | Extracted indicators                                                                 |
|----------------------------------|--------------------------------------------------------------------------------------|
| Urban aspects                    | Mixed Land uses                                                                      |
| Judgment and decision making     | Respecting the urban context                                                         |
|                                  | Local materials                                                                      |
|                                  | Intensification of activities                                                        |
|                                  | Planning flexibility                                                                 |
|                                  | Activating the role of the local authority                                           |
| Design and technological aspects | Innovative design                                                                    |
|                                  | Carbon zero projects                                                                |
|                                  | Low carbon ecological projects                                                       |
|                                  | Energy efficiency                                                                    |
|                                  | Good finishing quality                                                               |
|                                  | Encouraging and attracting investments                                               |
|                                  | Respecting human scale                                                               |
|                                  | Considering proper building guidance (optimal use of ventilation and sunlight)        |
|                                  | Using wind turbines                                                                  |
|                                  | Using photovoltaics plates                                                           |
|                                  | Using of high insulation materials (triple glass)                                     |
Using renewable and recyclable materials
Using plants to purify water
Using plant and tree waste as energy sources

| Service and transportation aspects |
|-----------------------------------|
| Transportation services          |
| Good road planning               |
| Using environmentally friendly vehicles |
| Encourage public transportation  |
| Reducing distances and encouraging walking and cycling |

| Natural features and preservation aspects |
|-------------------------------------------|
| Respecting the environment and the earth |
| Respecting natural biodiversity           |
| Designing in harmony with nature          |

| Society and its relationship to urban and natural structure. |
|--------------------------------------------------------------|
| Pedestrian design                                           |
| Harmony achievement                                         |
| Well-designed social environments                         |
| Social and economic development                            |
| Activities Intensification                                  |

2.2. China Eco-city experience

China occupies 20% of the world’s population. It is experiencing tremendous population growth and requires urban, ecological and healthy areas to accommodate the increases. From this standpoint, China has moved towards intensifying and establishing Eco-cities due to the costs incurred by the Chinese government as a result of living in unhealthy environments unsuitable for quality living. Therefore, the role of society will be massive and more critical for urban governance in the future[14].

The 2010 China Low-Carbon Eco-Town Development Report describes the low carbon ecological city as an innovative type of urban development model based on the principles of balance with the natural environment. It aims to reduce resource consumption and emissions, while conserving energy and focusing on environmental protection. China aims to create 100 ecological cities in specific low-carbon policies[12]. There is an overview of practices, assessment, and techniques, like performance indicators, technical standards, and verification methods that represent a summary of the most satisfactory Eco-city experiences [7]. Such practices include defining the energy performance of buildings, smart transportation systems, smart cities, geographic information systems planning tools, and eco-labelling schemes.

The technologies include green buildings, green transportation, solid waste treatment, water management, urban renewal and revitalization, green industries and clean energy. In addition to improving the ability of Chinese municipalities (municipal finance) to finance low-carbon solutions by activating public-private partnerships as seen in table 3 [17]. An evaluation of China's low-carbon cities identified three types of ecological cities, the technologically innovative low-carbon Eco-cities, a liveable Eco-city model that has been typically designed for up to 300,000 people and uses green building technologies and emphasizes green transportation patterns (walking, biking, and public transportation). The third type is the Eco-city model, which refers to the rehabilitation and renewal of "traditional cities" towards more sustainable urban development[18][19]. Dongtan to Todtown the city will change while maintaining the same indicators to follow the ambassadors of sustainability project is a mixed-use development model in Minhang-Shanghai area. It is scheduled to be completed by 2020. The project will include 1,000 residential units, a shopping mall, retail store, office space, and a cultural centre. It consists of green roofs all the way to the small gardens scattered throughout the project. The masterplan developed by architectural firm Goettsch Partners and Lead Studio [7].
Table 3. The main aspects and the indicators of China Ecocity projects[12][17][18][19]

| Main aspects                   | Extracted indicators                                                                 |
|-------------------------------|--------------------------------------------------------------------------------------|
| **Urban aspects**             |                                                                                      |
| Judgment and decision making  | Low carbon cities                                                                     |
|                               | Liveable cities                                                                       |
|                               | Updated old cities (urban renewal and revitalization)                                 |
|                               | Solid waste treatment                                                                 |
|                               | Water management                                                                      |
|                               | Green industries                                                                      |
|                               | Municipal financing                                                                   |
| **Design and technological aspects** |                                                                                   |
|                               | Performance indicators                                                                |
|                               | Technical standards and verification methods                                            |
|                               | Determine the energy performance of buildings                                          |
|                               | Green buildings                                                                       |
|                               | Clean energy                                                                          |
| **Service and transportation aspects** |                                                                                   |
|                               | Intelligent transportation systems                                                     |
|                               | Smart cities                                                                          |
|                               | GIS planning tools & eco-labelling schemes                                             |
|                               | Green transportation                                                                  |
| **Natural features and preservation aspects** |                                                                                   |
|                               | Afforestation and the development of new protected areas to improve green coverage in cities and surrounding areas. Green coverage expanded to over 50 percent of the city's area. |
| **Society and its relationship to urban and natural structure.** | Activating the partnership between the public and private sectors                      |

2.3. Spain Eco-city experience

The City of Madrid has approved a redevelopment project for Castellana Norte, an area north of the city centre. The site is a bus station with a few houses, a series of semi-abandoned industrial buildings and warehouses. The redevelopment will transform Castellana Norte into a modern neighbourhood that includes skyscrapers, parks, roads, bridges and apartments for an estimated 17,000 people. The goal of the project is to rehabilitate and urbanize the area and intensify jobs by focusing and diversifying events and preserving large green areas. Another project in the direction of establishing new ecological cities is the decision of the Spanish provincial government and the independent community to proceed with the development of the urban sprawl project towards Logroño, Eco-city designed by MVRDV in cooperation with GRAS[7]. The neighbourhoods of the city are divided into three “districts”, each of which includes distinctive areas for development - the city centre, the conversion of lands into green areas, public parks, mountainous areas and protected forests. These three districts link the city to the electric tram system[20].

The city includes the construction of 3,000 social homes with complementary services, and the new neighbourhoods achieve a neutral footprint of carbon dioxide by producing renewable energy on site. Where the site north of Logroño provides a direct natural view on two small hills from Montecorvo and La Fonslada, the city views over the vast slopes facing the south. The masterplan is designed in a compact manner that occupies only 10% of the site, providing each apartment in the city natural views. In addition to the other necessary facilities, for example sports, retail, restaurants, infrastructure, public and private parks, within the general plan for urban development The rest of the landscape appears as an ecological park. As well as, the on-site greywater recycling and natural water purification are part of the plan that combines dense urban living with real environmental improvements[5].

In addition to the redevelopment projects adopted by many municipalities in Spain, Spain is moving towards eco-planning systems in its urban policy. Sarriguren represent the first ecological city in Spain, planned to expand the city of Pamplona, located 3 km from the city. The ecological city of Sarriguren was promoted by the Navarre Government Department for Environment, Spatial Planning and Housing and was designed by Fundación Metropoli to follow ten principles as specifications for
ecological performance as seen in table 4, with a specific focus on protecting natural areas, saving energy, integrating renewable energies and healthy construction. In 2008, the city won the seventh European Urban Regional Planning Award for spatial planners of the European Council, as the city relied on ecological urbanization standards that can be summarized as follows: focus and nature conservation as an integral part of urban design, maintaining the structure of rural settlements, the priority of public transport, Cycling and walking, high quality housing diversification, housing and workplace integration. The effects of climate engineering on design, commitment to innovation, high quality of the natural environment, and a compact physical framework for the ecological city were also adopted. The masterplan of the Ecological City of Sarriguren consists on some strategies reduced the greenhouse gas emissions and proposes innovative environmental measures in cooperation with high-tech companies with reliance on sustainable public transport and the promotion of bicycles and pedestrian traffic [19][20].

Table 4. The main aspects and the indicators of Spine Eco-city projects[5][19][20]

| Main aspects                                | Extracted indicators                                           |
|---------------------------------------------|----------------------------------------------------------------|
| Urban aspects                               | Low carbon cities                                              |
| Judgment and decision making                | Liveable cities                                                |
|                                              | The layout of the master plan in a compact manner occupies      |
|                                              | approximately 10%                                               |
|                                              | On-site renewable energy production (solar and wind energy)     |
|                                              | The city is divided into three parts: Centre, green areas and   |
|                                              | natural environment                                            |
|                                              | Collaborate with high-tech companies for innovative             |
|                                              | environmental management                                       |
|                                              | Eco-planning systems                                           |
|                                              | Preservation of rural settlements                               |
|                                              | Compact physical framework for the Ecocity                     |
| Design and technological aspects            | Healthy building                                               |
|                                              | Diverse housing patterns                                       |
|                                              | Preserving the structure of rural settlements                  |
|                                              | Integration of renewable energies                              |
|                                              | Energy saving                                                  |
|                                              | Integration between housing and workplaces                     |
|                                              | High quality and energy efficiency                             |
|                                              | Reducing greenhouse gas emissions                              |
|                                              | Observe the right direction and take advantage of the natural   |
|                                              | city views                                                     |
|                                              | Gray water recycling and natural water purification on site     |
|                                              | Reliance on climatic engineering in design with a commitment   |
|                                              | to innovation                                                  |
| Service and transportation aspects          | Reliance on sustainable public transportation.                 |
|                                              | Public transport priority                                      |
|                                              | Biking and walking                                             |
| Natural features and preservation aspects    | Protect natural areas and high quality of the natural environment preservation. |
|                                              | Keeping the green areas and orchards                           |
| Society and its relationship to urban and   | Intensification of jobs                                        |
| natural structure                           | Focus and diversify events                                    |
|                                              | Respecting the Socio-cultural aspects                         |
2.4. Finland Eco-city experience

In 1998 the Finnish government approved an ecologically sustainable development program for the building and property sector, which focuses partially on the access to the good ecological practices. During the period from 1998 to 2002, a pilot zone for ecological buildings of international importance was established in Vikki, a region to the northeast of the center of Helsinki, where Eco-Vikki is part of the Sustainable Cities Initiative and exchange of experiences between European and other countries[17]. The proposals submitted for the contest were evaluated using environmental criteria established by a multidisciplinary operational group. Environmental standards are defined in five levels: pollution, natural resources, health, biodiversity and urban agriculture, as seen in table 5. The Eco Principles put into effect the actual implementation of the Vikki Environmental District, where winning planning allows for the normal collection of jobs, nutrient and water recycling (compost, surface runoff collection) and the use of solar energy[21]. In 2010, the Viikki Eco-neighbourhood was completed. Still, large agricultural lands nowadays characterize the open landscape. Carbon dioxide emissions are expected to be reduced by at least 20% in relation to conventional construction and clean water consumption by more than 20%. Waste during construction is 10% less than usual, and when buildings are in use, the amount of mixed waste (up to 160 kg/person/year) aims to be 20% less than usual. Non-renewable fossil fuel use and greenhouse gas emissions are prevented by reducing energy consumption. 60% of normal heating capacity (105 kW/m2/year) and 45 kW/m2 / year of electricity is used. The primary energy consumption (energy associated with materials) has also been reduced by a fifth of that of conventional buildings. Emission targets over 50 years are 2575 kg/total square meter which is approximately 30% less than traditional buildings. Water efficiency is calculated at 126 litres per person per day, or 22% less than no water-saving formulations. Local solid waste recycling reduces available waste to 160 kg/resident/year, which is about 20% compared to traditional settlements[22]. Given that the region is far from current services and there is no investment in public transportation as an alternative to private automatic transportation or the use of sustainable transportation based on clean energy, the continued use of the private car will eliminate most of the energy efficiency benefits of residential blocks and increase the carbon emission ratio, and this issue Critical Therefore, the solar heating project included in the Viikki financing schemes has been approved under the European Union's Thermie program which requires the incorporation of sun universities into the roof structure to heat the water, and the solar electricity project. The solar panels have been incorporated into the construction of porches for residences[21]. With the 2015 borders, the design of environmental buildings in Eco-Viikki Housing that provides energy and water with negative and effective utilization of solar energy have been completed in the internal climate of the building with flexibility in the use of sanitary materials in construction like wood in addition to high quality in recycling surface water in public streets and parks and improving them before it reaches Vanhakobonki Bay, providing a living environment for plants, birds and small animals within the natural life cycle[22].

Eco-Viikki is famous for its innovative design and high technology, named the most practical and sustainable city in the world. It is recognised to be based on social cohesion; it involved the community in authentic experiences, attractive spaces and nature exploration, adopted smart tourism and the most efficient services for digital mobility. In addition, it developed smart solutions to reduce urban energy use by 10-20%, which led to increased use of renewable energy. So the criterion for success here is the new digital services, the participation of experts, residents and company representatives to formulate the city's business plan, the adoption of a partnership approach between the public and private sectors and individuals, the work of residents, the city, companies and organisations together; to find new solutions and new business and help solve global challenges. All this made it the pleasantest place for foreign investment among the European regions[21].
Table 5. The main aspects and the indicators of Finland Eco-city projects[17][21][22]

| Main aspects                                      | Extracted indicators                                                                 |
|--------------------------------------------------|---------------------------------------------------------------------------------------|
| **Urban aspects**                                | The benchmark for success is the new digital service                                  |
| **Judgment and decision making**                 | Participation of experts, residents and company representatives to formulate the city's business plan |
|                                                 | Adopting a partnership approach between the public and private sectors and individuals |
|                                                 | Requires residents, the city, companies and organizations to work together; to find new solutions and new business and help solve global challenges. |
| **Design and technological aspects**             | The best place for foreign direct investment                                          |
|                                                 | Take advantage of the correct orientation of buildings                                |
|                                                 | The use of solar heating                                                              |
|                                                 | Solar electricity use                                                                |
| **Service and transportation aspects**           | Smart tourism                                                                         |
|                                                 | Better digital mobility services                                                      |
|                                                 | Developing smart solutions to reduce urban energy use                                 |
|                                                 | Increased use of renewable energy                                                    |
| **Natural features and preservation aspects**    | Focus on biodiversity                                                                 |
|                                                 | Focus on urban agriculture                                                            |
|                                                 | Providing spaces for a natural environment                                            |
| **Society and its relationship to urban and natural structure.** | The most practical and sustainable city in the world                                  |
|                                                 | Built on social cohesion                                                              |
|                                                 | Committed to bringing people together through authentic experiences, interesting spaces and nature exploration |
| **Pollution**                                    | Focus on reducing pollution rates                                                     |
|                                                 | Recycle nutrients and water (compost, collect running surface water), and collect them naturally |
|                                                 | Use of solar energy                                                                  |
|                                                 | Reducing carbon dioxide emissions by 20% thereby reducing greenhouse gases            |
|                                                 | Reducing the consumption of clean water during construction by more than 20%          |
|                                                 | Reducing waste during construction by 10%                                             |
|                                                 | Local solid waste recycling reduces available waste by 20%.                           |
| **Natural resources**                            | Investing natural resources                                                           |
|                                                 | Preventing the use of non-renewable fossil fuels                                      |
|                                                 | Less water consumption (about 22%)                                                    |
|                                                 | Water treatment and recycling                                                         |
| **Health**                                       | Focus on health                                                                       |
|                                                 | Use of healthy building materials                                                     |
|                                                 | Use of natural and local materials in the construction                                |
2.5. Germany Eco-city experience

Freiburg consists of 220,000 residents, located in the southwestern corner of Germany, and surrounded by the slopes of the Black Forest to the east and the Rhine Valley to the west. The region is considered as an administrative and commercial centre and is characterised by an ancient university, a limited industry, and an economy geared towards providing services. In 1992 Freiburg was chosen to be the "Environmental Capital" of Germany for its ground-breaking achievements. Such as installing an early warning system for smog and ozone pollution, pesticide ban, recycling measures, innovative transportation policy which developed the green city image. Since then, creative innovations have been made in environmental protection and solar engineering, which have been accompanied by a series of awards: European Public Transport Award, Gem Solar Award, Federal Awards for Sustainability in Urban Development, “Sustainable Society” Award from Deutsche UmwelthilfeeV being relied on the following indicators[23].

- Merging all segments of society regardless of race, gender or age, creating a state of diversity, safety and tolerance, encouraging a balanced age while providing suitable job opportunities for all ages, and encouraging innovative housing models with their services.
- Activating the decentralized rule of cities in living and housing work, social infrastructure, education and culture, entertainment and green space management and networks.
- Promote the idea of a compact city (a short-distance city), with support for present facilities and the introduction of new facilities compatible with access to all infrastructure networks.
- Integration of public transport with the vision of urban design and increasing urban density over sustainable public transport, with the development of public transport. As well as developing the pedestrian and bicycle networks and their preference for the use of private cars. Thus, improving environmental quality.
- Planning a city culture, the city should create opportunities for individual development and lifelong learning, which affect the city's attractiveness, quality, industry and jobs. The most crucial task for the future is to maintain current employment and develop innovative and pioneering businesses.
- Nature and a healthy environment, the conservation of biological diversity and the judicious use of resources for the benefit of future generations and the protection of a healthy and sustainable environment are major goals of urban development. While preserving landscapes of historical importance. And the trend towards developing green fields and the edge of the city with a focus on renewing the current urban fabric[24].
- Supporting the design and inclusion of public spaces as a major role in most planning decisions that shape the appearance of the city.
- For long-term vision, coherent urban planning and development is needed (maintaining old designs and encouraging new ones).
- Create transparency in urban political decisions and encourage community participation. Communities should work continuously on their collective vision of the city and support continuous communication between decision makers and stakeholders inside and outside the city administration at all stages of urban development to establish a culture of participation.
- Detailed planning and management. Use a wide range of technologies available to the central, regional and local authorities to establish clear urban environmental planning visions approved from the initial stages through to the detailed. Urban policy must be based on fundamental decisions that have a binding effect on city administration.
- Reliability, commitment and sincerity create the appropriate environment in which all participants in urban development can act with equal rights. For the city to become a reliable partner of all citizens and investors [23].
- Demographic shifts, economic and technological change, sustainable energy diffusion and climate change adaptation. The German experience confirms an integrated approach to convert existing settlements into environmentally friendly cities, through several pilot projects implemented at the local level in the following areas: land use, green spaces and environmental industrial parks, climate protection, public transport and sustainable transport.
All the examples stress the importance of all dimensions of sustainable development such as economic prosperity, social balance and a healthy environment. This is done through improvements in areas such as transportation, energy, buildings, technology, water and waste management systems, as well as to produce a wide range of economic and social benefits[24]. The indicators used in Germany - Freiburg are represented in table 6.

| Main aspects                                      | Extracted indicators                                                                                                                                                                                                 |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Urban aspects**                                 | Long-term, prospective, urban environmental planning visions                                                                                                                                                    |
| Judgment and decision making                      | Transparency in urban political decisions                                                                                                                                                                          |
|                                                  | Implementing model projects at the local level                                                                                                                                                                      |
|                                                  | Mixed Land use                                                                                                                                                                                                     |
|                                                  | Developing city edge                                                                                                                                                                                              |
|                                                  | Supporting the design and inclusion of public spaces as a key role in planning decisions                                                                                                                          |
|                                                  | Revitalizing the decentralized rule of cities                                                                                                                                                                      |
|                                                  | Refining the image of the green city                                                                                                                                                                               |
|                                                  | Revitalizing the decentralized rule of cities                                                                                                                                                                      |
|                                                  | Promoting the idea of a compact city (short-distance city)                                                                                                                                                         |
|                                                  | Decisions have a binding effect on city management                                                                                                                                                                 |
| Economic prosperity                               |                                                                                                                                                                                                                     |
|                                                   |                                                                                                                                                                                                                     |
| **Design and technological aspects**              | Encouraging green buildings                                                                                                                                                                                      |
|                                                   | Adopting solar energy engineering                                                                                                                                                                                  |
|                                                   | Installing multiple sensing systems                                                                                                                                                                                 |
|                                                   | Achieving new innovations and improve technology                                                                                                                                                                   |
|                                                   | Development and promotion of innovative and pioneering businesses                                                                                                                                                 |
| **Service and transportation aspects**            | Integrating public transport with the vision of urban design                                                                                                                                                       |
|                                                   | Increasing urban density on the edge of sustainable public transportation                                                                                                                                           |
|                                                   | Development of public transportation and reducing the use of private vehicles.                                                                                                                                      |
|                                                   | Promoting sustainable public transportation                                                                                                                                                                       |
|                                                   | Identifying bicycle networks                                                                                                                                                                                      |
| **Natural features and preservation aspects**     | Preserving biodiversity                                                                                                                                                                                           |
|                                                   | Protecting the natural environment                                                                                                                                                                                 |
|                                                   | Banning pesticides                                                                                                                                                                                                |
|                                                   | Development artificial parks                                                                                                                                                                                        |
|                                                   | Increasing green areas                                                                                                                                                                                             |
| **Society and its relationship to urban and natural structure.** | Healthy environment                                                                                                                                                                                            |
|                                                   | Promoting a liveable environment                                                                                                                                                                                   |
|                                                   | Improve pedestrian networks                                                                                                                                                                                        |
| **Preservation**                                  | Preserving the old building and encouraging the new one                                                                                                                                                           |
|                                                   | Convert existing settlements into environmentally friendly cities                                                                                                                                                 |
|                                                   | Focusing on regenerating the current urban fabric                                                                                                                                                                   |
Prospects of Sustainability and Planning of Cities (SPSC 2020)

IOP Conf. Series: Earth and Environmental Science 754 (2021) 012005
doi:10.1088/1755-1315/754/1/012005

14

Landscape conservation
Development of green fields
Achieving new innovations in the field of environmental protection
Development of green fields of historical importance

| Energy, water and waste management | Wise use of natural resources | Spreading sustainable energy and relying on alternative energies |
|-----------------------------------|-----------------------------|-------------------------------------------------------------|
|                                   | Improve the sustainable energy field and reducing energy waste | Improving water management systems and adopting the principle of recycling |
|                                   | Installing multiple early warning systems for smoke mist and ozone pollution |

| Sustainable Social balance | The city is a reliable partner for all citizens and investors |
|---------------------------|---------------------------------------------------------------|
|                           | Diversity and integration of different age groups and encourage balanced age |
|                           | Emphasising on safety, tolerance and equal rights |
|                           | Employment and the provision of appropriate job opportunities |
|                           | Maintaining current employment |
|                           | Creating opportunities for the individual development |
|                           | Lifelong learning |
|                           | Establishing a culture of participation and encourage community participation |
|                           | Establishing a common urban culture and work towards a collective vision of the city. |

2.6. USA Eco-city experience

One of the most important US quality standards in energy and environmental design is the LEED standard of the non-profits U.S. Green Building Council. Its reputation has crossed America to be embraced by many other countries[25]. After falling apart urbanely as a result of urban decay and sprawl and accompanied with multiple problems arising from car-centred development. Portland shifted the pattern in most North American cities and helped direct a movement towards sustainable urban living with the limits of urban growth. Portland encouraged good public transport and citizen participation in everything from local and regional planning to neighbourhood associations. Landscape features have been incorporated into the shape of the city in a way that preserves and restores environmental elements, as regional and local planning agencies have set up park networks, green roads, protected wetlands and stream lanes and changed development codes to require a park or open space. The Portland area has equally developed a pedestrian environment factor for various neighbourhoods, street connectivity, sidewalks availability, and unlimited access to streets[27][26]. Later, it was revealed that the city has major impacts on the urban heat island (UHI). A large amount of municipal water is used outdoors to maintain ornamental lawns, and none native trees and shrubs (40% in Portland), and are prone to increased water stress due to climate change[28]. So, and in terms of water management, Portland planned to study water use to reduce climate impacts, which resulted in a nearly 30% decrease in average daily per capita water use in Portland.

On the other hand, the waste is managed as part of the production system. The relationship of waste with other parts of the system is revealed, thus increasing the likelihood of greater sustainability of the process. Therefore, the city adopts some measures towards sustainable waste management. Therefore, reducing the environmental impact by reducing pollution and closing small landfills. This has
increased the economic viability of methane energy generation from landfill emissions. As a result, the greenhouse effect was reduced by 95%. By-products from the waste disposal service such as restoration of organic materials, recycling of packaging, reuse of goods, it has become economical to construct large urban catchments and recycle solid waste to liquid and hazardous waste[28].

As for land use, the Portland City Planning and Sustainability Office (BPS) is charged with a set of responsibilities related to land use, zoning, climate change, transportation, waste and energy. As part of Portland’s Central 2035 City Plan. BPS developed the Green Ring idea as a way to connect the eastern and western sides of the Willamette River. The city explained the objectives of the Green Circle project as it is linked to broader social and environmental goals such as improved health, increased equity (justice), degree riding, use of GIS in community research, increased efficiency, participatory mapping, participatory recruitment and community engagement, spatial analysis and coding Geographic and clothing making. The city formulated the goals as well as the participation of all the residents of the city who gain the capabilities to achieve and benefit from the green circle[27]. Suburban development in the Portland area was contained by the urban growth boundary (UGB) that encouraged the relatively compacted development of the American city. As well as, Portland is Encouraging sustainable design, recycling, and the use of sludge from filtering plants and entering it into the manufacture of building and construction materials such as making bricks, manufacturing cement and cement materials and using it in paving and geotechnical works[26]. The indicators used in USA - Portland are represented in table 7.

Portland occupies the most significant percentage of green buildings subjected to the LEED Green Building Standard, increasing energy efficiency and reducing greenhouse gas emissions, while relying on renewable energy resources [26]. It turned a highway into a riverbank park. In 2001 it became the most enormous urban reserve in the country, Forest Park [29]. In 1986 it chose to build a light railway rather than a highway. In addition, Portland was among the first U.S. cities to introduce passenger rail carriages into modern streets; Portland offers a very comprehensive mass transit system, including light passenger rail, buses and tramways, as well as pedestrian and bike paths. This helps reduce the number of individual cars, keeping the air clean by reducing carbon emissions.

Table 7. The main aspects and the indicators of Portland Eco-city projects[28] [27] [26]

| Main aspects                  | Extracted indicators                                              |
|-------------------------------|-------------------------------------------------------------------|
| **Urban aspects**             |                                                                   |
| Judgment and decision making  | Determine urban growth                                            |
|                               | Intensive development                                             |
|                               | Cooperating with regional and local planning agencies             |
|                               | Adding open spaces and parks within the design codes              |
|                               | Spatial analysis                                                  |
|                               | Geocode development                                               |
|                               | Diversity of different neighbourhoods                             |
| **Design and technological aspects** | Increased energy efficiency (reduce greenhouse gas emissions) |
|                               | Dependence on renewable energy resources                           |
|                               | Increased the percentage of green buildings                       |
| **Service and transportation aspects** | Reducing city dominance of cars                                  |
|                               | Green road planning                                               |
|                               | Good public transportation                                        |
|                               | Cycling                                                           |
|                               | Street connection                                                 |
|                               | Availability of sidewalks                                         |
|                               | Easy access to streets and terrain                                 |
| **Natural features and preservation aspects** | Park networks                                                   |
|                               | Protected wetlands                                                |
|                               | Tables corridors                                                   |
| **Society and its relationship to urban and natural structure.** | Sustainable urban lifestyles  
The use of geographic information systems in community research  
Improved health and greater equity (justice)  
Participatory mapping  
Recruit participants and engage the community. |
| **Environment and Pollution** | Reducing the impact on the environment  
Reducing the effects of greenhouse gases 95%.  
Reducing pollution rate. |
| **Energy, water and waste management** | Close small waste landfills  
Treating waste as part of a production system  
Restoring of organic matter  
Recycling of solid, liquid and hazardous waste  
Packaging recycling  
Using water to reduce climate impacts  
Dependence on surface water provided by the Paul Run catchment  
Groundwater use from the Southern Colombia Well Field. |
| **Industrial Health** | Economic reuse of goods  
Increased efficiency  
Manufacturing of building materials and cement  
Manufacturing clothes |

### 3. Result and discussion

Extraction the cities experiences and their focus in the urban ecological aspect represented as following:

**England experience at BedZED**
- In the UK, sustainable urban growth that respects urban traditions and contexts has adopted.
- A strong focus on environmentally friendly housing projects and their promotion.
- Supporting a more sustainable lifestyle and environmental protection.
- Creating zero carbon emissions.

**Chinese experience in Todtown and Dongtan**
- Intensifying and establishing Eco-cities based on three types of low-carbon eco-cities.
- Adopting the technologically innovative Eco-cities Model (requires substantial funding).
- Adopting a liveable environmental city model (it can be reproduced and sustained).
- Adopting the progressive development of the Eco-city model (or the modification or modernization model), rehabilitating and renewing ancient cities towards more sustainable urban development.

**Spanish experience in Castellana Norte and Sarriguren**
- Rehabilitation and urban renewal, intensification of functions and focus of events.
- Urban policy depends on ecosystem planning systems.
- Creating new ecological cities.
- Adopting ecological urbanism standards.

**The Finnish experience in Viikki**
- An ecologically sustainable development program for the building and property sector.
- Focusing on good ecological practices.
- Establishing pilot areas for ecological buildings which have an international importance.

**German experience in Freiburg**
• Take an integrated approach to convert existing settlements into environmentally friendly cities.
• Demographic shifts.
• Economic and technological change.
• Adaptation toward climate change.
• Transportation, energy, building improvements, technology and water and waste management systems.
• Implementing pilot projects at the local level.

The American experience in Portland
• Adopting a sustainable urban lifestyle.
• Controlling urban decay
• Social participation from local and regional planning and neighbourhood associations.
• No framework has been drawn for a final urban form or a restriction on the value of the resulting urban form.
• Regional and local planning agencies have worked together to define regions, movement networks and natural areas.

The results drawn from the Eco-city experiences of the England, China, Spain, Finland, Germany and America countries are represented by the variation of the environmental advantage adopted by each country according to their general directions and the specificity of that country as noted in table 8. To begin, Most of Europe focused on greening, preserving nature and green natural resources (including gardens, forests, meadows, marshes, grasslands, rocks, waterfronts, water areas and even private green areas in urban areas). According to natural studies, they are ecological environments affected by human actions. These environments have proven they can be very important for humans to recreation and human entertainment related to different age groups, especially young people[29][30]. Elsewhere, the Chinese experience is oriented towards compact urban intensification, and emphasizes the economic aspect as part of the individual's development and development by providing decent jobs and appropriate job opportunities. Consequently, the work environment will be improved, and then the living environment will evolve with attention and maintenance of infrastructures, with the expansion of public and green spaces and the creation of artificial natural environments. Subsequently, the perspective of ecological urbanization in American cities focuses on technology and intelligence in the green design aspect more than urban sustainability.

Finally, China has concluded several ecological agreements with the European Union and America within the framework of the United Nations, thus promoting common sustainable ecological urban development. Therefore, all studies have directed to integrate scientific, natural, social, economic and urban research and design, leading to concerted efforts in urban planning and management and biodiversity conservation, to a situation in which land use planning and management decisions are based on sufficient information about the benefits that can be derived by humans From urban gardens and forests to reduce pollution and preserve the environment. Additionally, the impact of governance cannot be neglected in all of these countries, as studies have focused on the importance of governance as crucial to the development of Eco-cities, starting with the first scenarios that Eco-cities seek to address, to creating a certain constellation of actors, through to the implementation of specific projects and their ongoing maintenance. Governance is widely known to intersect with the gap between the public and private sectors, and diverse levels of government and transnational squares that operate through different social and technical systems of cities[5]. This helps partnerships succeed at various levels.
Table 8. Comparing the aspects of ecological urbanization of the experiences under study

| Aspects of urbanization for Eco-cities in the European countries | Aspects of urbanization for Ecocities in the Asian countries | The Chinese experience | Spacing Aspects of urbanization for Ecocities in the American countries |
|---|---|---|---|
| Nature related | People-related - Urban Society Development | Individual and Environmental - Suburban Development |
| Carbon reduction | Economic - Environmental growth | Warming and methane Reduction |
| Private cars restriction | Better transportation | Better transportation |
| Waste resource reduction | Living conditions Improvement | Economic viability Increase |
| Historical preservation | Social progress | Justice and fairness equity |
| Environmental development - sustainable society | Economic development and primitive environmental progress for infrastructure | Economic environmental development based on reducing emissions and pollution |
| Existing settlements Preservation and rural area developing | Focus on nature and conservation, green industries and inter-sectoral partnership | Industrial health - attention to technology, intelligence, energy and waste management |

4. Conclusions and Recommendations

The study analysed the most important basic aspects that most of the countries have taken up to adopt the concept of Eco-cities and extracted and sorted some of the special aspects from the global experiences under study. The most significant findings of the research are that the five essential aspects that the countries of the world have adopted, which represented by (the urban and policies aspects - the design and technological aspects - transportation aspects - society aspects and nature or natural features and preservation aspects) comprise a fundamental structure for countries to ensure achieving ecological urban sustainability within all levels and in various fields and therefore should be adopted as a general direction within the framework of the local experience. In addition, reliable indicators that can be adopted locally might be sorted as a first step to shift towards Eco-cities in its simplest form to identify suitable lifestyles as a healthy urban environment within local capabilities. For developing countries, ecological design is still a forward-looking perspective, as it is a high-cost technology, so the use of low-cost technology, passive design techniques are still the main directions. Locally, in Iraq it can be confirmed as a basic solution to climate problems. Also, encouraging public transportation and economic development that is dependent on reducing resource waste is a basis from which to start.

As for urban society, participation and partnership between sectors are experiences can be achieved at the local level. In addition, enhancing the role of women and the societal balance are basis for the success of the local experience. Social participation and the opinion polls exploring became essential to improve the urban reality. Hence, the steps towards sustainable lifestyles require awareness for walking and cycling. In addition, improving public transportation, reducing distances, urban renewal development, are required to provide spaces and public areas. As well as, cars restriction and the alternative energies cars supporting with an emphasis on greening in all its aspects and natural and industrial parks, all are necessary to enhance urban sustainability.
As for urban areas, the first step may be to preserve what exists and develop it ecologically, while preserving the historical and archaeological areas that Iraq abounds in and encouraging investment towards preserving and developing these areas. Emphasis on the municipal institutions and their active role in the transformation processes and conferred them the appropriate powers within the ecological path to carry out their work. Encouraging pilot and innovative investment projects as steps towards opening and announcing the beginning of change. Providing it with the necessary infrastructure for its success, as in Finland and China, as well as in the cities of America. Optimizing and supporting the various sectors and adopting long-term plans and moving away from short-term plans that may be socially unacceptable.

All the above can be achieved within the planned local boundaries and within long-term and future ecological visions. Critically, most countries were unable to make these transfers except when they joined under the banner of the United Nations and concluded broad bilateral and tripartite regional and international convention. These conventions provide support and exchange of experiences, information and studies, which received an effective impact in supporting and encouraging experiences (financially and ethically) and providing them with all the necessary studies. All these help in encouraging global and experimental investment within those international ecological agreements. Therefore, the first of these steps may be to amend local legislation and comply with international agreements where the legislation works as guarantees and practical rules to protect the environment and the individual, whether at the local or international level. All of the above mark the first step towards gradually transforming Iraq towards sustainable Eco-cities.

References
[1] S. Joss 2012 Initiative Tomorrow’s City Today Eco-City Indicators Stand. & Frameworks Bellagio Conf. Rep. (London: University of Westminster) pp 2–20.
[2] S. Pickstone 2020 Europe’s Cities Call for Clean Energy-Future (EndsEurope) [Online] Available: https://energy-cities.eu/policy/cities-call-for-a-more-sustainable-and-equitable european-future.
[3] J. G. Carter and G. Cavan and et al 2015 Climate Change and The City: Building Capacity for Urban Adaptation (Prog. Planning) vol 95 (Manchester: University of Manchester/ UK Elsevier) pp 1–66.
[4] M. Pederson-Zari 2018 Regenerative Urban Design and Ecosystem Biomimicry - Maibritt Pedersen Zari (New York: Routledge-Taylor & Francis Group) pp 1–15.
[5] D. wilhel. Hofmeister and P. Rueppel and et al 2014 Eco-Cities Sharing European and Asian Best Practices and Experiences (Singapore: Konrad Adenauer- Stiftung Ltd.) pp7–176.
[6] S. Çelikyay 2016 A Theoretical Framework on Retro-Fitting Process Based on Urban Ecology (Sustainable Urbanization) (Open access books: Intech Open) chapter 11 March pp 251–267.
[7] C. F. Pardo 2011 Shanghai Manual– A Guide for Sustainable Urban Development in the 21st Century (United Nations Bureau Int. des Expositions) (Shanghai: Bureau Internation des Exposition) pp 3–320.
[8] T. Jashari-kajtazi 2016 An Insight into Green/ Ecological Architecture and Natural Building (Riinvest: University AAB) pp 1–7.
[9] Lydia KallKalli 2018 History of Ecological Design (Oxford: Oxford University/ USA) pp 1–60.
[10] Z. Hou and J. Yao 2012 Ecological Design Strategy of High-Tech Architecture vol 174–177 (Switzerland: Tech Publications doi: 10.4028/www.scientific.net/AMM) pp 3186-89.
[11] Peder Anker 2010 From Bauhaus to Ecohouse: A History of Ecological Design (Louisiana: Louisiana State University/ United States of America Thomson-Shore) pp 1–175.
[12] F. Steinberg and Li Chunyan 2018 Compact Urban Development: EC-Link Draft Version 1.5 (China: Europe-China Eco-Cities Link Project (EC Link)) January pp 1–188.
[13] Z. R. Abaas 2009 The Impact of The Residential Units’ Formation in Raising the Functional Performance Efficiency of the Human Activities - The 6th Engineering Conf. (Baghdad: Univ. of Baghdad/ College of Engineering Journal of Engineering) No. 2 April pp 278–296.
[14] F. Steinberg 2018 Eco-Cities in China – Building the Chinese Dream (China: Europe-China
Eco-Cities Link Project (EC Link) April pp 1–128.

[15] W. A. Yakoub and G. M. Elrayies and et al 2019 Ambassadors of Sustainability: An Analytical Study of Global Eco-Friendly Cities Second Int. Conf. (Tenth Conf. of Sustainable Environmental Development) (Egypt: Menoufia University) March pp 16–20.

[16] T. Chance 2009 Towards Sustainable Residential Communities; The Beddington Zero Energy Development (BedZED) and beyond vol 21 (London: International Institute for Environment and Development (IIED) UK) No. 2 pp 527–544.

[17] S. Joss D. Tomozeiu and et al 2011 Eco-Cities — A Glob. Survey 2011 Int. Eco-Cities Initiative (London: University of Westminster/UK) No. September pp 1–107.

[18] C. Shiuh-Shen 2013 Chinese Eco-Cities: A Perspective of land-Speculation-Oriented local Entrepreneurialism (China Inf.) vol 27 (UK: sagepub co.) No. 2 pp 173–196.

[19] EC-Link 2020 link Eco Cities in Europe and China (EC-Link) [Online] Available: http://www.eclink.org/eclink/en/frontpage.

MVRDV Architects 2020 Logroño Montecorvo Eco City in La Rioja, Spain (Design build network) [Online] Available: https://www.designbuild-network.com/projects/logrono-montecorvo/#:~:text=Environmental Engineer&text=Government officials have approved a wind energy generated on site.

[20] S. E. 2019 Smart Helsinki (Sustain Europe 2020) [Online] Available: https://www.sustain europe.com/smart-helsinki-20191025.html.

[22] T. Eskola 2020 Viikki – Ecological Housing and Planning in Helsinki (Viikki-project) (Helsinki: City Planning Dep.) pp 24–68.

[23] P. Späth and H. Rohracher and et al 2011 Cities and Low Carbon Transitions- The ‘eco-cities’ Freiburg and Graz (London and New York: Routledge Taylor & Francis Group) part II pp. 88–106.

[24] S. Fastenrath and B. Braun 2018 Sustainability Transition Pathways in The Building Sector: Energy-Efficient Building in Freiburg (Germany) vol 90 (Germany: Applied Geography Elsevier) pp 339–349.

[25] J. Cidell 2009 A Political Ecology of The Built Environment: LEED Certification for Green Buildings vol 14 (London: Local Environment Routledge) August No. 7 pp 621–633.

[26] W. Sandra and C. Bill and et al 2008, Portland Plan Comprehensive Plan Evaluation (Draft Report) (Portland: Bureau of Development Services-Design Review) March pp 1–40.

[27] D. Mahmoudi and A. Lubitow and et al 2019 Reproducing Spatial Inequality- The Sustainability Fix and Barriers to Urban Mobility in Portland, Oregon (UK: Urban Geography Journal Taylor & Francis Group) Nov. pp 1–25.

[28] T. K. BenDor and E. Spurlock and et al 2017 A Research Agenda for Ecosystem Services in American Environmental and land Use Planning, International Journal of Urban Policy and Planning, 60, pp 260–271.

[29] J. S. c Liisa and Tyrv’aainen a and et al 2007 Tools for Mapping Social Values of Urban Woodlands and Other Green Areas, Landscape and Urban Planning, 79 (April), pp 5–19.

[30] J. Niemelä and S. R. Saarela and et al 2010 Using the Ecosystem Services Approach for Better Planning and Conservation of Urban Green Spaces: A Finland Case Study vol 19 Biodivers. Conserv (Published online: Springer) July No. 11 pp 3225–43.