C2C

NETWORK

PERSPECTIVE STUDY: AREA SPATIAL DEVELOPMENT

European Union
European Regional Development Fund

INTERREG IVC
INNOVATION & ENVIRONMENT
REGIONS OF EUROPE SHARING SOLUTIONS

Colophon

This perspective study will serve as frame of reference for follow-up activities and exchanges both within and outside the Cradle to Cradle Network (C2CN) and it aims to reflect the current challenges and opportunities associated with implementing a Cradle to Cradle approach. In total, four perspective studies have been written, in the areas on industry, area spatial development, governance and on the build theme.

These studies are not formal academic literature reviews, but are written from a practical point of view and offer some general understanding and guidelines for those engaged in C2C initiatives, as well as policy-makers. They aim to consider 'on the ground' delivery of the C2C philosophy and reflect on both theory and practice. While the perspective studies focus on applications in one thematic area, a separate document – Theoretical Framework – provides more detailed information on the principles of the Cradle to Cradle concept and its implications at a theoretical level. The framework helps to develop a common language for the Network and underpins the perspective studies and the ongoing work of the C2CN.

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Disclaimer

The Cradle to Cradle concept was developed by W. McDonough and M. Braungart. The term Cradle to Cradle is a registered trademark.
The Cradle to Cradle Network project is not designed to develop a criteria-based evaluation tool to determine whether the applications are Cradle to Cradle. It considers that C2C is an approach designed to assist (the search for) better solutions (and ultimately (at) good solutions). Rather than being a score sheet for compliance, the Cradle to Cradle Network approach is oriented to help people understand what the wider implementation of Cradle to Cradle principles in the areas of industry, buildings, governance and area spatial development might look like; and, to disseminate and learn from current and emerging good practice.

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1 Introduction

1.1 Cradle to Cradle

The Cradle to Cradle concept was developed by William McDonough and Michael Braungart[1]. The power of the Cradle to Cradle concept lies in its innovativeness and its ability to mobilise and inspire. The Cradle to Cradle approach is a positive one, starting with an initial intelligent design. It is also a concept that integrates, as it incorporates a design approach and systems thinking. It covers supply chains (the recycling of natural resources, via product and manufacturing design, to high value re-use) and also involves systems as well as management. It envisages a challenging future and incites us to move to a complete new way of product design and innovation. Cradle to Cradle is innovative given the very ambitious goals concerning continuous loops in production, namely to integrate high standard principles in building and area spatial design.

Three principles are essential in the Cradle to Cradle concept:

- Waste equals food: everything is a nutrient for something else. Biological and technological 'nutrients' are reused as nutrients for natural and/or human production processes;
- Use of current solar income: the use of energy sources that are renewable in the timeframe they are used;
- Celebrate diversity: promoting and combining biological, cultural and conceptual diversity.

These principles are key to any Cradle to Cradle inspired development and are supplemented with other principles based on local conditions and interests.

The use of Cradle to Cradle invariably results in the definition of very high project ambitions[2]. Cradle to Cradle helps to build a vision of where regions and organisations want to be in the future. It helps to set the beacons and directions to which innovation should lead. It promotes a shift from eco-efficiency towards eco-effectiveness. A positive agenda plays a central role in the design and manufacture of products and services, in which the synergy between economic (business), ecological and social objectives will be strongly promoted.

'Our goal is a delightfully diverse, safe, healthy and just world, with clean air, water, soil and power – economically, equitably, ecologically and elegantly enjoyed'.[3]

It is not about 'doing more with less' and reducing waste (cradle to grave) but about 'doing right from scratch'. It is logical that these transitions are not realised overnight. Developing a growth path to these newly set goals is necessary and continuous improvement is thus an implicit requirement of engaging in Cradle to Cradle.

1.2 Cradle to Cradle Network

The C2C Network is a capitalisation network (Interreg IVC) which aims to reduce the utilisation of raw materials and to generate less waste and less environmental pollution as well as enhancing innovation and economic development. The C2C Network brings together 10 EU regions to share and capitalise on regional good practices in implementing C2C principles.

The overall objective of the C2C Network is to develop regional action plans, reflecting the principles of the Cradle to Cradle concept, systematising its regional interpretations and setting out how the good practices critically assessed by the network will be implemented within regional mainstream structural funds programmes.

Within the overall more strategic objective the C2C Network project aims on the short term at the following operational goals:

- To create an enduring network of regions related to Cradle to Cradle;
- To promote regional stakeholder involvement;
- To disseminate and communicate to a wider EU audience outside the partnership (awareness raising) and to the European Commission (policy recommendations) on approved methods for waste prevention/reduction based on the Cradle to Cradle philosophy.

The ambition of the C2C Network project is to help understand what the implementation of Cradle to Cradle for the target areas industrial design (materials, products, production processes), buildings (design, materials, construction), area spatial development and governance could look like and to disseminate and learn from good practices. The objective is not to use or develop a criteria-based evaluation

1 William McDonough and Michael Braungart. (2002). Cradle to Cradle: Remaking the way we make things
2 Stouthuysen, P., Le Roy, D. (2010). Theoretical Framework. Commissioned by Cradle to Cradle Network
3 McDonough, W., W. McDonough on Cradle to Cradle design, presentation at TED 2005 conference http://www.ted.com/talks/willam_mcdonough_on_cradle _to_cradle_design.html

tool that states which applications are Cradle to Cradle and which are not. A theoretical Cradle to Cradle framework has been developed for a common language within the network[2]. This framework may form the basis of the regional action plans to be developed.

1.3 Objective perspective study area spatial development

The aim of this perspective study is to provide insight into the state of the art as well as future developments in area spatial development from the Cradle to Cradle point of view. In this study area spatial development has been defined as methods used by the public sector to influence the distribution of people and activities in spaces of various scales. Area spatial planning includes all levels of land use planning: urban planning, regional planning, environmental planning, national area spatial plans and plans at the international level in the European Union.
In doing so area spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organisation of space according to an overall strategy[4].

In this perspective study, area spatial development is formulated as a joint, coherent entity, more than just one building. This perspective study will serve as frame of reference for follow-up activities and exchanges both within and outside the C2C Network. This study will not be a formal academic literature review, but is written from a practical point of view. This report will offer some general learning points and guidelines for those engaged in C2C initiatives as well as for policy makers. It aims to bridge the gap between the Cradle to Cradle concept and C2C inspired practices.

4 The European Regional/ Spatial Planning Charter (often called the 'Torremolinos Charter'), adopted in 1983 by the European Conference of Ministers responsible for Regional Planning (CEMAT).

2 A C2C approach for area spatial development: theoretical framework

Especially since the appearance of the book Cradle to Cradle: Remaking the Way We Make Things (McDonough & Braungart, 2002) cities and regions have been thinking how to apply the ideas of C2C in area spatial development. The three general C2C design principles (waste equals food, use of current solar income and celebrate diversity) are key to any Cradle to Cradle inspired development and are supplemented with other principles based on local conditions and interests.

When looking at area spatial development 'Doing right from scratch' means that, from the design stage on, the various functions of living, working, recreation, transport, nature, food production, etc. are fully integrated. The use of resources and renewable energy and water treatment are conceived from an integrated perspective including production, use and recovery. The quality of the built environment has to ensure a safe, healthy and pleasant environment for its users. Making reference to how nature is managed, Cradle to Cradle stimulates us to design our buildings as trees and our cities as forests.

The implementation of Cradle to Cradle on the scale of area spatial development was first introduced in the Netherlands in the Venlo area[5]. More information about the C2C-inspired projects in this region e.g. Floriade2012 and Four-Leaf Clover can be found In paragraph 3.4.

Cradle to Cradle in relation to spatial area development is not yet as developed as it is in building design. However, many similarities within the approaches can be determined as buildings are linked in one way or another to the area where they are constructed. The role of Cradle to Cradle in spatial area development is that of helping to state intentions on how to come to beneficial links between building elements and the physical layer, the various flows (water, air, food, energy) and the functions needed in the area.

2.1 The formulation of guiding principles

An element that returns in almost all area spatial developments, inspired by the C2C concept, is the use of guiding principles. This means that the three main principles of the C2C concept are translated into specific principles at local or regional level. Define principles at the start of an area spatial development and use them for inspiration during the whole development. By defining local principles the unique, local aspects of the location are incorporated in he area spatial development. In this way in the Netherlands principles were drawn up for regional developments in the municipalities of Venlo (2009)[6], Almere (2008)[7] and IJburg (2009) as well as for the area developments Floriade2012 and Four-Leaf Clover in the province of Limburg (2008)[8]. The basic principles 'waste equals food' and 'use of current solar income' are usually translated into general goals and measures like the application of closing the loops of material and water flows and the use of renewable energy. The 'celebrate diversity' principle is used to incorporate local conditions in area spatial development.
In the end, principles are made concrete in strategies and tangible measures, for example large scale application of solar energy in an area spatial development. Figure 1 shows the route from C2C and its basic principles to the formulation of principles for various area spatial developments. In the end formulated principles must result in concrete goals/measures and processes that lead to the realisation of these goals and measures.

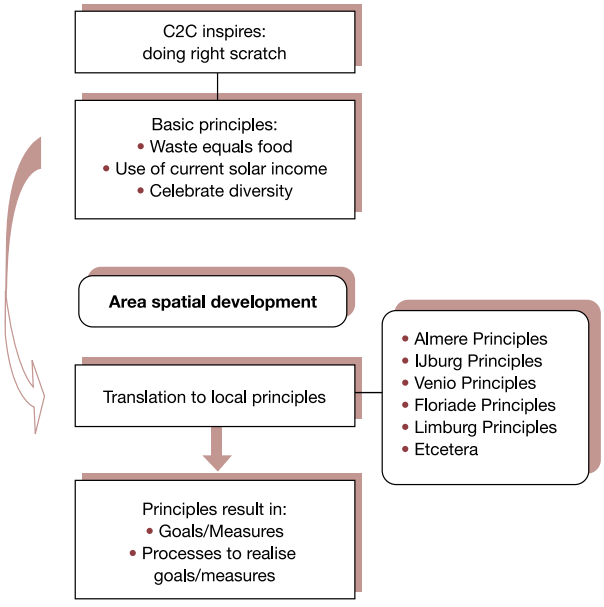

Figure 1: C2C approach for area spatial development

5 A cradle to cradle vision for Floriade 2012 and Venlo (2007). W Mc Donough and Partners, Architecture and Community Design, USA
6 Regio Venlo, C2C in Venlo, www.regiovenlo.nl
7 The city of Almere (2008). De Almere principles: voor een ecologisch, social en economisch duurzame toekomst van Almere 2030 (the Almere principles; for an ecological, social and economical sustainable future of Almere 2030)
8 Klavertje 4 ruimtelijk ontwerp, het cradle to cradle werklandschap van greenport Venlo

Limburg Principles

Since 2008 Limburg has aimed to design and implement area spatial planning programs based on the Cradle to Cradle concept. This ambition has been stated in the 'Policy Framework on Sustainable Development 2008-2011' of the Province of Limburg[9]. This policy framework identifies six principles that are Cradle to Cradle based but also takes into account aspects that relate to area spatial development. These principles are referred to as the Limburg Principles (see table 1). The Limburg Principles are broadly formulated. In the C2C Network they are used as a starting point for Cradle to Cradle inspired area spatial development.

Table 1 The Limburg Principles (Province of Limburg, 2008)

We are native to our place
Our waste is our food (closing the cycles)
The sun is our income
Our soil, water and air are healthy
We provide enjoyable mobility for all
We design enjoyment for all generations

2.2 The use of guiding principles during the process of area spatial development

Area spatial development processes are split into phases. Many phases are used in practice. The following distribution of phases is often found

1 idea/vision
2 design
3 implementation
4 construction
5 use

Defining project-specific principles at the start of area spatial development and reflecting on them during the entire process of area spatial development is a powerful tool to safeguard the original ambitions and mission of that development. Throughout the whole development process the principles inspire and guide people and organisations involved to come up with innovative solutions. In the end, principles will need to result in strategies and tangible measures.

Figure 2 illustrates this safeguarding and learning process that is often found in area spatial development projects inspired by C2C[10]. This scheme shows how regular reflection on the development principles can be used in an area spatial development process to safeguard the original mission and to inspire people and organisations to come up with innovative solutions.

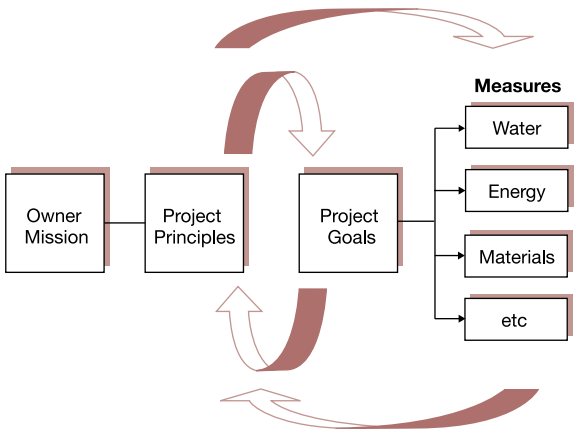

Figure 2: The use of guiding principles during the process of area spatial development

The Limburg Principles are the leading principles in the C2C Network. In chapter 3 good projects within the Cradle to Cradle network will demonstrate how these principles have been or can be applied in practice.

9 Policy framework on sustainable development 2008-2011 (2009) Province of Limburg, Maastricht
10 Kees Noorman (2010), McDonough + Partners, Amsterdam

3 C2C in practice: good practices

3.1 Introduction

In this chapter we illustrate how the Limburg Principles have been used in the C2C Network. Within this network it has been investigated whether the Limburg Principles are inspiring and of practical use for area spatial development. More than 25 cases in five participating regions were identified.

Figure 3: Distribution of good practices within the C2C Network

Limburg principles

At the start of the C2C Network each of the six Limburg Principles was worked out in more detail, to ensure that all participants had the same perception of what is meant by the Limburg Principles (Table 2).

Table 2 Elaboration of the Limburg Principles for the C2C Network

We are native to our place
• integrate in your project the natural, historical and cultural assets that are already present in the area • improve ecological quality • maintain as much as possible, integrate natural areas with the structured landscapes • make use of the added value of natural materials • use materials cleared from the site in productive ways on the site • encourage the use of local construction materials • create area spatial quality
Our waste is our food (closing the cycles)
• use materials that can be recycled in the future and that are either biological or technical nutrients • use regional products: exploit the dynamic force and strength of the area itself and the various levels of recycling and social energy • use materials with a low life cycle impact and low embodied energy • evaluate and optimise the full life cycle of products and processes to approach the state of natural systems, in which there is no waste
The sun is our income
• encourage the use of technologies which can reduce CO2 emissions • encourage the use of energy from renewable resources • be a sustainable energy producer • percentage of renewable energies used/incorporated (solar, wind, bio-based); green roofs, green walls; on-site power generation, combined heat and power energy strategies; 100% renewable energy

Our soil, water and air are healthy

- create soil balances and closed cycles of excavated soils by reuse, protection against erosion and avoidance of contamination
- create water balances and closed cycles by the use of rainwater, dual piping systems, low water impact appliances, infiltration and water retention
- prevent toxic offgasing in buildings
- prevent and/or reduce emissions into ambient air

We provide enjoyable mobility for all

- support environmentally friendly transport
- demonstrate alternatives to fossil fuel
- provide eco-effective transportation ('green' public transport, bicycle, low/no-emission vehicles)
- promote reverse logistics/reduce transport kilometres
- integrated in the landscape, with use of sustainable materials and with contribution to energy production, and with minimal nuisance (noise, air), design sustainable infrastructure

We design enjoyment for all generations

- act socially responsibly
- create opportunities for cultural and educational improvement
- provide opportunities for innovation, creativity and sustainability
- promote social fairness by delivering competitively priced goods and services that
  - meet customer requirements
  - and contribute to the quality and convenience of life
  - and do not burden future generations with
    - requirements for maintenance
    - or vigilant administration of potential design due to the careless creation of products processes, or standards

To collect and describe the examples, within the C2C Network indicated as good practices, a good practice form was made. The description focuses on general information about good practice and a part where the good practice owner was asked to indicate how the Limburg Principles can be applied in his/her project.

Categorisation of good practices

All good practice forms were analysed and categorised. It appeared that a categorisation based on scale level and area type was useful.

Scale levels and area types

Area spatial development takes place on various scale levels. In this study three scale levels have been distinguished:

- regional, e.g. a large agricultural area consisting of various villages and cities;
- municipal, a single city or village;
- part of municipality, like an industry area or a neighbourhood.

In addition a differentiation between three area types has been made: rural, urban and industrial.
The rural projects all had a regional scale. The urban projects were on a (part of) municipality scale. Industrial type projects dealt with industrial zones in municipalities.

Table 3 Categorisation of the good practices in the C2C Network project

Regional scale	Municipal scale	Part of municipal scale	
Rural	Urban	Urban	Industrial
9 good practices	1 good practice	11 good practices	4 good practices

Development phases

The good practices in the C2C Network also differed in development phase of the area spatial development process. Some good practices are still in the idea/vision phase. In others, parts of the area spatial development are finished and in use.

Table 4 shows an overall view of the categorisation and the development phase of all good practices in the C2C Network.

Table 4 Overall view of the categorisation and the development phase of all good practices in the C2C Network (no good practice in 'use' phase)

Scale	Area type	Phase			
		Idea/vision	Design	Construction plan	Realisation
Regional	Rural	Maastricht-Valkenburg Country Estate Zone (NL)	Pedemontana Lombarda Motorway (IT)	The Great Fen Project (UK)	Nutrire Milano (IT)
			Wicken Fen and the Wicken Fen Vision (UK)	Sarsven/De Banen (NL)	La Cassinazza (IT)
			De Wijers (BE)		Merode (BE)
Municipality	Urban			Ecopolis-Vlaanderen (BE)	
Part of municipality	Urban		Cohousing Milano (IT)	Kerkrade-West Living District (NL)	District of Tomorrow Heerlen (NL)
			Peterborough Cathedral Square Redevelopment (UK)	A2 Tunnel Maastricht (NL)	Belvedere Maastricht (NL)
			Northstowe Eco-Town Development (UK)	Ringoven Park Peel en Maas (NL)	
			Ieper Sustainable Quarter (BE)		
			Tampere (FIN)		
	Industrial			Four-Leaf Clover (NL)	Floriade 2012 (NL)
				Greenportlane (NL)	ENCI (region Maastricht) (NL)

3.2 C2C inspiring good practices

The C2C Network has investigated whether the Limburg C2C Principles are inspiring and of practical use for area spatial development. The following three subparagraphs, based on categorisation for area types (rural, urban and industrial), describe how the good practices can be linked to the Limburg C2C Principles. For each area type, one or several good practices is/are described in more detail. The Nutrire Milano (Italy) case can be categorised as a mainly rural project on a regional scale. The Tampere (Finland) and Ecopolis/Ieper (Belgium) projects are about urban developments on a (sub)municipal scale. The good practices at Floriade 2012 and Four-Leaf Clover in the Venlo region (the Netherlands) are about area spatial development of an industrial area.

3.2.1 Rural areas: transition of agriculture

The rural projects presented to the C2C Network were all on a regional scale (see table 3). Many of them dealt with agricultural areas in transformation. There are two important drivers for this transformation:
- diversification of agriculture. To keep a region economically vital, people search for alternatives;
- adaptation to the changing climate. To reduce the increased risks of flooding, farmland is turned into water storage and nature.

The Nutrire Milano project focuses on regional food production and consumption. The Estate zone in the Maastricht-Valkenburg area and the De Wijers project have similar goals, so here are opportunities for international co-operation.

In the Great Fen, Wicken Fen, Merode, De Wijers, Sarsven/De Banen and Country Estate Zone projects water management and nature conservation play an important role. In the UK the focus is on safeguarding and developing the unique fenland habitat. The Sarsven/De Banen project and the Country Estate Zone project search for a good balance between water needed for nature and agriculture. In De Wijers project pumping water from the former (coal)mines is one of the regional challenges.

The Pedemontana Lombardo Motorway project is an attempt to integrate motorway design, green technologies and environmental mitigation and nature compensation. The backbone of the project is a greenway, a linear system at a regional scale that links 50 local projects for landscape conservation and valorisation alongside the motorway. In addition, a huge solar roof (60,000 m2 of solar panels, 9 MWh of energy production) will be installed.

Table 5 Overview of rural good practices

Country	Good practice
Italy	Nutrire Milano[11] Pedemontana Lombarda Motorway (as initiatior for area spatial development) La Cassinazza
United Kingdom	Great Fen Wicken Fen and the Wicken Fen Vision
The Netherlands	Maastricht-Valkenburg Country Estate Zone[12] Sarsven/De Banen[13]
Belgium	De Wijers[14] Merode

The results in the frame of this C2C Network show that the use of the Limburg Principles helps to structure the challenges and goals for the various regions, in spite of the fact that they were developed from a different point of view and for different challenges. In practice it appears that the solutions found for these challenges show many similarities, like developing nature in combination with tourism.

The Limburg Principles help to structure the goals and measures of area spatial development projects. This improves the possibilities for cooperation of different regional area spatial development projects that do not have much in common at first sight.

Nutrire Milano was a current area spatial development when it joined the C2C Network. Instead of using the Limburg Principles as starting point, they used them to:
- structure measures already planned;
- make plans for new, innovative measures;
- find common interest and areas for cooperation with other good practices.

So even for area spatial developments which have already started the Limburg Principles can be of use. Table 6 shows how the Nutrire Milano goals can be categorised based on the Limburg Principles.

11 www.nutriremilano.it
12 www.gomv.nl
13 www.sarsvenendebanen.nl
14 www.dewijers.be

Table 6 Nutrire Milano goals in relation to the Limburg Principles

We are native to our place

- permanent education and engagement
- promotion short supply chains of locally produced (slow) food

Our waste is our food (closing the cycles)

- use natural fertilisers

The sun is our income

- promotion renewable energy

Our soil, water and air are healthy

- promotion organic food chain

We provide enjoyable mobility for all

-

We design enjoyment for all generations

- social and environmental development and innovation
- promote (local) tourism

Good Practice: Nutrire Milano

Nutrire Milano is good practice on a large regional scale that shows that area spatial development does not only deal with the construction of buildings, but is also about the development of new economic activities in a region.

Nutrire Milano aims to redevelop the metropolitan area of Milan (both the city and the agricultural area south of Milan) in such a way that a consistent regional network is created between farmers, retailers and catering operators involved in fresh, organic, locally produced food. In this way more favourable economic conditions are created for producers, sellers and consumers[15].

The Milan Earth Market shows how Nutrire Milano works in practice. The venue for the market is Parco Vittorio Formentano, traditionally known to local people as the Largo Marinai d'Italia Park. The main market producers are from the South Milan Agricultural Park (Parco Agricolo Sud Milano), which at over 47,000 hectares is one of the largest urban-edge agricultural parks in Europe. More than 40 producers with an extraordinary range of products are involved, including some Slow Food Presidia. The market's initiatives include Taste Workshop tastings organised by the Slow Food Lombardy Convivium to enable visitors to compare the outstanding products presented at the market with ones of lesser quality.

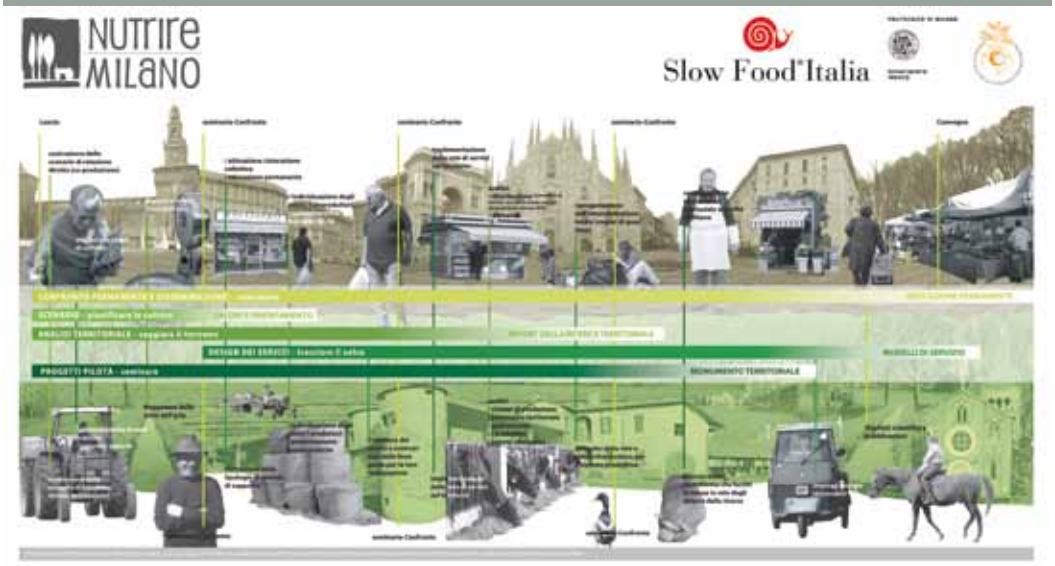

Figure 4: Nutrire Milano

The market offers an opportunity to bring the big city closer to the nearby countryside, something which many people have not previously experienced. Producer Elisa Pozzi describes her contribution:
'We have been selling our raw milk and fresh cheeses direct to the public since 2004; we also have beehives on our farm and produce honey from acacia, lime and millefiori, the most prevalent blossom in our area. A small part of our land is used for growing rice and we still use an old husker to process it. Children and interested members of the public often come to see our activities and I am delighted to answer their questions'.

Producer Elisa Pozzi

15 See: http://www.nutriremilano.it.

3.2.2 Urban areas: keep them unique, vital and sustainable

The urban projects of the C2C Network are mostly on a municipal scale. They deal with the development of more sustainable cities or parts of them. In many good practices the focus is on the reduction of energy use and the application of renewable energy. All urban good practices are shown in table 7.

Attention for the process of area spatial development is important for many of the projects and many projects recognise that this process is crucial for the success of the project.
Traditional approaches are slow and time-consuming. The urban good practices did not really formulate clear C2C inspired principles that are easy to communicate at the beginning of the area spatial developments. In Chapter 2, in the paragraph about using guiding principles during the process of area spatial development, it is argued that generally formulated C2C-inspired principles have the advantage that they will be applicable over a long period, in contrast with more technical goals mentioned for example in the good practices of Ieper and Tampere. The use of guiding principles and a development route that regularly uses these principles to reflect on might simplify and speed up the area spatial development process for urban projects.

Table 7 Overview of urban good practices

Country	Good practice
Italy	Cohousing Milano[16]
United Kingdom	Peterborough Cathedral Square Redevelopment. Northstowe Eco-Town Development
The Netherlands	Kerkrade-West Living District[17] District of Tomorrow Heerlen[18] Belvedere Maastricht[19] A2 Tunnel Maastricht[20] Ringoven Park Peel en Maas[21]
Belgium	Ecopolis-Vlaanderen[22] Ieper Sustainable Quarter
Finland	Tampere[23]

In the Kerkrade-West Living District (NL), A2 Tunnel Maastricht (NL) and Peterborough Cathedral Square (UK) projects an existing neighbourhood will be among the things restructured and redeveloped.

The first step in the Kerkrade-West Living District project has been to examine which sources this area has for the supply of energy, materials and water and which users the neighbourhood has. A feasibility study is in the making to gradually apply the results. Goals are include the renovation of existing houses into so-called passive houses. The use of solar energy is related to the program for passive housing. The development of new houses for people already living in the neighbourhood is foreseen. Where demolition is necessary, this will be done in a sustainable way and construction materials will be reused. Cycles for energy, water and materials will be closed as much as possible.

The redevelopment of Peterborough Cathedral Square is one of the projects within the zero waste places initiative. Peterborough is one of the six zero waste places in the UK. The visionary goal of the zero waste places is to prevent waste occurring, conserve resources and recover all value from materials. No less than 3,000 tonnes of waste have been saved through the use of a shallower sub-base. Redundant materials find a new destination via the Eastex materials exchange programme. Already 54 tonnes of additional materials have been diverted from landfill and an estimated 1,500 tonnes of CO2 have been saved.

To improve access to Maastricht and to improve the flow of local and international traffic, a tunnel 2.5 kilometres long will be incorporated into the A2 motorway in a comprehensive and sustainable manner. Materials released during the works will be reused, including limestone, asphalt and concrete. As a result of the project the air quality in the city will improve. Measures will be implemented to improve the biodiversity and the specific Southern Limburg biotope of marl soil. Above the tunnel, new living space will be developed, with parks and green areas. The city districts on both sides of the road will be connected again by (sustainable) traffic routes like walking and bike tracks.

16 www.cohousing.it
17 www.hestiagroep.nl
18 www.dewijkvanmorgen.nl
19 www.belvedere-maastricht.nl
20 www.a2maastricht.nl
21 www.ringovenpark.nl
22 www.ecopolisvlaanderen.be
23 www.eco2.fi

In the Eco-town Development at Northstowe (UK), District of Tomorrow (NL), Ringoven Park Peel en Maas (NL), A2 Tunnel Maastricht (NL), Belverdere (NL) and Cohousing Milano (IT) new districts are being developed. A newly started project is the development of the new town of Northstowe. The aim is for the site to be a net zero-carbon development from day one. Some 9,500 homes are expected to be built in this proposed new town. Background work is already being undertaken.

The District of Tomorrow is a study project that develops, implements, exhibits and operates four energy-efficient, innovative buildings (Passive House, Exhibition Building; Exergy Building and Zero Energy Materials Building) at the Avantis European Science and Business Park in Heerlen (NL). The buildings have been developed and constructed by students at university of applied sciences level in collaboration with companies and local and regional authorities. The area will use zero fossil fuels. Sustainable management of resources is at the heart of the project: closing cycles and renewable resources. Ambitions in social and health issues have been defined as requirements for the buildings' design. A new residential district will also be developed around a former brick-kiln in the municipality of Peel en Maas (NL). Restoring the former brick-kiln by using the original materials as far as possible is at the centre of this plan.

Belvedere is one of the largest urban development programmes in Europe covering 280 hectares. The development aims at, among other things, relocation of polluting businesses, preserving and reinforcing characteristic historic, ecological and rural values and sustainable construction of homes. Highlights may be the construction of a renewable energy power plant, consisting of PV solar cells, wind turbines, a biomass power plant and a hydropower plant. The sustainable performance of the whole Belverdere area will be assessed with a new BREEAM-related labelling method of the Dutch Green Building Council.

Another example of good practice in developing a new district is Cohousing Milano. Usually a cohousing consists in 20-40 living units, the people in which have chosen to be together and have decided to live as a 'neighbourhood community' in order to start– through a participatory design process – the building of a 'village' where private spaces (one's own house) and communal spaces (shared services) coexist, where human relations help to reduce the complexity of life and where great attention is paid to sustainability and energy saving (e.g the selection of local and low environmental impact materials, the possibility of producing a share of the vegetables). The first projects have been started in the Milan region.

Good practices: Tampere and Ecopolis/Ieper

In the Tampere and Ecopolis/Ieper good practices CO2 emission reduction plays an important role. Both Tampere and Ecopolis/Ieper had translated their goals into concrete measures before the C2C Network project started. They used the Limburg Principles to categorise their selected measures (see tables 8 and 9 respectively). Both good practices aim at involving all relevant stakeholders, and they both recognise that this is a challenging process.

Table 8 Tampere Measures

We are native to our place

- density increase
- energy-efficient renovation

Our waste is our food

- waste water/sewage/sludge investigated for energy recovery at central waste water treatment plant
- investigate the use of waste energy in the Tammervoima Power Plant project

The sun is our income

- energy production
- use timber
- use hydro power
- use wind power

Our air, soil and water are healthy

-

We provide enjoyable mobility for all

- limit the need to travel
- public transport attractive; rental bicycles
- develop city rail
- stimulate electric cars

We design enjoyment for all generations

- services & open spaces easily accessible for all

Good Practice: ECO2 – Eco-Efficient Tampere 2020[24]

Tampere City has chosen a pioneering path in the climate change strategy. Tampere will stop the increase in greenhouse gases although the population will increase. The city will commit to the vision of a carbon neutral Tampere. This means a decrease in emissions of at least 30% in comparison to the 1990 level by 2020. Greenhouse gas emissions in 2030 should be 50% less than in 1990 and 80% less in 2050. To reach its goals Tampere has chosen an eco-efficient, compact city structure in city planning, both building new and repairing the old, as for example in certain areas of the city such as Nurmi Sorila,and Vuores.

The start-up phase of ECO2 Ekotehokas Tampere 2020 will be in 2010–2012 and it is supported by Sitra, the Finnish Innovation Fund. ECO2 will continue as a strategic project until 2020. Objectives are the implementation of Tampere's climate commitments, developing operational methods in urban development, supporting the growth of the environment business and assuming the role of a forerunner in environmental matters. Ways and means to reach these goals are wide-ranging cooperation between various actors (for example public/private partnerships between building companies and the city in the field of energy efficiency), new city planning tools, project development and pilot projects in energy efficiency.

All the new building projects of the City of Tampere will be comply with at least class A energy level. The city challenges private constructors to follow suit. Luhtaankatu daycare centre will be built as a passive energy building that also utilises solar energy. Real estate services will compile a set of regulations for energy-efficient renovation. The Energy-Efficient Service Buildings project in Tampere will be launched in cooperation with the area's parishes, hospital district and various other players. A new Sustainable Building Centre will be established in Tampere where residents will receive guidance and information on energy-efficient building, renovation and living.

By 2020, the local power utility, Tampereen Sähkölaitos Oy, will increase its production of renewable energy to 30%. The long-term goal is to produce 80% of the city's heat and electricity with renewable fuels by 2040. Residents are encouraged to use renewable energy sources. The possibilities for eco-efficient complementary construction in all the city's districts will be investigated. Low carbon and carbon neutral residential areas are being planned. Our target is to find housing for 15,000 new residents by 2030.

Carbon dioxide emissions of traffic are to be reduced by developing public transport, bicycle and pedestrian traffic and logistics systems. The planning of a tram system will be started and negotiations with the government for its finance model will commence. A new centre for electric vehicle conversion will be established in Tampere.

The city's sustainable energy programme foresees evaluating the long-term financial impacts of the programme (KH Thesis) and promoting the energy-efficiency agreement and its actions between the city and the other Tampere partners and their organisations like Tampere Chamber of Commerce and Industry or the Employment and Economic Development Centre for Pirkanmaa.

Figure 5: ECO2 - Eco-Efficient Tampere 2020

24 www.tampere.fi
www.eco2fi/default/en/

Table 9 Ieper Measures

We are native to our place

- integrating water and water related plants
- integrating playgrounds and circuits for slow traffic
- use of local and natural building materials

Our waste is our food

- houses are built to last
- waste should be reduced
- green waste reused as compost

The sun is our income

- sufficient insulation
- orientation of the houses
- flat roofs for compact building
- green roofs
- solar panels are possible
- check if CHP (Combined Heat and Power) is possible

Our air, soil and water are healthy

- use of rainwater, infiltration
- water retention on the surface
- reuse of grey water
- excavated soils are spread out locally
- erosion prevention by use of terraces

We provide enjoyable mobility for all

- routes for fast bicycle connection with the city centre
- introduction of 'Cambio' cars
- improve local transport

We design enjoyment for all generations

- offer building plots at affordable prices
- support social responsibility by organising collective maintenance of green spots
- shared private gardens
- attractive public spaces for encounters
- streets with low traffic movements
- separate car parks

Good Practice: Ieper

The Ecopolis approach in Belgium and its planned demonstration project in Ieper goes further and uses the holistic approach of the city as an eco-system. It is based on the basic triple strategy of:

- the responsible city (close the loop);
- the vital city (bring diversity and liveability);
- the participating city (engage all actors and stakeholders).

Cradle to Cradle ideas are clearly reflected in the Ecopolis strategy. A city should produce in a positive and equitable way, without 'leaking' and compromising the next generation.

City of Ieper: BlueGreen Network in a new quarter of the city (private housing)

West-Vlaamse Intercommunale (Wvi)[25] is an intermunicipal association, working for the Province of West Flanders and 54 municipalities and cities in the Province of West Flanders. Wvi develops new industrial zones and redevelops old industrial sites, develops social housing projects, assists municipalities in making spatial structure plans and spatial allocation plans, and also assists municipalities in issues such as mobility, environment, nature, and public spaces. One of its projects is the development of a new quarter of the city of Ieper (Ypres) with sustainable housing based on a BlueGreen Network. It will consist of about 246 houses, some privately owned, some social housing. The greater part is intended as building plots for private families. Wvi wants to support those families and their architects to build sustainable houses. Wvi is now implementing the results of the water management study into an allotment plan. The Flemish government has signed a contract with an engineering office to start infrastructure planning. With these plans a permit can be obtained and a public tender can be organised to start building the infrastructure.

An ambitions statement has been drafted by the municipality. Building plots will be offered at affordable prices. One of the aims is to prevent waste during the building process. Sufficient insulation is a condition; green roofs and solar panels are possible. An energy study should show whether a geothermal heat pump is possible. Once the houses are occupied green waste will be collected at allocated places and reused as compost. Water will be retained on the surface instead of using the traditional dual sewage system. Water related plants will be integrated in the project. The use of rainwater is encouraged; the reuse of grey water is currently being examined. Streets will be constructed that allow low traffic movements and have separate car parks. There will be routes for fast bicycle connections with the city centre. Local bus transport should be improved. Social responsibility will be supported by organising collective maintenance of green spots, shared private gardens, and attractive public spaces for encounters.

Actors involved are the City of Ieper[26], Ons Onderdak[27] (a social housing company), a private company, and Wvi, who are partly financing the project. The involvement of future residents is considered desirable, but has not yet been achieved. Other finance is coming from Flemish and European funds.

Figure 6: BlueGreen Network Ieper

25 www.wvi.be
26 www.ieper.be
27 www.onsonderdak.be, www.arch-janmaenhout.be

3.2.3 Industrial areas: use C2C as innovation engine

Industrial good practices show that Cradle to Cradle and the Limburg Principles can lead to innovative area spatial development of industrial sites. Innovation results from combining activities in a way that would not have occurred with standard area spatial development methodologies, for example at the ENCI, an industrial site in Maastricht where marl is quarried and processed into cement. In 2018 quarrying will end and from 2010 the ENCI site will be transformed into a site where industry, wellness and nature exist side by side. Although Cradle to Cradle was not the starting point, the Limburg Principles have been used to structure the activities and measures of this transformation process.

All the industrial good practices presented to the C2C Network are shown in table 10.

Table 10 Overview of industrial good practices

Overview industrial projects	
Country	**Good practice**
The Netherlands	Region Venlo projects: • Floriade 2012/Venlo GreenPark[28] • Four-Leaf Clover • Greenportlane (road) Region Maastricht projects: • ENCI[29]

28 www.floriade.com
29 www.encitransformeertnu.nl

Good practices: Four-Leaf Clover, Floriade/VenloGreenpark, Greenportlane

The main industrial good practices are projects in the Venlo region in Limburg (The Netherlands), with the Floriade2012/GreenPark as the most striking example. The Floriade is the world horticulture exhibition that will take place in 2012. The area that is currently being developed for the Floriade will be transformed into a high tech sustainable C2C-inspired business park after Floriade has closed its doors in autumn 2012. This business park, called Venlo GreenPark, will be dedicated to innovation, logistics, knowledge transfer and market orientation. So, ever since 2008 the Floriade organisation has been involved in area spatial development of the future Venlo GreenPark area. In this area three sustainable buildings[30] are already under construction (Innova Tower, Villa Flora and the World Pavilion, see figure 7).

Figure 7: Innova Tower at Floriade/Venlo GreenPark

The area of Floriade/Venlo GreenPark is part of the so-called 'working landscape' Four-Leaf Clover. This working landscape is about 5,400 hectares in size and consists for about 50% of nature areas and for 50% of industrial sites intended for agrofood businesses (mainly greenhouses and agrologistics) and high tech industries (e.g. solar cell manufacturers). See figure 8.

30 Sustainability of the buildings is labelled with the Breeam methodology. The goal is to develop buildings that score at least very good to excellent.

Figure 8: Artist impression of the future working landscape Four-Leaf Clover.

To ensure that the Four-Leaf Clover area and especially Floriade/Venlo GreenPark becomes more accessible, a new access road will be constructed: the Greenportlane. The name Greenport is used for economic networks of companies, organisations and institutes involved in agribusiness and agrologistics. Figure 9 shows the area spatial scale of the Four-Leaf Clover, the Floriade/ GreenPark area and the Greenportlane.

Figure 9: Four-Leaf Clover, Floriade/Venlo GreenPark area and Greenportlane.

The whole industrial area of Four-Leaf Clover as well as Floriade2012 and the Greenportlane have been developed using C2C-inspired principles right from the start of the developments (see table 110. This means that the development corporation and business companies have to face the ultimate challenge of implementing the C2C concept in their buildings and business operations. To control this an Area Spatial Master Plan has been drawn up in which development goals are laid down in accordance with the C2C philosophy. The Area Spatial Master Plan tackles issues like nature, ecology, energy (exchange and neutrality), water (exchange and neutrality), and traffic/mobility. During the subsequent 30 years, each part of the Four-Leaf Clover area will be (re) developed or tackled in a different way as time goes on (transformation) by employing various allocation models (ground lease, concessions).

The various development programmes will put the C2C-inspired goals into practice. Land will be used intensively by combining water management, nature conservation, landscaping and recreation, but also by means of an effective traffic system. These issues are translated into goals such as:

- Create multifunctional and multiple use of space;
- BlueGreen and area spatial framework: nature, watercourses, infrastructure and landscape are area spatial carriers that warrant accessibility and liveability in the long term (also with respect to climate change);
- Minimise traffic movements by chain optimisation in agrologistics;
- Maximise self sufficiency in (renewable) energy, water and soil by closing loops of production, use and reuse;
- Sense of place: creation of a attractive, green and healthy environment to work, recreate and be in;
- Make use of the opportunities of the area spatial quality to give the area a special, distinguished identity.

These goals are translated into concepts and measures. For instance, efforts are being made to make the buildings 'water neutral' by swapping water between different functions (supply and demand) via the natural water system. Water will therefore not be supplied to or drained from the site by supply and sewage pipes. Instead, rainwater will be used and stored in the ground. Also, waste water will be purified by helophyte filters on site in so-called 'living machines'.

The same principle will be applied with respect to energy. Maximum use will be made of energy sources such as heat cold storage, solar energy, wind energy and biomass. This will go to link up the various sections within the entire area. To create an effective traffic system collective parking facilities and placing traffic-intensive functions close to the main road are applied. Figure 10 shows a schematic representation of these ideas. Table 11 shows how the Limburg Principles are used in the Four-Leaf Clover project and Floriade/Venlo GreenPark.

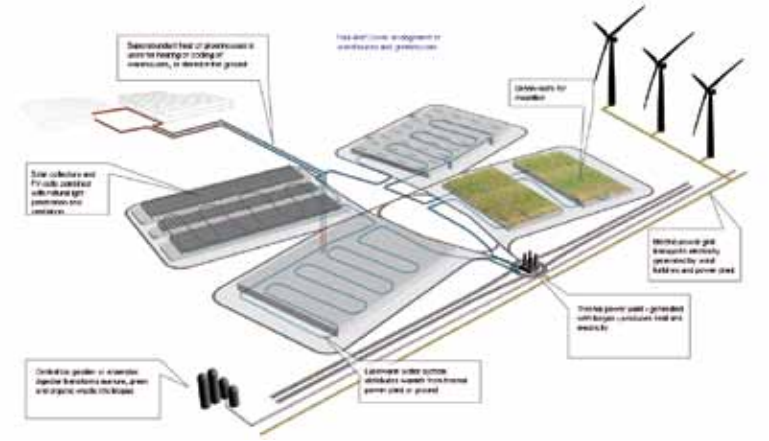

Figure 10: Schematic representation of allocation of businesses, traffic movements, water chains and energy system in de Four-Leaf Clover area

Table 11 Practical translation of Limburg C2C Principles in the Four-Leaf Clover project and Floriade/ Venlo GreenPark

We are native to our place

- area spatial design based on the existing green-blue underlay and biodiversity
- reinforcement of ecological main structures by planting 1500 new trees and 80.000 new perennials in the Floriade/VenloGreenpark area
- maintain and strengthen cultural-historic and archaeological remnants

Our Waste is our Food (closing the cycles)

- development of the areas with closed soil balance and closed water loops. Wastewater is purified with helophyte filters
- application of C2C-certified materials in infrastructure and buildings
- buildings and materials designed for or used by Floriade will be reused by VenloGreenpark
- waste management of Floriade event (with 2 million visitors expected) based on eco-effectiveness

The sun is our Income

- energy supply with renewable energy, generated within the area of Four-Leaf Clover by a renewable energy power plant, consisting of wind turbines, PV-solar cells and a biomass fermentation plant
- energy conservation by energy-efficient buildings and underground heat/cold storage

Our soil, water and air are healthy

- as little as possible disturbance of soil layers
- use of biological and organic fertilizers and soil fungi (Mycorrhiza)
- closed watercycles with natural purification and infiltration
- pilot project: green plants for eliminating fine dust from ambient air

We provide enjoyable mobility for all

- C2C-inspired design and sustainable measures applied in the construction and maintenance of the Greenportlane
- public transport arrangements for Floriande visitors
- C2C-inspired design and construction of the pedestrian bridge over the A73 highway

We design enjoyment for all generations

- sustainable and innovative economic development of the Greenport Venlo area, focussed on agro-food business and agrologistics. Development of Agrofood campus Venlo
- knowledge development in sustainabilty and green economy area spatially concentrated on Venlo-Greenpark
- integration of Floriade open air theatre and World Pavilion in VenloGreenpark
- permanent use of the 2 main sustainable buildings (Innovatoren en VillaFlora) after Floriade

The innovative area spatial development approach of Four-Leaf Clover and Floriade/Venlo GreenPark using Cradle to Cradle inspired principles as starting point shows that goals can be set to a higher ambition, and that these goals can be realised by technical and financial means. In this approach, the process of involving all stakeholders and keeping the faith in success is crucial. One should not be discouraged by people telling you ‘it can’t be done’, ‘it’s too expensive’ ‘it’s against the rules’, etc.

4 Conclusions: C2C helps to create unique sustainable area spatial development

The C2C Network project's ambition is to help understand what the implementation of Cradle to Cradle for area spatial development could look like and to disseminate and learn from good practices. An element that returns in almost all area spatial developments inspired by the C2C concept is the use of guiding principles. The Province of Limburg has formulated six principles which make up the Limburg C2C framework. This framework is used as an inspiring starting point for area spatial developments and is used in this perspective study to evaluate the good practices.

By adopting the theme of C2C and area spatial development, the C2C Network project has tried to answer the question:

'Can the Limburg Principles help to create innovative, qualitatively better and more sustainable area spatial development?'

For all good practices concerning area spatial development used in this perspective study it was possible to apply the Limburg Principles. This leads to the following findings:

- The good practices that use the Limburg Principles right from the start of the development lead to innovative and more sustainable area spatial development, in which activities are combined and developed in a way that would not have occurred when using standard area spatial development methodologies.
- Most good practices were not aware of C2C and had progressed in their development at the moment they were introduced to C2C. Instead of using the Limburg Principles as starting point, they used them to:
  - structure goals and measures already planned,
  - make plans for new, innovative measures,
  - find common interest and areas for cooperation with other good practices
- The Limburg Principles can be applied on various scale levels, from regional to (partly) municipal.
- The Limburg Principles can be applied for different area types: rural, urban and industrial.

Based on the experience with 25 good practices, the question raised above can be answered with a 'Yes'. For new and already started area spatial developments the Limburg Principles can be of use. By defining principles at the start of an area spatial development and by reflecting on them during the entire process of area spatial development, C2C-inspired principles are a powerful tool to safeguard the original ambitions and mission of the development. For developments already underway the principles are a powerful tool to structure goals and measures. In general, throughout the whole development process the principles inspire people and organisations involved to come up with innovative solutions and realise better and more sustainable area spatial development.

Appendices

Some examples of principles for area spatial development

Almere Principles

1. Celebrate diversity
This includes diversity within ecological, social and economic systems.

2. Link place and context
This principle is about intense involvement of the local community and its social, cultural and economic power and making use of local energy – and material streams.

3. Combine city and nature
The combination of urban and natural structures will lead to an increased awareness of the connection between man and nature.

4. Anticipate changes
Always include some kind of flexibility and adaptability within sustainable development plans.

5. Keep innovating
Promote new and improved processes, technologies and infrastructure and support experiments and knowledge exchange.

6. Develop healthy systems
Implementation of the waste equals food principle at the urban level.

7. People make the city
Key principles are individual freedom, emancipation, social cohesion, self-realisation, self-organisation and self-regulation.

IJburg Principles

1. **IJburg 2 will plan for change.**
   At every stage and at every scale, IJburg 2 will anticipate and facilitate the island's – and the world's – dynamic evolution.

2. **IJburg 2 will be powered by renewable energy.**
   Buildings, neighbourhoods, public spaces, systems and island infrastructures will optimise energy use and integrate clean energy production to meet all energy demands using renewable sources.

3. **IJburg 2 will strengthen the health and vitality of the IJmeer.**
   Building and urban designs will increase local biodiversity, create a vibrant habitat and generate clean air, water, energy and soil.

4. **IJburg 2 will integrate urban and natural experiences through design.**
   Reinforcing IJburg's unique and iconic identity, the design of the public realm will promote community interaction and create meaningful connections to nature.

5. **IJburg 2 will demonstrate leadership through collaboration and innovation.**
   New products, technologies and approaches – including new partnership models and prototyping – will be used to create a global model of sustainable urbanism.

6. **IJburg 2 will create and maintain a safe, open and cohesive community that provides residents with access, choice and quality at all scales.**
   To create a sense of identity and collective responsibility, urban designs will provide diverse housing options, education, healthcare, employment and recreational opportunities, and exemplary mobility systems.

7. **IJburg 2 will eliminate the concept of waste.**
   From building design to city operations, IJburg 2 will embody the C2C design philosophy and treat all materials as nutrients to be maintained in closed-loop biological or technical metabolisms.

Venlo Principles

1. Innovate, innovate, innovate

We see the district of Venlo as a pilot project in which experimentation leads to the development of a new order comprised of man, the economy and ecology, side by side and hand in hand. Our focus is on developing and sharing knowledge, creating economic innovations, stimulating a free spirit and cultivating new paths.

2. Link place and context

In order to link the city and the district, we secure the authentic values in our identify and anchor our past in the future. Located on the Maas sleeping in her bed, we take our cure from her unstoppable strength. We are proud of our identity, celebrate our future with passion and work energetically to realise the future that we envision.

3. Manage and appreciate food

We use and process our raw materials in such a way that they are never wasted. We produce in perpetual cycles.

4. Enjoy mobility

We design and develop mobility systems that contribute to our economic, ecological and social well-being – to realise access for everyone.

5. Let the sun shine

We enjoy being creative and, just like nature, we use the sun as a perceptual source of energy and inspiration.

6. Create clean air, water and soil

We design systems focused on purifying and maintaining our living environment.

7. Design with future generations in mind

We will not burden our children and grandchildren with responsibility for maintaining or monitoring thoughtlessly designed objects or processes. Our designs have their enjoyment in mind and give colour to their future.

The Cradle to Cradle Network (C2CN) is an Interreg IV C capitalisation project consisting of ten partners from ten European regions which aims to reduce raw materials' utilisation, to generate less waste and less environmental pollution, as well as to enhance innovation and economic development.

Province of Limburg (NL)
www.limburg.nl

Flemish Public Waste Agency (BE)
www.ovam.be

Milano Metropoli Development Agency (IT)
www.milanomet.it

Department for Economics and Tourist Development of the City of Graz (AT)
www.wirtschaft.graz.at

ARDI Regional Agency for Development and Innovation (FR)
www.ardi-rhonealpes.fr

Kainuun Etu Ltd (FI)
www.kainuunetu.fi

West-Transdanubian Regional Development Agency (HU)
www.westpa.hu

Suffolk County Council (UK)
www.suffolk.gov.uk

North-East Regional Development Agency (RO)
www.adrnordest.ro

Government Office for Development and European Affairs (SI)
www.svrez.gov.si

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