



UNIVERSITY
OF OULU

C4CA-PUBLICATION



Eco-City Game Book

JEAN-NICOLAS LOUIS, ANTONIO CALÓ, VICTOR PAVLOV,
JENNIYLÄ-MELLA, SARI PIIPPO, ARTTU JUNTUNEN,
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Investing in your future
European Regional Development Fund



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Preface

This game has been developed at the University of Oulu, Thule Institute, Centre of Northern Environmental Technology (NorTech Oulu). The original idea for the game was invented by D.Sc.(Tech.) Jean-Nicolas Louis and PhD Antonio Caló, and it was meant as an exercise for master's students of the Barents Environmental Engineering (BEE) International Master's Degree Programme. The goal then was to work on existing cities in the Barents region and formulate solutions on how these cities could be further developed. The game was first played during May 2012 at the "Oulanka seminar" (Environmental issues of the Barents Region BEE course), organized within the "Finnish-Russian Masters' Programmes in Environmental Engineering and Social Work" (SYMO) project.

When the University of Oulu organized its Science Day on September 10th 2013, the game was re-designed to be suitable for 11-18 years old students. Jean and Antonio were joined by rest of the staff at the NorTech Oulu to fine-tune the game, to make it suitable for young people wanting to learn more about how environmental science and technology can be used in building cities. At this time, the game also got its current look, which was designed by graphic designer Heidi Pruikkonen and was called "I'm the king of the World!"

The final corrections to the game were made in frames of the Green cities and settlements (GREENSETTLE) project, financed by the Karelia ENPI CBC Programme. The game incorporates many elements that the GREENSETTLE project has been working with, including environmental technologies, resource and land-use solutions and socio-economic development efforts.

This English language version of the gamebook, which you are now holding in your hands, has been created in C4CA - Champions for Climate Action project. C4CA is an Arctic clustering project, which is financed by Northern Periphery and Arctic (NPA) programme and brings together three Arctic projects funded from different EU programmes. The Water, Energy and Environmental Engineering research unit (WE3) at the University of Oulu has worked together with International Resources and Recycling Institute and Developing the Young Workforce to update the contents of the gamebook and adapt it to the needs of Scottish gamers.

We hope that students can enjoy the game and can learn through it how to make our cities green and build a better future!

Wishing you an enjoyable gaming and learning experience,

Eva Pongrácz, Professor at the WE3 unit, University of Oulu

Niko Hänninen, C4CA Project Manager at WE3 unit, University of Oulu

Eilidh Edgar, Operations Manager at Developing the Young Workforce

Ewan Ramsay, Managing Director at International Resources and Recycling Institute

Eco-Cities

Eco-Cities is a concept that might not be that well known to everyone, so it is best to start with these words and find out what they stand for - what are eco-cities? These are the places where the well-being of people, the society and the environment is harmonized. In eco-cities, people live healthy and economically productive lives and at the same time reduce their negative impact on the environment. This implies that local policies, business strategies and economic drivers will need to be kept in mind. Ideal eco-cities are able to involve their citizens into collaborative and transparent decision making processes, and educate them about being mindful of social equity.

Eco-cities concept

The concept of eco-cities goes back to 1975 when the group of visionary architects and activists founded a group called Urban Ecology. The mission of Urban Ecology was to rebuild cities in balance with nature. In 1985, the Urban Ecology team collaborated with citizens of Berkeley, California, to restructure a street of the city. The street was made suitable for bicyclists, it was safe for pedestrians to walk and the speed of cars was slowed down. The name of this effort was “slow street” and the mission was to raise awareness about our dependence on fossil fuels. Such actions soon started to interest more people and in 1990 Urban Ecology hosted the first International Eco-City conference in Berkeley. The aim of the conference was to discuss ecosystems, alternative transportation, environmental justice and urban design in modern cities.

The 10 principles of eco-cities

Eco-city initiatives have defined a common framework of ecological cities (Roseland, 1997):



Land use

Revise land-use priorities to create compact, diverse, green, safe, pleasant and vital mixed-use of communities near transit nodes and other transportation facilities



Urban greening

Support local agriculture, urban greening projects and community gardening



Transportation

Revise transportation priorities to favor foot, bicycle, cart and transit over autos, and to emphasize access by proximity



Recycling and resource conservation

Promote recycling, innovative technologies, and resource conservation while reducing pollution and hazardous wastes



Urban restoration

Restore damaged urban environments, especially creeks, shore lines, ridgelines and wetlands



Responsible economic activity

Work with businesses to support ecologically sound economic activity while discouraging pollution, waste, and the use and production of hazardous materials



Mixed housing

Create decent, affordable, safe, convenient, and racially and economically mixed housing



Voluntary simplicity

Promote voluntary simplicity and discourage excessive consumption of material goods



Social justice

Nurture social justice and create improved opportunities for women, people of color and the disabled



Public awareness

Increase awareness of the local environment and bioregion through activist and educational projects that increase public awareness of ecological sustainability issues

Our ideal eco-city structure

Our eco-city incorporates environmentally friendly technology solutions for building, energy, transport, waste management and water systems. It is also envisioned to be an economically prosperous dwelling that provides employment for their citizens and places of commerce. It cares about the well-being of people, provides the necessary services and satisfies also social, cultural and recreational needs.

The boxes below list the ideal criteria for **Housing, Energy, Food, Waste, Water, Services, Transportation, Industry** and **Recreation** that define our eco-city. This color coding will be further used in the game cards as well.

Housing <ul style="list-style-type: none"> • Energy-efficient • Comfortable • Densely built environment • Availability of services 	Energy <ul style="list-style-type: none"> • Low emission • Renewable • Carbon neutral • Smart systems 	Food <ul style="list-style-type: none"> • Domestic production • Ecologically clean • Not genetically modified • Fresh, healthy, inexpensive products
Waste <ul style="list-style-type: none"> • Waste is a potential raw material • Source separation • Efficient collection system • Recycling Infrastructure • Waste energy recovery 	Water <ul style="list-style-type: none"> • Clean drinking water • Water saving • Energy efficient wastewater treatment • Nutrient recovery from sewage sludge 	Services <ul style="list-style-type: none"> • Versatile • Accessible • Improves people's well-being • Versatile job opportunities • Add local know-how
Transportation <ul style="list-style-type: none"> • Low emission • Promoting walking and cycling • Effective public transport • Electric car infrastructure • Accessible and easy to access 	Industry <ul style="list-style-type: none"> • Provides a variety of job opportunities • Well-paid jobs • More financial prosperity • Does not pollute 	Recreation <ul style="list-style-type: none"> • Environmentally friendly • High capacity • Minimal use of resources • Multi-function • Facilities where you can relax, move, walk, meet people, etc.

How to organize the game?

The Target groups

The game is built for 11-18 years old students, who are interested in environmental technologies and want to learn how to build eco-cities.

The goal

During the game, students should build together an ideal eco-city in a Scottish setting. Students should strive on building such a city that they themselves would like to live in. This game is team oriented and science based. The teams will use their previous knowledge about environmental issues, science and technologies as well as information from the game cards. With the help of this they will have to choose those technologies and living solutions for their own city, which will be beneficial to both humans and the environment.

General requirements

- Space and place requirements: The organizers will need to set up 9 sales points with tables for the different technologies, where the players can buy them. The "game master", who oversees the game, needs to have a home base, as do the teams that are building their own cities. They need tables to work on and also a poster stand or table for the city grid to which the cards can be placed.
- Equipment: Each group gets one grid map (A0) and a starting budget, e.g. stones or any other tokens that they can use as "diamonds". Each of the 9 technology stations need a table to hold the cards and the "diamonds" and also a printed sign (A3), which tells what technologies/solutions are sold there. We also recommend to devise some prizes for the winning team.
- Amount of students will define the number of groups. We recommend min. 4 and max. 7 players for a group. There should not be more than 9 groups, as this is the number of the technology stations. If there is more, the stations might get crowded.
- The game is played on a 10x10 grid, that is equivalent of 5 km x 5 km area. The city needs to host 20 000 people. The starting budget given to the groups is 60 diamonds. You can also experiment with larger cities with more inhabitants or give fewer diamonds.
- If you want to give the teams a chance to earn more diamonds, distribute the teams quiz sheets. These sheets include questions about the different aspect of eco-cities and they can address, local, national or global issues. You are in charge of making the questions. The teams will answer the questions and return the sheet to the Game Master. Game Master corrects the sheets and awards the team one diamond for each correct answer. Reserve some diamonds for the Game Master too.
- Alternatively, you can require that the teams answers questions at each station. For instance, those who answer correctly most of these questions, can purchase 3 star solutions, whereas the 1 star solution is available only for those who answer poorly the entering questions.

Personnel requirement:

- The "Game Master" is the one who manages the game, has the final say in scoring and declaring the winner of the game. The game master also corrects the quizzes.
- 9 experts, one at each sales point, who can also provide advice on the selection of technologies. If there is less assisting staff, stations can be combined, but this is not recommended
- Also, have at least two teachers, who can help and supervise the groups, guide them to the stations and maintain order.

Game Rules

Aim of the game

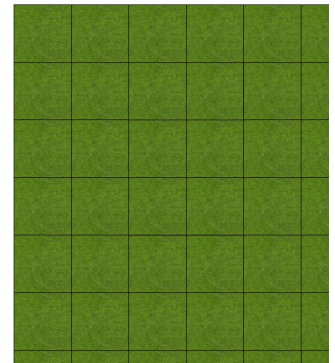
The objective of the game is to build an eco-city. This is a game for teams of 4-6 members.

Playing the game

- The city is to be built on a foundation of 100 grids, as seen on the right
 - Each grid represents a 500 m x 500 m area.
- You will also have a starting budget of 60 “diamonds”
- Using your budget, you will build a city of min. 20 000 people on this area
- Your citizens will need to have the following to supply them: (1) Buildings, (2) Food, (3) Energy, (4) Water, (5) Waste management, as well as (6) Industry and (7) Services, (8) Transportation and (9) Recreation.
- There will be 9 stations where you can buy solutions/technologies for each

Consider the following age breakdown of your citizens:

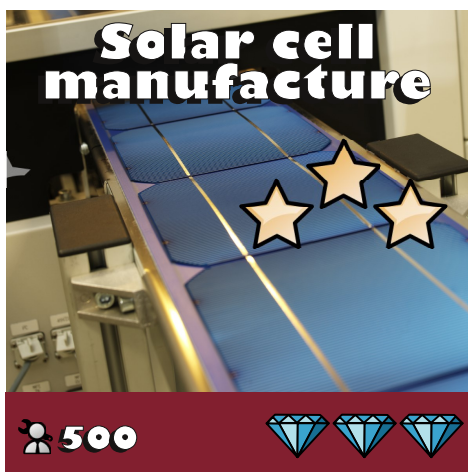
- 50% are in working life – They will need to have jobs!
- 5% are small children - Remember nurseries for them!
- 20% are senior citizens
- 25% are students – They will need schools!
 - 10% in primary school
 - 8% in high school
 - 7% in university - If you do not have a university, this 7% needs to be employed as well!



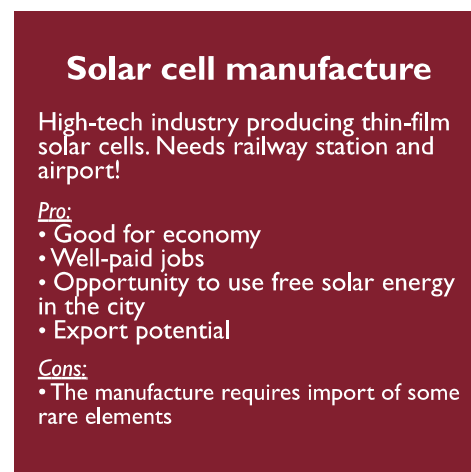
A platform for building a city.

The cards representing the technologies and services can be bought at the 9 sales points. Below is one example of a card. The size of cards is 1-4 grids, representing the area each technology or building would occupy in your city. You will need to place these cards directly on your city foundation. The technology is described on the backside of the card - as you can see on the right - and the advantages and disadvantages of each solution are highlighted in the card.

Watch out for a number of synergy cards – some of the cards need to have some other solution to work properly. Some buildings produce their own energy, others need a power plant to supply electricity and heating. If you have a university or a certain industry, you need to have an airport. Read the info on the back of the cards carefully!



*Technology Card
(Recto)*



*Technology Card
(Verso)*

Card markings

Each card is distinguished by the following markings:



= Price

The number of diamonds indicates the cost of cards (1 - 3). Manage your budget wisely; divide it among all categories and technologies.



= Level of sustainability

The sustainability score indicates how environmentally friendly, socially acceptable and economically feasible a certain choice is. The more stars, the better the solution!



= Unsustainable solution

The card with a black star is an unsustainable solution. It is a negative score, so for every black star a gold star will be deducted.



= Inhabitants

This symbol marks how many inhabitants the building option houses within the given land area. You need to have a min. 20 000 inhabitants!



= People served

This symbol indicates how many people the solutions benefits or services. You will need to match the total amount of people served to the amount of inhabitants.



= Jobs

This symbol indicates how many people this technology or service employs. It is important that the cities have employment for all of the working age.

Critical services

Critical services are those that you will need to closely balance to the number of inhabitants. These are: **jobs, food, energy, water** and **waste management**. For each of these, you will lose 1 gold star for every 1000 person not in balance. You will need to count these and add the sums on your city foundation (on the right).

	=	Food		Water	
	=	Energy		Waste	

Changing cards

You can return or change cards while the sales points are open. They will close 30 minutes before the game ends.

More diamonds

If a quiz has been distributed to the teams, the teams have a chance to boost their budgets by answering it. The answered sheets must be returned for the Game Master before the sales points close. Every correct answer is rewarded with a diamond.

Evaluating and scoring

At the end of the game, each team will be evaluated and debriefed. The winner is the one with the highest number of gold stars! Mind the balance of critical services! Transport is not a critical service, but if your city relies solely on cars, reserve an empty grid for parking places or lose one gold star! The evaluators will also want to know the reasons behind your choices. Why was the city developed in a certain way? What was the logic behind? Did you go for a city of a certain profile? Heavy industry, high-tech, greentech, or academic? Why? Were some expensive or land consuming choices made for the development of some particular technology or with a particular model in mind? We encourage you to build a city you would like to live in! The idea behind your city will be decisive in case there are two groups with the same amount of gold stars.

Important hints

Reserve about 20-30 grids for buildings, and divide the space for the rest. Begin with critical services. They are mandatory and help shaping the profile of your city. Time is limited! Get the most out of your team; decide who is in charge of which aspect of the city, who goes to the sales points, who keeps track of the balance of inhabitants and critical services, who answers the quizzes, etc. Do not hesitate to ask for help!

Housing

Whether big or small, all the cities have either apartment buildings or private houses for people live at. Every city has its unique view, and buildings are a key element in defining the look of a city. You know that Rome has a lot of great historical buildings, whereas New York is full of skyscrapers and busy streets. But in which one it is better to live in? And what kind of houses would the inhabitants of your city prefer? Well, it is up to your personal taste and desire.

In this game, you are given a fantastic opportunity to create a city with an image that speaks to you. If you'd like it to be a city for students and young families, feel free to build **student apartments** to accommodate your future scientists and specialists. The latter will definitely help your city to be one step ahead in technologies and scientific discoveries compared to other towns. But don't forget to build also a University where the students can study, and Stem hub and other Hi-Tech companies where they can work after they graduate. Please, note that student apartments are meant only for university students! For young families there are nice and cheap options as well, such as **Terrace house areas** and **suburban apartment building complexes**. They will accommodate your population, and will not take too much space on the city map. Wait a minute! What about eco- and environmentally friendly solutions? How about making your city green?

The green or eco-city is more than just housing. The main idea is to provide citizens with services, which are located close them. Transport, parking zones for cars and bicycles, walking streets, etc., should support this development, as well as usage of modern information technology solutions. And if you have heat and power coming to your buildings from renewable energy sources, then your city has taken this key element of the eco-city concept into consideration.

As for the eco-alternatives, you are offered brilliant two- and three-gold star solutions:

- **City centre district** with services and shops, places to meet and walk;
- **Eco-house area** with IT-innovations, renewable energy supply and energy efficient technologies;
- and last but not least and probably the best – **Green high-rise district** built in the city centre. It is energy efficient, environment friendly, secure and comfortable, full of modern IT-gadgets and everything else that makes it all eco-inclusive.

Whatever you choose, remember that you are building your very own eco-city. As in any game, there are some rules and limitations. The task for you is to build the greenest city ever possible (within your budget) and win the whole game. We wish you success!

Eco-house area



Energy efficient and environmentally friendly houses with solar panels and geothermal heating. Promotes occupant comfort and security. Integrates smart solutions

- Green, efficient use of energy
- Low density

Green high-rise district



Energy efficient and environmentally friendly building in the city centre. Promotes occupant comfort and security. IT-services integrated. Underground parking and services in the building. Uses waste heat and geothermal for heating. Rooftop garden.

- Offers areas for social contact
- Efficient use of space and energy
- Expensive

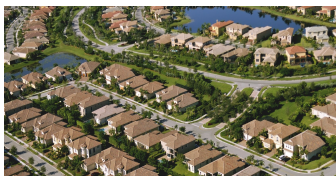
City centre district



Regular building blocks with services/shops on the ground level, apartments in the upper floors. Located by a walking street, no car parking, only bicycles. **Needs electricity & gas or other heat source!**

- Close to services, places to walk and meet
- Medium density
- Costly

Detached house area



Conventional detached houses. High privacy level. Big yard/garden included in every house. Includes a garage. Needs electricity. Gas or other heating source needed!

- Privacy, own garden
- Low density, distant, involves car use

Student apartments



Suburban, high density, no services, only bicycle parking. Needs electricity. Gas or other heating source needed! Only for university students!

- High density
- No services

Terraced house area



Small yard and space for cars/bicycles included with every house. Needs electricity. Gas or other heating source needed!

- Low environmental impact, reasonable privacy
- Low density, no jobs, no services nearby, increases car use

Suburban apartment building complex



Densely built apartment block area. Needs electricity! Gas or other heating source needed!

- High density
- Includes parking area
- Far from city centre, no jobs or services nearby
- Involves a lot of transportation, high environmental impact

Energy

In the 21st century it is hard to imagine life without electronic devices. Our living environment is full of them: cell phones, computers, cameras, DVD-players, washing machines, electric kettles & TVs, etc. All of these consume electricity, which comes from the socket. But how does it end up there? This energy is produced by power plants and transferred to our homes via grid network. In addition to this, our homes also need heat, especially in the winter. We can keep our houses warm using either centrally produced and distributed heat or firing up our own heaters that feed on electric, wood, wood pellets, gas or coal. Ideally, your city gets the heat from the same power plant that produces electricity. We call them combined heat and power plants, or CHPs. In an eco-city you should use renewable sources of energy. You just need to choose the right option. What is the right one? Let's think.

Burning fossil fuels, such as **oil**, **coal** and **gas**, gives us heat and also electricity. But they also produce bad emissions that pollute the environment. These emissions have negative effect on our health and on the well-being of the planet. You have heard about global warming, climate change and the greenhouse effect – they are all consequences of fossil fuel consumption. Nobody should use them, since they are bad, unecological energy sources. In addition, oil and coal reserves are limited. It means that these fuels are non-renewable. Why do people still use them? In most of the cases it is due to the fact that they are easy to use, cheap, and we don't have to change a thing if we continue on the same way. Big old power plants can supply cities with enough heat and power.

If you want enough heat and power for your city - and even sell some surplus to other cities or countries - you could consider building a **nuclear power plant**. Operating it does not generate greenhouse gas emissions, and it has no visible pollution effects, so it sounds almost eco-friendly. Why just almost? Unfortunately, nuclear power plants also generate highly dangerous radioactive waste that needs to be stored carefully for hundreds and hundreds of years, unless you want your city to be full of zombies and mutants. Many people are also afraid of nuclear power, because there have been a number of really bad nuclear power plant accidents, in which many people were killed and got sick due to radiation. It is up to you to decide if your city runs on nuclear or not.

Ok, what are the real environmentally friendly options? These include power plants based on **solar**, **wind**, **hydro** and **wave & tidal energy** or **burning biomass**. These sources are renewable; they have low impact on human health and the environment. What's the catch? Well, solar, wind, wave & tidal and hydro do not generate heat, the sun does not always shine, the wind does not always blow, and not every city has a river to build hydro power plant on. Also nothing is free, these energy solutions have reasonably high price tag and they might require a lot of space.

You know the big picture now, the basics of energy. Now it is your task to choose which of the above suits your eco-city best. Just remember that a good eco-city, as a first priority, has to consider the well-being of its citizens. There should be enough heat and power to supply all the inhabitants. In addition, the "eco" part of the eco-city should be visible. Cities should limit the generation of greenhouse gas emissions; therefore; we encourage you to use solar, hydro, biomass, wave & tidal and wind energy solutions.

Wave and tidal energy



Partly or wholly submerged turbines, which produce electricity by the sea motion



- Utilises a renewable energy source
- Clean and sustainable

 = 10 000  = 50

- High maintenance costs
- No heat generation
- Disturbance to maritime ecosystems

Hydro power plant



A dam that utilizes water power

☆☆☆☆☆ = 50 000 = 50

- Utilises a renewable energy source
- Adjustability of power generation
- Can be used to control floods
- The river can also be used for water uptake
- Dams are expensive to build
- Environmental impact on the upper pool area which is left under water
- No heat generation

Wind power plant



An area covered with large wind turbines

☆☆☆☆ = 10 000 = 50

- Utilises renewable energy source
- No emissions
- Highly irregular energy supply
- Expensive, requires subsidies
- No heat generation
- Requires a lot of maintenance

Photovoltaic power plant



A large land area covered with photovoltaic panels that generates electricity from the sunlight

☆☆☆☆ = 2 500 = 50

- Abundant, renewable energy source
- Zero emissions from power generation
- No moving parts
- Predictable supply
- Silent
- Intermittent
- Low efficiency
- Efficient only during summer in the north
- No heat generation

Biomass CHP plant



Power plant that generates electricity and heat by burning wood and other plant biomass

☆☆☆☆ = 50 000 = 50

- Provides electricity and heat
- Can use local fuel, such as wood or agricultural by-products
- CO₂ emissions
- The quality of the raw material can be difficult to control

Nuclear power plant



A thermal power plant with a nuclear reactor

☆☆☆☆ = 300 000 = 500

- Almost no atmospheric emissions
- High power generation
- Generates radioactive and toxic waste
- Dependency on imported fuel
- Evokes negative images

Gas condensing plant



Power plant that generates electricity from natural gas and distributes gas to residents for heating purposes. Refines also natural gas, mandatory for gas and oil industry!

☆☆☆☆ = 100 000 = 50

- Provides electricity & gas for consumers
- Utilises domestic fuel (if combined with gas and oil industry)
- Generates emissions
- Gas is non-renewable

Coal condensing power plant



Power plant that generates electricity and heat by burning coal

☆☆☆☆ = 100 000 = 50

- Provides both electricity and heat
- High emissions and environmental impact
- Dependency on imported fuel, unless coal mining is carried out in the city

Food

Being a human being, we all know that at some point during the day we need to eat. More than that, most of us do it three times per day - at least! =) The question is how an eco-city can supply **enough food for everybody**. The latter is crucial – take this into account when building your city! Food is our first priority need, starving citizens usually do not worry about full employment, efficiency of transportation or clearness of air. Everyone wants to receive at least 2000 cal. per day.

What does it cost for an eco-city to solve this problem? First of all it is question of who much of land area and funds do you allocate to food supply. Should you, as the city creator, grow fruits and vegetables inside the city territory? Or is it better to import them and other food products from outside? Land resources - to use or not to use? These are the questions you will have to answer in the game. And if you do it better than other teams, you will win.

Anyway, how do they normally do it in eco-cities? In real eco-cities greeneries and landscape have big role. There are a lot of parks and green walking areas. All these maximize biodiversity and create nice and calm environment for the citizens. Principals of small urban farming and local food production are also important. In eco-cities you can often have fresh eco-friendly food and at the same time large areas of natural environment. Doesn't that sound great? Besides, it makes city self-sufficient and provides stable food supply.

In the game there are many choices you can choose from to supply people with local food. Large areas of estate provide you with possibilities for hunting, fishing, collection of berries and mushrooms. This requires land but on the other hand it make city greener and gives diversity of provision.

If you want your citizen to have fresh dairy products and vegetable every day, all year long, you can set up **orchards, greenhouses, organic farms & fish farms or take up crop farming or live stock farming**. Some of these will provide your city with products that are grown even without chemical fertilizers, herbicides, pesticides, or fungicides of any kind. These will have health benefits to city inhabitants, but they are good for the nature. The downside of producing your own food production is that many of these require a lot of energy, other resources, land and they are not cheap either. Please, remember to provide all the food groups (vegetables, grain, meat and dairy) for a varied diet. You would not want to live only on milk and bread every day, right? Symbols for the food groups have been marked in the cards.

Bringing your food supplies from the outside of the city has its pros and cons. If you want to cover your food supply with small **grocery stores** and **superstores**, which stock imported products, you might not get products of the same high quality as you would get from local producers. Imported food has high transportation cost and food transportations cause emissions and pollution. On the other hand, grocery stores and Superstores do not take much space, they provide jobs and are not that expensive. But again the final decision is yours - decisions, decisions...

Orchard



- Berry and fruit orchard, which provides residents with fresh goods
- ★ ◆ ■ ● = 3 000 ● = 100
- Food supply for the locals
 - Requires only a small piece of land
 - Requires water, fertilisers and chemicals

Fish farming



- Salmon farming for domestic and export market.
- ★ ★ ◆ ◆ ■ ■ ● = 4 000 ● = 250
- Utilises natural resources (lochs and rivers)
 - Provides workplaces
 - Possible water contamination
 - Threat to other sea life
 - Fish fodder requires a lot of resources

Organic farm



Local production of ecologically clean agricultural goods (including grain, vegetables, meat and dairy products)



- Local food production leads to lower transportation costs and less pollution
- Can utilise compost or digestate from other biological processes (bio-waste or wastewater treatment)
- Requires a lot of water
- Demand for large land areas
- Expensive

Greenhouse



Production of the greenhouse vegetables



- Local production of vegetables
- Fresh products even during the wintertime
- High demand for energy
- Requires a lot of water, fertilisers and chemicals
- Expensive

Intensive crop farming



Intensive local farming of grain and vegetables

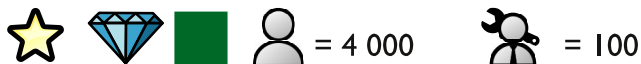


- Local production of goods
- Can utilise compost or digestate from other biological processes (bio-waste or wastewater treatment)
- Requires a lot of water, fertilisers and chemicals
- Expensive

Grocery store



Grocery store with imported products



- Food supply for the citizens
- Requires only a small land area
- Transportation costs and pollution
- Intensive farming
- Use of water, fertilisers and chemicals in farming

Live stock farming



Local production of meat and milk for people as well as feed for cows, chicken and pigs.



- Local meat and milk supply for the citizens
- Can utilise compost or digestate from other biological processes (bio-waste or wastewater treatment)
- Occupies a large land area
- High demand of energy and materials

Estate



Estate with possibilities for hunting, fishing and collection of natural products (meat, fish, mushrooms, berries)



- Wood from the forest can be utilised
- Local food production leads to lower transportation costs and less pollution
- Can be used also for recreation
- Requires large land areas
- Uncertain source of food
- Does not provide workplaces

Superstore



Superstore, where all types of food can be bought, but they are mainly imported products



- No need for land to grow food
- Provides workplaces
- Monoculture and intensive farming, excessive use of water, fertilisers and chemicals in farming in the foreign country
- Transportation costs and pollution

Waste Management

Can you imagine the situation when you are allowed to eat but not allowed to visit a toilet? Does not sound good at all, right? The city works in a same way as a human body - it also needs a place to dispose its waste. Think about all the households, industries, university, restaurants, shops and other city objects! They all consume something and they all create following kind of waste:

- recyclables (e.g. glass, metal, papers, plastics, fibre packages),
- bio-waste (e.g. banana peels, tea bags, food leftovers),
- energy waste (e.g. plastic bottles, plastic bags, cardboard, paper, small wooden packaging).

All three waste categories need to be taken care of. Preferably, in as environmentally friendly way as possible. Landfill used to be easy solution in waste management. Just collect everything together, dump them into one place and move on and open a new landfill, once previous one has been filled. Does not sound very eco-friendly? No! Therefore you won't find landfill in the game cards. But what waste management system is then the best for eco-cities? Naturally, it is the one where most of the produced city trash can change its status from "waste" into "resource". In other words, waste management is good when we throw away the least amount of waste. In northern European cities, about half of this waste is utilised – as material or as source of energy. Is 50% the limit? Definitely not! How high will it be in your eco-city - it is up to you to decide! Let's take a look at the options that at you have:

- If you do not want to deal with the waste in your city, you can transport it to other cities that have recycling industries and can utilise your recyclable waste such as glass, metal, paper and cardboard. However, you will need to separate it first to fractions that can be utilised. You will also need a **waste transfer station**, where your waste is separated and stored, until it is transported to recipient facilities. This way, part of your wastes can be recycled, but it will cost you money to store and transport them.
- **Waste incineration plant** is the "Let's burn it all!" solution. Well, by "all" we mean bio-waste and energy waste, you cannot really burn glass and metal. Mind that incinerators are economic only in large scale, so your incinerator will probably utilise also waste transported from other cities. This is one way to generate heat and power, which brings you money. On the other hand, you may not like the idea that your city is known as the "incinerator city", a city that burns its waste. Having a waste incinerator on your backyard might not be that appealing to everyone either.
- Recyclables, which cannot go to the waste incinerator, can be utilized in the **recycling centre & plant**. This is very nice and green idea as it contributes to circular economy. All your glass, metal, papers, plastics, fibre packages can have a second life. Hence, there is no need to produce new materials. However, this kind of plant should be large to be economically viable, so most likely it will also handle waste from neighbouring cities. Otherwise, it would be far too expensive for just one city to run it. On the other hand, this can bring revenues to the city coffer.
- Bio-waste has a huge potential in your city. It smells bad, especially when it stays long in your kitchen bin. But to the professional's nose, it smells like money! You just send your bio-waste to **anaerobic digestion** and you get biogas from your banana peels that you can use to generate heat and power. Or you send it to a **composting plant** and you get a fertilizer that can be used in your city's parks or in agriculture. The latter will increase your food production.

Whatever you choose, remember that all three categories (recyclables, bio-waste and energy waste) have to be utilized. Make sure they are all covered by your services. Best of luck in choosing the best options!

Recycling centre & plant

Waste types – recyclables



Functional devices are inspected, repaired and sold for re-use. Recyclable materials are separated and reprocessed to new materials.

- Extends life time of functional products
- Creates jobs for people
- Secondary raw materials for industry
- Decreases the need of primary raw materials

- Impurities reduce the quality of secondary raw materials
- Only profitable in large scale.

☆☆☆ ♦♦ ■ = 500 000 = 150

Anaerobic digestion

Waste types: bio-waste



Biodegradable wastes are treated anaerobically to produce biogas.

- Generates a renewable fuel
- Reduces the need for fossil fuels
- By-product (digestate) can be used as fertiliser

- High investment and operating costs

☆☆☆ ♦♦ ■ = 50 000 = 20

Composting plant

Waste types: bio-waste



Biodegradable wastes are treated aerobically to produce compost

- The end-product (compost) can be used as fertiliser
- Moderate need for land area
- Release of greenhouse gases (CO₂)

☆☆ ♦♦ ■ = 50 000 = 20

Waste transfer station

Waste types: recyclables & energy waste



Recyclable and combustible wastes are separately collected and transported outside of the city for treatment and utilisation

- No need for recycling facilities within the city
- Transportation and labour costs
- Waste needs to be clean and properly sorted

☆ ♦ ■ = 10 000 = 100

Waste incineration plant

Waste types – bio-waste, energy waste



Combustible and biodegradable wastes may be incinerated to decrease the volume of waste for final disposal

- Produces electricity and heat
- Substitutes primary (fossil) fuels in energy production
- Transportation costs
- Ashes contain various hazardous substances
- Only economic in a large scale

☆ ♦♦♦ ■ = 200 000 = 100

Water maintenance

Since the dawn of time, cities were mostly built close to rivers. But why were we drawn to the water systems? Because we need water for survival; about 75% of human body consists of water. We need water to drink, to cook, to grow food and many branches of industry require it also, for instance papermaking. Having a city right by the source of potable water was and is the best strategy for successful city development. Water supply plays important role in our lives. Every city has to have it, even an eco-city!

There is two water supply sources you can choose from. These are **river** and **groundwater**. In the first case, because the river water is often dirty, you need to clean it first. You pump it to the water treatment plant, clean it, and then distribute it to the households. In the second case, the ground water tends to be cleaner, so there is no need for much cleaning; however you need a stronger pump and more energy to bring the water from underground to the surface. And if you keep pumping the groundwater, the groundwater levels can drop and then you need to pump the water from even greater depths. As the eco-city creator, you decide, which one you prefer, but make sure that everybody who lives in the city **has access to water!**

All right, once we have used the water in our kitchen/bathroom/toilet sinks, what next? What do we do with the dirty water? It would be very bad just to pump it back to river. Imagine how the river would look like and smell - yuck! Many people in the past and in less developed countries got sick this way. Do not mix dirty and clean water, we must clean the dirty water first and only then lead it back to the river!

What are the technological solutions? Let's explore them. We can make it simple and just use **chemicals to clean it**. It's like magic, you just add chemicals to the dirty water. Then the chemical substances will combine all the pollutants in the water, so they are easier to separate from the clean water! We call the combined pollutants as sludge, and we can get rid of it by burning it in a **sludge incinerator**. Sounds cool? Yes, it is. But the cost of the magic chemicals will make a magical dent to the city budget! Another option is **advanced wastewater treatment and sludge digester**. Here we use special filters, to sieve the dirty water through them. Dirty water in, clean water out. Supercool! The sludge that is captured in filter does not have chemicals, so you can put it into a digester, and it will produce biogas. We burn the gas, and besides cleaning the water we have created heat and power for our eco-city. Sounds perfect? It gets even better! The most environmentally friendly solution would be to filter the wastewater through a **reedbed**. What is that? It is a natural solution where we use plants to clean the water. Reeds are plants that grow in water and they work as a filter because they utilize the biological pollutants in the water. So you have no wastes, only clean water after the process. No need for energy nor chemicals, perfect! Well, except that you need a lot of those magic reeds and a large area to clean all the wastewater of your city.

Once again, your eco-city has a big population. Remember to organize good water supply and wastewater treatment for all the residents! Good luck!

You need to select both drinking water and wastewater treatment solutions!


Drinking water solutions:


Water uptake from the river



The drinking water is taken from the river



 = 50 000

 = 10

- Pumping of water from the river requires less energy than when using groundwater


- Cleaning of river water requires more effort than when using groundwater

Drinking water from groundwater



The drinking water is pumped from the ground



 = 50 000

 = 10

- Groundwater does not need much cleaning

- High energy consumption for pumping from groundwater
- Heavy use can result in lower groundwater levels


Wastewater treatment solutions:


Reedbed



The wastewater is cleaned using plants: water plants, such as reeds, are used to filter impurities from the water



 = 50 000

 = 10

- No need for energy or chemicals


- Needs lots of space


Advanced wastewater treatment and sludge digester



Wastewater is cleaned with advanced membrane and UV processes and the sludge is biologically decomposed in an anaerobic digester



 = 50 000

 = 20

- Technologically advanced
- Energy recovery from sludge


- Advanced processes require energy
- Sludge digestion requires land area


Chemical wastewater treatment plant with sludge incinerator



The wastewater is cleaned using chemicals. The wastewater sludge is incinerated



 = 50 000

 = 20

- Efficient and relatively easy
- Small need for land area

- Pollution from chemicals and from sludge incineration
- Price of chemicals

Services

What is one of the biggest advantages of living in the 3rd millennium? It is of course access to knowledge. Only 200 years ago most people could not properly read or write. Nowadays it is no longer an issue. The challenge is how many languages you can speak or how good you are with computers. Computers, laptops and tablets have become our everyday tools, with which we have access to limitless information. But have we become wiser as a result of this data revolution, can we master this information flow? Let's put your knowledge to a test! What services do you need to provide for your eco-citizens so that they can get just as smart as you are?

But hold on a second! Are there any environment friendly services: for example, eco-friendly method of teaching or sustainable way of learning? Essentially, the services themselves are similar everywhere: whether it is city or eco-city. But we need to emphasize that an eco-city is not just about green technologies, it is also providing your citizens the means to reach their full potential. You need nurseries so that parents do not have to stay at home with kids, and they can have jobs and pursue their careers. All children of school age need access to primary and secondary education. And if they want to be teachers, doctors, engineers or scientists, they have to be able to go to university and realize their dreams.

In this game you are offered the following services:

- Small **nurseries, local primary schools** and local high schools, which are easy to reach and have a cosy studying environment. Just remember to build several of them, so that all the children have a school to go to;
- **Centralised primary and high school** is a large school that can serve many students, but since there are fewer of them, some kids will have to travel long distances to reach them. It is for you to decide if you like smaller or larger schools!
- **University** is where the best specialists and future scientists are prepared to develop your city industry and economy. University is the place where research is carried out, and where citizens get their higher education and become very clever.
- **Library and cultural center** offers a lot of activities to keep your city inhabitants entertained.

What else does our modern age provide to people? If you guessed medicine, you are right. Whilst 200 years ago people suffered a lot from toothache and died from infections, these days trained doctors in hospitals and health care centres can cure their patients and save them. In the best hospitals, skilled doctors can even replace hearts and other important human organs if they malfunction. Honestly! Do you need something like that for your eco-city? I bet you do! You have options to choose between small and cosy **health care centers**, which are only 10 min away from home, or a large **hospital** where there are more services available with doctors of all possible specializations. Of course a cool hospital like that will need a large space, but you will find the best way to arrange your services! Plan your city well!

Just remember, 25% of your inhabitants are of school age or students, so you need to have enough schools for all of them! If you don't have a university, then you have to provide jobs for those, who would have continued their studies there otherwise. And you want your people to be healthy, so there should be medical services to everyone. Good luck!

Library and cultural centre ★★☆☆☆☆ = 50 000 🛠️ = 100



Large city library combined with a cultural centre

- Provides library services
- Cultural centre provides entertainment for young and old
- Increases local know-how

- Expensive to maintain and run

University

★★★☆☆☆☆ = 5 000 🛠️ = 1 500



Multi-faculty university (science, technology, medicine). Requires an airport.

- Offers education for graduates of high school
- Provides qualified workforce for local services and industries
- Research done in the university benefits local economy and industries
- Increases local know-how

- Expensive to maintain and run

Hospital

★★☆☆☆☆ = 50 000 🛠️ = 1 000



Large regional hospital that serves also people outside of the city

- Provides more services than health centres

- More difficult to reach than local health centres
- Not as cozy as smaller health centres

Centralised primary and high school

★★☆☆☆☆ = 4 000 🛠️ = 400



Large school with both primary and high school

- More study options and activities for students
- Cheaper than decentralised schools

- More difficult to reach than local schools
- Not as comfortable as local schools

Nursery

★☆☆☆☆ = 500 🛠️ = 100



A small nursery to take care of small children (You may need several of these!)

- Nurseries allow parents of small children to work and contribute to the economy and to their own well-being

- Expensive to maintain

Local primary school

★☆☆☆☆ = 1 000 🛠️ = 100



Small primary school

- Easy to reach, close to the residential areas
- More comfortable atmosphere

- You need to build several for the whole city

Local high school

★☆☆☆☆ = 1 000 🛠️ = 100



Small high school

- Easy to reach, close to the residential areas
- More comfortable atmosphere
- High school graduates can continue to university

- You need to build several for the whole city

Health centre

★☆☆☆☆ = 5 000 🛠️ = 150



A small, local healthcare centre

- Easy to reach, close to the residential areas
- Small unit, doctors know their patients

- You need to build several for the whole city

Transportation

Can you imagine a city where everybody moves around by foot? Hardly. Every city needs a transportation system, even the small ones. **Public city transport** and **taxi rank** provide means to get around within the city, if the housing areas and services are located on the opposite sides of the city. Or would you like to walk every morning 5 km to school or work? **Long distance busses, railway station and harbour** make it possible to travel to neighbouring cities and further away. You might think that your city can cope fine without these. Everyone is happy, no one wants to leave their city, but if people do not have enough jobs, some might have to travel to neighbouring cities to work. Long distance transport makes commuting easier. People working in industries and at the university might have to do business trips to distant destinations, so an **airport** will come handy for them.

People have to get around, but good transportation network is also a major factor in city development from another perspective. If your city produces for instance surplus food, you have to be able to transport this to other cities. Otherwise, the fruits and vegetables will get bad and they will end up in the hands of your waste management system. Trucks, trains, ships and planes give you access to other cities and you can make money by selling and transporting your goods to your neighbours. The money can be put in good use in the development of the city and in improving the wellbeing of the inhabitants. You got the point? What about green transport solutions? Good question! Let's focus on them next!

The most eco-friendly ways of traveling are, of course, **walking and cycling**. You do not release greenhouse gas emissions as other vehicles do! You don't need to go to gas stations to get fuel, just visit your fridge. These are the greenest transport solutions! You just need bicycle roads, parking places and bicycle repair services. Well, of course, you also need sporty citizens who are willing to cycle... But that's not a technological problem =) As a matter of fact, there are cities in the world where people cycle a lot. In Holland, for instance, they make up to 25% of all the trips on bikes; and 85% of the population have at least one bicycle. Can you imagine? So how can you motive your citizens to cycle? Here's an idea: how about providing your citizens with **free do-it-yourself bicycle repair center**!

Ok, what to do with those 75% who prefer other transport? Every problem has a solution, remember it! You can create (environmentally friendly) electrical cars. They use electric batteries instead of petrol to get around. That would make your city greener and would cause less air pollution. Hence, the citizens will be happier as they are breathing fresh air. And the cars look great, that also counts! Just remember, batteries do not like cold, so the electric cars need to have heated garages in the winter. **Heated garages with charging stations** is a must! Why not build it high, so it does not take too much space in your city! Another solution is to offer everybody **public city transport**. Set up good bus schedules that are comfortable for the people, plan the network so that the buses can reach everyone, and there we go – all together in a bus. Who would still need a car of their own? More travel with less pollution, and fewer traffic jams! Terrific!

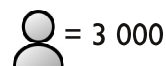
Another green solutions is a **travel centre**. Why? The travel center offers several transportation options under the same roof for the people on the move. Very efficient! There is also hotels for weary travellers, shops, restaurants and tourist info. If you want to have some visitors to come to see how cool your eco-city is, that's the best option to have! It provides efficient transportation and also creates many jobs.

As usual, golden stars will help you to choose the best transportation options for your eco-city! Good luck!

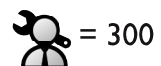
Harbour



Multi-purpose, energy-wise harbour. Mandatory for serving oil and gas industry & wave and tidal energy operations. Mandatory for solar cell manufacture, if there is no other means to transport goods. A passenger terminal



- Shore power to ship at berth
- LNG fuel available for ships
- Promotes tourism



- High maintenance costs
- Expensive

Travel centre



Multi-purpose travel centre with hospitality services for tourists and locals. Train station, car rental, long-distance and local bus station, hotels, shops, restaurants and tourist info



- Efficient land use
- Promotes tourism
- Creates jobs
- High maintenance costs

Free DIY bicycle repair centre



Do-it-yourself bicycle repair centre, which the citizens can use for free. There is tools and staff, who can help bikers to service and repair the bicycles



- Lowest environmental impact and land use
- Promotes green transportation
- High maintenance costs – need to pay salaries of workers
- Unlikely that the whole city would turn to bi-cycling

Public city transport



The city has a public bus transport system



- Reduces the need for cars
- Lowers overall environmental impact and land use
- Green buses can use locally produced fuels
- Higher expenses for the city administration, especially in case the city has a low population density

Railway station



A station for both passenger and freight trains. **Necessary when there are not enough jobs in the city! Mandatory for the solar cell manufacture, if there is no harbour/travel centre!**

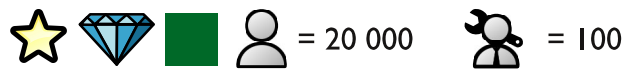


- Low environmental impact
- Rail tracks require a lot of space

Long-distance bus stop



Bus stop for long-distance buses that can take you to other cities. **Necessary when there are not enough jobs in the city!**



- Low land use requirement
- Relatively high environmental impact
- Buses use diesel

Multi-storey, heated parking garage with charging for electric cars



A heated parking garage with charging stations for electric cars



- Reduced land use
- Can collect fees
- Encourages greener car use
- It still results in some pollution
- Needs energy

Taxi rank



A fleet of licensed cars available for public hire in the city



- Reduces number of cars
- Provides employment
- Dependence on oil as fuel
- Causes pollution

Airport



Commercial airport serving passenger planes. **Necessary when the city relies on hi-tech and R&D and if there is a university!**



- Enhances tourism
- Provides flight connections to destinations both close and far away
- High land-use
- Environmental impacts
- Noise

Industry

What does industry mean for a city? Is it mandatory to have or is it more kind of optional one? Everyone, who has played strategic computer games knows how it works. The more developed your industries are, the higher your chances of winning are too. When thinking about your own city, industry is like the main factor for the city development. Once you have good industry, your economy grows and your city gets richer. With more jobs, services, shops, parks comes high quality of life. The latter basically states your people live happily.

This was crucial part of the ancient towns when craftsmen produced goods and sold them – which actually helped to develop the town's trade and, hence, economy and well-being. This is how it works nowadays too: the USA is far more developed compared to Honduras, as is the United Arab Emirates to Mali. Why? The answer is clever administration of resources and perfectly developed industry (e.g. oil and gas, hi-tech, construction, automobile industries). The industry, by the way, provides also jobs for the city population. It is an advantage as well. Do you also want to have a good industrial sector? Let's see what options you have.

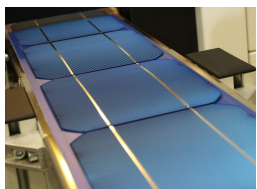
In terms of employment and economy, **mining industry** is a tempting option to have. You get raw materials and you can export it abroad. That generates you a good income. However, the citizens will suffer much, as will the environment. This type of industry is very dirty: it produces a lot of waste and in addition this the air and water will be polluted. It is even marked with a black star... Do you still want to buy it? Hmm, probably not.

Everybody wants the eco-city to be more environmentally and people friendly. **Oil and gas** is a really people friendly industry. It employs 5 000 people at once, the workers are well-paid, the city economy is growing, life is good. All is fine as long as things run smoothly. If an accident happens, then it is a totally different story, especially in the north, where the ecological consequences can be really severe. The ecosystems are very vulnerable there and it might take up to 50 years for the ecosystem to recover after an environmental accident whereas in the tropics it might take just take a week. See the difference? Besides, oil and gas are non-renewable. It will end one day, and then what?

All right! We are done with bad options for the environment and heading towards the eco-friendly industrial solutions. Here they come. The options that are close to perfect are the following ones: **electric city car manufacture** with high-paid jobs and eco-cars production; **service centre** with all services in one place – people don't need to use a lot of fuel to move around the city from one place to another to reach the services they want; and **biorefinery** run on renewable biomass raw material, which is also good for economy. But there is even better ones. Have you heard about the hi-tech industries? Hi-tech? These produce most advanced high technological solutions, as do for instance **solar cell manufacture**. **Stem hub**, on the other hand, offers office spaces for companies involved in software development, designing of video games and other IT-systems. These two offer your city environment clean industries and modern research activities, which bring a lot of revenue to your city budget. It is worthwhile to mention that the jobs available for the citizens are high-paid and the level of environmental pollution is minimal. What else do you need for the best eco-city? Yes, that sounds good. Keep in mind though, that these industries need highly skilled workers, so you need to have a university in your city. This kind of solutions are not the cheapest either, they can cost your city a lot of diamonds. But that's another story =)

Ah, I almost forgot something there. The industry offers the best job opportunities for the citizens, but be sure to count those other workplaces, too. Everyone should have job or a study place!

Solar cell manufacture



High-tech industry producing thin-film solar cells. **Needs both university and airport and in addition to that either railway station, travel centre or**



= 500

- Good for economy
- Well-paid jobs
- Opportunity to use free solar energy in the city
- Export potential

- The manufacture requires import of some rare elements

Biotech industry



High-tech industry, producing biotechnological products; medicines, components for agriculture and biomaterials.

Needs university and airport!



= 1 000

- High-paid jobs
- Renewable raw materials
- Export potential

- Low scale production

Stem hub



A large office building housing offices of several ICT companies.

Needs university and airport!



= 1 000

- Good for economy
- High-paid jobs
- Research activities keep the city "on the move"

- Requires university and airport

Electric city car manufacture



Manufacture of small electric cars



= 3 000

- Good for economy
- High-paid jobs
- Eco-friendly private transportation
- No need for oil/gas in the city

- Car battery replacement needed after 8 years
- Need for public charging infrastructure

Service centre



A large building for all sorts of services (Hairdresser, dry-cleaner, computer repair, locksmith, etc...)



= 500

- Efficient for people, several services in the same place
- Environmentally friendly

- Low-paid jobs

Biorefinery



Combined pulp & paper and bio-fuel manufacture from wood. **Needs wood from estate!**



= 1 500

- Good for economy
- Well-paid jobs
- Renewable raw material
- Export potential

- Environmental impacts to water, air and soil
- High water consumption
- Deforestation

Oil and gas industry



Refinement of oil and gas resources



= 5 000

- Very good for economy
- Provides employment for many
- Export potential

- Non-renewable resource
- Both extraction and use of product generates a lot of pollution
- Extensive damage to ecosystems in case of an accident

Mining



Mining operation for strategic metals/coal



= 5 000

- Provides employment for many
- Provides important raw materials for economy
- Export potential

- Low-paid jobs
- Pollution to the environment, especially air and water, generates a lot of waste
- Loss of biodiversity
- Extracts non-renewable resources

Recreation

Eco-cities need places where people can meet, interact and relax. Keep these in mind when you are creating your city – make it a place you would like to live in! How do you normally spend your free time? Do you like sports, swimming, playing football or going to the gym or dancing? Or do you prefer being out in the nature and doing jogging, golf or skateboarding? Maybe you like to go to the movies? How to meet all the needs of all the citizens in the city; and, at the same time, do it in the most eco-friendly way!? Quite a challenge, right? But nothing is impossible. Let's see what you have.

In the ideal eco-city the words “nature” and “recreation” should be connected. It means that the people should have access to green walking areas and parks, outdoor facilities, and nature with all the biodiversity it has to offer. OK, maybe not all the biodiversity... It is not that cool to meet a bear in the park when you are walking from school back to home, isn't it? =)

What else is meant by recreation? People are social creatures. You cannot just sit inside your eco-building and eat totally organic food all day long! Everyone has a need for socializing, meeting new people and making friends. In this sense, recreation facilities are important gathering places. All these recreational objects contribute to the physical, mental and social health of the eco-city community. And then people can live nice and happy lives!

But as we are all for good and clean environment, the facilities themselves should meet increasing expectations of environmental performance. Athletic and recreational facilities are usually resource demanding, both in their maintenance and utility usage, and normally have a high environmental impact. On the other hand, certain types of recreation facilities can be green. The question is what recreational facilities we can call green:

- **Green city-park with ecological playground** that is made out of natural materials is an example of eco-friendly recreation site with many pros;
- **Sustainable full size golf course** created in 100% environment-friendly way, where biodiversity is preserved but it requires high investments and is expensive to maintain;
- **Multipurpose green area with a small lake** where only natural materials are used and the area provides outdoor activities all-year around (Frisbee golf, picnic areas, fishing, skating during the wintertime).

Nowadays urban extreme sports, including skateboarding, are quite popular. Why not to have a **skate and BMX park** in the eco-city? City officials usually like them since they keep kids off the streets, and kids like them because they provide an adult-free time. These plazas do not take much of land and do not require high investments, but their capacity is low. You might need something else beside them...

Multi-purpose recreational facilities, such as **football field or city center shopping mall with cinema** are always a nice solution for eco-city. It is a great place for people to socialize! The latter one provides a lot of jobs in shops, restaurants, cafes, etc., which might come handy when you are starting calculate the jobs in your city. But keep in mind of how much investment they need and how much natural resources they demand!

Sustainable, full size golf course

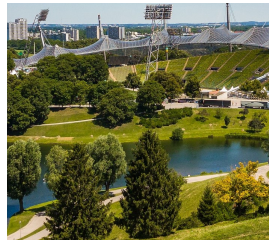


Decorative, low-carbon.
Biodiversity is maintained.

Water use is optimised,
rainwater collected and
stored for re-use

- Provides leisure activities
- Uses renewable energy
- 100% Environmentally friendly
- Tourist attraction
- Takes a lot of space, needs parking places
- High building and maintenance costs

Multipurpose green area with a small lake



A lake area that offers outdoor recreational and sport activities all-year round (frisbee golf, picnic area, fishing in summer; skating and curling in the winter)

- Provides leisure activities for entire city
- High capacity, low maintenance costs
- Only natural materials used
- Free Wi-Fi hubs with solar batteries
- Biodiversity preserved
- Takes a lot of space

Green city park with ecological playground



Green area for everyone and playground for kids with locally made toys from natural materials

- Provides leisure activities for entire city
- High capacity, low maintenance costs
- Natural materials used for playground
- Free Wi-Fi hubs with solar batteries
- Biodiversity preserved
- Takes a lot of space
- High investment

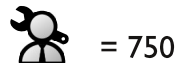
Football field



Municipal football field

- Multi-purpose, can be used as outdoor ice hockey ring in the winter
- High capacity
- High maintenance costs
- The upkeep requires water, energy & waste management

City centre shopping mall with cinema and free Wi-Fi



= 750

Contains everything local shopper needs: clothing, food court, cinema, coffee shops

- Serves as a meeting point
- High capacity
- Offers jobs
- Very high maintenance costs
- Needs a lot of natural resources
- Takes a lot of space, including parking

Skate and BMX Park



Skateboarding and BMX park

- Low cost of building, low resource use
- Low capacity

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