ID 1645 | A THEORY OF TECHNOLOGICAL CITIES

Milan Martinović[1]
[1]Faculty of Geography University of Belgrade
milan.martinovic05@gmail.com

1 INTRODUCTION

When two forces unite, their efficiency double.

Sir Isaac Newton, 1687- Approximately

Spatial planners must adapt to the modern way of planning cities. In today's modern world planners play a key role in the development of cities, but on the other hand have equal opponents in the form of policy, regulation, technology, where each individual has a certain role in development. The planner is the one who needs to adapt all the obstacles, to rise above all and successfully directed the planning of the city.

Cities in Europe are the main driving force of the economy and any change of the urban environment can leave severe consequences, both good and bad. It is very important that the planner should be careful and wise with the withdrawal of drastic moves to improve the city. Cities were created with a great goal to provide the best possible life for the population. The modern city for its population should provide good health care, good jobs, education, fast and reliable transportation, a healthy environment, a variety of cultural events, a place for rest and relaxation. Humanity over the next 100 years are expected the era of technology and energy, and we, as planners we have to be ready to prepare our cities through technological and energy development. Late implementation of modern technology can leave major implications on the functioning of cities, such as non-use of renewable energy, which directly leads to uncontrolled consume non-renewable natural resources. The current and future reality of space must be understood as a system in an uncertain environment, the development of which influence tendencies and "breaks" their subsystems and the interactions between them (Dabović, 2008).

Currently, in the world, about 50% of the population lives in cities, and the UN forecasts that by 2050 will reach 70%, and by 2100, 86% of world population will live in cities. Total population by 2100 will be between 11 and 12 billion, and just in cities is expected to live about 10 billion people, so it is important that cities adapt to the future. Our understanding of cities is being transformed by new approaches to the complexity of Sciences (Batty, 2005). One of the main goals of this paper is to activate the cities through technological development, especially cities that are in various indexes are not in the top 50 in the world, who do not have a very high income. Cities such as Belgrade, the capital of Serbia, with its 1.6 million inhabitants strategy must be oriented to the planning of the city with the great help of technological innovation. The energy that surrounds us and which is accessible must successfully collected. Precisely this kind of technological developments in cities such as Belgrade will quickly make progress in the future, and the current position as a medium-developed city can be ranked even better and more powerful in the world's top developed cities.

2 METHODOLOGY

In this paper, for the first time was presented a theory of technological cities. The paper introduces the concept, characteristics, and definitions of the technological city. Also explained the solution to the city to overcome the problem of lack of space for living, through a new vision of urban planning of cities, where a circular belt from the center to the periphery are alternately residential zones and green zones. While heavy and polluting industries ejected from the central and changed with the new modern high residential - business buildings. Regarding the latest technological achievements are represented by the superior technology in the field of transport - trains Hyperloop. The paper analyzed the long-term trend of global warming, for these purposes, data were collected from NASA and is based on an analysis of existing data collected in recent decades, and recent data from 2017. A comparative method was used in comparing Lisbon, Madrid, and Belgrade for daily solar radiation, data were collected from the archives of NASA. The method of analysis and evaluation was applied during the collection of relevant data from the scientific literature, statistical registers. In this paper, one of the prime objectives is to present the sustainable

development of cities in the near and distant future and to answer questions on how cities should be developed in the future with the help of technology.

3 TECHNOLOGICAL CITY: T-CITY

Definition of a technological city:

The technological city represents the sustainable functioning of the population and the nature, which are connected by modern technology into one entity.

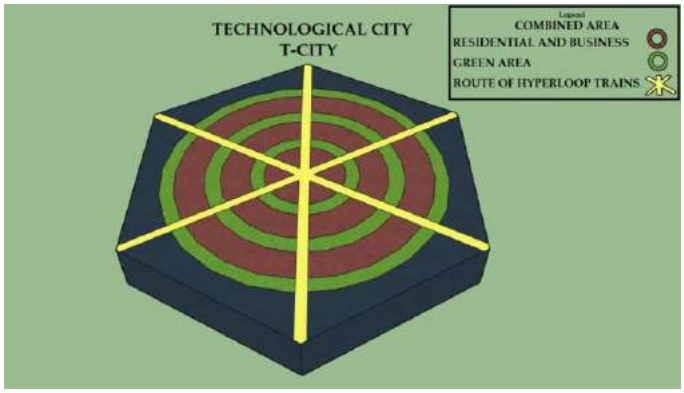
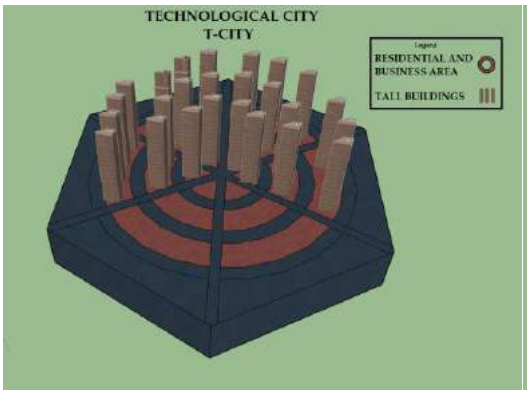


Figure 1 - T-city, Residential - business area, Green area, Hyperloop route.

As shown in (Figure 1) the combined system of residential and business areas, green areas and tracks of Hyperloop trains. The current way of building a residential zone that was based on the outskirts of the city buildings lower number of floors, and in the city center we have a very high building. Such an approach leads to the constant expansion of the city due to the increasing population in cities as a result of the lack of places in the city center for the population. An express development of cities and their remarkable functional significance requires a large number of the population lives and works in the city center, a technological cities must be planned to meet the needs of future life and work.

The three lines of Hyperloop trains that will connect the outskirts of the city with the city center. The trains that reach speeds of up to 1200 km/h, will be transporting passengers in the future in an incredibly short time. A combined system of residential and commercial areas, green areas and tracks Hyperloop trains.

T-city (short) as a modern technologically innovative system consists of three zones that circle from the center distributed in the form of residential - business complex with extremely high buildings in each of the three rings (Figure 2, red). This approach construction for the period from 2020 to 2100, provides enough capacity for all residents of the periphery to the center.



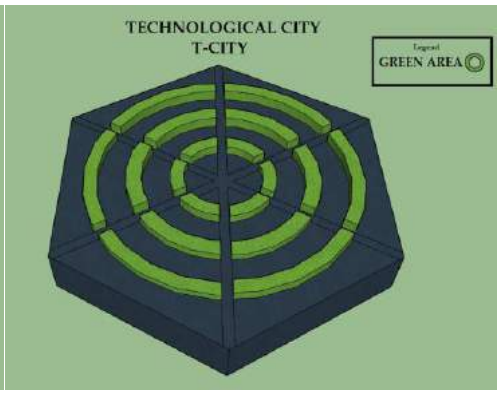


Figure 2 - T-city, Residental and business area. | Figure 3 - T-city, Green area.

Three rings of green belt that would be located near residential and commercial buildings, which would enable the population fast and easy access to nature. This kind of planning green spaces are innovative, and provides all residential - commercial buildings to be between green areas. In doing so, the planning of cities, attention should not be focused only on the construction but must devote a lot of attention to the protection of nature. The spatial planner in the city has two masters, one is population and the second is the nature. Nowadays nature is the one who calls out loudly for help, and we as planners we must not fail to respond to this call.

4 CHARACTERISTICS OF TECHNOLOGICAL CITY

To become a sustainable technological city, it is very important that each segment of the technological development of the city is at a high level.

The technological city is characterized by:

1. A large number of technological innovations.
2. Modern infrastructure.
3. Metro or a light rail system with high throughput capacity, with the remaining synchronized traffic, that is extremely fast and practicable (present). In the future, technology city will adorn Hyperloop trains that reach speeds up to 1200 km/h.
4. The high population density. The high modern building will allow the amortization of a large number of people.
5. Special places on the outskirts of the city that will serve to collect energy from renewable energy sources: solar farms, windmills, solar collectors: MEC (Milan Energy Collector) This ambitious project is expected in 2026-2030 etc.
6. Extremely high modern buildings that are energy efficient, which will in future be covered all over the windows, which will have solar panels installed, all windows will collect solar energy into a single solar system in one building.
7. Digital systems for monitoring all types of changes in the demographic changes, social changes, pollution of air, water and land, economic changes, etc..
8. A large percentage of investments from the budget of the City in the development of new technologies.
9. Transparency between the city, experts and the population, a high percentage of citizen involvement in solving problems. Group and individual involvement in the adoption and implementation of innovative technological solutions that can improve the functioning of the city, as well as public access to all types of information.
10. Flawless land use planning, land that will be a valuable resource in the future.

5 TRAFFIC - CURRENT STATUS AND FUTURE - HYPERLOOP TRAINS

5.1 CURRENT SITUATION

Cities that have not developed their own Metro systems and light rail systems remains largely limited to the requirements of the modern city. High density and a large number of employees in the central zone requires Metro, and the city that does not have built Metro is slowly but surely becoming not sustainable. In the absence of Metro, traffic jams occur, primarily because of a large number of cars, buses, and trams in the city center. On the other hand, cities that have recognized the demands of the modern city and started with the construction of the metro system, 70's, 80's, 90's, have the ability to implement new technology in existing infrastructure (underground roads beneath the city that are dug decades ago). The problem occurs in cities that do not have formed full Metro systems (such as Belgrade), which already has a traffic system unsustainable. Also, investors do not want to invest money in something that can be realized through several decades, and the idea of giving up is on both sides, by investors, and by the management board. Construction of Metro puts the city on the world map, strengthens the business area, contributing to the economic and social sphere, as well as environmental protection. Cities without subway can have a certain development, but lose every race with a serious city in which a metro system in the center of one of the basic components of good functioning.

5.2 THE FUTURE

Hyperloop concept including traffic vehicles like the current speed trains, but in this case transported the goods or population inside the tube, and moving at a speed up to 1200km/h. High speed is the result of the lack of air resistance in the tube and magnetic levitation which eliminates friction from the wheels.

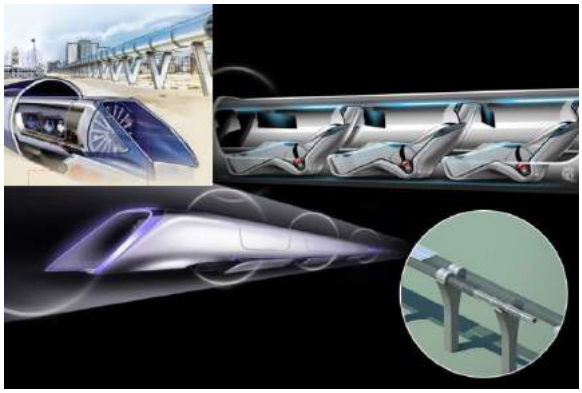


Figure 4 - Hyperloop trains, Source: https://hyperloop-one.com/

Hyperloop will probably initially be granted for freight traffic, which will allow the company to demonstrate the safety of such an advanced system. If the system proves reliable then it will go to the transport of passengers. This project represents an exceptional engineering challenge, and one of the biggest problems is the construction of huge vacuum tubes, which must be perfectly sealed, the length of several hundred kilometers. Instead of complete vacuum in the tube, it will only lower the air pressure that can be achieved with standard industrial pumps. The initial budget for Hyperloop is "only" $ 6 billion, and it is expected that this figure rapidly increased by ten times.

5.2.1 AUTOPILOT 2.0

Self-driving vehicles could reinvent how people live and travel around cities. They could also prompt cities to reconsider whether they even need parking spots. In the development of cars that have automatic control leading company is Tesla, which has the most innovative solutions when it comes to the development of this technology. Tesla vehicles have the hardware needed for full self-driving capability at a safety level substantially greater than that of a human driver. According to the Tesla Company „Eight surround cameras provide 360 degrees of visibility around the car at up to 250 meters of range. Twelve updated ultrasonic sensors complement this vision, allowing for detection of both hard and soft objects at nearly twice the distance of the prior system. A forward-facing radar with enhanced processing provides additional data about the world on a redundant wavelength that is able to see through heavy rain, fog, dust and even the car ahead“.

5.3 SOLAR ROADS

By 2050, energy demand in the world will increase twice. It is because of these problems that await us in the future, we as a society should discuss further how we can take advantage our cities, but not to jeopardize nature, in order to collect the greatest possible amount of energy. The exploitation of the roads as a collector of energy is one of the newer ideas. Roads is everywhere in the world, but they occupy only 10% of the time. According Wattway (2015) to a house fed electricity is enough Wattway 20 m² of solar panels, which are embedded directly in the road.

This pilot solar road is located in a small community in Normandie Turuvr, which has about 3,500 residents. France has started building the first 1km of solar road, with a donation of 5 million euros and thus encourage other countries to invest in modern technology that can lead to positive effects, and that in addition to the environment remains intact. The Wattway company plans by 2020 could lower the price at

the approximate price of ordinary solar panels, noting that the price of solar energy production in just 6 years from 2009 to 2015. reduced by 60%. It is obvious that this is a remarkable technological advance, but it is not currently viable. It is questionable how will road behave during the rain, and how to expect the tire contact under different weather conditions? The original plan of the project is to set up 1,000 kilometers of road, which would cost a lot, even $ 5 billion. A price per installed watt solar maximum capacities of the road is 17 euros, by comparison, the solar rooftops achieved 1.3 euros and 1 euro on the ground. Simply at this point, the solar road in this way is not sustainable, but it is a great incentive for the installation of new innovative technologies for the common good.

6 SUSTAINABLE DEVELOPMENT OF TECHNOLOGICAL CITIES

Cities in the coming decades have to implement innovative technology to achieve constant sustainable development. During the Climate Convention held in Paris in late 2015, representatives from 194 countries agreed to continue activities to reduce emissions of gasses that cause the effects of "greenhouse gasses". The meeting was held in order to avoid further and greater damage ecosystems around the world due to climate change. They discussed a number of strategy for overcoming this problem, one of them is the transition to renewable sources of energy (COP 21, 2015). The state of the environment in cities is not in a state where it should be. Change of purpose of land in cities is a major problem, the largely agricultural land is converted into construction, green area is almost gone, except for a few small parks in the city center. It is therefore of great importance that cities of the future plan good environmental protection, which would preserve the natural resources that adorn cities in the world. In recent decades, the combination of technology and the development of cities is inevitable, a technological innovation can greatly contribute to improving the current state of the environment. It is very important that good technological innovation systems implemented in cities and have a good think about what type of technology used to exploit the maximum potential of a particular city. The technology is developing rapidly, and if certain city invests a large amount of money, such as solar farms, it is important that the funds invested payments over a certain period, not only the pure economic profits but also "eco-profit" where minimizing adverse environmental impact. Solar energy is clean and renewable energy or green energy, also called clean energy, because its use does not pollute the environment (Stevović, 2016). In addition, if the city decides to solar energy, care must be taken to purchase solar systems tested according to the latest standards, which from day to day have a better result in the collection of solar energy. The progress of science in modern society has contributed to the man mastered various technologies but is pushing the same society as a "risk society" (Jovanović, 2015). In coming period, cities have to adapt to technological innovations to every segment of the city could be further improved, where each denial or deviation from the technology in the development of the city leaves a big lagging behind the other European cities.

6.1 CLIMATE OF CITIES

The combustion of large amounts of fossil fuels in cities leads to the formation of high concentrations of carbon dioxide and the formation of greenhouse gasses, wherein the sunlight is retained in the earth's atmosphere. Increasing the concentration of carbon dioxide in the atmosphere has reached the highest level in the past 800,000 years, which has led to a global average temperature increase of one degree Celsius from the period 1880 to the present. According to NASA, the surface temperature in 2016 was the warmest since modern record-keeping in 1880 (Figure 5).

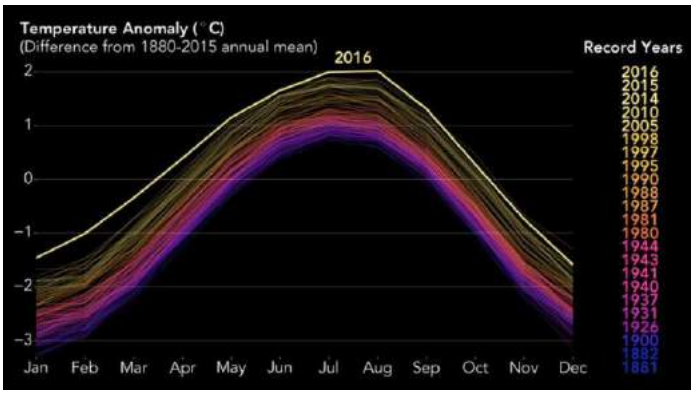


Figure 5 - Long-standing trend of global warming, Source: NASA

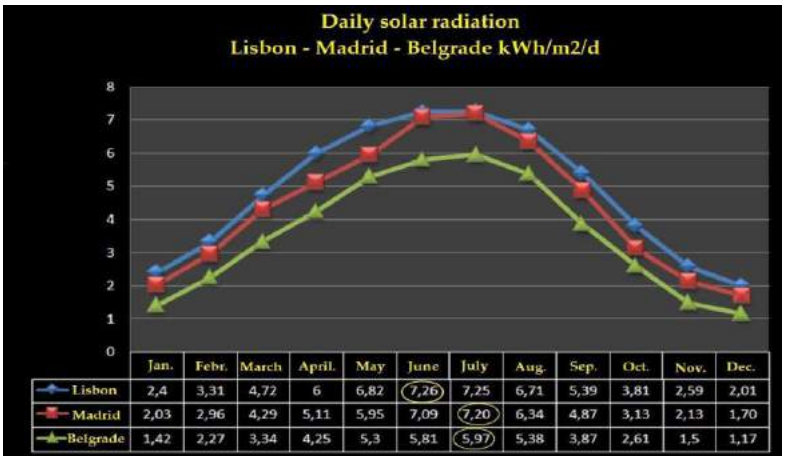
Cities must more decisively to apply all available technologies to adequately reduce unnecessary energy consumption. Some of the ways in which cities can provide sustainability are the following:

1. The use of renewable energy sources – use of solar panels is of great importance for the incredible energy savings, and also for the preservation of natural resources that cities have and more rational use. The solar farm needs to be built on the edges of cities, where land prices is lower.
2. It is important that each city starts with the reduction of electricity consumption, one of the solutions is the introduction of LED lighting as street lighting, which can greatly reduce power consumption.
3. Replacement of old cars that run on gasoline, with new electric cars. Replacement of old buses with new eco-buses, replacing the old dilapidated trains with new Hyperloop trains that reach speeds of up to 1200 km/h, which is expected for 5-10 years.
4. Green roofs on the tops of buildings in cities have a direct impact on cleaner air and a healthier environment.

It is expected that the supply of fossil fuels, as well as non-renewable sources of energy, are consumed in the next hundred years (Šešlak, 2015).

7 DAILY SOLAR RADIATION

For the purposes of this study, an analysis is made to the potentials of the following cities: Lisbon, Madrid, and Belgrade, with the aim to show that Belgrade does not lag behind too much for the cities that largely use solar panels and take advantage of solar energy. When mentioned solar energy in Serbia, it is immediately thought of South Serbia as a great potential, but from a given graph can be concluded that Belgrade has enough energy that could be collected, and that the lack of solar panels is just an excuse. In order to compare the potential (Figure 6) of cities to collect solar energy, studied the data received by NASA (the National Aeronautics and Space Administration). Calculating the amount of electromagnetic energy (solar radiation) on the surface of the Earth.



	Jan.	Febr.	March	April.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Lisbon	2,4	3,31	4,72	6	6,82	7,26	7,25	6,71	5,39	3,81	2,59	2,01
Madrid	2,03	2,96	4,29	5,11	5,95	7,09	7,20	6,34	4,87	3,13	2,13	1,70
Belgrade	1,42	2,27	3,34	4,25	5,3	5,81	5,97	5,38	3,87	2,61	1,5	1,17

Figure 6 - Daily solar radiation - Lisbon, Madrid, Belgrade, comparative overview Source: NASA, Chart – author.

From presented three cities, Lisbon has the highest potential daily solar radiation, which is the highest level in the period from May to August, with a maximum in June of 7.26 kWh/m2/d. Madrid in every month of the year has a slightly lower that are approximate to Lisbon. While Belgrade expected in the third place, the maximum in July of 5.97 kWh/m2/d, but still have sufficient amount of solar energy that can be collected.

8 GLOBAL ENERGY POTENTIAL OF RENEWABLE ENERGY SOURCES

It is very important to know the accurate and reliable data on how much each state has a capacity of renewable energy. In the following charts (Figure 7,8,9) is displayed the 15 leading countries that have the greatest potential of renewable energy in the world. The paper analyzes solar energy, wind energy, and bioenergy.

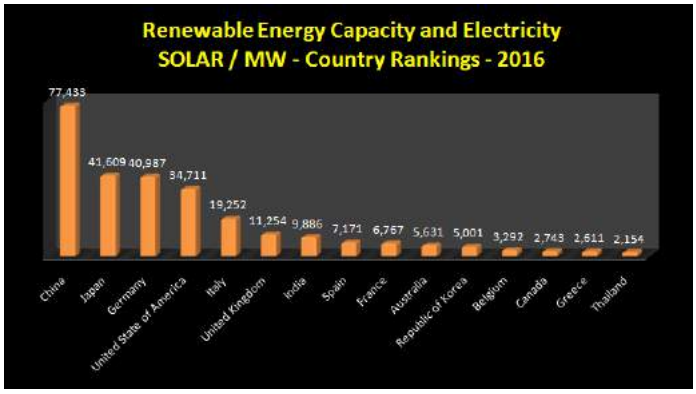


Figure 7 – Solar - Renewable Energy Capacity top 15 Country, Source: http:/resourceirena.irena.org, Chart – author.

China is the leading country when it comes to solar energy with exceptional 77.433 MW, Japan with 41,609 MW and Germany with 40,987 MW almost equal second and third position.

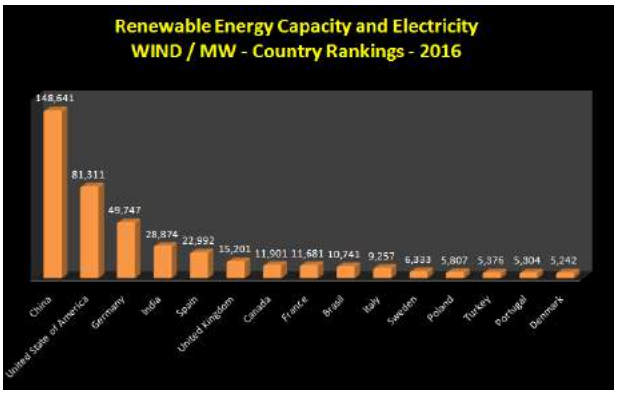


Figure 8 – Wind - Renewable Energy Capacity top 15 Country, Source: http:/resourceirena.irena.org, Chart – author.

As wind energy is concerned, China is also in the first position with 148.641 MW, United State of America is second with 81,311 MW, while the best ranked European Country is Germany, which has a capacity of 49,747 MW.

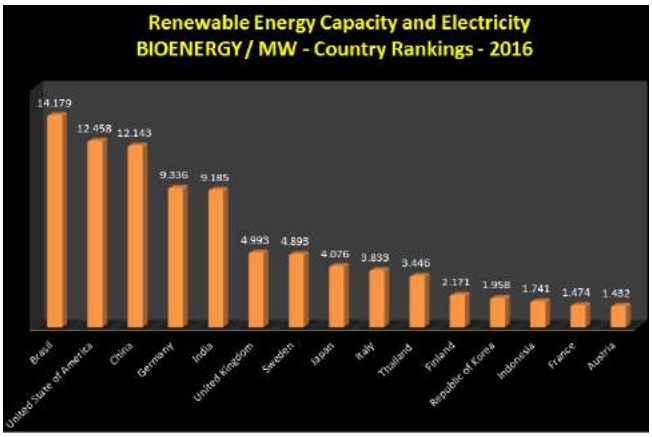


Figure 9 – Bioenergy - Renewable Energy Capacity top 15 Country,
Source: http:/resourceirena.irena.org, Chart – author.

The top five countries stand out when it comes to the capacity of bioenergy, the first is Brasil with 14,179 MW, followed by the USA 12,458 MW, China 12,143 MW, Germany 9,336 MW, and India with 9,185 MW.

These data clearly show an extremely large amount of energy available. Some countries that are ranked lower, can boost the particular country to advance in the segment in which lags behind competing countries in the region. The cities are epicenters of the economy and such resources must be used in the best possible way to get more energy from renewable energy sources, and thus save natural resources.

9 T-CITY

Each technological innovation can contribute to a better, healthier, and more beautiful life for the residents in the technological city. Further in the paper are described briefly my two original technological innovation, which can contribute to improving life in the city. First innovation is large and the second is small scale, precisely this difference in size tells how both small and large technological innovations can contribute to the development of the city in the future.

9.1 MILAN ENERGY COLLECTOR – MEC

The first one is a big and ambitious project called the Milan Energy Collector, a collector that collects solar energy through the multiplication of sunlight through the latest innovative lenses. The resulting overall energy is many times greater than a conventional energy collected by ordinary solar panels.

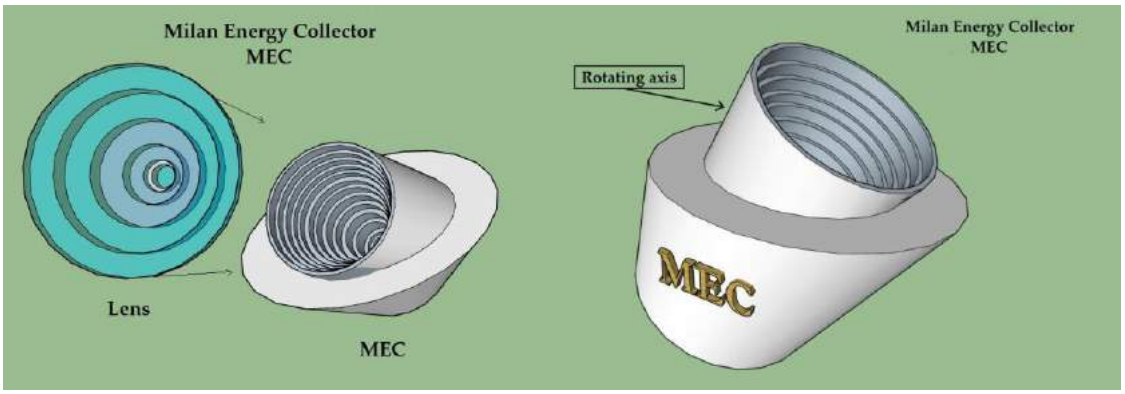


Figure 10 – Milan Energy Collector - MEC | Figure 11 – Milan Energy Collector - MEC

The collector consists of a large number of special lenses that are lined one above the other and in the end, solar energy is collected into a special generator.

The generator has a moveable front part, there is installed a sensor that monitors the intensity of the sun's rays and rotates to exploit the maximum potential of the sun's rays.

9.2 KEEP WALKING

Second technological innovation is very little, approximately is the size of a credit card. This is a sensor that detects movement of cars in the open building entrance, and an audible signal informs the population that passing along the street to avoid traffic accidents with cars coming out from a buildings output.

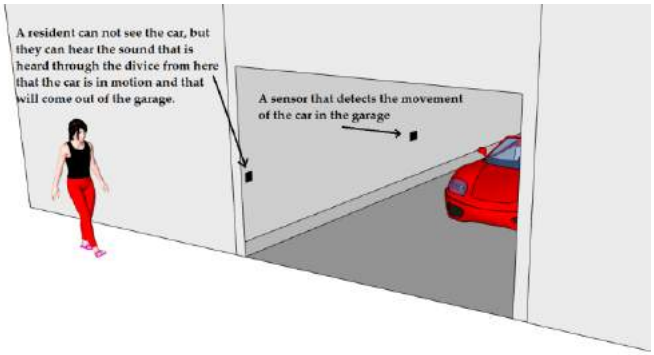


Figure 12 – Keep walking sensor

This is a technological innovation that can save people from injury. In my street, which is a few hundred meters long, there are more than 5 of these open passages through which the cars coming out from building. Both technological innovations are in the process of developed, which should be protected by a patent.

10 CONCLUSION

In recent decades, modern period brings with it a large number of technologically advanced systems that are being implemented in developing cities to become a more functional city. If in the city center, we have one good thing - a large number of technological buildings, and many negative things - a lot of traffic congestion and a lack of energy, whether we can then only after a one positive parameter classify a particular city as a technological city? Of course not, it is necessary that each segment of the technological city works seamlessly with to the modern technology used for energy, environmental monitoring, use of the latest technology in order to improve and modernize transport, all cars should switch to electric drive, to contribute to the reduction of air pollution in cities. Can Belgrade become a technological city?

Daydreaming or potential feasibility in the future? Belgrade has the potential to be in the next few decades (2030-40) closer to the technological cities. To achieve such an ambitious goal, it is a lot of investment in all aspects of development. Beginning in the infrastructure, transport, environment, quality of land planning, making better laws and regulations, construction technology modern buildings that are more energy efficient, the implementation of digital systems and monitoring of all segments of development, pollution, large investments in technology systems. The impact on the movement of climate change in cities to a large extent has a society, and that anything could change in the future, it is necessary to include more technological innovation that can have a positive impact on improving the current situation. The sudden use of energy in the world has raised concerns about supply and exhaustion of energy and resources, as well as a heavy impact on the environment: ozone depletion, global warming, climate change. Transport in urban areas is one of the leading polluters, a strategic city should direct a change in the automotive industry to eradicate polluting fuels and to move on cars driven by electric power. Eko buses that do not cost a lot more than just old buses can also contribute less to air pollution. Hyperloop trains that should work in the coming period, can greatly change the way population movement and transport of a large population in a short time and certainly brings benefits in the economic and the ecological sphere. Now is the time to plan the future.

This paper is dedicated to my professors.

BIBLIOGRAPHIC REFERENCES

Batty, M. (2005). Agents, cells, and cities: new representational models for simulating multiscale urban dynamics. Environment and Planning A 2005.

Dabović, T. (2008). National Strategy for spatial development in Europe. Belgrade: Faculty of Geography, University of Belgrade. ISBN: 978-86-82657-66-8

Interact website: https://hyperloop-one.com/ Retrieved Feb. 18, 2017.

Interact website: https://www.tesla.com/autopilot, Retrieved March 1, 2017.

Jovanović, L., Radović Vesela, R., Radosavljević M, (2015). Industrial activities and alleviating the consequences of a disaster NATECH in Serbia, ECOLOGICA Vol. 22, No 80, Belgrade, ISSN 0354 – 3285

NASA - The national Aeronautics and Space Administration, Interact website: https://eosweb.larc.nasa.gov, Retrieved Feb. 11, 2017.

Newton, I, 1687- Approximately, n/a

Šešlak, B., Uljić, P., Vukanac, I., (2015). Content Cs^{137} ^{40}K in ash wood, ECOLOGICA Vol. 22, No 80, 2015, Belgrade, ISSN 0354 – 3285

Stevović, I. (2016). Sustainability and cost of application of solar energy with a case study, ECOLOGICA Vol. 23, No 83, 2016, Belgrade, ISSN 0354 - 3285

United Nations Climate Change Conference, COP 21, 2015, Paris

Wattway, (2015). Press kit Paving the way to tomorrow's energy, Retrieved March 10, 2017 from wattwaybycolas.com

ID 1673 | A CLOSER LOOK INTO HOW LAND-USE, SOCIAL NETWORKS AND ICT INFLUENCE LOCATION CHOICE OF SOCIAL ACTIVITIES

Vishnu Baburajan[1]; João António de Abreu e Silva[1]
[1]Instituto Superior Técnico
vishnu.baburajan@tecnico.ulisboa.pt ; jabreu@tecnico.ulisboa.pt

ABSTRACT : Technology now enables individuals to travel more flexibly, thanks to ICT and the numerous social networks. The choice of location for social activities has become very flexible, sometimes allowing changes to a previous decision on the move. In addition to this, the characteristics of the residential and