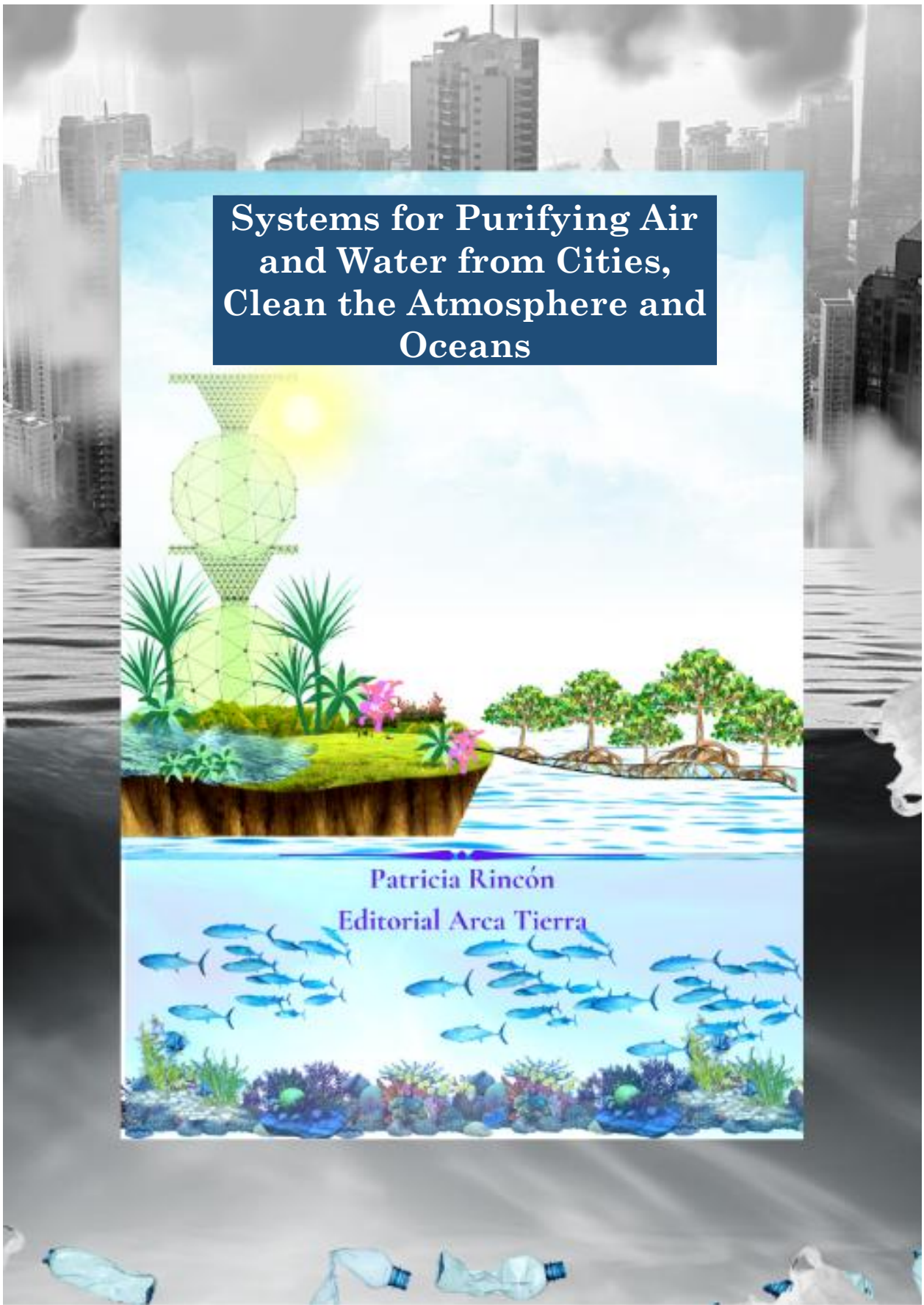
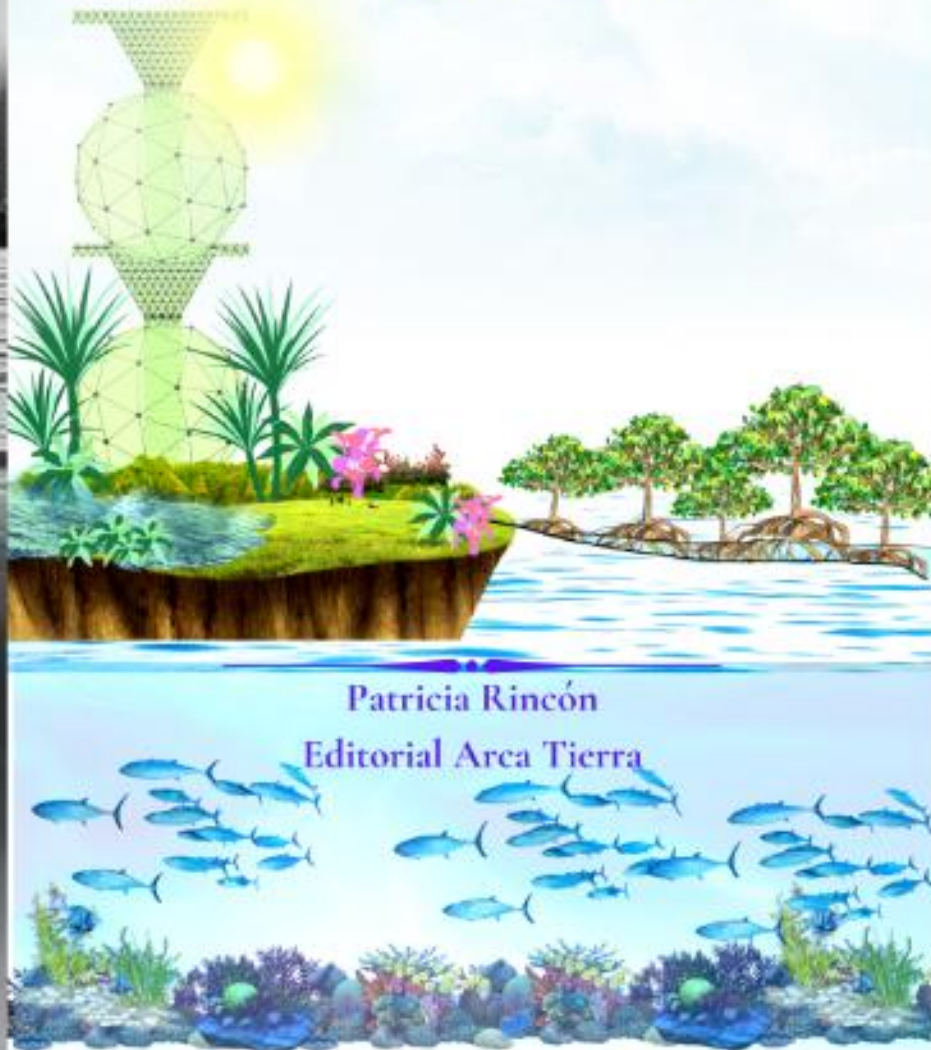


Systems for Purifying Air and Water from Cities, Clean the Atmosphere and Oceans



Copyright

Author Patricia Rincón

registration code **2008265127737**

Registration date **26 Aug 2020 14:41 UTC NGO Arca Editorial Tierra**

Index

Introduction	1
Section 1	2
System to Decontaminate Air, Water and Surfaces in Closed Spaces	2
Class 1 Transmission of the COVID-19 Virus	2
Laboratory Test to Determine Contagion of COVID-19	2
Transmission of Covid-19.....	6
Persistence of COVID-19 in the Environment	7
.....	11
Class 2 Today's Enclosed Space Purification Systems to Prevent COVID-19 Contagion and for Other Uses.....	12
Ozonation.....	12
Infrared Lasers.....	13
Algae.....	14
Class 3 Recommendations to Improve Current Technology to Purify Closed Spaces.....	15
System to Purify Air and Water Indoors.....	15
Recommendations for the Treatment of COVID-19.....	17
Life Protection System Against Biological and Chemical Weapons.....	19
Class 4 How to Maintain Human Activities in a Pandemic Through the Use of the Indoor Purification System and Prevention and Containment Measures.....	20
Section 2.....	22
System to Purify Air and Water in Urban Areas.....	22
Class 5 Components of Vertical Gardens in Urbes.....	23
Natural and Technological Resources.....	23
Factory of Modular Graphene Triangles for Buildings.....	51
Ventilation Systems.....	58
Class 6 Design of Air and Water Purification System through Urban Vertical Gardens....	59
Current Vertical Garden Models.....	59
Design of the Urban Vertical Garden of the NGO Arca Tierra.....	63
Class 7 Food Production.....	69
Food Production in Urban Vertical Gardens.....	69
Poverty Solution in Rural Areas.....	74
Solving Hunger, Improving Humanitarian Assistance and Shelter Management.....	76

Class 8 Water Availability Function.....	78
Rainwater Collection, Wastewater Treatment and Water Battery.....	79
Wastewater Re-Treatment.....	82
Surface Aquifers.....	83
Desalination.....	85
Class 9 Function of Providing Food and Shelter for Birds, Butterflies and Bees.....	90
Class 10 Function of Providing Safe Spaces in Cases of Toxic Air, Biological and Chemical Weapons.....	92
Section 3.....	97
System to Clean Plastic Continents, Atmosphere and Oceans.....	97
Class 11 Cleaning of Plastic Containers.....	97
Current Ocean Conditions.....	98
Measures to Reduce Plastics in the Oceans.....	100
Techniques for Cleaning Oceans and Coasts.....	102
Class 12. Mangrove Islands for the Purification of the Atmosphere and Oceans and the creation of Anticyclone Zones.....	104
Mangrove Islands and Natural Anticyclone Barriers.....	104
Stages for the Installation and Commissioning of Atmospheric and Ocean Purification Systems.....	106
Due to the urgency of the availability of biological CO2 pumps, it is important to consider that, instead of seeds, mangroves should be placed with a prudential size for their optimal growth and adaptation to the TetraPot, there are various foundations and government efforts for the reforestation of mangroves, which grow mangroves in hatcheries, Vertical Gardens, explained in section 2, could assist the rapid and healthy growth of mangroves on a large scale.....	108
.....	121
Class 13. How can you help the development and implementation of this system and make it available to everyone.....	122

Introduction

The Purification Systems textbook of the Air and Water in Urbes, of the Atmosphere and of the Oceans, correspond to the text of the course of the same name of the NGO Arca Tierra, in order that this knowledge is available as soon as possible, because it presents various solutions to crises that we face today, such as COVID19, air pollution that increases the spread of viruses, causes diseases that kill 8.8 million people a year and the toxic cloud caused by the ammonium nitrate explosion of the attack terrorist occurred in Beirut, we first published the written classes.

It guides you on how we can innovate to improve air quality in cities, purify closed spaces to prevent pandemics from collapsing human activities, clean plastic continents and instead place systems to purify the atmosphere and oceans, making use of mainly from mangrove islands.

The Systems to be developed will be the following:

1. System to decontaminate the air and surfaces in closed spaces, through ozone, laser rays and algae, to avoid the contagion of COVID-19 and any other virus, so that activities education and work can be carried out with the corresponding provisions.
2. System to purify the air in urban areas, through the innovation of Vertical Gardens, which involve technology and natural resources, to decontaminate water sources, absorb large amounts of CO₂, emit oxygen through plants and algae, generation of clean energy, decontaminate water sources, collect rainwater, improve desalination processes, food production processes, conservation of flora species and create habitats for butterflies and bees through living flower sculptures.
3. System to Purify the Atmosphere and Oceans, which involves several innovations to clean the continents of plastic and waste from the oceans, with technology and natural resources, explains how to carry out the work of reducing ocean acidification, freeing from excess of CO₂, Nitrous Oxide and other pollutants to the atmosphere and oceans, making special use of mangroves, to provide shelter for birds and marine species and that in turn serve to protect coasts from tsunamis, typhoons, hurricanes and cyclones, reduce the formation of these phenomena in the oceans, because they generate high pressure systems.

Section 1

System to Decontaminate Air, Water and Surfaces in Closed Spaces

In this section you will guide yourself on how to develop innovations for the creation of closed spaces safe against viruses, to prevent pandemics or chemical weapons from collapsing human activities and the survival of the humanity.

Class 1 Transmission of the COVID-19 Virus

An analysis of the laboratory tests and the mode of transmission will be carried out to determine the risks of contagion and the successful actions to contain the COVID-19 according to the available studies. Determine the relationship of air pollution with the spread of COVID-19 and other viruses, the generalized mode of transmission of viruses through contact and through the air.

Laboratory Test to Determine Contagion of COVID-19

The nations that have best contained the virus, with a minimum number of infections and deaths, according to a BBC News report by Lioman Lima, are: Singapore, Taiwan, Hong Kong, Japan, Korea The South, Germany, and Israel, because these countries have paid special attention to early detection, test effectively, quickly and widely, with their own mechanisms for taking these tests efficiently. Examinations and isolation of those infected and their possible contacts, to contain the number of infections by Covid-19 is what these nations mainly carry out.

The methods of taking samples more efficiently, considering: time, cost and effectiveness demonstrated in the reduced number of infections and deaths in the country where they are practiced are:

Germany: they do not know why they have such a low death rate, but it is especially due to early detection, its health centers carry out 160,000 tests per week to detect the coronavirus.

"Although we do not know the precise reason, the truth is that we have recommended, from the moment we became aware of the emergency, expanding the number of tests among the population and thus reducing the possibility of contagion," said the Robert Koch Institute of Virology , responsible for the German strategy against covid-19, when consulted by BBC Mundo.

Singapore: In addition to emphasizing testing, it went further, using disease detectives to find out where the virus had been in the country. And in this way he managed to cut the chain of contagion from the sources of infection.

Vo' Euganeo Pueblo Italiano: despite the fact that Italy is one of the countries with the most cases of infected and dead, this small town managed to contain the spread of the virus, its strategy was of course to carry out extensive tests in the town's school. According to the professor of Epidemiology and Virology at the Hospital of the University of Padua Andrea Crisanti, they managed to have a diagnosis of almost all the people of this Italian town. And from there they applied an experimental method that allowed them to reach two conclusions: "We scientifically demonstrate that the incubation period of the virus is two weeks and that any containment strategy has to take into account the high number of asymptomatic positives". With these data, they managed to contain the epidemic within this locality.

South Korea: managed through early detection to contain the virus, despite being a neighbor of China, where COVID-19 originated. According to the South Korean government, there are about 10,000 tests per day, which has allowed the asymptomatic population to be isolated, which is one of the main problems in the spread of the infection.

Israel: at the beginning of the pandemic it created a rapid virus detection system, which could be useful to consolidate this successful action around the world, developed by Dr. Amos Danielli of the Alexander Kofkin College of Engineering, which uses a combination of Optics and magnetic particles to analyze 100 saliva samples from patients possibly infected with the virus very quickly and reduce the diagnosis time to only 15 minutes.

In fact, Israel is among the nations with the least infected and killed by Coronavirus, for emphasizing prevention, early detection with its detection method. And they have been continuously improving the methods of taking tests, professionals from the University of Ben Gurion in the Negev (Israel) developed a test that is capable of identifying people infected with Covid-19 in less than a minute through the breath. "The device shows 90% accuracy in the tests carried out so far", explains the professor, the head of the Center's Electro-Optics Unit and project leader, Gabby Sarusi. The study, which has the collaboration of the Israeli Ministry of Defense, has been carried out on a population sample of 120 people who have undergone preclinical tests, with a higher success rate than that obtained by PCR (chain reaction) tests. polymerase, in English).

"We measure the physical characteristics of the virus, things like, how it conducts electricity, not its DNA, and by treating it as a physical particle, which it also is, our processes are much faster than biological ones and our methods radically different. They go. at the speed of light, "says Sarusi. "This virus resonates at the THz (terahertz) frequency," adds the physicist. The test is based on a change in resonance of the range of a type of electromagnetic waves known as terahertz radiation in the presence of the virus.

The researchers assert that the production of each detection kit would cost between 45 to 91 euros, "a price much lower than what the laboratory test costs today, Sarusi indicates. The reason for this price is" because current coronavirus tests They are based on the identification and amplification of viral RNA, and therefore depend on expensive biochemical reactions, "he concludes.

Israel also redoubled efforts to massify the tests to its population, carrying out 3,000 analyzes per day. Another of the strategies deployed by the Government It was the active participation of its Armed

Forces, who, together with paramedics and health professionals, will test for coronavirus. (Source www.perfil.com)

Japan: the country with the least fatal infections, with scientific evidence that says that has really contained the spread of the disease, at least so far.

(Telecom giant Softbank performed antibody tests on 40,000 employees which showed that only 0.24% had been exposed to the virus. Random tests of 8,000 people in Tokyo and two other prefectures showed even lower levels of exposure. In Tokyo, only 0.1% tested positive.)

Prime Minister Shinzo urges that his Covid-19 containment model be taken into account by the rest of the countries of the world. Since the beginning of the pandemic, they have implemented their rapid tests for early detection and have continually improved them. Japan refused to heed advice from the World Health Organization (WHO) for its testing systems. Even in early July, the total number of PCR tests (to diagnose covid-19) was just 34,000, or 0.27% of Japan's population, and it also didn't follow the WHO recommendations for severe lockdown, just ordered a state of emergency in April 2020, with voluntary confinement and only closed non-essential companies, with no legal penalties for refusing to do so.

Instead of emphasizing confinement, they reinforced early detection, continually improve test systems, on May 13, 2020 they approved a rapid antigen test kit for COVID-19, manufactured by Fujirebio, its production capacity is 200,000 kits per week; which offers a diagnosis in less than half an hour without the need for a laboratory, unlike the PCR method (polymerase chain reaction), this was announced by spokesman Yoshihide Suga, of the Japanese government and the Ministry of Health adopted the guidelines on Wednesday corresponding. Suga said that in case the person examined with this negative test, the PCR test will be performed because it has greater precision, but for those who test positive, it will be certain that they have been infected. The rapid antigen test is used in health centers and in people close to those who have been infected with SARS-CoV-2. These tests are covered by national health insurance. The governor of Tokyo, Yuriko Koike, said that some 3,000 tests a month can be carried out in the health centers of the capital, and they began to carry them out since June 2020, according to a report by Deutsche Welle, Germany's international broadcaster.

And they developed another test from saliva samples, Shionogi & Co., a Japanese pharmaceutical company signed a license agreement with Nihon University, Tokyo Medical University, and Gunma University to develop the test method that will detect the virus with saliva in about 25 minutes, Kyodo News reported.

This sample has the same effectiveness as the current annoying PCR test and is being considered by other countries due to the need for massive tests. The FDA in the United States also approved its use in that country. Because like a quick test, it is autonomous and the sample can be sent from home.

A technique that is also being worked on in Chile and could speed up the number of exams and considerably reduce the possibility of contagion. This is in addition to another Chilean innovation that aims to revolutionize the current PCR, said Dr. Rafael Medina from the Molecular Virology Laboratory of the UC School of Medicine.

The Japanese pharmaceutical company said in a statement that the new method "does not require specialized equipment or a technical expert" and can "detect the virus with an accuracy equivalent to the widely used polymerase chain reaction test." "The new ternary initiation complex signal amplification method measures coronavirus genes, proteins and metabolites in saliva, and its results can be determined visually," Shionogi said.

Other key components of the Japanese COVID-19 containment model, apart from the key factor of early detection, have been its cultural factors of maintaining good personal and space hygiene, the social distancing of not greeting each other with kisses or handshakes. hands, the continuous use of face masks, when faced with flu or any infectious disease, they wear a mask to protect those around them. As well as the monitoring and investigation of the sources of infection, they have specialized teams to track infections, carry out follow-up and meticulous isolation of those infected.

This continuous investigation and tracking of the disease has made it possible to detect the main sources of infection, closing only those potential contagion establishments and carried out a national campaign for the population to avoid them, called the three C's:

- (*Closed spaces*): closed spaces with poor ventilation.
- (*Crowded places*): places full of people.
- (*Close contact*) *Close contact* , such as face-to-face conversations.

These places were established by an investigation carried out by the University of Kyoto, where a third of the infections originated “Our figures showed that many infected people had visited music venues where they shouted and sang. We knew those were the places people needed to avoid. ”

They identified “strong breathing at close range,” including “singing in karaoke rooms, parties, yelling in clubs, conversations in bars, and exercising in gyms” as the highest risk activities. “I think it probably worked better than just telling you people staying home, ”said Kazuaki Jindai who led the investigation. This national campaign in Japan also asked its citizens to take care of themselves, wear masks and wash their hands, and the Japanese responsibly followed these preventive indications of contagion.

So the countries that have best contained COVID-19 have implemented their own rapid and efficient tests for early mass detection, have called for preventive measures, and in the case of Japan, the only country that has contained it, has been Without confinement, only by closing possible sources of infection determined by expert investigations, they have contained it mainly through the measures described above, which basically consist of early detection, prevention of contagion with hygiene, use of a mask and avoiding places considered as sources of infection.

On the other hand, the WHO discourages the use of rapid tests outside laboratories, despite the fact that it has been shown that the best way to contain COVID-19 is by carrying out as many tests as possible, to detect those infected, isolate them and their possible contacts. The WHO encourages total confinement, quarantine areas and says that masks should only be used by those infected. Urges the realization of the PCR test in the laboratory, although it is one of the ways that many consider the best, false positive and negative cases have been detected, as in Chile, according to the former Minister of Health, Jaime Mañalich, who confirmed the information, pointing out that up to 30% inconsistencies were detected during a control. Although, there are specialists who agree with the WHO not to carry out rapid tests, the facts, the results in Japan and in other countries where rapid or mass tests have been used outweigh the opinions.

So, the tests from Germany, Singapore, Vo' Euganeo Pueblo Italiano, South Korea, Israel and Japan should be evaluated for rapid detection, low cost, efficient to do mass tests, which have demonstrated with facts its effectiveness, especially those of Israel and Japan.

These facts with results such as those of Japan and the contradiction of the WHO to discourage the Japanese model that has contained COVID-19, make us wonder what the WHO is playing at? This has also been asked by the United States and other European countries, in a future class we will see it when addressing the issue of China's laboratory origin of the virus.

In this class it is to determine the best way to detect and contain the virus, which we have already established. In other words, it is a virus that we must prevent and contain and not fear, because despite the increasing number of cases, the majority of infected people suffer only mild symptoms and recover.

Transmission of Covid-19

In June 2020, the WHO (World Health Organization) considers that there are two ways to become infected with coronavirus, one through contact with surfaces where the virus is and the second is by inhaling the emission of small drops that causes a sneeze or cough. In both cases, it occurs through the respiratory tract (nose and mouth) and the eyes. The WHO recommendation is to maintain a social distance of one and a half meters, wash your hands well and not put them in your face. On the other hand, for the CDC (Centers for Disease Control of the United States), the distance between people should be two meters.

However, on March 26, 2020, the president of the Japan Association of Infectious Diseases, Kazuhiro Tateda, warned that there is a third way of contagion, through simple loud conversations between two people or strong breathing, even when the people keep a distance of one and a half meters or two, COVID-19 could be transmitted. "We think that this contagion comes from micrometric particles, and can be called 'infection through micro droplets", explained the researcher. But he also revealed that you should not panic, because it can be easily avoided by avoiding this route of contagion and doing something so simple and even older than washing your hands. This transmission medium was demonstrated in a documentary at the Shin Nippon Air Technologies Co. facilities through a simulation with high-sensitivity cameras in a closed room, which allows the detection of droplets down to 0.1 microns. First they do it with people who are encouraged to sneeze, and you see drops that fall, and others, smaller, that remain floating in the air and disperse much more slowly: the micro droplets. These microparticles can travel up to 11 meters for a simple sneeze and can remain suspended in closed spaces for up to 20 minutes, promoting contagion. In addition to sneezing, these micro droplets can be transmitted by coughing, by speaking, singing or screaming, although it is still unknown how many micro droplets are necessary to infect, but it is proven that "micro droplets carry many viruses, and human beings we produce them. People around us inhale them, and so they spread," said Tateda. Masashi Tamakawa, from the Tokyo Institute of Technology, points out: "If the air doesn't circulate, the microdroplets don't move, they stay in the air for a while." However, there is a way to prevent this, and it is as simple as opening the windows and increasing air circulation. The micro droplets are quickly swept away when that happens, which is why they recommend "two air vents, and ventilate once an hour", concludes Tateda.

Despite the conclusive evidence from the Japanese experiment and that Japan has managed to contain COVID-19, the WHO denies the possibility of contagion by respiratory droplets more than a meter away, and that these micro droplets are only produced by sneezing. The WHO defends the theory that the virus is not transmissible in the air simply because China reports that there is no form of airborne transmission, they give greater weight to the conclusions of China's investigations than to those of Japan, when China was the epicenter of the global contagion and has failed to contain the virus.

Another study that we must consider in the transmission guidelines of Covid-19 is that carried out by the National Center for Infectious Diseases and the Singapore Academy of Medicine, which reveals that after 11 days, patients with Covid-19 are not contagious. In the investigation, the virus could not be isolated or cultured after this period, regardless of whether the patients obtained a positive test result. The document was based on a study of 73 patients in the city-state.

Singapore's strategy regarding the management of patients with Covid-19 is based on the most recent national and international clinical scientific data, and the Ministry of Health assesses whether this latest data can be incorporated into the patient's clinical management plan, as reported Straits Time newspaper. This is a very successful action, in the containment of the coronavirus, keeping up to date, evaluating and improving prevention and containment measures.

Persistence of COVID-19 in the Environment

The asymptomatic spread of the coronavirus and the lack of availability of rapid tests for COVID-19 in the world, make it necessary to know its stability in the environment and the real measures for its prevention.

The virus that causes coronavirus disease 2019 is stable for several hours or days in aerosols and on various surfaces, according to the study published in The New England Journal of Medicine, a team of scientists from the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), the University of California in Los Angeles and Princeton University in the US. In conducting this study, they used real samples of the pathogen on different surfaces and means of transmission, either due to contact or sneezing, which leads to suspended particles and they concluded that it remains for a maximum time of three hours, up to four hours in copper (present in many coins), up to 24 hours in cardboard and up to two or three days in plastic and stainless steel. This is key information to know the stability of the virus and confirms that people can acquire it through the air and after touching contaminated objects.

SARS-CoV-2 transmission appears to be occurring to a greater extent in community settings rather than healthcare settings. However, hospital environments are also vulnerable to the introduction and spread of COVID-19, whose stability in aerosols and surfaces contributes to its transmission, and measures to prevent the spread of: avoid close contact with infected people should be emphasized ; do not touch your eyes, nose and mouth; staying home when you are sick, coughing or sneezing into your elbow, and using disposable tissues that are thrown away; and cleaning and

disinfecting objects and surfaces that are frequently touched. This according to the NIH source, Agnecia SINC on March 23, 2020.

So, according to facts, the COVID-19 virus can remain in the air by micro droplets and on surfaces, the time varies according to the temperature, if it is an environment closed or open in terms of air ventilation and depending on the surface material. Now, we must also consider environmental factors.



Environmental factors have been recognized to control the persistence of the virus in the environment, which requires further research in collaboration with environmental scientists and engineers. Until now, the virus that causes Covid-19 has been known to spread through the environment. "We must identify the viral and environmental characteristics that affect transmission through surfaces, air and fecal matter, according to Alexandria Boehm, professor of Civil and Environmental Engineering at Stanford University (California, USA), and Krista Wigginton, Associate Professor at the University of Michigan (USA), Co-authors of a paper published in

'Environmental Science & Technology', which advocates a broader, long-term and more quantitative approach to understanding viruses, such as SARS- CoV-2, which spreads through the environment. They are also principal investigators in a recently announced project funded by the National Science Foundation to study the transfer of coronavirus between the skin and other materials, the effect of UV rays and sunlight. on coronaviruses and the connection between disease outbreaks and virus concentrations in wastewater., which indicate that drinking water treatment systems t They have numerous barriers to eliminate the most common and difficult ones. iris. Research on viruses similar to the SARS-CoV-2 virus suggests that they are susceptible to these treatments. The two researchers are asking experts in various fields, including medicine and engineering, to work together to advance the fastest methods, make discoveries, and formulate strategies that would not be possible independently.

In addition to water pollution, there is research to suggest that persistent air pollution in the worst affected regions could have led to worse overall health in the people who live there, making them particularly susceptible to the virus. According to a study by the Martin Luther University of Halle-Wittenberg (MLU), in Germany, elevated levels of nitrogen dioxide in the air may be associated with a high number of deaths from COVID-19. The research paper published in the journal Science of the Total Environment combines satellite data on air pollution, provided by the European Space Agency (ESA) Sentinel 5P satellite, which continuously monitors air pollution on earth, and the air currents, with confirmed death figures related to COVID-19 and reveals that regions with permanently high pollution levels have significantly more deaths than other regions. Nitrogen dioxide is an air pollutant that damages the human respiratory tract. It has long been known to cause many types of respiratory and cardiovascular diseases in humans. "Since the new coronavirus also affects the respiratory tract, it is reasonable to assume that there could be a correlation between air pollution and the number of deaths from Covid-19," says Dr. Yaron Ogen, of the Institute of Geosciences and Geography of the MLU. Some suggest that this should be investigated further.

The air pollution data was combined with data on vertical airflows, from the US meteorological agency NOAA. Their premise: if the air is in motion, pollutants near the ground are also more widely spread. However, if the air tends to stay close to the ground, this will also apply to airborne pollutants, which are then more likely to be inhaled by humans in larger amounts and thus lead to health problems. Using these data, the researcher was able to identify hot spots around the world with high levels of air pollution and, simultaneously, low levels of air movement. He then compared them to data on deaths related to COVID-19, specifically looking at data from Italy, France, Spain and Germany. It turned out that regions with a high death toll also had particularly high levels of nitrogen dioxide and a particularly low amount of vertical air exchange.

“When we look at northern Italy, the area around Madrid and the Hubei province in China, for example, they all have something in common: they are surrounded by mountains. This makes it even more likely that the air in these regions is stable and pollution levels are higher,” continues Ogen. The advantage of its analysis is that it is based on individual regions and does not only compare countries. “Although we can obtain the average value of air pollution for a country, this figure could vary enormously from one region to another,” said the geoscientist. This correlation of contamination and proliferation of virus contagion must now be examined for other regions and put in a broader context.

Other investigations that support the relationship of air pollution with the contagion of Covid-19 are:

- As a background, mortality from SARS-CoV doubled in sectors of China that had poor air quality compared to areas with clean air. While its expansion increased by 84% in those places with moderate air quality, compared to areas where there were better atmospheric conditions (Cui et al., 2003).
- There is solid scientific evidence that correlates the incidence of cases of viral infections with concentrations of atmospheric particles (PM10, PM2.5 and ultrafine particles) (Setti et al., 2020; Cieniewicz et al., 2007; Sedlmaier et al., 2009, and Díaz-Robles et al., 2015). These tiny agents act as a carrier vehicle for many chemical and biological contaminants, including viruses. Ultrafine particles (PUF) are considered within this category due to their size. They are generated as a result of poor combustion of residential biomass or by diesel vehicles and can penetrate deep into the pulmonary respiratory system, transporting the viral load to where the alveoli are, even these particles are capable of penetrating the alveolar-capillary barrier and, therefore, be distributed throughout the body through the circulatory system, transferring its toxic load of atmospheric and microbiological pollutants. In other words, they have the potential to be vehicles for the SARS-CoV-2 coronavirus. Thus, the particulate material, in addition to being a carrier, constitutes a substrate that would allow the virus to remain in the air in vital conditions for hours, days or weeks and that could travel long distances, on the order of tens or hundreds of meters. The rate of inactivation of viruses in atmospheric particles depends on environmental conditions. In this way, an increase in temperatures and solar radiation favors this indicator, but a high relative humidity can lead to a higher diffusion rate (Setti et al, 2020 and Despres et al., 2012). This according to the scientific research on the spread of viruses in relation to atmospheric particle

concentrations, presented in the "Report on the effect of air pollution and the spread of viruses in the population", led by Dr. Leonardo Setti, from the University of Bologna, Italy (Setti et al., 2020).

- Air pollution weakens the immune system.
- It is important to consider atmospheric pollution in the winter months and the isolation in the houses will cause people to stay much longer in closed places, with poor ventilation, with "intramural" pollutants associated with food cooking processes, pollutants from cleaning, painting and construction products, among others, and the need for heating, in Chile most families use the combustion of firewood to generate it. Such conditions could favor the duration of the SARS-CoV-2 coronavirus and its entry into the body, since it exposes the population to chronic contamination to toxic compounds, as evidenced by work carried out by Dr. Francisco Cereceda in conjunction with other researchers, linked to the determination of PAHs in the air of Temuco and Santiago (Francisco Cereceda-Balic et al. Journal of the AWMA, 2012). Therefore, air pollution outside and inside establishments are important to consider in the transmission of COVID-19.
- The improvement of air quality, through the reduction of CO₂ emissions from 25% to 40% due to quarantines, coupled with the fact that they left winter towards spring and improved ventilation conditions in the environment, reflected a reduction of infected.
- In Chile, PM_{2.5} Monitoring is being coordinated by collecting samples of atmospheric aerosols from the air in cities like Santiago, Temuco and Quintero, to evaluate the microbial community that has accumulated in them. SARS-CoV-2 has a fairly large diameter, of the order of 120 to 160 nm -that is 0.12-0.16 μm-, so it can be trapped within the PM_{2.5} contained in the filters. So, the idea is to analyze the correlations that could exist between the presence of SARS-CoV-2, the occurrence of Covid-19 and the atmospheric pollutants present in PM_{2.5}. This study will be carried out with the contribution of Dr. Francisco Cereceda, Professor of the Department of Chemistry and Director of the Center for Environmental Technologies (CETAM) of the Federico Santa María Technical University (USM), an expert in atmospheric chemistry and who will lead the campaign of sampling and chemical speciation of pollutants present in PM_{2.5}; by Dr. Luis Díaz Robles, Professor of the Department of Chemical Engineering from the University of Santiago de Chile (USACH), an expert in atmospheric modeling and health impact of atmospheric pollutants, who will lead the risk assessment studies for exposure to air pollution; by Dr. Michael Seeger, Professor of the Dept. of Chemistry of the USM, expert in environmental microbiology, who will develop the analysis of the microbial community present in the PM_{2.5} filters, and of Dr. Nicolás Schiappacasse, Associate Professor of the Dept. of Industrial Processes of the Catholic University of Temuco (UCT), who will be in charge of obtaining and analyzing the data provided by the SINCA (National Air Quality Information System) and, in addition, will collaborate in the study of PM_{2.5} and chemical speciation. Additionally, international experts in different subjects will participate. The CETAM-USM will be the general coordinator of the campaign. The parameters to be evaluated in the filters will be gravimetry and chemical speciation of PM_{2.5} (elements, ions, anhydrosaccharides [ANHS] and polycyclic aromatic hydrocarbons [PAHs]); criteria polluting gases (NO_x, SO₂, CO and O₃), presence and identification of SARS CoV-2 and diversity of bacteria. According to Article published in InduAmbiente N ° 164 (May-June 2020), pp. 48-52.

These studies and preliminary data partially show that ventilation, air currents and air pollution do have a correlation in the incidence of infected and deaths from COVID-19. There is enough evidence to say that air pollutants can penetrate the respiratory and circulatory

systems, damaging the lungs, heart and brain, so it should be noted that deaths from COVID-19 are minimal compared to 8.8 million. According to a study published in the European Heart Journal magazine and carried out by German researchers, the number of people a year in the world who die from air pollution exceed the figure of seven million deaths per year due to air pollution estimated by the World Organization of Health (WHO).

Despite the need for further studies on the correlation of water and air pollution in the transmission of COVID-19, the statement that the lower the pollution, the lower the degree of illnesses and deaths, either from COVID-19, is overwhelming. any other virus or health condition, which makes us conclude that we must reduce environmental pollution, urgently establish mechanisms for the purification of the atmosphere, water resources and oceans, not only to guarantee the survival of natural resources , but as a determining factor in the survival of humanity in the NOW, in the present. For this purpose the NGO Arca Tierra has several proposals explained in this course and in general in the free course The First Steps to Resolve Climate Change, available on the tutellus platforms and on the blog www.arcatierra.blogspot.com the video classes in different languages.

Class 2 Today's Enclosed Space Purification Systems to Prevent COVID-19 Contagion and for Other Uses

You will learn about the current ozonation, laser and algae technologies that are used to purify air and surfaces in closed spaces.

Ozonation

Ozone is the most efficient disinfectant for all types of microorganisms, it is a powerful oxidant, that is, rich in oxygen and constitutes an efficient and economical cleaning procedure, harmless to the environment. The effectiveness of each ozone molecule - made up of three oxygen atoms - means that ozonation treatments lower costs and avoid having to use chemical products.

This can be produced by means of an ozonizer, an ozone generator machine in the place where it is to be disinfected, since it is a gas that rapidly decomposes into oxygen and its packaging is difficult. There are residential and industrial ozonizers, different companies provide disinfection services through ozonizers to industries and homes, in restaurants for air hygiene, water and odors they use them, they avoid the contagion of viruses in these rooms, because it eliminates odors, purifies the Water, is used for medical treatments, is ideal for the treatment of lung and respiratory diseases, as well as to disinfect viruses and bacteria from the body through ozone therapy, purifies the air, surfaces and is beneficial for human health, stimulates the oxygen metabolism and activates the immune system.

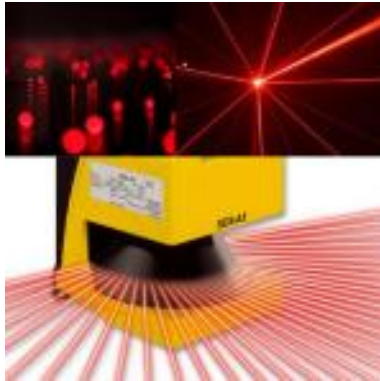


As we observed previously, COVID-19 can remain hours or days on surfaces, depending on the material where it is deposited, in the air it can spread and remain due to atmospheric pollution and possibly in water, since studies continue in this regard. . So why take the risk, we must ensure clean surfaces, air and water. Ozone is used to disinfect indoor environments, in order to ensure the microbiological quality of the air, as well as to control odors in food storage, restaurants, dry food disinfection, gyms, waste management plants, water treatment residuals It is an excellent disinfectant for indoor air, water, food and surfaces. In its disinfection process, it does not generate any type of chemical

residual, as it naturally decomposes into oxygen. According to various scientific studies, ozone has no limits on the number and species of microbes that it can eliminate, since it acts on them at different levels. There are dual-use ozonizers, for the disinfection of air and water, as well as to purify water and / or produce ozonized water, it carries a dual-use advantage, as it purifies and disinfects the air in the closed space, eliminating bad odors, viruses and bacteria

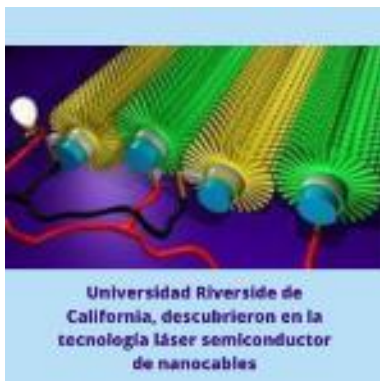
and, on the other hand, it ozonates the water to turn it into a natural disinfectant to wash food and the surfaces that are considered, there are even water ozonizers for human consumption.

Infrared Lasers

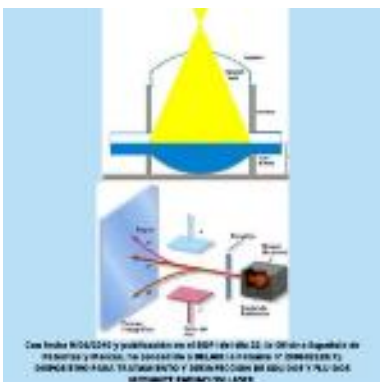


The laser beams, "Light Amplification by Stimulated Emission of Radiation" (LASER) which means amplification of light by stimulated emission of radiation. Lasers can have different wavelengths, infrareds are outside the visible spectrum, they are commonly used in security systems, for topographic studies or as terrestrial sensors. Laser emitters can control or direct the way atoms emit energy in the form of photons, transforming other forms of energy into electromagnetic radiation, different patterns can be configured to cover an entire

area, they can even detect the slightest movement, as well as large objects or surfaces. That is, infrared laser emitters can be calibrated to the desired intensity, to detect a droplet of saliva or large areas to irradiate them with lasers, they can emit from one beam to multiple beams and spread them through lenses to cover wide areas, It has the advantages that it does not disperse and can be directed at a great distance with great accuracy, these can disinfect the air, water and surfaces, and even be used for medical and dental treatments to eliminate viruses and bacteria.



In infrared laser purification, different studies support its use, in 2011 a team from the Riverside University of California, discovered in nanowire semiconductor laser technology that could do everything, from killing viruses and purifying water, advances have been made in the disinfection of water, air and surfaces in various laser technologies. Taking advantage of the exceptional properties of laser radiation in its interaction with living matter, as air and liquids are the medium for transmitting energy, it allows purifying and disinfecting said media, destroying microorganisms in seconds, using a very low emission power.



It offers important advantages compared to other technologies: lower cost, low energy consumption, non-ionizing action, zero environmental impact, long life of the equipment, much higher than UV, requires little maintenance, its application does not present any occupational risk, eliminating risks produced by other disinfection processes, according to Julio Luis García García DEPURATION BY LASER. DELAIR S.L. "Disinfection by Laser Radiation is a physical process defined by the transfer of electromagnetic energy from a generating source (laser) to the cellular genetic material of an organism contained in a

liquid or air. The effects of this energy are to disable the cell to reproduce and to eliminate it by heating. It produces photophysical reactions activating dynamic processes in the molecule and electronic activation in atoms, causing heating at different levels and changing to heat energy. The effectiveness of radiation is a direct ratio of the amount of heat energy that is

absorbed by microorganisms. This dose is the product of intensity and time of exposure to intensity. The laser radiation is absorbed by the molecules, producing a photophysical reaction and causing heating. The energy of the radiation produces ionization and molecular dissociation, causing the destruction of the molecules. The amount of energy carried by a ray of light is a factor of its frequency and wavelength. When a ray of light with sufficient energy levels is absorbed by a material, it causes chemical or physical changes in it. However, atoms and molecules will absorb only that wavelength that provides the amount of energy to change state. In the case of microorganisms, laser radiation with wavelength (0.38 nm to 10.6 nm) will be absorbed at a level that will be sufficient to cause a physical shift of electrons and molecular dissociation. Laser radiation reduces the oxidability of the medium to be treated, and it is a physical procedure characterized by its calorific effects that does not react chemically, purifying the medium without causing any harmful effect on human health, as it is irradiated at very low emission powers " .

The Fundación Universidad de América in Bogotá, Colombia, in 2017 determined that infrared laser light has a disinfectant effect on water samples contaminated with Escherichia coli when using powers of 7 and 10 watts and exposure times of 180 and 270 seconds using a Infrared laser equipment with a wavelength of 980 nm and variable powers ranging from 0 to 16 watts, in this experiment they used the Wiser dental equipment High-power infrared laser with a maximum power of 16 watts and a wavelength of 980 nm used in disinfection of contaminated water samples.

Algae



Algae capture CO₂, purify water and air from microorganisms, purify water and air from biological and chemical waste, and is therefore used in different projects for these purposes. One of them, is the research project of the University of Concepción (UdeC) supported by Fundación Copec-UC, Corfo and Brain Chile, which would convert agro-industrial waste to be reused into other raw materials, to purify water from farming centers.

In relation to air decontamination, worldwide filters have been manufactured to capture atmospheric pollution in cities, as is the case of Bio Urban, in Mexico, a system based on microalgae that capture toxic gases and particles in urban areas. suspended less than 10 and 2.5 micrometers (PM₁₀ and PM_{2.5}), in Europe there are various designs of purifiers with algae that can be integrated into buildings to capture particles and atmospheric pollutants, which can provide clean energy and help save energy by improving comfort thermal, and even provide lighting with luminescent algae. In Paris, with microalgae, contained in a column of water and designed to do the work of at least 100 trees, when exposed to artificial light, photosynthesis is triggered: they capture carbon dioxide and release oxygen. Algae can capture in addition to CO₂, nitrogen, among other pollutants, they also trap bacteria and microorganisms.



Class 3 Recommendations to Improve Current Technology to Purify Closed Spaces

You will be guided on how to improve today's ozonation, laser and algae technologies to purify the air and surfaces in closed spaces in the creation of an Indoor Air and Water Purification System.

So, we already observed in the previous classes, where the COVID-19 virus remains and how we can eliminate it from the environment, even from the body, this and any other virus. Now we will see how we can use these technologies to create indoor, safe environments for work, education and entertainment.

System to Purify Air and Water Indoors

We observed in the first class, the demonstration that a safe distance to avoid contagion without a mask is greater than 11 meters, or if the sneeze is contained, with a disposable tissue, it is avoided to shout, speak loudly, sing, or speak face to face, the spread distance of saliva droplets in the air can be reduced, that COVID-19 can be asymptomatic and that until now most countries do not have sufficient mechanisms to perform rapid and effective tests in masses, while this it is not resolved there will be a possibility of contagion, without being worrying, since it is a virus with a low mortality rate compared to other diseases that can be avoided, such as malnutrition, according to UNICEF 2,800,000 children die a year from this cause, the holodomor that is happening in Venezuela where they are exterminating the population with disease, hunger and repression, among other challenges that humanity faces daily, such as air pollution. spherical, where 8.8 million people die a year

The good news is that humanity has the technology and infrastructure to achieve the disinfection of closed spaces so that work and education are reactivated as a priority and the world does not suffer the holodomor that my country is suffering. These recommendations are to be widely used once and for all.



En las Industrias se colocan ozonizadores en los ductos de ventilación. Estudios demuestran que mejora la productividad de sus empleados y el absentismo laboral debido al efecto de eliminación de gérmenes, los empleados se contagian menos.

In closed spaces, dual-use ozonators can be placed, for water and air, in workplaces and schools, establishing schedules for continuous automatic disinfection of spaces, assisted

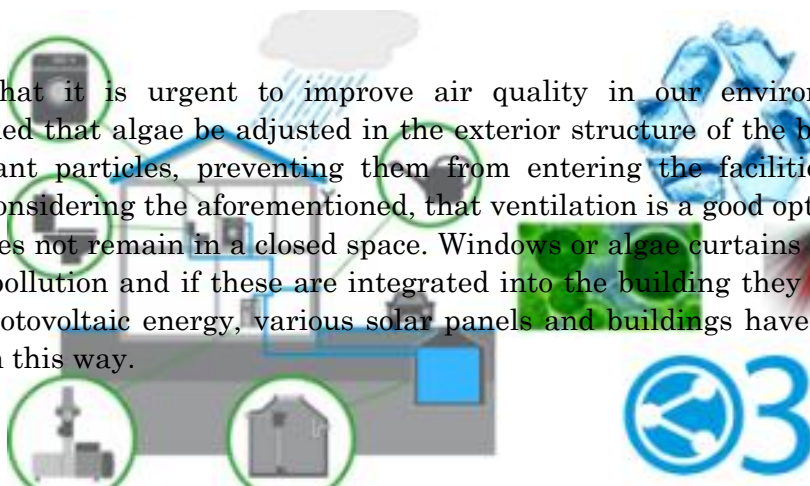
by laser beams that are activated in the same way, but interspersed, with the provision of microalgae lamps that will assist the trapping of surrounding particles and germs, to ensure continuous disinfection without chemicals and in a harmless way for the environment and living beings, benefiting the health of humans, their system respiratory and immune.

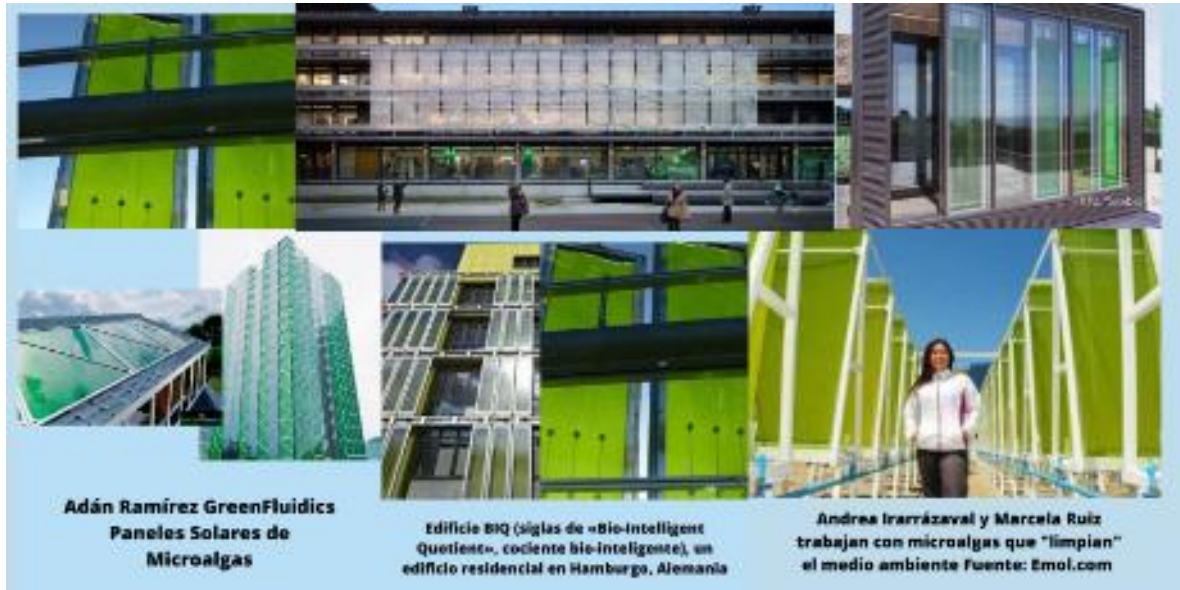


The system must be put to the test and maintain the precautions of a prudent distance and the use of masks if in the place they do not have reliable tests, such as those of Israel and Japan, they should maintain a distance greater than 11 meters between the workstations or study station or, failing that, continue with the use of masks. If the rules of holding back sneezing, talking loudly, yelling, singing loudly or talking face to face are followed, they will be able to stay within two meters. They would stop using a mask until the effectiveness of this system is proven 100% to avoid contagion. Microalgae filters can be established within the facilities to maintain clean air, which can in turn serve to assist lighting. Regarding the ozonation of water, it should be used as far as possible for the disinfection of hands, food and for human consumption.

New Zealand, one of the countries with the best air quality, is one of the first to not register COVID19 cases for 100 days, according to a report of August 9, 2020. In view of the fact that environmental pollution, both atmospheric and water sources affect the contagion of diseases, in the health of living beings, we must begin to apply this technology in turn, for the purification of wastewater and filters to contain CO2 emissions. Therefore, this water and air purification system to purify closed spaces should also be used so that the wastewater from industrial, residential, study and entertainment facilities is treated for irrigation or storage use for dry seasons and so that supply water to the Closed Space Purification System proposed here, through ozonizers, lasers and algae, it is also recommended to reuse algae as raw material for other industries, extra income that could help maintain the system.

We note that it is urgent to improve air quality in our environment, it is therefore recommended that algae be adjusted in the exterior structure of the building to capture CO2 and pollutant particles, preventing them from entering the facilities, filtering the air in windows, considering the aforementioned, that ventilation is a good option so that the COVID-19 virus does not remain in a closed space. Windows or algae curtains would allow air to flow, capturing pollution and if these are integrated into the building they could supply electricity through photovoltaic energy, various solar panels and buildings have already been designed and built in this way.





If you use this technology, you must ensure the sustainability of natural resources, the mass production of algae can be carried out in artificial hatcheries without affecting the availability of algae in the oceans, which absorb most of the planet's CO₂. Ensure that the facilities that use these systems use clean energy to reduce air pollution.

The NGO Arca Tierra recommends this system so that human activities can be carried out in closed spaces, in subsequent classes we will observe how to develop

Systems to purify the air in urban areas, through the innovation of devices, which involves technology and natural resources, to decontaminate sources They absorb large amounts of CO₂ and emit oxygen, through plants, algae and limestone rocks, to decontaminate water sources, collect rainwater and create habitats for butterflies and bees through living flower sculptures. It is imperative that any environmental solution must involve the recovery of natural resources, because without doing so, the ecosystems would be unrecoverable and our planet would not be able to sustain the living beings that we know today, including humanity.

Recommendations for the Treatment of COVID-19



In relation to the treatment of COVID19 and infectious diseases caused by viruses and bacteria, these technologies would

also serve for this, since it has been shown that ozone therapy eliminates bacteria and viruses from tissues and improves the immune system, the beneficial effects of gas from ozone in the body are very varied, it acts as an antioxidant; immunomodulator, that is, it increases the body's defenses against infections, mutagenic cells that can cause cancer or autoimmune diseases and viruses; improves circulation, cell function by oxygenating cells, and acts as a powerful germicide: eliminates fungi, bacteria and viruses, has a vaccine effect, against virus fragments, it can stimulate the production of antibodies; Furthermore, as ozone induces a greater aggressiveness of leukocytes, it causes viruses to be attacked more quickly and with greater force.



As well as the application of lasers, low intensity laser therapy in specific areas can help eliminate infections, viruses and bacteria, in dentistry it is used for the treatment of periodontitis, acts on cells under the principles of biostimulation and photomechanical stimulation, there are medical devices that modulate the

different intensities to achieve the desired effect. The longer the wavelength, the greater the penetration capacity. The application of photons of light should be a branch of quantum medicine, more studies should be carried out in this regard, studying at a quantum level the treatments with electromagnetism phenomena and their influence on our cells and tissues, in itself receiving solar radiation helps to the health of our cells, in our Plan 22 Sun we will deal more in this regard, but we can begin to study the application of lasers in the treatment of diseases, viral diseases, there are already advances in this regard in phototherapy, according to Its intensity has different applications in modern medicine and has been tested in the treatment of COVID19, Turkish scientists developed the TurkishBeam, a laser and UV treatment system, which has been successfully tested, although it is still In the clinical study phase in Turkey and in clinics in the United States, the treatment ensures the complete destruction of organisms such as microorganisms. isms, fungi, bacteria and viruses and does not damage human cells and DNA in this process.



In the same way, algae in the diet improve the immune system, a fact shown by several scientific studies and the high resistance of the Japanese to COVID19 shows it.

Life Protection System Against Biological and Chemical Weapons

There are suspicions and accusations that the COVID-19 virus was created in a laboratory in China, a communist country that has several laboratories that study viruses and has great ties in health research with the dictatorial regimes of Cuba and Russia, some believe that it was created in China COVID-19 on purpose, US Secretary of State Mike Pompeo claimed to have "an enormous amount of evidence" that the virus came out of a laboratory in Wuhan in central China where it was first detected in late 2019, others that were created but by accident, such as Luc Montagnier, famous biologist and virologist, Nobel Prize winner in medicine, affirms that the SARS-CoV-2 coronavirus, responsible for the Covid-19 pandemic, which has claimed more than 120,000 deaths , on five continents, would have been accidentally created in a Chinese laboratory. In addition to having evidence and believing that it was created in the laboratory in China, either intentionally or by accident, in China its contagion and expansion was caused, since the outbreaks of COVID-19 were silenced, scientists and doctors tried to alert but were silenced, as is the case with Li Wenliang, in December 2019, Li was working at the epicenter of the outbreak when he detected seven cases of a virus that resembled SARS, the one that caused a global epidemic in 2003, he tried to alert his colleagues doctors from another deadly coronavirus, but the police told him to "stop making false comments" and he was investigated for "spreading rumors", unfortunately this doctor died in February 2020 infected by COVID-19. The European Union's position on China has been relatively measured, but mainland leaders are beginning to call for a more thorough analysis of its actions, amid accusations that Beijing has covered up the true scale of the epidemic. Leaks in recent weeks from US intelligence agencies indicate that China concealed the extent of its outbreak and underestimated the number of cases and deaths, for which China is currently facing various lawsuits.

In addition to these tests, accusations and lawsuits, it is very suspicious that when the virus broke out worldwide and the increased chaos unleashed in the media and social networks, social networks in which the United States has denounced the influence of Russian hackers to generate chaos and misinformation in different periods of the pandemic, China victim of a large number of deaths and infected, "collapsed by the unexpected virus" was not in chaos, they were ready to invest in the stock market, China became the majority shareholder of The companies based in the country by Europeans and Americans, took advantage of the panic of the "markets" due to the coronavirus without hesitation and when the price of the shares fell below the allowed limit, they bought them, as if they had cutlery in hand and The table is set to wait for the feast and devour the markets, as published by the Heraldo de Baja California in a note entitled "Operation Checkmate."

Another accusation that raises suspicions about the intentionality of the COVID-19 pandemic is the mishandling of the pandemic due to the aforementioned points in the previous classes and the accusations that WHO directors have covered up against China, since it has been pointed out to the Communist Tedros Adhanom Ghebreyesus, director general of the World Health Organization (WHO), of being part of the China cover-up of which the United States and Taiwan accuse him, and for which Donald Trump has withdrawn the funds of 450 million from the WHO of dollars that the North American country contributes annually compared to the 44 million of China. If the

COVID-19 pandemic continues with confinement, humanity will be pushed towards the abyss of the collapse of their economies, it would drag the world towards the holodomor, as they have done with my country Venezuela, where international terrorism and the regimes of Cuba, Russia, Iran and China have plunged Venezuelans into the worst humanitarian crisis in the hemisphere. The Director General of the WHO has received other accusations from non-governmental organizations such as Human Rights Watch HRW, they have accused Tedros Adhanom of causing hundreds of deaths in his country of origin, Ethiopia, for not having reported the three cholera epidemics when he was Minister of Health, in 2006, 2009 and 2011. In addition, Human Rights had reproached him for being part of the nucleus closest to the Ethiopian regime, indicated by the UN for having committed "systematic violations and political repression", among many other accusations by Ethiopians of genocidal, Tedros is in charge of solving the pandemic, who believes that the Cuban health model is one of the best, when that Cuban health model has caused thousands of deaths in Venezuela by destroying the Venezuelan health system.

The NGO Arca Tierra believes that it is possible that the COVID-19 pandemic was created in China, until it is conclusively proven otherwise, we urge the competent authorities to investigate, if these well-founded suspicions are true, we demand that it be applied Justice.

In short, whether it is a pandemic created in the laboratory or not, intentionally spread or not, humanity was not ready to face it, bravely hundreds of thousands of women and men of the health union have faced it with their hearts in hand and without tools for a new virus, humanity has come together, everyone from their area of influence has done their best to overcome this crisis and help others, demonstrating the true greatness of humanity and what we humans are made of, and They have shown that each nation can provide solutions and improve the quality of life.

But, it is a fact, that we face risks, that together we can overcome, so, in the face of this crisis, we must say what the Jews said to the Holocaust: NEVER AGAIN, NEVER AGAIN A PANDEMIC SHOULD BRING US TO THE EDGE OF COLLAPSE.

Therefore, we urge that these open and closed space purification systems be used to purify air and water continuously, or ensure that they are available in crucial facilities, to guarantee the protection of human life against biological weapons attacks. and chemicals, the air purification system in cities is described in our book Plan 1 The Climate. Now and at the end of this crisis, let's continue with the purification of the atmosphere and water resources with technology and recovery of natural resources, the NGO Arca Tierra has several proposals contemplated in its 24 Strategic Plans for the solution of climate change with quality of life human rights through sustainable development and equal rights.

Class 4 How to Maintain Human Activities in a Pandemic Through the Use of the Indoor Purification System and Prevention and Containment Measures

You will learn how the Interior Purification System and Prevention and Containment Measures can be used, so that human activities can be carried out without stopping, with the necessary prevention and containment measures.

So, we know the behavior of the Covid-19 virus, the best options to contain the contagion made in different nations, such as Japan, the technologies currently available to create an Air and Water Purification System in Closed Spaces so that it is possible for them to human activities are carried out with preventive measures until the total containment of the Coronavirus, then we must start activities.

One must begin to innovate and install the system recommended here or similar that fulfills the same functions, as the system proposed here is developed and installed, the available systems can be used, such as ozonators and lasers, since they exist various private companies with infrastructures to carry out its installation. Companies and industries are closing or declaring bankruptcy, governments are paying subsidies, banks are giving soft loans to medium and small companies so that they can remain closed, it would be logical to use these resources is for the reactivation of activities and not to maintain them paralyzed, investing in the installation of these systems, starting with priority companies for the reactivation of the economy, educational centers, means of transport, airports, ... A schedule of installation of the systems and reactivation of activities. The residential and industrial installation of these systems would return to normal, although the forecast must always be maintained until the absolute containment of the virus, then they will serve to prevent the spread of any other virus and create breathable environments in case of chemical and biological weapons.

Foci of infection determined in Japan, places where people shout or sing, bars, discos, gyms among others with poor ventilation, should improve ventilation and make use of this system with the appropriate spacing. Until it is resolved as a source of infection, they should remain closed. Successful actions to contain the virus, carry out massive tests and only the isolation of infected and possible infected should continue to be carried out, according to studies from Singapore, they stop contaminating after 11 days. Ozone therapy, laser rays and the consumption of algae should be considered in the treatment of patients with COVID-19, and in the diet the consumption of algae, since they strengthen the immune system, the Inmugal project, led by the Fedit Ainia Center, has given the first evidence of the application of these algae as food ingredients aimed at stimulating the immune system, this may also explain why the first sushi consumers in the world have such high resistance to COVID-19, despite the fact that Japan is the country with the highest risk of contracting the coronavirus, since the majority of its population is made up of older adults.

Given the risks that air pollution makes COVID-19 remain in the air and that air pollution is actually killing us, 8.8 million each year, effective measures should be taken to reduce it, the NGO Arca Tierra has several proposals to achieve this in his book Plan 1 The Climate are described and in summarized form in his online course The First Steps to Solve Climate Change, the option of the Systems to Purify Interiors and Exteriors proposed here would serve to start, but to be enough, we must consider the technologies available to reduce greenhouse gas emissions, the use of clean energies, the activities that can be carried out online should be encouraged to continue in this way, improving augmented and virtual reality technologies, availability computers in schools and for students in their homes and the internet The vast majority of legal and b Ancarios, they should be carried out online to avoid long lines and high concentrations of people, the country with the most progress in this regard is Estonia, where most of the procedures are carried out in online media, so the government, companies and citizens they generally save large amounts of money from their budgets. Teleworking reduces

transportation traffic, so this modality should be improved and reinforce the actions that improved online jobs in this crisis, as well as in education through online means, because transportation that runs on diesel or gasoline Besides being the main CO2 emitters, they absorb oxygen, seriously damaging air quality. At the same time, taking measures at home, in Chile, as in other countries that have the winter season, residences are the main emitters of greenhouse gases, so not leaving home does not represent a reduction at all of CO2 emissions, for which we must orient ourselves towards a sustainable economy that supports the supply and demand of sustainable products, goods and services, the way to achieve this is described in our management policy to improve air quality, described in the Plan 1 El Clima book, on our website <https://ongarcatierra.wixsite.com/inicio> and blog www.arcatierra.blogspot.com that would work to effectively reduce greenhouse gas emissions.

In short, may this be the beginning of the evolution of nations and the world towards a better survival of humanity and the planet towards sustainable development. LET'S START!

Section 2

System to Purify Air and Water in Urban Areas

In this section you will learn how to create a system to purify the air in urban areas, since more than 8.8 million people die each year from atmospheric pollution, (according to studies carried out in Germany, led by Thomas Münzel, researcher at the Department of Cardiology University Medical Center), through the innovation of the system called Vertical Gardens in Urbes, which involve technology and natural resources, to decontaminate water sources, absorb large amounts of CO2, emit oxygen through plants and algae, wastewater treatment, desalinate water sources, collect rainwater, and create habitats for butterflies and bees through living flower sculptures. Likewise, to create safe areas against attacks by biological

and chemical weapons, which will assist the Indoor Air and Water Purification Systems to protect the population.

Class 5 Components of Vertical Gardens in Urbes

Components, design and general functions of the Vertical Gardens in Urbes of the NGO Arca Tierra, to improve air quality, availability of clean water in cities and provide safe areas against toxic gases and viruses.

Natural and Technological Resources

- A) Natural Resources to Purify Air and Water
- B) Technological Resources to Purify Air and Water

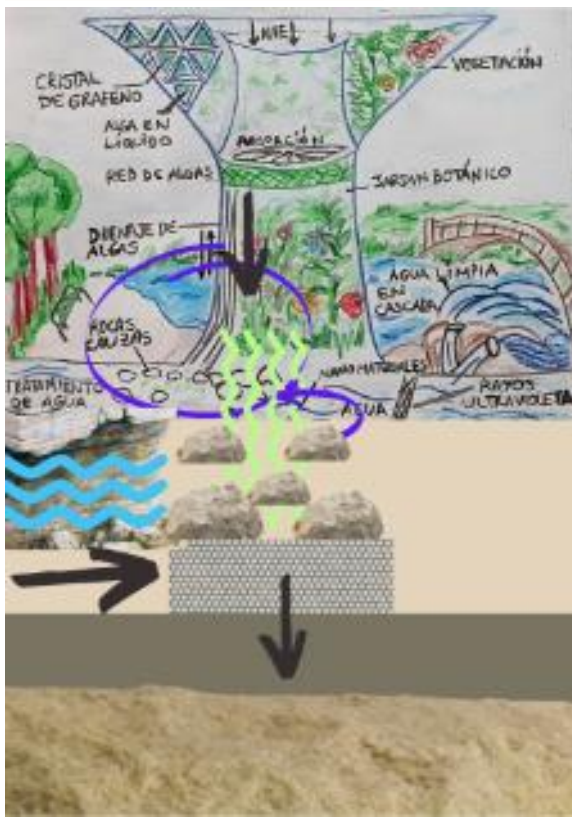
A) Natural Resources to Purify Air and Water

Rocks and Minerals to Trap CO2



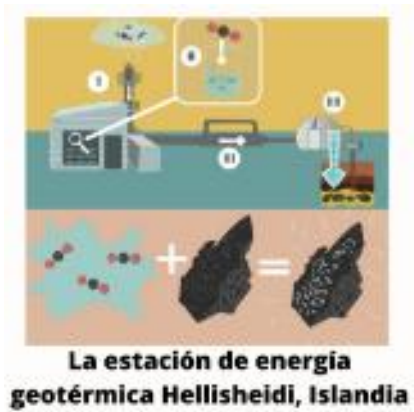
Roca Caliza

Limestone rocks are part of the carbon cycle, composed mainly of calcium carbonate, it is very resistant to weathering, that is, they do not decompose easily when in contact with the atmosphere, biosphere or hydrosphere, that is why the old constructions of this material still exist today. However, rain and rivers can erode it if the water is slightly acidified by carbon dioxide CO₂, karst erosion occurs, reliefs are created where the acidified water rests or circulates as it dissolves it, I presume that when dissolving the limestone rock absorbs part of the it to the bottom of the earth or the ocean.



The wear of terrestrial rocks is part of the carbon cycle, a vital process for life, which ends in the storage of organic carbon in solid form in sedimentary rocks under the ground or at the bottom of the ocean. Limestone rock is the largest carbon pool on Earth. The natural carbon cycle is a very slow process, which is not sufficient to capture excess CO₂ in the atmosphere, therefore, in addition to reducing greenhouse gas emissions, it is necessary to use systems that help to the carbon cycle, a function that the Vertical Gardens system in Urbes will fulfill, which will use limestone rocks to trap the acidification of the treated water and the

excess CO2 that will capture the vertical garden of the atmosphere through microalgae that will be arranged in liquid solutions within the main structure of the garden. At the bottom of the structure the limestone rocks would be arranged, as they dissolve in two channels, one that would receive the treated water and the other the microalgae drainage, they will dissolve the limestone rock into sand over time, which will fall towards the bottom, passing Through grids and meshes, to be stored in a chamber, the collected material would serve as raw material to produce graphene, in this way the excess CO2 would not go to the oceans or back to the atmosphere.



To this CO2 collection system, in addition to the statement, another existing method could be integrated, such as the proposal of scientists from Iceland, in the Hellisheidi geothermal power station, they trap the CO2 in the volcanic basalt rock, so that it becomes in limestone rock in a matter of months and the rocks produced, the solidified CO2 would be used in the garden for the process described above and / or would directly go to the graphene factory, to be used as raw material.

"Of our 220 tonnes of CO2 injected, 95% was converted to limestone in less than two years," explains study author Juerg

Matter of the University of Southampton in the UK.



It is worth mentioning that other scientists see the possibility of trapping CO2 and converting it into magnesite, a mineral formed by calcium carbonate, since the groundwater that circulates between the olivine rocks of the northern beaches of British Columbia is loaded with ions of magnesium and carbon, which in the end forms magnesite, which is a mineral that captures and stores carbon dioxide, due to a geological process that can take thousands of years. The group of scientists from Trent University in Canada found a method to reduce the process in a few months, according to a report

by Marta Sanz Romero from Computer Today.

Grits and Rocks to Purify Water

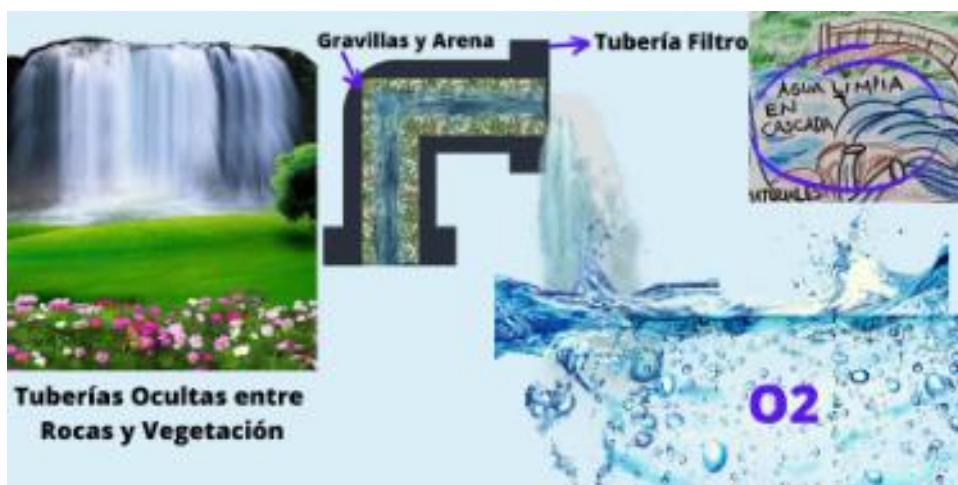
Gravel and Sand



Just as the carbon cycle is saturated by pollution, so is the water cycle, so the system will also assist in the purification of the water. Filtration through granular media, such as gravel and sand beds, is one of the most economical and efficient ways to separate suspended solids that are not removed by sedimentation, because they emulate nature, the formation of underground aquifers and the rivers, but this natural system of filtering water is overwhelmed by high levels of pollution. Filtration is an important operation in water treatment, prior to this, large solids must be removed, so that the filters are not

saturated and if they are not present, it is possible to go directly to filtration. Periodically the filters must be cleaned, that is, the gravel and sand must be removed and replaced by another,

of course, the extracted material must be reused as raw material or cleaned to take it back to the artificial underground or surface basin created for the system of the Vertical Garden in Urbes, the best methods must be chosen to do it, which reduce costs and facilitate maintenance. The gravel and sand trap the sediments by forces of cohesion and electrostatic attraction, before the moving water circulates over gravel and sand, for the creation of the movement and to assist the continuous process of purification of the water, other means will be used that will be described. later, one of them is to provide movement through waterfalls, because filtration by gravity can be slow or pressure, we recommend it to be pressure, through the simulation of natural waterfalls, through pipes provided with gravel that will filter the pressure treated water and they will fall into a lagoon or river, natural or artificial, provided with sand and gravel at its bottom. The continuous slow movement of the water provided by the waterfall in a lagoon will keep the water clean, or if it is in a river, it will keep the water continuously being purified by its base of gravel or sand and different waterfalls should be arranged along the river path by gravity. The design will depend on the terrain and the available resources, it is recommended that either lagoons or rivers, or both, be superficial and underground, so that it also serves for the storage of drinking water in times of drought or for the replenishment of water sources exhausted, prior to cleaning, since, if the lake or river to which water is to be supplied are contaminated, so much effort to supply clean water would be in vain.



Rocks to Purify Water



Previously we observed that limestone rock probably reduces the acidification of the water by trapping CO₂ when it collapses, the pertinent studies would have to be carried out, but we do know for sure that several kinds of rocks purify water, mainly those found in rivers and springs, Among them are the rocks that contain the mineral ilmenite, which is found on the banks of rivers and seas, according to a university article, researchers from the National University of Colombia determined that this mineral could be the solution to decontaminate the wastewater of Hundreds of industries that today poison rivers, it is

composed of titanium and iron oxide (FeTiO₃), it is originally formed in magmas, and later, when the rock decomposes due to weathering, it is concentrated in the sands of rivers and beaches.



It would be necessary to evaluate river rocks, apart from gravel and sand, to determine the ideal ones to purify water, such as volcanic ones, the Universidad Católica del Norte de Chile (UCN) is developing biofilters from volcanic rocks and energy solar for wastewater treatment. Dr. Javier Quispe Curasi, academic of the UCN Department of Chemical Engineering, the unit that leads the project, explained that the use of volcanic stones is not random, since they constitute a high quality support so that bacteria that degrade organic matter can adhere. Among their characteristics, these rocks present good porosity, high roughness and a favorable chemical composition

for the growth of biofilm (consortium of bacteria that purify organic matter), ideal aspects for use in water purification tasks.

"Other filters use synthetic supports or industrial pumice stones, but, unlike the previous ones, the volcanic ones are much cheaper, do not harm the environment and are also friendly to the bacteria that develop the purification treatment", says Dr. Wanted. Another aspect that the researcher highlights is that volcanic rocks in their molecular structure contain carbon and hydrogen in the form of calcium and magnesium carbonates, characteristics that are very useful for water purification; according to UCN news.



Among volcanic rocks we must not ignore the commonly used pumice stone, its volcanic origin gave it certain characteristics, a multitude of pores and closed cells resulting in porosity with a grain solidity at the same time. Its porosity allows it to absorb and retain water, in addition to making it light and giving it special conditions, especially for filtering industrially produced products.



Minerals for the purification and enrichment of water should also be considered, river rocks contain various useful minerals to purify and flavor

the water very special. But also, there are minerals on their own that purify water, such as the mineral shungite, which is housed in rocks and is found in some few countries, contains 98% carbon, scientists highlight its properties to treat water, and that purifies the water of almost all organic compounds (including pesticides), metals, bacteria and harmful microorganisms, because it is not an abundant mineral, among many other options, it would not be used, unless the geographical location makes it feasible its access or can be produced industrially, from its natural formation process, which is carried out on a layer of sedimentary rock and on a shallow water carbonate platform, endowed with the mineral evaporite and high levels of nutrients, so that high rates of biological activity occur among volcanic material.

So, we would have a great variety of rocks and minerals to be evaluated and selected according to their availability, purpose and efficiency in wastewater treatment, in purifying surface and groundwater reservoirs, their storage or hydrodynamic behavior.

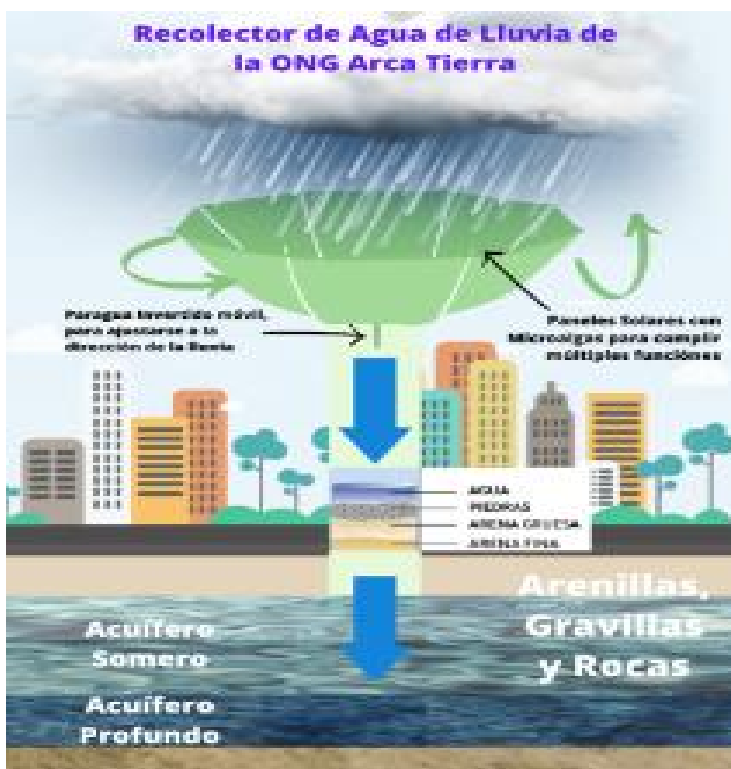
Aquifer Systems



Nature uses rocks, gravel, and sand to filter water and store it in underground aquifers. It would be necessary to consider the rocks used by nature in the main reservoirs of fresh water, the sand or rocks of the aquifer determine its functionality in the storage and underground distribution, by allowing or not transmitting water, that is, the gravel, sand and rocks determine the hydrodynamic behavior of a water reservoir. If we have the main purpose of storing large amounts of water, consider the main aquifers, such as the Guaraní Aquifer, nature filters rainwater through extensive layers of sand and rocks, until it is stored in basalt rock caves. And if you want to create a large underground water reservoir in the Vertical Garden System in Urbes, you should analyze the possibility of increasing the concentration of iron in the aquifer so that the water

remains in the subsoil, based on the discoveries made by A group of experts from the British University of Oxford, led by the expert Jon Wade, in an experiment that tried to explain why water disappears from the surface of Mars soon after it forms, unlike Earth, discovered that the The abundance of basalt, relatively rich in iron, found on Mars may

contain about 25% more water than those on Earth. Of course, it would be necessary to consider the appropriate levels of iron so that these reserves are suitable for consumption by living beings and supplying water to rivers and lakes. In fact, in the Guaraní aquifer, in certain areas there is a high concentration of iron, perhaps its high water storage capacity is due to this.



In nature there are sand, rocks and gravels, soils that absorb rainwater, in cities we have asphalt, which does not absorb water and this is wasted in the drainage network to become contaminated and when these are saturated they generate floods. The asphalt of the cities reduces opportunities to supply rainwater to underground aquifers, for which reason rainwater collectors must be available that flow into artificial underground aquifers created for the Vertical Garden System in Urbes.

Algae

Algae have the ability to purify the air of carbon dioxide (CO₂), nitrous oxide N₂O, sulfur dioxide (SO₂), as well as to be used in water purification, in wastewater treatment, as well as for the cleaning the water in rivers and lakes, from which it can remove even heavy metals. The kinds of algae to use will depend on the biome and the purpose for which they would be used. In the facilities of the Vertical Garden in Urbes, they would be used for both purposes.

Microalgae in Air Purification



Algae in the oceans produce between 50% and 85% of the planet's oxygen and bury about 10 gigatons of carbon from the atmosphere in the depths of the ocean annually, in turn, they transform CO₂ into carbohydrates that are ingested by organisms alive. Microalgae have been developed for use in cities, from different species of algae. Different studies worldwide in this regard have been carried out with the purpose of reducing air pollution and after use, microalgae can be reused for other industrial purposes, since it is converted into biomass, which can be used to produce animal feed, produce cosmetics, make biopolymers, dyes, foods with a high concentration of proteins, among others.... These studies include:



- Biourban, is a microalgae-based system created to capture toxic gases and suspended particles smaller than 10 and 2.5 micrometers (PM₁₀ and PM_{2.5}) in urban areas, designed by Carlos Monroy, for air purification in Mexico City. He designed two classes of technological systems, one for interiors of buildings, two meters high (BioUrban 1.0) and another for urban areas (BioUrban 2.0) with a height of four meters. The equipment for urban areas is shaped like a tree and inside there are four water tanks with algae with a capacity of 125 liters each, which purify the air through the photosynthesis of algae.
- Windows of Algae, consist of panels with microalgae to be placed on the ground to reduce atmospheric pollution, a project led by Andrea Irarrázaval in Chile, which seeks to develop a sustainable technology in economic and environmental terms, aimed at developing an integrated biological system capture of CO₂ and NO_x, SO₂ based on the cultivation of microalgae, which allows access to a high rate of capture of greenhouse gases (GHG) from emission sources. In section 1 we suggest that they be adapted as curtains, awnings or windows for buildings, so they would contribute to air quality in cities.
- Algae Filters and Cooling and Heating Systems, in this design the microalgae have multiple uses, for the treatment of wastewater, absorption of atmospheric pollution and energy production for the cooling or heating of a building, it can produce 80% of energy of the building, with the help of the sun. This innovation

was developed in Germany and they already built the first building with this new technology in Hamburg, with four floors and fifteen apartments, called BIQ (Bio INtelligent Quotient) that has “bioreactive” facades, made up of glass panels full of microalgae that they are grown on light, water, nutrients, and carbon dioxide. The microalgae are cultivated in the glass elements that make up their “bio skin”. These in addition to producing energy, control light, provide shade and serve for acoustic insulation. There are two ways of producing energy, one is by transforming biomass into methane gas and fuel oils and the second is through solar thermal heat captured by the water contained in the panels, which is then used for heating and hot water. In my opinion, the second option of producing energy through the sun and microalgae is the most viable to use and improve to produce clean and sustainable energy.

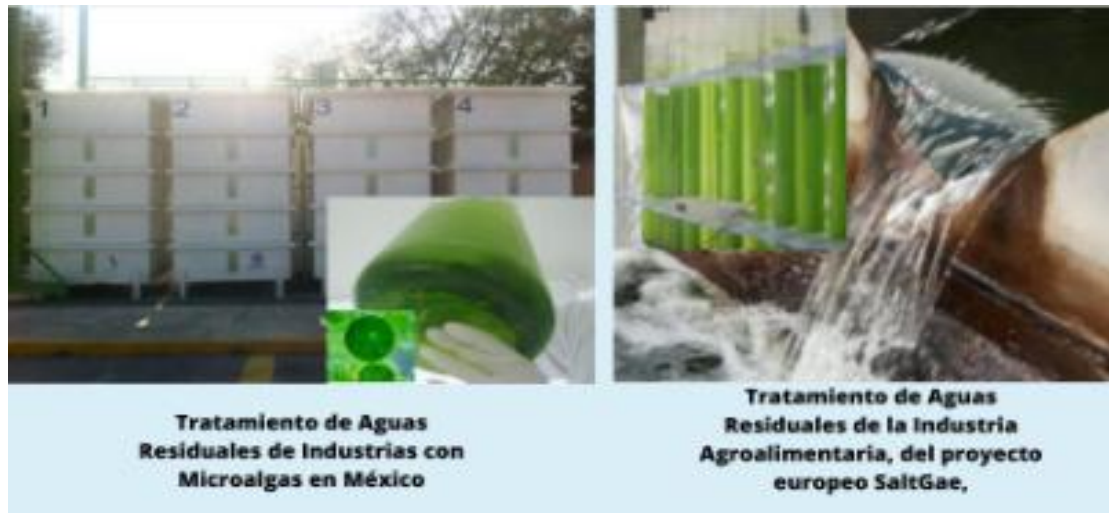
- Intelligent Solar Biopanel, microalgae solar panels that produce energy, capture CO₂ and emit oxygen into the atmosphere, devised by 23-year-old Adán Ramírez, a graduate of the Autonomous University of the State of Mexico, these Biopanel generate 160Wp and produce biomass, They are triangular in shape with a metal frame and a translucent green surface, this innovation has received innumerable recognitions by different institutions, for achieving through microalgae and carbon nanoparticles to generate electricity while cleaning the air, due to its triangular shape it can be adapted to many forms and integrate into building structures. In my opinion this is a highly recommended model, in fact, the NGO Arca Tierra in its 24 Strategic Plans, explained in the book 531 Beauties of the World II Edition, published in 2015, we recommend the use of triangular shapes for the internal structures of the buildings of our three city models, Galaxy, Tree and Earth Globe, mainly composed of buildings in the shape of geodesic domes, which are made up of modular and assembleable graphene crystal triangles, which would function as graphene solar panels and in conjunction with algae for CO₂ capture and oxygen emission, which would be useful in cities to improve air quality and in the creation of a space base on the moon, so that in addition to producing energy, it also produces oxygen for facilities. In the Urban Vertical Garden the graphene glass triangles of our design will be used as photovoltaic panels, for the purification of air and water. Saving land and sustainable buildings is one of the solutions to population growth, growth in coexistence with nature, with a high quality of life and respecting human rights without discrimination, is our proposal through our models of cities Galaxia, Globo Earth and Tree, described in our online course number 1 The First Steps to Solving Climate Change and which we will delve into in our course number 5.



- Anuka Microalgae Filters, developed by Queenny López and Gabriela Samaniego, two Ecuadorian graduates of the National Polytechnic School in Quito, have a capacity up to 100 times greater than trees to absorb CO₂ and transform it into oxygen. They used algae from hot springs, from an extreme ecosystem in Ecuador, where it is difficult for certain organisms to live under conditions of high sulfur content, high temperatures and little light availability, they arranged them in a cylindrical tower, 50 centimeters in diameter and 2 meters high, measurements obtained from biochemical calculations so that the algae maintain well, because they are quite sensitive, from mechanical calculations, related to the resistance of materials, the transparency necessary to receive irradiance and from hydrodynamic calculations, so that the mixture inside the filter is also uniform. It has a pump at its base, which absorbs CO₂; from there it goes to a physical filter, which retains particulate matter, nitrogen and sulfur oxides and other microorganisms. The CO₂ continues on its way and, from the filter, passes to a sprinkler, which makes it bubble and allows it to be dissolved in the tower that has water, nutrients and microalgae. At the top, the tower has a semi-permeable hood, which allows oxygen to escape, but does not allow the entry of air or microorganisms, to avoid contamination. Inside the towers, the microalgae, as in their natural environment, meiosis, they multiply, until the environment where they are growing is saturated. When this happens, they use biomass for other purposes, such as those mentioned above. They plan to use these biofilters in highly polluted urban areas where trees cannot be planted, to help mitigate climate change.
- Algae lamps, there are different models of these lamps that absorb CO₂, emit oxygen and illuminate interiors and exteriors through the process of photosynthesis generated by natural or artificial light, since an experiment that was carried out in 2010, in which scientists from Stanford University and Yansei captured electricity from photosynthesis by algae.

Sewage treatment

Several innovations have been made from microalgae in the treatment of livestock, industrial and residential wastewater, which can be carried out in open spaces by cultivating algae in lagoons, which deserve a lot of land, or in closed spaces through compact photoreactors, that need investment, but for both cases the reuse of biomass and the effectiveness of the process can solve the challenges for its wide use in cities, some of these investigations are:



- Bioreactors in Water Treatment in Industrial Processes, the company from Monterrey in collaboration with the Research Center for Marine Sciences and Limnology, of the UNAM; the Faculty of Chemical Sciences of the Autonomous University of Nuevo León; and the Water Center for Latin America and the Caribbean, of the Tecnológico de Monterrey, develop projects that use microalgae in water treatment, since these plant species can absorb different metals, minerals, chemicals and organic matter that have resulted from any process industrial. This purification process would take place during the production of algae, because these plants use pollutants as a source of nutrients. In this way, if a company uses water in its production process, it places the bioreactors to cultivate the microalgae, it could treat the liquid and reuse it; while biomass can be easily sold.
- Treatment of Wastewater from the Agrifood Industry, the European project SaltGae, treats the water with spirulina algae, cultivated in the laboratory, it only needs sun, CO₂ and wastewater to treat them, later the biomass is sold to other industries.
- The GMAE group, in its line of research on Water Resources and Environmental Sanitation (REHSA), has carried out various projects focused on the cultivation and application of microalgae in the treatment of wastewater and the generation of energy from algal biomass. This is the case of the construction of a microalgae solar cell to analyze the purification of domestic wastewater, where they studied the performance of three different strains of microalgae: *Chlorella vulgaris*, *Hematococci*, and endemic microalgae, extracted from the water channel that runs through the University. The microalgae culture was carried out in closed systems with controlled conditions of light, stirring and temperature in small laboratory-scale reactors. Once the crop reached optimal growth, identifiable by its dark green color, the performance of these microalgae in the treatment of domestic wastewater is analyzed, captured directly from the wastewater intake from the Ambalá neighborhood that passes through the University. yielding excellent results in water purification, but technological and investment challenges still need to be overcome to expand its use, according to Leandra Cepeda Sánchez, a young researcher at the GMAE Group.

- The University of Valladolid, Spain, is working on the treatment plan, with a focus on optimizing the wastewater treatment process through Aerobic Membrane Bioreactors (MPBR) to create a viable two-step process for the recovery of water, energy and nutrients.



Studies show the effectiveness of algae in the treatment of wastewater, compact photoreactors can facilitate their installation in houses, residential buildings, offices, commercial and industries, to motivate investment and make this process self-sustaining and profitable, it can be used to the production of solar energy for heating and cooling, supplying water to the building and as well as there are incentives for the production of electricity through solar energy, such as the Chilean program, which encourages the purchase and sale of solar energy, where Private electricity companies buy from solar energy users the injection of surplus solar energy production to the urban electricity grid, it could also be applied to the insertion of drinking water into the underground aquifer created for the Vertical Garden in Urbes, as well as the sale of biomass to other industries would make its wide use in cities feasible.



Algae in the Purification of Rivers and Lakes

Rivers and lakes have algae that help their oxygenation and cleaning, therefore, if it is considered that the Vertical Botanical Garden supplies water to rivers and artificial lakes, in addition to ensuring rocks and sand that purify it, it is important to select the algae to be placed on the bottom and float for continuous cleaning, adjusted to the biome where it will be placed. If water is to be supplied to natural rivers and lakes, the recovery and conservation of their endemic algae must be ensured.

In addition to conventional freshwater algae, microalgae must be considered, because nature is overwhelmed by pollution levels, the efficient solution would be to reduce pollution, by law nations should require the treatment of residential water and mainly industrial standards, such as construction standards for new residences and industries and for those that are functioning as Safety, Hygiene and Environment operating standards, the hydrological system for buildings in cities proposed by the NGO Arca Tierra could be taken into account, exposed in the illustration, which includes rainwater harvesting, wastewater treatment, and groundwater aquifers. Of course, initially for the financing of these systems, countries that apply sanctions and fines to pollution, should use these resources to provide soft credits to industries and subsidies to low-income residences, so that they have residential water treatment and rainwater collection systems, so that it is not wasted and increases the amount

of sewage, rain is a source of clean water that is wasted in sewers and sometimes generates unnecessary floods.

In short, in reducing the contamination of water resources, we must consider the use of microalgae and marine algae, for water reserves exposed to pollution, there are several technological innovations that use them for cleaning rivers and lakes, some of these are:



- **Indus:** consists of a passive purification system made up of a set of ceramic tiles that contain a hydrogel of microalgae and seaweed, capable of purifying heavy metals in water, they are easy to assemble to create walls that purify the water that passes through them. This system is sustainable and with a low production cost due to the use of clay as a basic component, developed by a British laboratory and devised by Shneel Malik, a doctoral student at the Bartlett School of Architecture, created this innovation to solve the contamination of water in India. The shape of the tile is that of a leaf from a prehistoric plant, the arrangement of its ribs optimizes the distribution of water and nutrients that allow filtering various types of heavy metals. Indus tiles are modular and easy to install, they are assembled vertically and contaminated water spills from the upper part to descend spontaneously, filtering until it reaches the lower part. In case the water is heavily contaminated, the water purification process can be repeated as many times as necessary. The tiles are designed to cover the walls of factories or other types of buildings and are fully recyclable. This sustainable biomaterial has been approved by rigorous performance tests in the UK and is planned to be used for India, according to a report from the National Institute to Transform India (NITI). These could be adapted to purify lakes and the Hydrological System for Urban Buildings proposed by the NGO Arca Tierra.
- **Seaweed in the Poultry Industry:** there are several innovations in the treatment of water with algae to treat industrial waste, one of these is the one developed by researchers from the National University of Entre Ríos (UNER) for the cleaning of industrial effluents from the industry poultry farming through the phytoremediation process, that is, the decontamination process through the use of algae, which according to laboratory tests proved to be more efficient than treatment with chemical products. They use a local strain of a microalgae that grows in the Uruguay River, *Scenedesmus obliquus*, an algae that has the

particularity of being very resistant to the high concentrations of nutrients presented by the effluents and to variations in acidity and temperature. The effluents of the poultry industry carry large amounts of pollutants that are difficult to absorb by rivers and that generate eutrophication, that is, the reduction of oxygen in the water due to the proliferation of unicellular algae, which prevent the entry of light and by as long as there is photosynthesis at the bottom of the water beds. After the phycoremediation treatment of the effluents, a decrease of more than 90% of the concentrations of nitrogen, phosphorus, calcium, iron and chemical oxygen demand was observed, while the concentrations of sodium and zinc were reduced in the order of 50% and purifies the water of bacteria dangerous to health. In addition, it was not necessary to use fresh water to dilute the effluent, thus facilitating the growth of the microalgae.

- **Cultivation and Strengthening of Algae:** a team of Peruvian scientists, led by Enoc Jara, extract microalgae, green algae from lakes and rivers contaminated with harmful mining waste, to cultivate them and strengthen them with nutrients, with nitrogen, phosphorus and potassium and oxygen before returning them to purify bodies of water. This process is carried out every two years, in a laboratory in Lima.

Plants

On the banks of rivers and lakes grows a wide variety of plants that fulfill the function of purifying water, these are called aquatic plants, hydrophytes or hygrophytes, which adapt to very humid environments. It is therefore necessary to consider having suitable vegetation in these tributaries, so that they fulfill this function efficiently and adjust to the biome according to their geographical location.



Musgo Esfagnal

One of these plants to consider is mosses, Dr. David Knighton, studied sphagnum moss, for its antibacterial properties in the treatment of wounds and studied the possibility of treating water, now he is dedicated to using a variety of moss to purify The water, which can be used to purify swimming pools, the moss is packaged in a sleeve and placed near the residential swimming pool filter and removes the chlorine smell from the water and extends the life of the filtration equipment. For spas, their cleaning properties reduce the need for chemicals, as well as for larger industrial applications, moss containers are placed

in the water, where the properties of the moss spread throughout the pool and create cleaner water and can be reused multiple times. before you have to dispose of it, reducing water use by 40%.



**Sistema Biológico Natural (NBS,
en sus siglas en inglés)**

All aquatic plants by themselves purify water, in fact, there are residential and industrial water treatment systems that only use plants, such as the Natural Biological System (NBS, in its acronym in English) from Ayala Water and Ecology, the which is used for residential and industrial purposes with a wide series of

phytoremediation projects, including acid drainage in a mine in Chile, waste treatment at the Hiriya landfill, in Israel, and wastewater in India. The NBS is a closed circuit system that uses only the water of the place where it is installed, whether from filtration, waste or rain. And all that water can be used to irrigate crops or plants after the purification process. Eli Cohen, its CEO, points out that Ayala always tries to use native aquatic plants from where the system is installed. The system is portable and has low construction, operating and maintenance costs, does not need an electrical supply, is easily adaptable to the environment and does not pollute. It is widely used in the European Union, where legislation requires the treatment of wastewater in rural and urban areas to be able to discharge it into rivers or estuaries, this technology can be adapted to key technical and business needs.

Flowers

The growth of cities every day diminishes the spaces available for nature, hindering the migratory routes of birds and butterflies, preventing the support of bees, essential for ecosystems and according to the Royal Society of Geography of London and the Earthwatch Institute , they are essential for humans. Bees, birds, butterflies and beetles are part of a growing list of pollinating species that are in danger of extinction in the world, warns a study by the United Nations, which are essential for the generation of food on the planet .

"Pollinators make an important contribution to global food production and nutritional security," said Vera Lucía Imperatriz-Fonseca, evaluation co-chair and professor at the University of Sao Paulo, in a statement.

Pollinators need flowers for their survival, but wildflowers are also disappearing. The researchers point out that almost 90% of them depend on the pollination of animals to some extent.

For these reasons, it is necessary to include within the Urban Vertical Garden and its surroundings wild flowers, if possible of large size and height, for this the artists and florists have created living sculptures of incredible beauty with live plants that contain integrated irrigation systems . It would be advisable to use endemic flowers from the region and it will be possible to include those species that are in danger of extinction.



Waterfalls and Rivers



Proyecto de Corea del Sur, que recuperó el río Cheonggyecheon

Waterfalls provide bodies of water with movement, which benefits their oxygenation, as the water falls, depending on its altitude and collides with rocks, it releases ozone that purifies nearby water and air, so it is important to include at the end of the processes For wastewater treatment waterfalls, artificial rivers that are created should be provided with several waterfalls with rocks along the way, as explained when discussing rocks. If rivers are to be recovered in a city, as South Korea did, which recovered the Cheonggyecheon River, which was walled up and polluted by the city, now it is a river that runs

through the city in a linear park of more than 400 hectares, which provides water, lowers the temperature, creates habitats for birds and spaces for recreation; or if an artificial river was created, it is important to consider placing falls that provide movement, ozone and oxygen to the water. Another problem faced by cities in addition to the lack of spaces for nature, is the supply of water, the consumption of electricity from polluting sources, extensive electrical wiring lines, therefore, these waterfalls and water mobilization can be used to generate electricity with run-of-the-river hydroelectric plants placed in their path, which consists of taking advantage of the kinetic energy of the water to move a turbine connected to an electric generator, the electricity generated is injected into a power grid for consumers. This option in addition to generating and storing electricity will decrease the need for wiring, until witricity eliminates the need for electrical wiring entirely. Run-of-the-river hydroelectric plants with power less than 20 MW are considered as sources of Non-Conventional Renewable Energy, NCRE and as competitive solutions for energy production.

In the Urban Vertical Garden, a reservoir can be created on a higher level, an artificial lagoon, from where water is pumped into a reservoir on a lower level, due to the unevenness the water would fall by inertia through the artificial riverbed that would connect to The two reservoirs,

in their path would be several waterfalls and hydroelectric power plants in passing, in the case of artificial rivers, the turbines that will generate electricity would be built directly on the channel. It is recommended to create this system at the surface and underground level, for the electrical and drinking water supply for homes, industries and irrigation systems. At the underground level, the water would move through pipes and turbines would be placed in its path. In the case of a natural river, hydroelectric plants with a power of less than 20 MW would be used to reduce the environmental impact.



Lightning bolts

Thunder releases ozone into the atmosphere, purifying the air and water where it is expelled, such as the natural phenomenon Rayo Catatumbo, from my homeland, Zulia, which occurs continuously in the same place on a lake that is connected to the sea.

Here it is mentioned for the ability of plasma to generate ozone and to purify the air, of the use that can be given to this natural phenomenon to purify water and the atmosphere in the case of biological weapons, viruses without cure or chemical weapons. The Urban Vertical Gardens must have mechanisms for generating plasma and ozonators to improve air quality for these cases. In the market there are plasma ion purifiers and ozonizers, it combines these two options for an effective air purification.

The emulation of lightning can be a source of clean energy, knowing its full operation can serve both to make witricity a reality and for the generation of clean and economic energy, among other uses, the NGO Arca Tierra in its Plan XX will promote its development , which will be possible by understanding the Catatumbo Lightning, meanwhile, there are technological advances that do not emulate lightning, but one of the conditions present in the Catatumbo Lightning, the combination of fresh and salt water for the generation of electricity of blue energy or saline gradient, it takes advantage of the difference between fresh and salt water to produce electricity, especially it is used where a river flows into the sea, to generate electricity. It is an energy source that has been known theoretically for years, but is still in an initial phase of implementation.

A Stanford University laboratory has created the battery based on blue energy EMB, it has the peculiarity that it dispenses with pressure or membranes and generates electricity through an electrochemical process. The battery has a tank that is filled with water from the treatment plant. In the tank there are electrodes that release sodium ions into the solution. The movement of the ions causes a current to flow from the anionic to the cationic electrode. The fresh water is then quickly replaced by salt water, whereby the sodium and chlorine ions rejoin the electrodes and the electrical current is reversed. Both the freshwater and saltwater inlets generate electricity, so the battery is constantly charging and discharging without the need for power from external sources. They have reduced costs in materials and electricity consumption for their operation. The objective of the EMB is to provide wastewater treatment plants with an electricity source that allows them to be carbon neutral and energy self-sufficient.

If the Urban Vertical Garden is located near the sea, or the artificial river created flows into the sea, it is important to consider the possibility of generating this clean energy.

B)

		
<p>Rayo Catatumbo Estado Zulia, Venezuela</p>  <p>Plan XX ONG Arca Tierra</p>	<p>Depura el aire interior mediante iones de plasma y generación de ozono. Este purificador inteligente incluye la última tecnología en lo referente a la purificación del aire y esterilización por ozono en aire y agua.</p>	<p>Energía Azul: agua salada y dulce. Universidad de Stanford creó la batería basada en energía azul EMB, genera electricidad a través de un proceso electroquímico.</p>

Technology to Purify Air and Water

Rocks and Artificial Sand and Nanomaterials

With the purpose of purifying water, a series of systems, devices and materials have been created that emulate natural rocks and grits with technology to purify water, since those of nature are exceeded by the levels of contamination. Some of these are:



- **Sand and iron: HM Solution**, created by two Chilean Margaret and Constanza Lengerich, engineers from the Universidad del Desarrollo who decided to find a solution to the arsenic-contaminated water that affects more than 200 million people. They created a system to purify water in a massive way and at a cost 10 times less than others and for which they have received awards. Using the same absorption technology, they apply a different process without using chemicals or filters, the filter medium is constantly present in the pond and mixes with the contaminated water, with iron particles trapping the arsenic, becoming particles larger than then they are filtered by sand, where they get stuck. Thanks to this, two types of Arsenic -As (V) and As (III) - can be eliminated, when the classical system only eliminates one, and also removes 15 other metals and metalloids such as mercury, uranium, lead.
- **Nanomaterials:** various investigations around the world have shown that nanomaterials show high absorption capacities to remove heavy metals, oils, organic solvents and emerging pollutants from water. Which is why nanotechnology is an option for the treatment of toxic water. Among these investigations, those of the Residues, Energy, Environment and Nanotechnology Research Group (REMAN) of the University of Alicante stand out, based on the thesis of Blanca Calderón, which developed metallic iron nanoparticles with magnetic characteristics, encapsulated in a carbonaceous matrix; used residues from olive oil production, so this method is inexpensive and the magnetized nanoparticles are capable of removing pesticides and heavy metals such as chromium, nickel, copper or zinc present in wastewater, derived from industrial activities such as, the finishing of metallic products, the production of pigments or the fertilization of crops. This innovation could facilitate access to clean water in countries where investment in a traditional treatment plant is impossible, plan its location according to the pollutants present in the water and the industrial activities carried out in the area. For these reasons it is considered a very economical and sustainable method, for its use it is only necessary to deposit them in a container or water tank to eliminate the polluting substances, and to re-trap them with a magnetized surface so that the water is totally clean.

Artificial Plants and Flowers

We previously observed how algae and microalgae from nature have been used with technology to purify air and water, as endemic plants and trees are overwhelmed by levels of contamination. We will see other technological options to reduce pollution with technology that emulates plants and flowers, some of these are:



- **Floating Petals with Solar Power:** they are petal-shaped devices one meter in diameter, designed by Mark Owen to clean ponds and reduce river pollution, they are coated with titanium dioxide that acts with sunlight to disintegrate chemical substances, microorganisms and removes toxic metals without generating waste. These devices can treat 1 m³ of water per day for every m² of the product.
- **Floating Islands of Plants:** the Scottish company Biomatrix created floating islands with a group of plants that do the same task as wetlands, which are often scarce in rivers and lakes. These modules of plants clean ponds, rivers and lakes in a natural way, because the roots of the plants when being in contact with water develop biofilm, a green moss, which consists of a set of bacteria that perform the functions of decomposing, absorb and transform impurities in water, which is why they are widely used in wastewater treatment. These islands provide tentacle-like columns to extend biofilm growth to the maximum, can be integrated into the landscape and used as recreational spaces.
- **Artificial Trees and Leaves:** innumerable designs of trees and leaves have been made to reduce atmospheric pollution in cities, in our opinion the best options are those that use algae and microalgae due to their high capacity to absorb pollution and oxygen emission. However, we must highlight the aesthetic design of the Treepods system, because they use solar and kinetic energy for their operation and are made of recycled plastic, their branches spread widely, if the Treepods used luminescent algae it would be more functional, for lighting, solar energy generation and air purification.

All these efforts are valid in what we manage to reduce air and water pollution, rescue and integrate natural resources into cities, with sustainable development and growth, which are the true solutions to improve air and water quality in cities. .

Ozonizers, Lasers and Ultraviolet

Ozonizers, laser and ultraviolet rays, as we observed in the first classes, have proven their efficiency to purify surfaces, air, water and food. These would be useful in the Urban Vertical Garden for the treatment of wastewater and for the conservation of the purity of the water in underground and surface aquifers. In the case of the creation of rivers, purifying alcabalas can be established at a certain distance between one and another, these alcabalas would consist of stations for the emission of laser or ultraviolet rays and in the case of ozone lakes for the oxygenation of water, or both tools for rivers and lakes, depending on the pollution conditions in their path, until water pollution is reduced to zero.

The Urban Vertical Garden, as far as possible, must have systems of these rays, ionization and ozonizers so that they are activated in case of biochemical attacks, viruses or chemical weapons, so that they create safe perimeters for the population and nature at their disposal. around. For example, in the explosion caused by the terrorist attack in Beirut in mid-2020, it generated a toxic cloud that contaminated the air and water in the area, if this happened in a city that had these gardens, these systems would immediately be activated to guarantee the availability of breathable air and drinking water for the city.

Plasma and Drones (Atmospheric Buoys)

We noted earlier that lightning emits ozone and purifies water and air. In the course number 2 of the NGO Arca Tierra, the way to develop Atmospheric Buoys was explained, which mainly consist of drones equipped with ground sensors that can measure different variables, including air quality, as well as the possibility of equip atmospheric buoys with plasma engines to generate ionization in the ozone layer to contribute to its regeneration. In this course they are mentioned for their use in the management of high levels of atmospheric pollution and in the case of biochemical weapons, atmospheric buoys would detect the danger of toxic air and these through the use of plasma and ionization could release ozone in the affected area to eliminate or at least reduce air toxicity risks.

The Planetary Simulator and the Climate Prediction System, described in course number 2, would also help to monitor the toxic cloud for its control, reduction and disappearance, through the correct direction of a set of atmospheric buoys or, failing that, using manned ships. or unmanned existing.

Graphene

Graphene is a very thin, light, elastic, malleable, transparent, flexible and at the same time very resistant material, more resistant than diamond, it contains a great variety of properties that make it the ideal material to build, its other mechanical and optical characteristics Thermal, electronic, electrical conduction and energy use make it very attractive for energy technologies, which is why it is used in the manufacture of solar panels to optimize their performance. It is the material with which the translucent walls of the Urban Vertical Garden will be built. We have proposed buildings with this material due to its characteristics of resistance to natural disasters, generation of

thermal comfort and energy properties in our models of the Galaxy, Globe and Tree cities described above.



The Structure of the Urban Vertical Garden would be made up of triangles, each triangle would be a graphene structure and inside it a graphene crystal, within the graphene crystal would have microalgae, which would fulfill various functions, the absorption of atmospheric pollution, emission oxygen and solar energy production. These structures will provide high resistance to any weather condition, in fact, the NGO Arca Tierra considers that all the windows of the buildings should be like this, so as not to have broken glass and have a high capacity for capturing and generating solar energy, in addition to contribute to the solution of global warming.

In order to make this material available in graphene glass sheets, we will cite some advances in this regard:



Instant Graphene: students from the laboratory of the chemist James Tour at Rice University, developed a new process that is capable of converting large amounts of garbage into graphene, in just a matter of 10 milliseconds, heating materials that contain carbon to 3,000 Kelvin, approximately 5,000 degrees Fahrenheit, in an explosion of light and heat, inside a reactor, that compound that is not carbon releases as a gas and the carbon solidifies. As this process industrializes, elements such as oxygen and nitrogen leaving the flash reactor can be trapped as small molecules because they have value. The flash process produces very little excess heat, channeling almost all of its energy towards the target, and the container

cools a few seconds later, even though it is almost three times hotter than the chemical vapor deposition furnaces that others use to make graphene. Because in the flash process the heat is concentrated in the carbon material and not in the surrounding reactor, the excess energy comes out as light, in a very bright flash, and because there are no solvents, it is a super clean process. The raw material can be almost anything with carbon content, such as, food waste, plastic, petroleum coke, coal, wood chips and biochar are the main materials that they use. This large-scale process would greatly reduce the price of graphene. The researchers emphasize that it should be used for the construction industry, they propose mixing graphene with cement, because 0.1% flash graphene would reduce the environmental impact of concrete by a third, since cement production emits up to 8% of man-made carbon dioxide each year and lower manufacturing and transportation costs. This process would be trapping the carbon dioxide and methane that the waste would produce. They consider that the instant graphene process can also be used for asphalt, buildings, cars, clothing and more. The process is scalable and promises to quickly convert carbon from any source into bulk graphene, produces "turbostratic" graphene, with misaligned layers that are easy to separate, compared to other processes it is the best and it is much easier to work with graphene turbostratic, because the adhesion between layers is much lower. They simply separate in solution or by mixing compounds. To produce graphene sheets, the lab noted that used coffee beans were

transformed into single-layer graphene sheets. They plan to produce one kilogram (2.2 pounds) per day of graphene within two years, beginning with a project recently funded by the United States Department of Energy to convert American-sourced coal into graphene for the construction industry, considering usage. of coal for this purpose without polluting the environment would be a good option for its use, turning it economically into a construction material of much higher value.



Mixing Graphene with Crystal: Scientists at Stony Brook University developed a crystal with electronic properties that integrates graphene to optimize screens and solar cells. They used the doping method, by which external chemicals are introduced, they did it without adding chemicals, which makes the resulting compound more resistant to degradation, by means of graphene doping without chemicals, they added layers of graphene on the surface from common glass, it is a scalable, easy-to-apply and low-cost process. In the tests, the scientists used a soda-lime glass substrate, the most common type of glass, used in windows, bottles and many other objects. By applying graphene to the sodium atoms in the

glass, they enhanced their electronic properties, and the crystal created a high electron density in the graphene, which is useful for many processes, according to Nanditha Dissanayake, a member of the development team. They are still improving the doping process by applying resistance tests of the material to environmental conditions. The potential applications for conductive graphene glass are many, from consumer electronics to energy technologies. For example, it is useful to replace indium tin oxide in solar cells, organic light-emitting diodes (OLEDs), display screens and touch screens. In fact, there are already graphene solar panels, which are of higher performance.

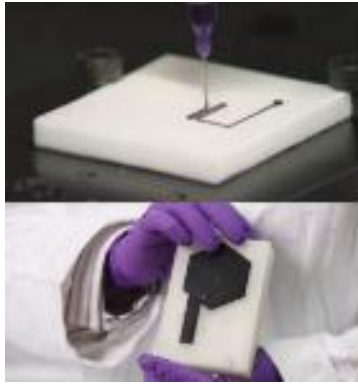
Production of Graphene Crystal Sheets: so far it has not been possible to produce sheets of pure graphene large enough to expand its use, in fact, they have turned to boron to achieve it, a scarce material that makes it unsustainable, unlike graphene, compound carbon, a material present in every element of nature, even in our bodies. In China, a group of physicists under the leadership of Li Wang created a 10 × 10-centimeter, two-dimensional white graphene crystal, that is boron, a square sheet of two-dimensional hexagonal boron nitride. To achieve this result, the researchers adapted the epitaxial graphene accumulation method on copper foil (111) (they used it to grow a 5 × 50 centimeter graphene foil two years ago).

A



team at MIT created a scalable process for producing graphene membrane sheets, similar to the production of thin metal sheets, but combined with the chemical vapor deposition method, the most common way of making graphene, the system consists of two coils connected by a conveyor belt that goes through a small oven. From the first coil comes out a copper sheet less than a centimeter wide that is first heated to a certain temperature, and then receives a dose of methane and hydrogen that generates the appearance of graphene on the sheet, when leaving the oven, it should be By covering the sheet in a single layer, the expected result is high-quality graphene at a rate of five centimeters per minute. After its departure, the graphene must be supported by something, because otherwise it winds up on itself. To avoid this, the scientists replace the copper with a porous polymer membrane with their bare hands so that the graphene clings and does not coil. According to the researchers, the performance of these membranes is as good as that observed in other studies where it is manufactured in smaller volumes. It is a flexible process, which allows modifying different parts of it, graphenes can be generated in different qualities and suitable for more uses. The scientists plan to continue to improve the scalability of the process by automating the move from copper to polymer. A research team led by ORNL used the method, known as chemical vapor deposition, or CVD, with localized control of the CVD process allowing evolutionary growth or self-selection under optimal conditions, producing a large, single crystal graphene sheet. . Like traditional CVD methods for producing graphene, the researchers sprayed a gaseous mixture of hydrocarbon precursor molecules onto a polycrystalline metal foil. However, they carefully controlled the local deposition of the hydrocarbon molecules, driving them directly to the edge of the emerging graphene film. As the substrate moved underneath, the carbon atoms continuously assembled as a single graphene crystal up to a foot in length. These efforts are made because graphene monocrystals are more mechanically robust and have better conductivity properties than polycrystalline graphene, according to Ivan Vlassiuk. They ensure that their method could be the key not only to improve the large-scale production of monocrystalline graphene but also for other 2D materials, for use on a large scale.

3d Printing with Graphene: graphene can become the most used material in 3D printing, due to its resistance, high conductivity and the structures of its pores.



Interconnected layers of graphene: They developed a process of 3D printing graphene with a much higher resolution than before, using graphene aerogel, it allows the 3D structure of graphene to maintain its properties. They use as raw material a graphene oxide powder in bulk, which is dispersed in a solvent. The material has a single layer of carbon atoms arranged in a hexagonal lattice. When graphene sheets are stacked on top of each other and formed into a three-dimensional shape, they turn into graphite. Graphite has poor mechanical properties, but if the graphite sheets are separated with air-filled pores, the

three-dimensional structure called graphene aerogel can maintain its properties. Now a designer can design a three-dimensional topology made up of interconnected sheets of graphene. It will lead to optimization of strength, conductivity, mass transport, and weight density that are not achievable in graphene aerogels.



Graphene Filaments: GRAFYLON 3D, was developed by Filoalfa, is an affordable filament with great advantages. The tests showed a large number of improvements in performance compared to other filaments without a graphene base. The elasticity of the filament increased 34%, the tensile strength of the material increased 23% while the stretching properties improved 28%, significantly improved the thermal conductive properties and an excellent surface finish with a unique texture.

3D printing using metallic materials is also difficult and expensive, although manufacturing in this way is advantageous for providing greater strength. To overcome these challenges, The Virtual Foundry created a hybrid thermoplastic and 88% metallic powder filament called Filamet. In the oven, the plastic vaporizes and the metal particles fuse together and the result is a 99.9% metal 3D figure. Filamet melts and flows through the printer head normally. However, the resulting fabrication is made up of a combination of metal particles contained within the thermoplastic that shapes the figure. Heating that printed figure in an oven fuses the metal particles and removes the excess thermoplastic, they are still improving the filament, so that the printed metals retain most of their natural properties, such as magnetism and electrical conductance.



Capaz de producir objetos de hasta 1,8 metros de altura en sólo siete horas, la impresora 3D Mimaki 3DGD-1800

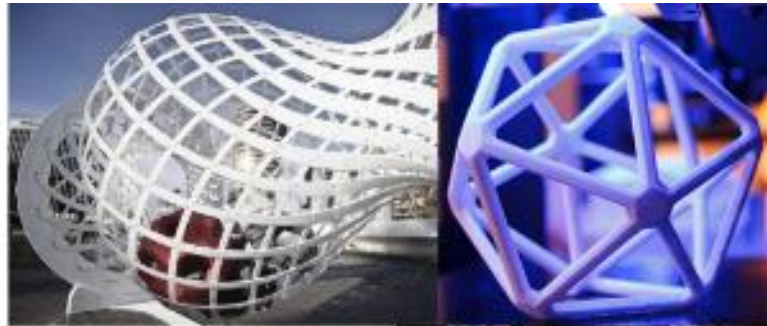
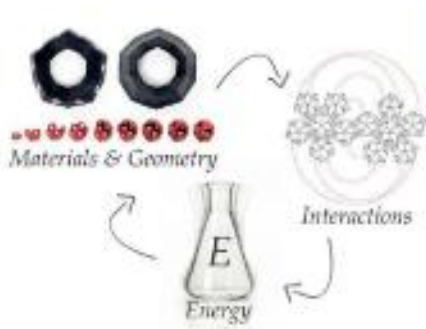
In Fused Filament Development, Mimaki Europe launched a Mimaki 3DGD-1800 3D printer, which facilitates large-scale production up to three times faster than with conventional Fused Filament Manufacturing (FFF) 3D printers. The Mimaki 3DGD-1800 3D printer connects the company's experience in 2D printing with 3D technological innovations, it is capable of producing objects up to 1.8 meters in height in just seven hours, with assembly-based designs can produce larger objects. It has the double head configuration to allow the simultaneous exit of two structures and

facilitates the production of hollow structures without support, it will be a new way in which large objects are created, reducing costs and construction times. It will facilitate the rapid and efficient production of industrial production parts such as molds for vacuum forming, helping manufacturers reduce their lead times. Unlike other 3D printing methods that involve hot melt lamination, the 3DGD-1800 employs gel dispensing printing technology, linearly extruding gel-type UV curable resin and using UV LED light to instantly cure the resin, allowing lamination speeds of up to 350mm high per hour.

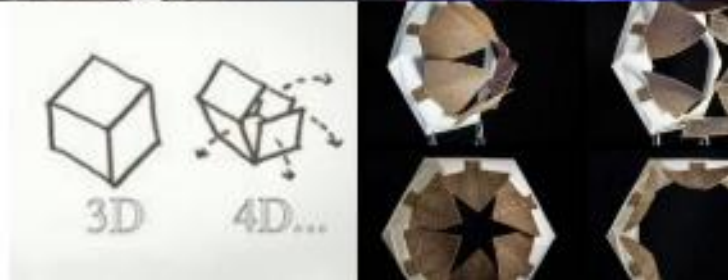


methods of 3D printing with hybrid filaments are mentioned, for the base structure that will support the graphene triangles, in case the weight increase is necessary, through the combination of graphene and steel. 3D printing in construction has made great strides, from the construction of houses, buildings, bridges....

4D Printing: it is an evolution within 3D printing, it is taking its first steps. It is about the creation of 3D printed objects that change after reacting with the environment, can bend, repair, assemble or even disintegrate when receiving a certain external stimulus, they also have the ability to acquire a new form or functionality under the influence of the input external energy, such as temperature, light or other environmental stimuli. It is the impression at the molecular level of the materials. Among the materials used in 4D printing are liquid crystal elastomers (LCE). They are materials that contain heat-sensitive liquid crystals, and whose orientation can be controlled, under the effects of temperature. Hydrogels are used in photopolymerization processes, which can be used to restore structures by means of electromagnetic signals. Various materials can be used in 4D printing, such as carbon compounds, which are added to shape memory polymers and hydrogels. 4D printing can be used for large-scale projects, bridges, shelters and facilities can be built that either assemble themselves or are capable of being repaired when environmental conditions damage the structure.



El MIT (Instituto de tecnología de Masachussets) SELF ASSEMBLY LAB investiga en este campo en colaboración con Strattasys. Para simular el comportamiento de los materiales antes de imprimirlos, utilizan el software cyborg, de esta manera pueden prever qué parte de la estructura se mueve primero y en qué momento.



Estudios de equipo de científicos europeos, demostraron que el magnetismo del grafeno se puede controlar con átomos de hidrógeno.

Reaction of graphene to magnetic fields, electromagnetism and magnetism: studies by a team of European scientists, coordinated from the Autonomous University of Madrid, by the physicist Iván Brihuega, have shown that the magnetism of graphene can be controlled with hydrogen atoms, graphene It does not present great magnetic characteristics, but this deficiency can be solved with hydrogen, which when contacting graphene transfers its magnetic moment. The results reveal that if a hydrogen atom touches a layer of graphene, it transfers its magnetic moment to it, the magnetic moment induced in graphene by

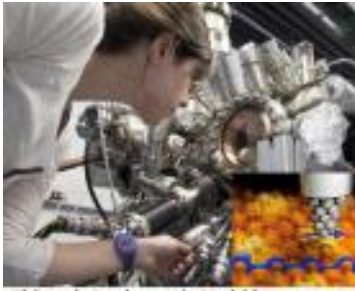
each hydrogen atom extends several nanometers and can be modulated at the atomic scale. The structure of graphene, made up of carbon atoms arranged in a hexagonal shape, can be considered as two triangular sub-networks, and if the hydrogen atoms are placed only in one of them, their magnetic moments add up. However, they cancel out when we put a hydrogen atom in one subnet and another in the other. They carry out this process through a powerful tunnel-effect microscope, with which they visualize and manipulate these atoms at the molecular level, individual, to establish the magnetic properties of selected regions of graphene at will.



En 1981, Gerd Binnig y Heinrich Rohrer (en el laboratorio de IBM Zürich) inventaron el microscopio de efecto túnel toma imágenes de superficies a nivel atómico.

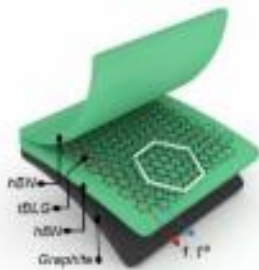
Existence of Magnetic Fields in Graphene: An international team from the Higher Council for Scientific Research (CSIC), demonstrated the existence of very high magnetic fields in graphene, confirming that certain deformations in this material give rise to effective magnetic fields of up to 300 Teslas , which corresponds to a very high value, useful for microelectronics and nanotechnology. They carried out these studies by means of scanning tunnel microscopy, with graphene samples on very perfect platinum surfaces, where the graphene uniformly coated the surface,

but at certain points small bubbles of 10 to 15 millionths of a millimeter or nanometers protruded, they intuit that they were formed by the difference in thermal expansion.



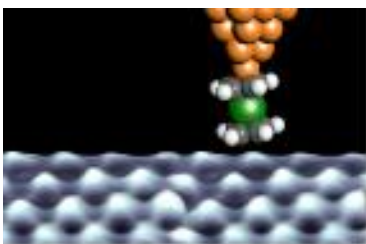
Físicos de institutos de Madrid crearon un material híbrido basado en grafeno que se comporta como un imán. Manuela Garnica, miembro del equipo

Graphene can behave like a Magnet: Physicists from the Madrid Institute for Advanced Studies in Nanoscience (Imdea-Nanoscience) and the Autonomous and Complutense Universities of Madrid created a hybrid material based on graphene that behaves like a magnet. Manuela Garnica, a member of the research team, explains that they developed the hybrid material formed by a layer of graphene that grows on top of a layer of a metallic ruthenium crystal. They deposited on the graphene organic molecules of tetracyan-p-quinodimethane (TCNQ), a gaseous substance that is semiconductor at low temperatures. These organic molecules periodically redistribute themselves on the graphene-ruthenium substrate until reaching the long-range magnetic order. The new material has magnetic properties similar to that of a network of tiny nanoscale magnets.



Esquema del grafeno bicapa rotado al ángulo mágico encapsulado por nitrito de boro hexagonal. / ICFO / X. Lu

Super Conductive Graphene and Magnetic States: Scientists from the Massachusetts Institute of Technology (MIT) reported that spinning two layers of this matter one on top of the other at an angle of 1.1 degrees behaved like a superconductor in which electric currents flow No resistance, magnetic and topological states with the magic angle of 1.1 degrees.



Detección magnética a escala atómica colocando un diminuto imán molecular en la punta de un microscopio de efecto túnel.

Graphene and Copper: Researchers from IMDEA Nanoscience and other European centers discovered that the union of graphene with cobalt offers properties in the field of magnetism, which would serve as the basis for developing data storage devices and developed a methodology to create a manufactured device. with stacked graphene films on the cobalt ferromagnetic material, arranged on a platinum layer with a certain crystallographic orientation, which allow to obtain a homogeneous flat and atomically perfect magnetic layer, with very stable magnetic structures, which can act as carriers of binary information.

The information about 4D printing, the magnetic properties of graphene in different circumstances, its reaction with other metals and gases, will be used to program the automatic assembly of the structures of the Urban Vertical Garden, as well as for the manufacture of small materials. and large-scale with graphene and graphene glass, to avoid its deformation and to preserve its properties or to add other properties according to its purpose, to overcome the difficulties of working with graphene and thus expand its use in different fields, especially in the construction. The following describes how the modular graphene triangles would be manufactured, the pieces that will make up the structure of the garden.

Factory of Modular Graphene Triangles for Buildings

Then, according to the discoveries and developments described above, the NGO Arca Tierra proposes different processes and methodologies to produce graphene crystal triangles on a large scale, to be used as assembly pieces for the botanical garden and for any building that wants to produce clean energy, capture CO₂ and release oxygen and resist any onslaught of nature.

Option A To Use What Is Currently Available

Raw Material: Currently we have available a very efficient way to produce turbostratic bulk graphene, developed by students of Rice University, through the flash process, it would only be necessary to promote its development at an industrial level, in which it could be used almost any carbon-rich material to produce graphene, which would be very beneficial to the environment to use non-biodegradable wastes such as rubbers and other petroleum derivatives in this process. There are several companies dedicated to producing biofuels from waste, through thermal processes with incinerators and by biological processes, these industries could adapt to continue generating energy and manufacture graphene in bulk, the carbon dioxide would solidify and no longer return to the atmosphere.

The flash process to produce graphene can be made cheap and facilitated with highly carbon-rich materials, such as limestone rocks and even algae that will be used in the Urban Vertical Garden, to capture carbon dioxide CO₂. In the industrial process the rocks and algae would enter on conveyor belts to the hermetically closed chamber where the flash process will take place, where the heat will be concentrated in the carbon material. In this process, the excess energy comes out as bright light, it would be functional to find a mechanism that takes advantage of this excess energy to be reused for the electrical supply of the graphene factory, as do waste-based power plants, but with In this process, the factory of modular graphene triangles would differ in that the carbon would not be released into the atmosphere, but instead would solidify into graphene, and the molecules of other gases would be retained for other industrial uses; It would be necessary to evaluate the different existing mechanisms to generate electricity based on the gases released in different industrial processes. Once we have the turbo-static bulk graphene, like coffee beans at low cost and sustainably produced, we would produce the graphene glass sheets.



Producción de Láminas de Cristal de Grafeno con las Tecnologías Actuales

Polycrystalline sheets: with the available technologies, one of the easiest processes would be the mixture of graphene with crystal, developed by scientists from Stony University, the resulting crystal is functional for solar panels, resistance tests of the material would have to be carried out under the conditions environmental, since graphene loses some resistance as it is polycrystalline. Although they would be less fragile than conventional glass, it could be used for the structure of the Urban Vertical Garden, which would function as a solar panel and container for microalgae to filter air and water, if you want to improve its resistance, several sheets can be placed of polycrystalline graphene.

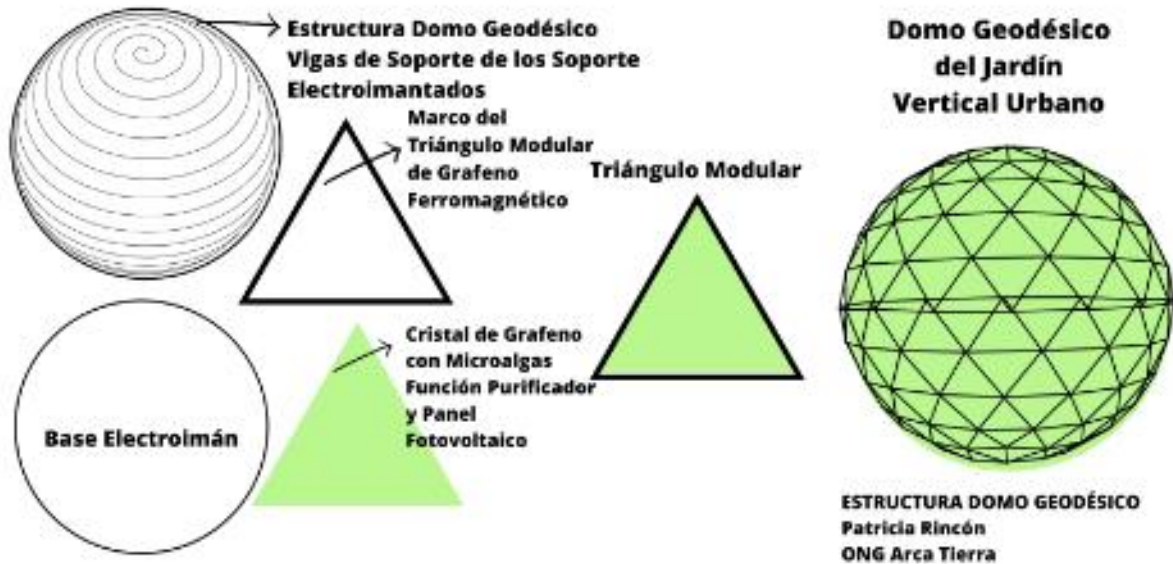
Monocrystalline sheets: so far with graphene, it has been possible to produce graphene sheets of approximately 5 cm by MIT, in a scalable process similar to the production of thin metal sheets, but combined with the Chemical Vapor Deposition method, the expected result it's high-quality graphene at a rate of five centimeters per minute. It is a flexible process, which allows modifying different parts of it, graphenes can be generated in different qualities and suitable for more uses. A research team led by ORNL managed to create sheets of up to 30 cm, but they use hydrocarbons in the process, if the hydrocarbons are substituted, or their origin is for recycling, it would be viable to use. Anyway, suppose we only had 5cm graphene glass sheets available, with the process described above from MIT.

Frames of the Graphene Crystal Triangles

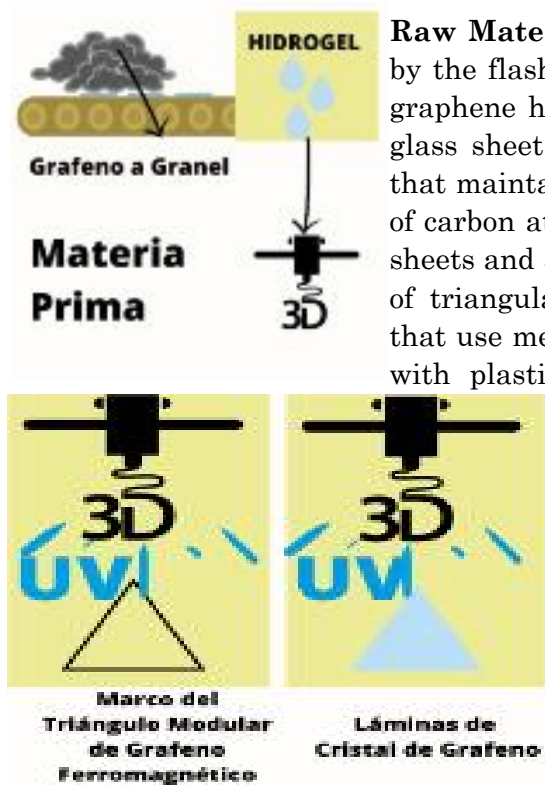
Graphene can be alloyed with other ferromagnetic materials, such as steel or iron and other metals observed in the different studies of graphene, we would have several options to create the alloys that would make the ferromagnetic material more resistant, and light and that promote the magnetic characteristics of the graphene, so that it can behave like a magnet. The frames would be manufactured with magnetized characteristics, to facilitate their assembly, if they are electrified with the solar energy that the graphene crystals and the algae will produce, they will increase the magnetic force of their union, making it very resistant, coupled with the fact that the triangular geometric shape is one of the most resistant forms will provide each one and the entire structure with greater resistance. The electromagnetic characteristics of the assembly would facilitate its assembly and replacement of parts with

new ones in the event of any damage or to change the microalgae. However, they may have the option of being attached by bolts that are easy to remove, but guarantee strength to the structure. The highest concentration of the material should be graphene.

Al proceso de fabricación de triángulos modulares de grafeno para edificaciones, habría que agregarle los procesos de hacerlos células fotovoltaicas y filtros con microalgas, para la purificación del aire, agua y generación de energía solar.



Option B Improve the Production of Graphene Glass Sheets with 3D Printers and Electromagnetism



Raw Material: we would have the bulk graphene produced by the flash process, we could use this graphene to produce graphene hydrogel, which would be used to make graphene glass sheets; They have already developed graphene airgel that maintains its properties, the material has a single layer of carbon atoms organized in a hexagonal lattice, to produce sheets and 3D shapes of pure graphene. For the manufacture of triangular ferromagnetic frames, there are 3D printers that use metallic materials, from metallic powders combined with plastics, in which the plastic melts in the process generating a 3D figure of metal in 99.9%, in This case would be the combination of a metal with graphene, to generate a material with a higher percentage rate of graphene than metal, adjusting the current metal 3D printing technique, it will be possible to print forms of graphene alloyed with ferromagnetic materials, Because with the advances in 3D printing, a series of fused filaments can be developed and

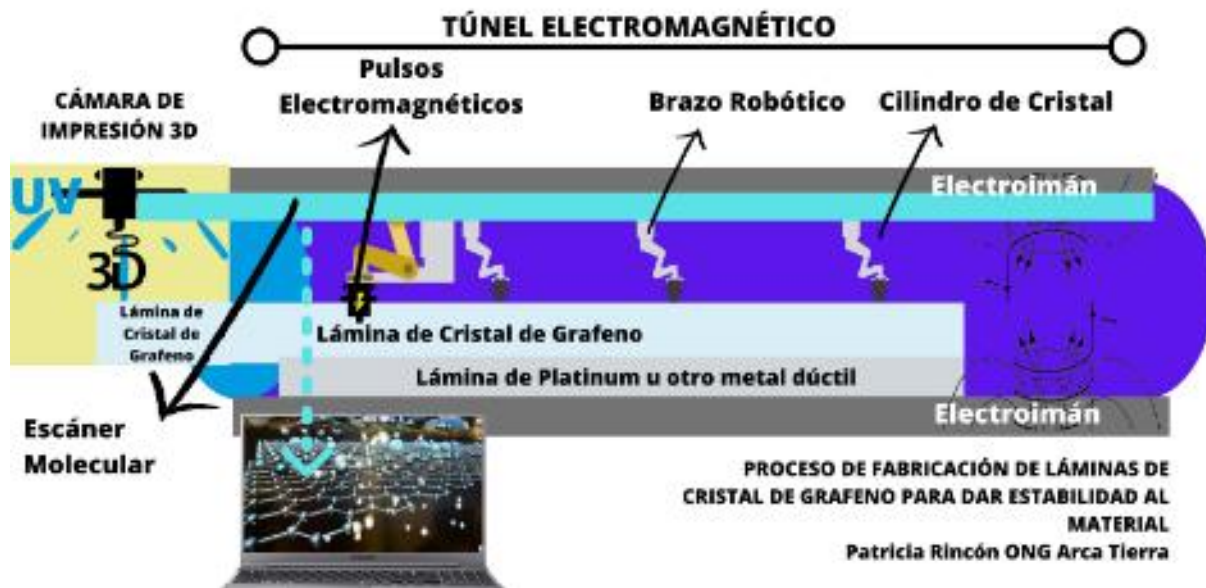
the speed of 2D and 3D printing of materials is continuously improved, objects up to 1.8 meters high can be produced in seven hours and with designs based on assembly, as is the case of the Urban Vertical Garden, large objects, such as the supporting structure, and small objects, such as the modular triangular frames, can be produced, reducing costs and construction times, therefore, 3D printing will facilitate the rapid and efficient manufacture of the base structure and modular pieces of the Urban Vertical Garden on an industrial scale.

Modular Triangles Production Process: The 3D printing method would be by dispensing gel by linearly extruding the gel-type UV curable resin and using UV LED light to instantly cure the resin, allowing lamination speeds of up to 350mm in height per hour. It would be necessary to check how graphene reacts to use this same process to laminate graphene crystal. What I have observed is that it has been difficult to produce large graphene glass sheets that retain their characteristics and in turn do not roll. To do this, we must consider the laws of electromagnetism, to generate stability to the graphene sheets, since all material reacts to these laws: "all materials are influenced, to a greater or lesser extent, by the presence of a magnetic field." Electromagnetism has been used to provide stability to unstable materials such as plasma, even in the universe we can observe how two magnetic fields can generate stability, even a magnetic field, like the terrestrial one, generates stability for the planet. An electromagnet can generate a uniform magnetic field.

And according to the different investigations mentioned above, it has been determined that graphene:

- The structure of graphene, made up of carbon atoms arranged in a hexagonal shape, can be considered as two triangular sub-networks, and if the hydrogen atoms are placed in only one of them, their magnetic moments add up. They carry out this process through a powerful tunnel-effect microscope, with which they visualize and manipulate these atoms at the molecular level, individual, to establish the magnetic properties of selected regions of graphene at will.
- The existence of very high magnetic fields in graphene shows that certain deformations in this material give rise to effective magnetic fields of up to 300 Teslas. They carried out these studies by means of scanning tunnel microscopy, with graphene samples on very perfect platinum surfaces, where the graphene evenly covered the surface, but at certain points small bubbles of 10 to 15 millionths of a millimeter or nanometers protruded, they intuit that they were formed by the difference in thermal expansion.
- Graphene can behave like a magnet from a hybrid material formed by a layer of graphene that grows on top of a layer of a metallic ruthenium crystal. They deposited on the graphene organic molecules of tetracyan-p-quinodimethane (TCNQ), a gaseous substance that is semiconductor at low temperatures. These organic molecules periodically redistribute themselves on the graphene-ruthenium substrate until reaching the long-range magnetic order. The new material has magnetic properties similar to that of a network of tiny nanoscale magnets.
- By rotating two layers of this matter one on top of the other with an angle of 1.1 degrees, it behaved like a superconductor in which electric currents flow without resistance, magnetic states and topological with the magic angle of 1.1 degrees.
- The union of graphene with cobalt offers properties in the field of magnetism, manufactured with stacked graphene films on the ferromagnetic material cobalt, arranged on a platinum layer with a certain crystallographic orientation, which allow to obtain a flat and atomically perfect homogeneous magnetic layer, with very stable magnetic structures, which can act as carriers of binary information.

So, considering the demonstrated behavior of graphene, the process of manufacturing graphene glass sheets for the pieces of the Urban Vertical Garden and for any building, would be the following, at the entrance of the tunnel, a chamber where the industrial 3D printer would be located equipped with UV rays to instantly cure the resin, which would work with graphene in hydrogel, the print head or heads would be inside the chamber, protected from the influence of magnetic fields. The electromagnetic tunnel, or cylindrical chamber, would consist of a conveyor belt, the belt would be made of sheets of platinum, copper or ruthenium or other ductile metal, depending on the desired size of the graphene crystal sheets to be produced. Inside the tunnel there would be two magnetic fields, one below the conveyor belt and the metal sheets and another above the graphene printed material, that is, electromagnets would be arranged, one below and the other above the surfaces where you work with graphene, these magnetic fields would be calibrated to provide stability to the material, the intensity of each magnetic field would have to be calibrated based on this, one that pushes downwards through its electromagnetic force and the other upwards to avoid bulges or deformations in the material and It would be necessary to consider whether the conveyor should have an inclination of an angle of 1.1 degrees so that the electromagnetic properties of graphene are increased. Perhaps it would not be necessary to apply heat, the process of using UV LED light to instantly cure the graphene hydrogel would be sufficient, but possibly hydrogen in gas or organic molecules of tetracyan-p-quinodimethane (TCNQ) is necessary, to ensure the stability of the material, when leaving the 3D printer heads, these other materials should only be used if strictly necessary, because the vital part of the process is that the graphene glass sheets are above 99% graphene. The process can be observed at the atomic level, molecular scanners will observe the graphene crystal sheets at the atomic level, from a room with protective crystals from magnetic fields it will be possible to monitor the process and make corrections by sending orders to the robotic arms that will be inside the glass tunnel. The robotic arms will have molecular vision by being connected with the molecular scanner to quickly make corrections on the material, they will ensure that the graphene crystal sheets at the atomic level are strictly according to the pattern they have programmed, when finding signs of bulging or deformation , the tips of the fingers of the robotic arms will have molecular magnets, electro-controlled tips that will correct the material immediately, these will be able to exert electronic pulses, electromagnetic pulses, which will exert attractive or repulsive forces, or small energy charges to correct imperfections of the material.



After printing the graphene glass sheets, magnets would be placed on the conveyor belt to separate the metal from the graphene. The metal plates can be reused for the process and the graphene glass sheets will be used to make the triangles of photovoltaic cells and microalgae, for the triangular windows of the Urban Vertical Garden or for another building. As an additional note, to make the calculations of this process it would be important to consider the advances of quantum electrodynamics (QED acronym in English of Quantum Electrodynamics) that describe with great accuracy the phenomena that involve electrically charged particles that interact by means of the force electromagnetic. It is capable of making predictions of certain physical magnitudes with up to twenty decimal places of precision, for that reason the theory was called "the jewel of physics" and the Quantum Hall Effect (EHCF).

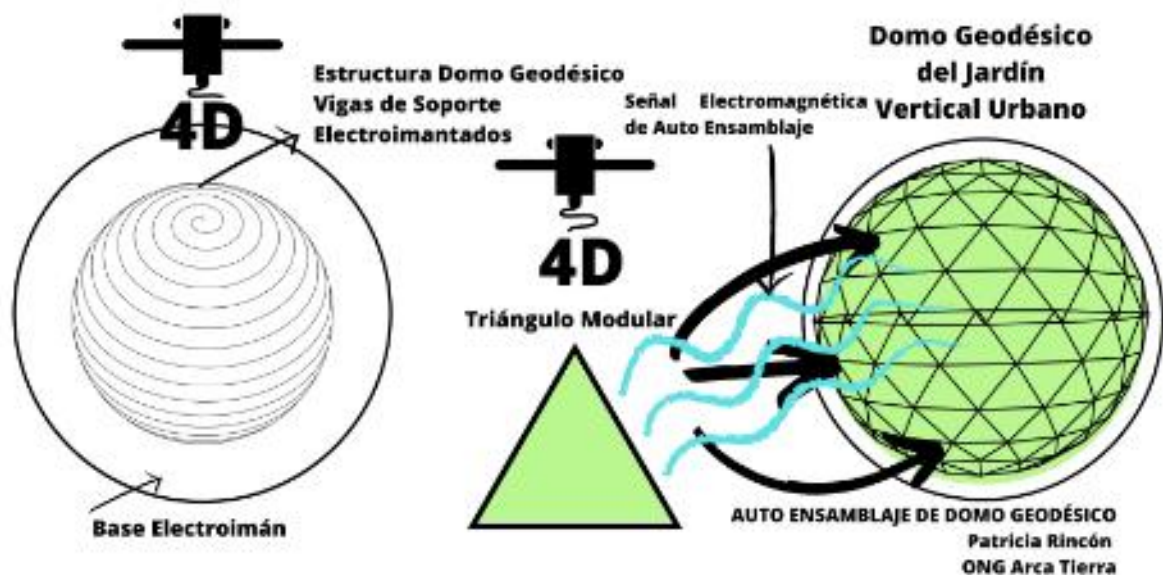
As previously observed, 3D printing with graphene has already been achieved, then the triangles that will serve as frames of the graphene glass sheets would be printed, perhaps, in the same production process of the graphene glass sheets or by separated as is most convenient for the industrial process.

Option C 4D Printing

Raw Material and Machinery: in this option we propose the same raw material and general description of the process of option B, using 3D printers, except that in this option 4D printers would be used.

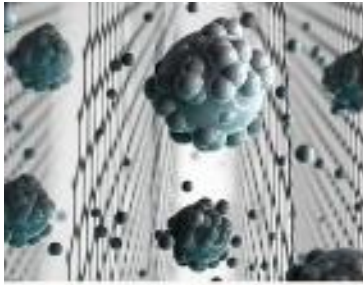
Production Process: the 4D printer would print at the molecular level, the 4D printer would be programmed to print the molecular structure of graphene with the hydrogel or graphene filaments on the graphene crystal sheet to be printed, so it can subtract from the process production actions to ensure the stability of the material. Reduce or not the actions will give greater accuracy to the quality of the material. The process would be faster if it is possible to print the complete assembly piece, made up of the triangular frame of ferromagnetic graphene and within it the graphene crystal, which is possible with 3D and 4D printers. The other great advantage that 4D printing offers us is that it allows us to program the materials that are printed, program the graphene glass sheets to react to sunlight like photovoltaic cells, program the ferromagnetic graphene glass frames, so that at the time of printing it is with

the programming of the general design of the structure to be built, its parts will make up a programmed software of the general design of the structure, so that when they are electrically charged in the place where they will be built, they are joined automatically within a base magnetic field, on an electro-magnetized base, so that the structure builds itself, so to speak. This would be useful to build on Earth where climatic conditions are extreme, it would facilitate its assembly quickly and efficiently, this self-assembly system would be very functional to build a lunar base or on other planets, where the force of gravity, that is, where the magnetic attraction of the core is weak, the electro-magnetized base must retain a high magnetic force to create artificial gravity in turn, the algae in this environment will provide oxygen to the geodesic dome built with graphene triangles, so that living beings in the Earth, including humans, we can live, since microalgae carry out their photosynthesis process with both sunlight and artificial light, in this regard, in our Plan 21 Moon more progress will be made for the construction of a lunar base that serves in turn platform for landing and taking off of our ships designed to travel and create human settlements in the solar system. Our 24 Strategic Plans are in my book 531 Beauties of the World II Edition written in 2015, the III edition is available in the library of the website of the NGO Arca Tierra, because I assigned the use of copyright to the NGO Arca Tierra for them to take place.



The modular triangle, made up of the ferromagnetic frame and the graphene crystals, will produce solar energy, absorb CO₂ and emit oxygen, it must be programmed to automatically repair itself when environmental conditions damage the structure, by means of electromagnetic signals, when the system automatically detects failures it would emit the signals of self-repair. This is possible with graphene, it has already been shown in the previously observed studies that very stable magnetic structures can be created and that they can act as carriers of binary information, for which the set of parts that make up the geodesic dome will integrate a software to continuously guarantee the design and its functionality.

So, we have 3 options to manufacture the modular graphene triangles, which will provide solar energy and contain the algae for the absorption of CO₂ and emission of Oxygen in the Urban Vertical Gardens. But we must also consider the properties of graphene and algae to purify water and its usefulness in desalination processes. Graphene oxide membranes have already demonstrated their ability to filter small nanoparticles, organic molecules in even



Filtrado de Agua y Desalinización a través de membranas de grafeno. Universidad de Manchester.

large salts and a team of British researchers led by Rahul Nair created a graphene oxide-based sieve, controlling the pore space in the membranes to carry out the desalination process, they are still comparing their functionality with other mechanisms and face the challenge of producing the membranes on an industrial scale, the previous processes described to produce graphene sheets, could also help the industrial scale manufacture of these membranes desalination and filtration plants. In desalination it is important to consider the energy savings that would be obtained if the water pressure were generated by waterfalls, in the form of waterfalls.

Desalination is mentioned, in case the Urban Vertical Garden is near the sea and there is a shortage of fresh water in its surroundings, so that in addition to treating wastewater, it carries out the desalination process to ensure the availability of fresh water in underground or surface water reserves that the garden will supply, in its process of purifying the air and water.

We will fully develop solutions to the shortage of drinking water in our strategic plans number 2, 12, 13, 14, 15 and 16. Similarly, in obtaining and processing graphene, we will develop greater advances in our strategic plan number 5 , to make it very economical, abundant and efficient as part of recycling.

Ventilation Systems

The Urban Vertical Garden must have ventilation systems, so that the canopy of the structure traps the surrounding CO₂ that is trapped on the city due to the deficiency of natural ventilation and is purified by microalgae, in turn, that ventilation helps to the diffusion of the oxygen emitted by the microalgae.

Class 6 Design of Air and Water Purification System through Urban Vertical Gardens

The structure and structural functions of the Urban Vertical Gardens of the NGO Arca Tierra will be explained, in terms of improving air quality, eliminating toxic elements from atmospheric pollution or biochemical attacks by viruses or chemical weapons, wastewater treatment, desalination and / or rainwater harvesting, to supply drinking water to surface and underground aquifers to have enough water reserves for the conservation of nature, human activities and human consumption, generation of clean, solar and hydraulic energy to supply energy to the garden and the city, as well as for lighting through the photosynthesis process of microalgae. Provide habitats for bees and butterflies through living flower sculptures.

Once the possible components of the Urban Vertical Garden have been observed, you will have an idea of what it will consist of, a model will be explained, but the components will be available in different ways, as long as it has natural resources and the aforementioned functions are fulfilled. sustainably.

Before starting with the design proposed by the NGO Arca Tierra, we will see several models of Vertical Gardens, from Singapore and Switzerland. Currently, vertical gardens have taken a great boom due to the aesthetic and environmental benefits that they generate in cities, due to their absorption of carbon dioxide and oxygen emission, temperature regulation, reduction of the consumption of electrical energy for generation. of thermal comfort and even generate positive sensations in citizens, according to a study by the University of California "nature has healing powers simply by observing it."

Current Vertical Garden Models

Singapore's Garden by the Bay

It is a 101-hectare botanical complex, inaugurated in 2012, created to serve as the tourist lung of the City of Singapore, a technosystem that integrates natural resources and technology.

It
is



Jardines de la Bahía (Garden by the Bay) de Singapur

made up of 3 gardens, the Garden of the East Bay, the Garden of the South Bay and the Central Garden. In the South Garden Skyway OCBC of 56 hectares, 18 towers are located, called super trees (Supertrees Grove), they were conceived and designed by Grant Associates, each tower is made up of:

- Reinforced concrete core: internal vertical structure that supports the Supertree.
- Trunk: a steel frame that is attached around the reinforced concrete core.
- Planting panels: installed in the trunk in preparation for planting the live skin.
- Canopy: In the shape of an inverted umbrella, the canopy was assembled and hoisted using a hydraulic jack system (except for the 50-meter Super Tree canopy that was assembled at its final height).



The towers are designed to resemble trees, they are made of concrete in the shape of a tree, about 50 meters high that house a set of vertical gardens. Of the 18 towers, 11 generate electricity, through a system of solar cells (photovoltaic) and hydraulic technology for the sustainable conservation of all the gardens, the photovoltaic cells, placed in the crown of the super tree, harvest energy for the garden and perform a secondary role in the biomass fuel plant, which recycles much of the city's green waste; They also have a rainwater collection system to irrigate plants and decorative water fountains; the towers are equipped with ventilation systems for the admission and exhaust of air as part of

the cooling systems of the conservatories. Visitors can walk between the towers through walkways at an altitude of 21 meters, giving them a panoramic view of the gardens and the city. During the day they provide shade and freshness and at night LED panels are activated to illuminate the complex, to offer a show of lights and sounds.



In this garden there are two domed greenhouses. The largest is the Flower Dome, a 1.2 hectare glass dome with dry and temperate microclimates to host hundreds of plant species from the Mediterranean and tropical regions of the planet. The second is the Cloud Forest Dome, a 0.8-hectare greenhouse with cold and temperate microclimates to safeguard plants that adjust to these climatic conditions. This complex houses more than 226,000 species of plants, trees and flowers from different ecosystems in the world, both inside and outside have water reserves, lakes and even an interior waterfall in the Cloud Forest Dome, the highest in the world that creates mist and provides moisture. The domes were designed by the firm Wilkinson Eyre Architects, which combine nature with intelligent technology through solar energy from super trees, which allows the greenhouses to be kept cool through their innovative air inlet and outlet and irrigation systems. The glass panels allow you to get the most out of sunlight and reuse the energy from super trees thanks to the special glass of the panels, they can dehumidify the air and maintain the ideal temperature in each dome, reducing energy consumption by up to a 30%. The Flower Dome uses horticultural waste to power a massive steam turbine that generates electricity to help maintain the cool temperatures of the biome.

In addition, its value to purify the air and generate electricity and encourage tourism, with scheduled visits due to the high influx of visitors, it is used to educate with the purpose of conserving different plant species and creating awareness about climate change.

The Bahía Garden also contemplates the conservation of water sources, they created two artificial lakes, Libélula Lake and Pez Rey Lake, to complement the irrigation systems as follows:

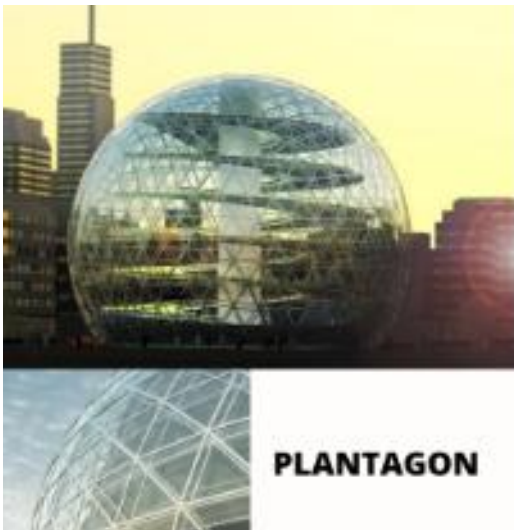
- The lake system incorporates key ecological processes and functions as a living system. It acts as a natural filtration system for the water in the garden basin and provides aquatic habitats for biodiversity, such as fish and dragonflies.
- The lake system is designed to be an extension of the Marina reservoir.
- Water runoff from the gardens is captured by the lake system and cleaned by aquatic plants before being discharged to the reservoir. The naturally treated water from the lake system is also used in the built-in irrigation system for the gardens.

A healthy ecosystem of aquatic plants purify water by performing the following processes:

- Filtering water runoff: Filter beds, made up of aquatic reeds and wetlands, are found where water enters and leaves the lake system. The flow of water is reduced and sediment is filtered.
- Reduction of nutrient load.
 - Islands of aquatic plants and reed beds are incorporated to absorb nutrients such as nitrogen and phosphorus in the water. A reduction in nitrogen levels is essential to minimize algal blooms and ensure better water quality.
 - Maintaining an aquatic ecosystem: habitats for fish and dragon flies are created within the lake system by maintaining a diversity of aquatic plants, good water circulation and aeration. This keeps potential problems like mosquito breeding under control.

This ingenious and sustainable work helps us to demonstrate that through technology and natural resources we can integrate nature into cities, for the socio-economic and environmental benefit of its inhabitants in a sustainable way.

Swiss Plantagon Vertical Garden



Another architectural design that should serve as inspiration are the Plantagon urban agriculture designs, their designs are focused on vertical agriculture, to supply food to the city where it is installed, in order to reduce costs and environmental damage by reducing dioxide emissions, of carbon from the distribution chain, eliminating long transport distances from rural areas to cities, thereby reducing costs and air pollution. Plantagon is a Swedish-American company and has several designs to achieve these ends, among its designs a geodesic dome stands out, which consists of a greenhouse to produce organic food with hydroponic techniques, using air and water within urban environments, the project presents a

large spiral ramp that will provide the necessary space for growth and food production, since the spiral distribution amplifies the available space, with an automated system of the ramps, where the plants will circulate, inside Upot containers that make up a greenhouse transport system that can increase production per square meter. The invention consists of an expandable pot that allows space between plants in two dimensions and that expands as the plant grows. Plants grow on pumice stone, due to its fantastic properties of purifying bacteria and it has the unique ability that it could be reused over and over again for 7 years, although each time it is reused it must be previously disinfected in an industrial microwave, to ensure that no harmful bacteria or spores are on the pumice stone for the next culture. These farming systems are estimated to produce 10 times more than a conventional farm compared to the land used.



The crystals of the geodesic dome will provide the light necessary to nurture the gardens. Since the glass is curved, varying amounts of sunlight will penetrate according to the angle of incidence. The company is working with Sweco, a consulting engineering firm, to calculate how much sun will reach the interior ramps as the seasons change and the position of the sun in the sky is the challenge they face, according to Stephan Stalared, a Sweco consultant.

They have also designed buildings with symbiotic systems for urban agriculture, the first Plantagon demonstration plant will be built in Linköping. The building is part of a group of clean technologies in the area and the demonstration plant is also a symbiotic system in itself. The electrical supply of the building and for the transport of food will be through biogas produced by organic waste from the fields. They have ventilation systems, provided by the external structure of double glass and silks, so that the air circulates properly to cool the building.

Design of the Urban Vertical Garden of the NGO Arca Tierra

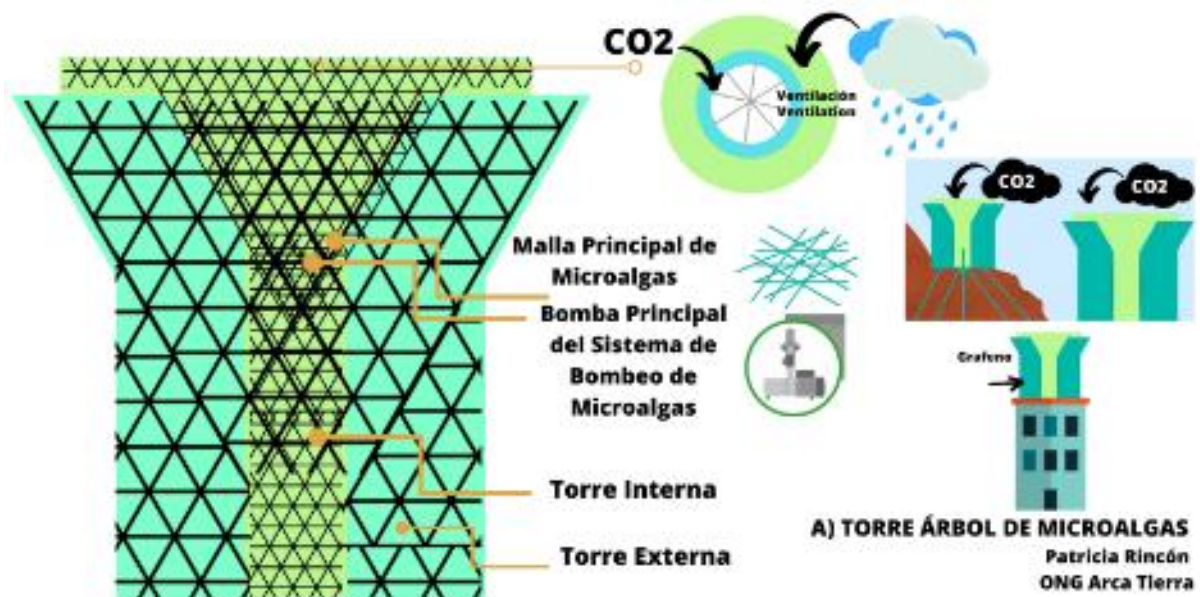
Then, our proposal will be explained below, the components, designs and functions can be adjusted to the geographical conditions and availability of land in cities.

Structure

Option A Microalgae Tree Tower

Its shape will be similar to that of the super trees in the Gardens by the Bay in Singapore, but it will be double. That is, an internal tower, which will cover from the base to extend throughout the crown, where ventilation systems will be available for the capture or absorption of CO₂, rainwater collection, irrigation pipes and microalgae supply and drainage pipes. . The supply and drainage of microalgae in a solution will be in the entire structure itself, by a pumping system installed in the structure, between

walls of graphene crystals, as a circulatory system, which will carry and bring nutrients, such as the roots of a tree. Approximately in the middle of the internal tower it will have a main network of microalgae that will purify the absorbed air and the water collected from the rain. This main microalgae network will be like the heart of the structure that will pump CO₂ and microalgae solution to all the microalgae networks of the total structure. The space between the internal and external tower will be in proportion to the total size of the structure, which provides balance according to the land available for its installation. It should be noted that these structures must be very tall, be located, above all, where the air does not circulate and atmospheric pollution is trapped, the ideal location would be in high areas of the city, if they are built on a plain they must be very high according to the circulation of the wind currents, in order to help the circulation and purification of the air of the city.



The base structure, the skeleton of the structure will be made of graphene due to its high resistance and because it is such a light material, it could be placed on existing buildings. If it is on the ground, steel combined with graphene can be used, to give it greater weight, according to the atlas of risk of natural disasters in the area, it will be the length of its roots, so to speak, to give it stability and root in the ground.

The outer tower will have solar panels, which were explained in the previous class in the description of the manufacture of the modular graphene triangles, they will contain photovoltaic cells and microalgae, for the purification of air, water and electricity generation. They would also be designated a place at the top, where it does not interfere with the CO₂ absorption and rainwater harvesting system. The electricity generated will be used for the operation of the Urban Vertical Garden and depending on its size, it may generate surpluses for the city's electricity supply.

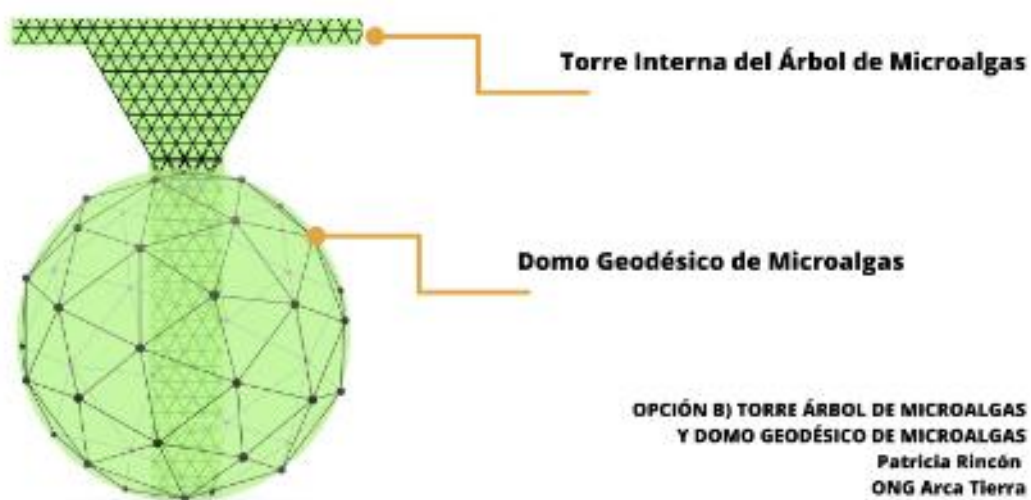
The pumping systems will be for liquid and gas flows, two hydraulic, one for pumping the fluids of microalgae, which will be connected to drainage systems, for the continuous replacement of microalgae and the other for the water collected from the rain, which will flow to the base where a water treatment system will be located, which will be explained later. The gas flow system will consist of fans, blowers and compressors to increase the pressure and generate the flow of gases, absorption of CO₂ and oxygen emission, in the absorption of CO₂ it will inject carbon dioxide into the central pumping system of microalgae and it will pump the oxygen generated by the microalgae networks, the oxygen will be expelled through pipes oriented according to the air circulation in the area and it must have an automated system to

regulate the direction of oxygen, adjusting to the optimal air circulation , to generate the best possible air quality in the city or area where the garden is located. The emission of oxygen may be internal and external, because it is recommended that its interior can be hermetically closed to generate microclimates according to the plants sown, to ensure their optimal growth and conservation, which would also be useful for the preservation of the flora in case of chemical weapons, toxic gases or acid rain, or simply to dispose of flora from a different biome from that of its location. On the moon or other planets, it would serve to emit oxygen into the base and outward for terraforming.

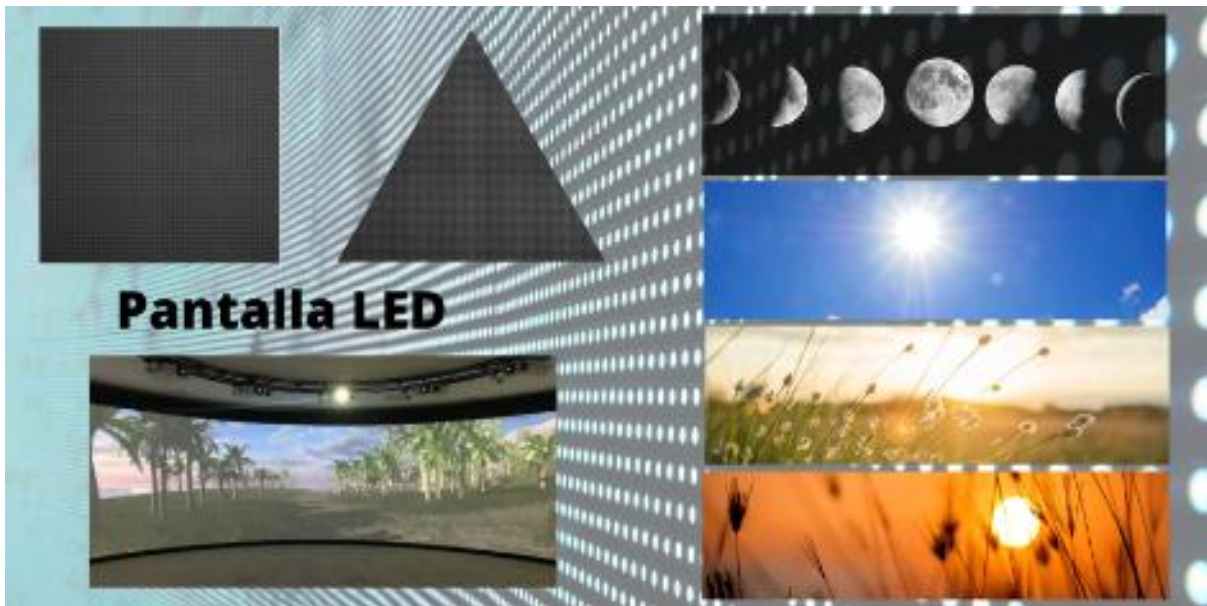
Option B Microalgae Tree Tower and Microalgae Geodesic Dome

Another option depending on the availability of the land is to integrate a geodesic dome into the structure, which would be very useful for the production of food in cities, in addition to entertainment and education purposes, if it were used for recreation, its usefulness would increase if the flora to be planted is in danger of extinction or species are produced on a large scale to reforest wild flowers, mangroves, plants, fungi and trees that play a fundamental role in the success of the fight against climate change, the effective recovery of ecosystems, desertified areas or eroded soils, for this it has been discovered that various species of grass contribute to the recovery of soils. Therefore, it would be important that when selecting the plants to be planted inside the dome and the towers, it is according to the needs of the region.

Since 2015, the NGO Arca Tierra, in the book 531 Beauties of the World II Edition, has recommended geodesic domes for all kinds of construction due to their resistance to any onslaught of nature, fire, floods, snowfall, hurricanes, typhoons, earthquakes, ... They provide thermal comfort, greater space, .. In short, it is the ideal form for constructions, its resistance and functionality would be increased through a structure built with modular graphene triangles, which will ensure air quality and clean energy to the installation towards the exterior and interior.

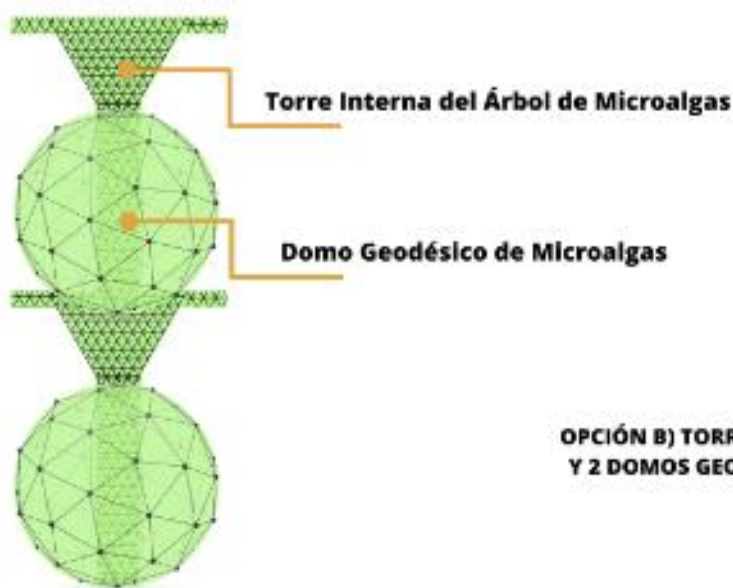


In addition, the modular graphene triangles will be able to perform other functions if we place another wall or internal walls of graphene glass, the space between one wall and another would serve for the ventilation of gases and / or for the circulation of liquid fluids. Modular graphene triangles facing the interior of the dome could be used in a similar way to the panels of a giant curved projection led screen, either for entertainment, generating landscapes or watching television for a home, in case of the gardens would be very useful for the generation of lights and sounds that promote the growth and productivity of plants, especially lights that project the lunar phases and sunlight according to the growth stage or harvest time that contribute to the healthy growth and conservation of plants or food production; This would solve the problem of Plantagon, of the incidence of solar rays in the dome for the growth of plants, we would then have the opportunity to conserve and reforest different biomes and to produce food with microclimates and electromagnetic sound and light systems.



The structure would consist of a geodesic dome, inside it would be a single tower that would fulfill the functions explained in the previous option of Microalgae Tree Tower. In the case of having 2 geodesic domes instead of 1, for the best use of space, the inner tower would also serve to interconnect the 2 domes; dimensions will depend on available space. Two interconnected domes would serve for the planting process in different stages, or would provide the opportunity to choose different functions, for example, if the upper dome is used for agriculture and the lower one for the industrial processing of food produced in the upper dome, for the manufacture of various derived products or to make them long-lasting and their storage place. This would be very useful for areas at risk of natural disasters, to harvest amaranth, due to its high nutritional value and produce long-lasting derivative products, solid, liquid and serum, reserve them for emergencies, replacing them periodically, when replacing them these would be donated to areas with levels of malnutrition. In the next class, it will be explained more in depth how these gardens would help to defeat hunger and make provisions for natural disasters.

In



**OPCIÓN B) TORRE ÁRBOL DE MICROALGAS
Y 2 DOMOS GEODÉSICOS DE MICROALGAS**
Patricia Rincón
ONG Arca Tierra

this class we already determine the general structure, the shape, materials of the structure

and the main structural functions of the Urban Vertical Garden, in the following classes we will see the rest of the functions in greater detail.

Class 7 Food Production

In this class we will delve into the fulfillment of the agricultural function of the Urban Vertical Gardens, to produce food in cities, to create a chain of food production and distribution, which lowers costs and reduces air pollution and contributes to the resolution of hunger , to the solution of poverty in rural areas and has improved humanitarian assistance and management of shelters.

Food Production in Urban Vertical Gardens

We learned about the different suggested structural models, for this class we will consider option B, a Microalgae Tree Tower that serves as support for 2 Microalgae Geodesic Domes. In the upper dome the arrangement of the plants will be as proposed by Plantagon, in a spiral for the use of space, planted in devices similar to the Upots, which will contain pumice stones that will serve as non-polluting natural pesticides, arranged on automated ramps to large-scale chain production of food.



ACUAPONÍA

The sowing techniques to be used will be mainly those related to aquaponics, to produce edible algae, vegetables, vegetables and grains, and which in turn will serve to raise fish and snails, that is, it will combine aquaculture, the production of aquatic organisms and hydroponics the production of plants without soil. Where each selected organism will fulfill some function to help the other to grow and produce food healthily. In the combination of these techniques there are many variables and proposals, the agrotechnological developments should be evaluated to select the best option. The interaction of the species in this system saves up to 90% of the water, since they nourish each other and in the process purify the water continuously.

In hydroponics, an artificial light system is essential for the healthy, rapid and abundant growth of plants, with an automated electric timer to recreate the conditions of solar and lunar radiation through the modular graphene triangles used for the projection of the lighting, will form a system with automated controls to improve plant growth and food production. Studies in agriculture have shown that the incidence of successful solar and lunar rays, depending on the growth stage of the plant and harvest time, contribute to the success of the planting. In addition, we should consider the species that we are cultivating and how they react to exposure to solar and lunar radiation, to determine the time intervals and intensity of illumination that consist of certain wavelengths of electromagnetic radiation. In hydroponics, different lamps have been put to the test to imitate solar radiation, such as HID bulbs, HPS, sodium bulbs, MH bulbs, ... Which, to increase their effectiveness, are inserted in reflector hoods, to reflect the light in multiple angles, so far the most functional lighting system consists of LED lighting equipment, thanks to which they allow to regulate the wavelengths that the plant receives in the different aspects of growth, adjusting the lighting to the crop, which increase the productivity of the crop inside. That is why in the explanation of the general design of the structure it was mentioned that the lighting solution for the Plantagon geodesic domes is artificial lighting, the NGO Arca Tierra proposes that the graphene crystal triangles of the Urban Vertical Garden towards the inner side make up a system of LED lights, microalgae solutions could also help the lighting system, since algae in their photosynthesis process generate electricity and various lamps have already been manufactured through this medium. It is important to highlight the importance of the lunar phases, as evaluated, in most artificial lighting in hydroponics only solar radiation is taken

into account, but it is already well known that the lunar phases directly affect the success of the harvest. Therefore, the artificial lighting system must consider this variable. It is possible to consider that the geodesic dome is divided into plant growth stages, that is, the spiral ramps would be divided into levels according to the growth stage, in each of them the lighting would be adjusted to its phase, in addition to the led lights on the wall of the geodesic dome lighting systems could be placed on them, making use of the same lighting system used on the walls, introduced in reflection hoods and with their automated timers, these will regulate the intensity and colors of the lighting. They would adjust to the growth phase in which a group of plants are found; the dome could also recreate undergrowth conditions for those plants that need them. The conveyor belt would move the plants towards the next phase once they are ready and thus progressively they would evolve until the time of harvest, of harvesting the fruits. This process of phases would make possible a continuous process of food production and it would not be necessary to wait for unnecessary periods of time to be able to have them, but we would continuously have fruits, vegetables and vegetables in any season, despite the meteorological conditions and seasons of the weather outside.



LA MÚSICA PUEDE AYUDAR AL CRECIMIENTO DE LAS PLANTA

In the previous class, the reproduction of sounds was also mentioned, different studies show that certain plants grow better through communication and music, which is also a way of communicating and emitting electromagnetic waves. The University of California showed that plants grow better by listening to Mozart, this was called the Mozart effect, this effect refers to the frequency of his music that ranges between 432 Hz and 532 Hz, although the National Institute of Biotechnology Agricultural of South Korea confirms that the frequency with the highest results ranges between 125 and 250 Hz. The results of different studies agree that from

125hz to 532 Hz produce favorable results for the development of plants and musical genres that stand out for yielding the best results are the classical music of South India, which stimulates germination, accelerates it and generates a greater development of the plant. The Canadian engineer Eugene Canby tested the Jazz and Classical genres of music, exposed wheat plants to classical music, noting 60% more growth compared to plants that had no music. Therefore, the best performing musical genres are South Indian classical music, classical music in general, and jazz. So in each phase, or for all phases of the sowing, sound systems should also be considered.

Then we would have the process of producing organic food on a large scale, effectively and through clean energy, from the cities, reducing costs and CO2 emissions in transport. In this way, the upper dome would be used for hydroponics, the algae, vegetables, vegetables, grains, fish and mollusks produced would descend to the lower dome, where it would be packed in ecological containers, that is, in biodegradable or reusable containers, they could also be processed for the production of products made in



By Flow Restaurante con Impresoras 3D



Barilla crea una impresora 3D de pasta fresca



La repostera ucraniana Dinara Kaske utiliza la impresión 3D



TechFoodHack por parte de la compañía inglesa Dovetailled, 3D Fruit Printer imprime frutas en forma de caviar.

different presentations, solid and liquid as produced in the upper dome. The planting of quinoa is encouraged due to its high nutritional value, especially in areas at risk of natural disasters and with high rates of

malnutrition. There are various technologies for food processing, to make them long-lasting, in the lower dome those that have been evaluated and better fulfill the purpose will be used, which must continually be improved, develop new technologies to reduce food waste, although Producing them from the cities would reduce the risks of decomposition when traveling over long distances. The technologies that stand out in extending the life of food are dehydration, salting and drying. But, the technology that will ensure on a large scale the conservation of what is produced is the production of gels for 3D food printers and in a very ambitious way, it would be that these domes distribute the food produced through pipes of fluids under air or liquid pressure, for the distribution of solid foods, capsules, beverages, the supply of gels and roasted and dried foods to supermarkets, restaurants and homes, so that their food 3D printers process them, just as buildings have gas and water pipes, they would have food pipes, so to speak. Today's 3D printers can print fluids and solids through cartridges or capsules that contain the raw material to be used, equipped with software that allows selecting the shape and presentation of the sweet or savory dish, they can print any food, such as pasta fresh and fruits. Microsoft is working on a 3D molecular technique called esterification, through the combination of powdered sodium alginate and fruit juice, the English company Dovetailed, created 3D Fruit Printer, prints fruits in the form of caviar. You may wonder why print fruits if the garden will produce them? Because fruits have a short freshness period, which can be extended through the production of fruit juices, through different processes, such as pasteurization that extend the life for months or treatment by high pressure HPP, which consists of submerging the juices, already packed in cold water and applying a pressure of up to 600MPa for a time ranging from 3 to 6 minutes, through this treatment high quality products are achieved and expiration periods of between 30 and 45 days in refrigeration, it is one of the favorites because it practically does not alter the flavor or nutritional value of the juice. These juices with 3D printers could create a constant tap in natural orange juice homes, or provide the possibility of being able to eat any fruit regardless of the season of the year. So we must continue with the development of these technologies, to extend the life of food and make it more accessible.

Then, in the upper dome the raw material will be produced and in the lower dome the cartridges or capsules for the 3D food printers, in proportion to the amount of what can be distributed fresh and the amount of food that would be lost by not processing them for make them long lasting. You could even make food supplements, such as serums, vitamins and minerals, drinks with low sugar levels, only sweetened by natural fruit nectar.

The waste of food, of millions of tons in the world by not applying mechanisms to extend the life of food, in this technological age is inadmissible and for the future with population growth it will be impossible to waste food.



Another viable technique on a large scale is dehydration, it is the oldest and considered the healthiest technique to preserve food, fruits and vegetables, because they intensify their flavor, facilitate their handling, storage and transport; There are household and industrial food dehydrators. The greatest technological advances in these techniques have been made for feeding astronauts. Sandwiches, dairy products, whole grain products, cereal bars, soups, or the production of prebiotic or probiotic food components are currently manufactured with dehydration mechanisms. Once foods are dehydrated, before they are consumed they must be rehydrated, generally with water, either sugary or saline.



Through this technique, the Mexican company Quinasa is manufacturing blister packs or food chocolates that gather all the necessary ingredients for human nutrition. They have the blister product of mango, of 20 capsules of 1 gram, the equivalent of a piece of fruit. To obtain it, they dehydrate the fruit and grind it into a powder, then compact it into tablets. This process is also done with avocado and guacamole to sell it in powder, with the advantage that they do not need refrigeration, since avocado is very susceptible to decompose quickly, it is an option to avoid being discarded; the company ensures that its products retain 98%

of their flavor. On the other hand, they produce as a dietary supplement, protein kinase tablets, which contain the necessary ingredients for a person to survive 60 days without the need to eat anything else, the effects on health and nutrition should be thoroughly evaluated. Their food is oriented to meet the needs of food emergencies caused by natural disasters and to reduce malnutrition problems, since people who suffer from obesity, cardiovascular problems or diabetes can be properly nourished according to their specific needs anywhere and with great ease, according to the manufacturing company.

So there is the option of food capsules that would be useful for emergencies or extreme living conditions or food supplements, but it would be very daunting if the food of the future were pills. There is the possibility of dehydrated food as the components of a conventional lunch, these are dehydrated in the domes and consumers by hydrating them can eat and savor a delicious meal with the same or similar nutritional value as a fresh product, for example, they already exist in the market has various dehydrated potato options to prepare mashed potatoes, just to consume them you would have to add the rest of the ingredients and liquid. However, there are conditions in which people could not gather all the ingredients, boil water and cook, such as in extreme weather conditions on Earth or in space, which is why the greatest advances in dehydrated food have been made with thinking about feeding the astronauts. In the International Space Station (ISS, for its acronym in English), they have specialized in freeze-dried dehydration, which is done through cold, it is until now an expensive technique, but it better conserves the nutrients of the food and serves to produce turn aerogels. They also have food that is thermostabilized (hot), ionized (sterilized), dehydrated with drying techniques, frozen, natural and powdered beverages.



Paquete de alimentos deshidratados empleado en la Estación Espacial Internacional

We then have a wide variety of food processing techniques to select from, to establish the automated machinery and procedures to install in the lower dome, as produced in the upper dome. In this way, the supply of fresh and long-term processed food would be guaranteed, whether for storage, to be used in emergency conditions, to be marketed or to ensure that they are donated before their expiration; the point is that food is not wasted and the gardens serve to guarantee its availability under any conditions.

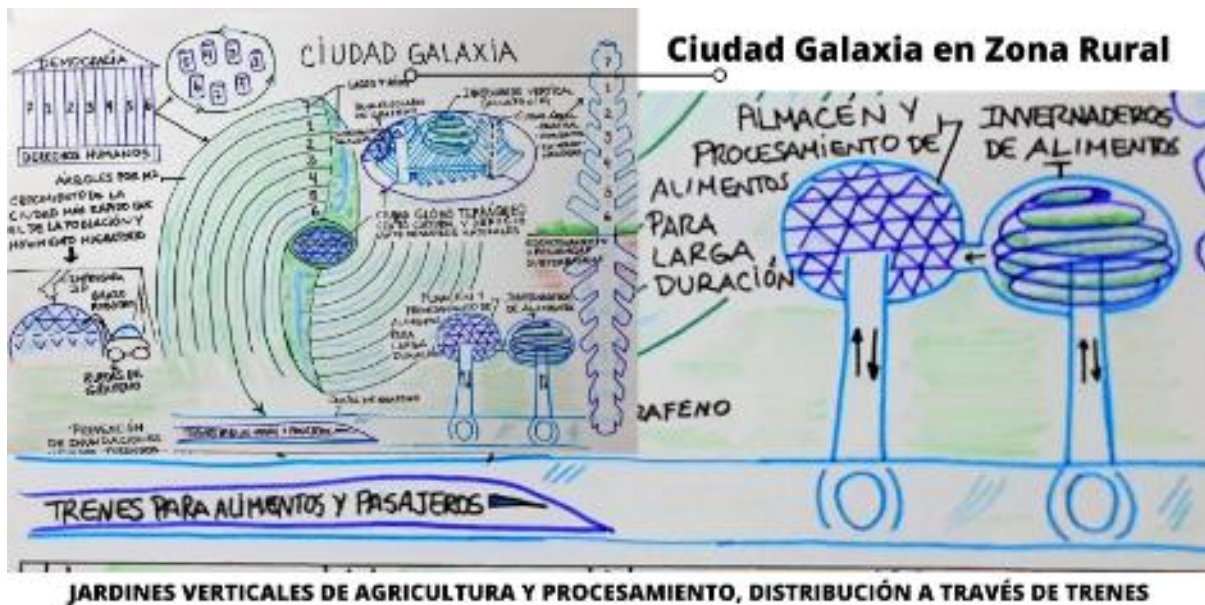


These Urban Vertical Agriculture Gardens would be used for small cities, where there are sufficient spaces for their installation, in large cities congested with buildings, they could be placed on buildings already built, if I have a restaurant or I am going to build one in a city, I would ensure that Have these vertical gardens, in fact many urban restaurants already have orchards, of course their production levels are incomparable with what they would produce with these technologies. But urban agriculture might be insufficient, so they would still need supplies from rural areas.

Poverty Solution in Rural Areas

Rural areas, in most countries are abandoned, lack support, good schools, buildings, do not have universities, which causes many to migrate to overpopulated cities in search of employment and education, leaving rural areas abandoned . In most Latin American and developing countries, farmers are on their own or with unpayable credits and it could be said that worldwide, farmers work a lot and earn very little, if the harvest is not. devastated by a plague, flood or drought, or if after overcoming all the obstacles when taking out their products, they are sold at very low prices or not. For example, my grandfather, who instilled in me the values of honest and efficient work, planted guavas, after so many efforts and working hours, when he put them up for sale no one wanted to buy them, because the market was saturated with guavas and practically had He had to declare bankruptcy, on various occasions he had fallen and got back up with courage and bravery, but already in old age he died defeated. In short, currently with the current risks of agriculture, being a farmer is brave and even more so in the future with the challenges of climate change. Therefore, food production must be made more fair and viable, farmers must be supported with these technologies, they must be offered scholarships for their training in the administration and operation of Vertical Agricultural Gardens..

It is



recommended that cities with advanced technology be built in rural areas, where there is more space compared to existing cities, new cities that consider human and environmental rights, such as our Tree Cities, Globe and Earth designs. Galaxia, in rural areas more space would be

allocated to food production, the atlas of risk of natural disasters should be considered in their design, if periods of floods and droughts occur in the area, it must be ensured that the gardens are at a height. Although these structures resist floods, they would be to guarantee access to vertical farms and ensure the availability of drinking water in periods of drought in proportion to its consumption, in the following classes we will see how these gardens will supply water and other sources of energy. The NGO Arca Tierra recommends city planning because it will allow the continuous development of the region and will guarantee equal development opportunities for rural areas as well as for urban areas, where human rights will be guaranteed. During the construction of the new city, in case the farmers have to be relocated, their lands would be bought from them, they would be paid the fair value according to the number of hectares and productive lands. In the allocation of the new land, which will produce ten times more per hectare with the new technologies of the Vertical Agriculture Garden, the farmer may decide to receive the same amounts of hectares, or a land of less size, but that will produce the same amount as in the past it produced or more and the difference in the remaining payment for unassigned hectares would be for the investment in the construction and operation of the Vertical Agriculture Gardens, which will be its private property. Farmers with these Vertical Agriculture Gardens will be able to produce edible algae, fruits, vegetables, fish, snails ... And they will be able to process them for distribution and sale. If you produce guavas, you will be able to sell fresh fruit, juice, dehydrated powder, frozen fruit, jams or other derivative products, you will not lose the harvest due to extreme weather conditions, pests or expiration of the product. This mode of financing is proposed because the countries where farmers need more support are emerging nations that do not have abundant resources, thus facilitating its implementation.

In the transition to these new means of production, it must be ensured, as in any system that is replaced, that the old system continues to function, even if it is deficient, until the new system produces the same or in greater quantity, in said transition process must ensure respect for the right to private property, integrate the locals into the transition, that they can manage and direct in a decentralized way and as mentioned before, if the farmer is relocated, he must receive land and facilities of equal value to their land sold, because we have already observed the failure and famine generated by the expropriations of the state and where the state is in charge of producing food, to use hunger as a control mechanism as unfortunately we can observe in my country Venezuela, where a holodomor it has been intentionally provoked by destroying the means of production, violating the right to private property. But, we are not going to go to the other extreme either, that for the excuse of free competition production is not coordinated and we put all guava farmers to produce, free competition is very valuable because it allows us and requires continuous quality improvement, but you also have to consider the laws of economics that are unbreakable, the laws of supply and demand.

Therefore, based on supply and demand statistics, projections of demographic growth and migratory movements of the region or regions to which food will be supplied, production should be planned. In the galaxy city of the rural area, 1000 guava farms will not be installed, the necessary ones will be installed, about 10 or 50 according to statistics and projections. During the operation of the new rural city, farmers will be kept informed of statistics and projections, so that they can plan their production and must be trained to do so. In this way, the farmer will see the costs and risks of agriculture reduced, they will obtain a greater margin of profitability, they would no

longer be to the fate of the weather and would not walk blindly in the market, production would be under their control, with their administration , planning and management of sustainable food production.

We would still have the problems of transportation, of the means of distribution that raise prices to consumers or that supplies are affected because the roads are flooded or due to another climatic factor, that the product expires on the road and the challenge of reducing remains. the emission of CO₂ and oxygen consumption caused by means of transport that use fossil fuels. Then, it must be ensured that these vertical farms are connected with electromagnetic trains of solar energy or other renewable energies, which travel inside photovoltaic graphene crystal cylinders, at a considerable height according to the risks of flooding, travel safely from the areas rural areas to urban areas, ports and airports, supplies would arrive quickly and safely in cities. The current distribution networks should be supported so that they are part of the transition towards new distribution technologies, so that they are not unemployed. In urban areas, supplies would reach supply centers or markets that will redistribute them to businesses. Supermarket chains could receive them directly from farmers or supply centers.

Solving Hunger, Improving Humanitarian Assistance and Shelter Management

Then we would have resolved to eat in cities and improve the quality of life in rural areas with the Vertical Agriculture Gardens, where fresh and long-lasting food with high nutritional value will be produced; with high levels of production that will allow to produce surplus food to store in case of disasters and there would even be the possibility of donating to regions with high rates of malnutrition or in need of humanitarian assistance. Of course, the viability of the areas to which the food will be donated must be determined, for example, if tons of food are stored in Chile and they will send food to a country in Africa, it would only be possible if ships took it for free. But, with these technologies, why continue to have people waiting for food, with the uncertainty of whether they will reach their hands before they die of hunger? Although it is true that most of the countries where they suffer from the highest rates of malnutrition and hunger do not have democracy, insecurity due to terrorism and organized crime is so great that humanitarian assistance is impossible, which is why the United Nations builds shelters, so they are in tents, given up just waiting for the food to arrive. The NGO Arca Tierra considers that in these situations the shelters should consist of a city model, depending on the available land, be it the Tree City, the Earth Globe or the Galaxy or all of them integrated, in fact, these cities were designed thinking about the extensive valleys of Africa to build gardens of Eden, where human life began on Earth. In these modern shelters, refugees must be responsible for their management in a democratic system, of course that due to the insecurity conditions the UN and NATO must continue to protect them, they must be assisted in education and theoretical and practical training for administrative and operational management of the city and the Vertical Agriculture Gardens, so that they have enough food produced by themselves, as well as to store and distribute food to other nearby shelters that are still in transition to this new model.



It should be noted that the location of these cities or of the Vertical Agriculture Gardens should consider the preservation of jungles and forests, indigenous settlements and animals, located in areas declared forest reserves or not, logging should be avoided and if necessary they should only plant in these places in a sustainable way and with understory techniques.

In this way we would contribute to solving hunger, regardless of the location and demographic growth, for the complete resolution, of guaranteeing respect for the right to food, the capacity of nations to offer equal opportunities to prosper and have a better quality of life, strengthening democracies, human and environmental rights, especially democracies, because democracy is the cornerstone of human rights, democracy is essential for these solutions to be viable and sustainable, for which we must promote the evolution of humanity towards this sense, that is why we consider the Management Policy “Gradient Scale of Humanity Between Succumbing and Surviving of Humanity” necessary so that the United Nations is based on the promotion of respect for democracies and rights humans in the world, this policy is explained on our website. And in order to improve the organization to achieve sustainable development, we propose the organizational model of the Department of Natural Resources, administrative development of our Plan 1 The Climate, which can be adjusted to a city, country, continent or for the United Nations, This organizational model is explained in our online course # 1, The First Steps to Solve Climate Change, class # 7. The NGO Arca Tierra in its 24 Strategic Plans, addresses the improvement of food production in its subsequent plans 2 Oceans, 8 Grasslands and Sustainable Cities, Food, where a formula is proposed to produce serum against malnutrition based on pyre and plan 10 Forests. These plans are generally available on the blog of the NGO Arca Tierra, in the book 531 Beauties of the World III Edition in our library on our website.

Class 8 Water Availability Function

The processes that involve water resources will be described, which will be carried out in the Urban Vertical Garden, such as, rainwater collection, wastewater treatment and / or desalination, to supply drinking water to natural and artificial surface and underground aquifers, to have sufficient water reserves for the conservation of nature, human activities and human consumption, generation of clean solar and hydraulic energies to supply energy to the Vertical Botanical Garden and the city, as well as for lighting through the photosynthesis process of the microalgae.

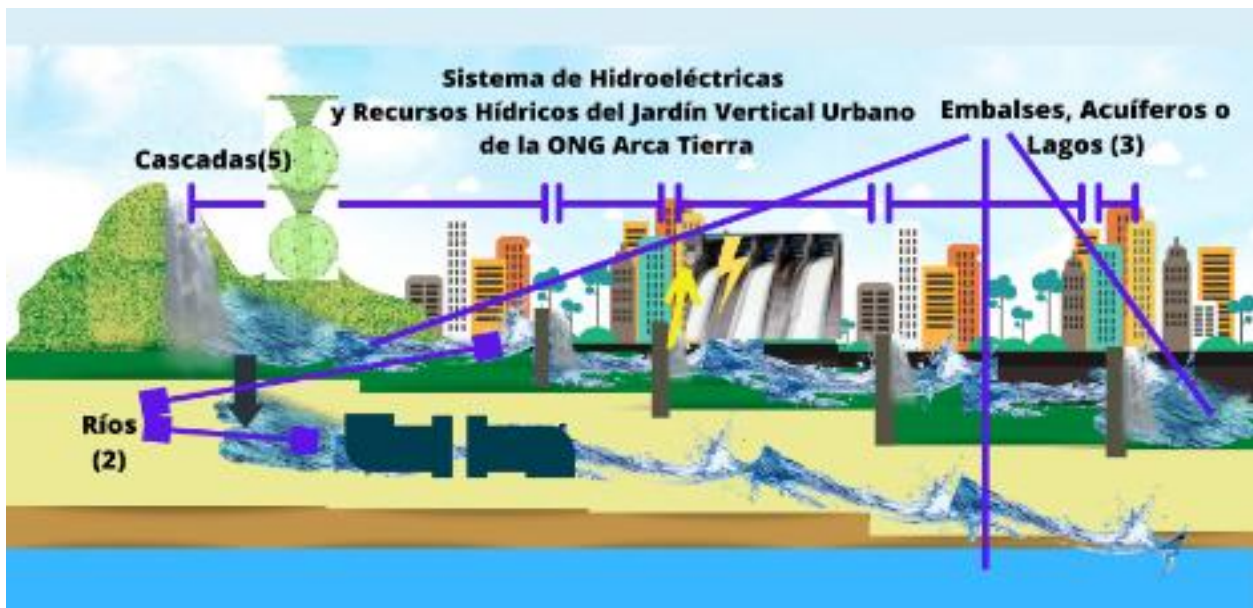
The Urban Vertical Garden must have water sources, the cities mostly use foreign water resources for the water supply and drain contaminated water from homes and industries in those water resources that provide drinking water or in others, this is so illogical as wasting millions of liters of rainwater, allowing this clean water to drain into sewers. It is a totally irresponsible management of water resources, which affects human health and nature. For example, the majority of the population consumes water with high toxic levels of arsenic, according to the United Nations 140 million people drink water with dangerous levels of arsenic for health, so solving wastewater treatment is as important as improving the air quality, since we ourselves are poisoning ourselves by breathing and drinking water.

Rainwater Collection, Wastewater Treatment and Water Battery

In previous classes, devices to capture rainwater in cities were explained, the structure of the Urban Vertical Garden will also be suitable to collect rainwater from the top of the Microalgae Tree Tower, this would be stored, preventing it from being contaminated, although the algae they would make sure of it. The microalgae solution pumping system will need water, so part of that collected water would be used for it. Both in the garden area and in the city, rainwater collection systems should be available, in fact, in Europe, various countries require that buildings have rainwater collection systems, just as fire systems are required, These reserves can be stored in underground tanks for storage, creating several alternate tanks for daily use for irrigation, drainage of wells, for fire fighting systems or other uses. In the area of the Urban Vertical Garden, there will be several artificial aquifers (if there are no natural



aquifers) both underground and superficial. At the bottom, at the lowest level of the subsoil, after several layers of rocks, sand and grit described in the components of the garden, the largest underground aquifer would be located. If possible, the structure should be on a high level, which would be very convenient for air and water purification; Natural mountains with waterfalls purify the water and naturally filter it between rocks, sands and grits that create natural underground aquifers, 30% of the world's drinking water is in underground aquifers, 69.7% in glaciers, in ice from Antarctica and Antarctica and only 0.3% in surface waters, mainly lakes, swamps and rivers.



So we must emulate nature, so that our main water reserves are protected from evaporation and contamination in underground aquifers. The artificial aquifer must have the main geological characteristics of the world's great underground aquifers, such as the Guaraní, where stones of volcanic origin and the presence of iron keep the water clean and under the ground, to which we can add other technological tools, such as periodic ozonation, application of UV rays or other technologies described above that keep the water clean. Ideally, this aquifer goes down, its artificial basin creates an underground river, which flows into a larger underground basin, where in addition to providing water, it supplies electricity, if it goes down with enough force, hydroelectric plants should be installed in each waterfall that will oxygenate the water and it will supply electricity for the garden's water system and the surpluses will be used for the city's electricity supply.



In fact, it would serve to be part of a water battery, which drives the city's wastewater upwards so that it passes through a wastewater treatment process with the combination of different technologies listed in the previous classes of components. of the garden, after being treated, the last phase of assuring the quality of the water, is the filtering through layers of rocks, sand and grit so that the purified water flows into the underground aquifer. At present,

in European nations there are hydroelectric plants and underground water batteries, they use reservoirs on uneven levels, abandoned mines and reduce the environmental impact by being underground, of course there are not yet or I have not known those that also fulfill the function of the treatment of wastewater from a city. One of these most impressive hydroelectric plants is the Linthal hydroelectric plant, it is an underground reversible hydroelectric plant that has a reservoir located upstream at 1860 meters above sea level and other downstream at 600 m, the set has a production capacity 1,450 megawatts of renewable energy. This shows that it is possible to do so, the point is that this system generally circulates water from one reservoir to another, for the continuous generation of electricity and is located in areas where there are natural resources that may be affected, build a hydroelectric plant in A city would be an area already impacted by human activity and its installation would represent the recovery of water resources and the maintenance of ecosystems. The hydroelectric of the Urban Vertical Garden consists of a set of hydroelectric plants located in different waterfalls in two rivers, one surface and the other underground, electricity will be generated as the clean water of the upper aquifer, the upstream reservoir, descends into the aquifer Lower, downstream, this would be used to supply drinking water to the city. To maintain the water flow, on the other hand, the wastewater would be extracted from the city's sewer network, on its way up under pressure to the waterfall located in the upper part of the water fluid, different processes would be applied to the exhaustive treatment of wastewater, with different technologies and natural resources, such as microalgae, graphene filters, HM Solution, nano iron particles, Indus tiles, laser rays, UV, ionization, ozone, ... Treatment processes that are they would be carried out in lagoons and / or in pipelines with photoreactors, a choice that will depend on the terrain conditions. Any other technology described or not may be used in the components of the Urban Vertical Garden, to guarantee that the water is once again drinkable in an efficient and sustainable way. Once the water has been treated, its quality would be verified with established controls, until it is guaranteed that it is drinkable, it would go up to the waterfall to fall to the upstream reservoir, the water flow would follow through rivers and waterfalls, which will contain rocks, algae, grit and technological devices for its continuous cleaning, until it falls downstream, to the lower reservoir that will supply drinking water, then this would be used and it would go to the drain to start the water cycle once again. Water coils, the mechanism of generating renewable electricity while descending water from an upper reservoir to a lower one, makes it necessary to pump water from the lower level back to the reservoir upstream. By adding that it serves to supply drinking water and for the exhaustive treatment of wastewater, it will encourage investment in the effective treatment of wastewater, it would be a self-sufficient system that would be self-financing for its continuity over time. Then this water battery will produce renewable energy, supply drinking water, through the treatment of wastewater it would avoid the contamination of water sources, it will improve the landscape and thermal comfort of the city, it will encourage tourism, it would serve for irrigation systems of gardens to Along the tributaries, for the maintenance of natural resources in the city, which will help the survival of birds, butterflies and bees, the maintenance of ecosystems, the excess water would serve to supply aquifers that are being depleted. In short, it offers a wide variety of advantages, which cities will consider investing in this system to improve the quality of life of citizens, the restoration and conservation of natural resources.

Water surpluses are mentioned, because the water battery would also receive water flows from the collected rain, in times of intense rains and floods, if they occur, these waters from the rainwater collectors described above, may also be redirected to underground aquifers depleted or low water levels. Rainwater captured in the rest of the city could also be redirected to the underground artificial aquifer of the Urban Vertical Garden or to natural ones, depending on availability and the levels of the surrounding rivers and lakes. In areas where large snowfalls occur, this system would also serve to reserve the water in ice and in liquid form when the season changes, in this way floods due to heavy snowfalls or rains would be avoided, efficiently managing water resources.

Wastewater Re-Treatment



At the top of the natural or artificial mountain where the Urban Vertical Garden is located, another wastewater treatment plant would be located, to treat CO2 and discard any remaining pollution, using a mixture of different technologies and natural resources, according to the availability of resources, the options are many, those enunciated in the garden components would be considered; the collected rainwater and the treated water from the Urban Vertical Garden would also be pumped to the waterfall, the waterfall itself will make another cleaning of the water through the friction of the rocks, which could be helped by moss,



vegetation and even The arrangement of Indus tiles, The Urban Vertical Garden would also be part of the water battery, because it would supply and take water from these tributaries for their operation, for the fulfillment of their functions of cleaning the air and water.

That is, it will have its own system to decontaminate the previously treated water that descends, for which a second underground aquifer would be

necessary well above the bottom aquifer, which will mainly use limestone rocks and algae to trap excess CO₂ from the water, After the expiration of the useful life of the algae, which will purify the water and the air, they would be reserved to be commercialized for other industrial uses, like sand, limestone or other volcanic rocks that trap CO₂, they will be used later To produce graphene, algae could also be reused for this purpose, thus ensuring that the trapped CO₂ does not return to the atmosphere, but is solidified into graphene. This second underground aquifer will treat the water that descends in a second process and from the vertical garden drain, through limestone rocks, sand, nanomaterials, algae, ultraviolet rays and ozonation, the ozonation process will be done to provide oxygen to the water underground and surface waters. From the shallower underground aquifer, after this second water treatment process, the water would be distributed, filtered towards the other underground aquifer that would be at a greater depth, guaranteeing that the water stored and distributed to the city is water free of Toxic and polluting agents, the water system of the Vertical Botanical Garden would have outlets towards a superficial lake and towards a shallower aquifer and the water would descend, filtering into a deeper aquifer, because the water reserve in different strata will facilitate the management of the levels of water in the event of major droughts and floods.

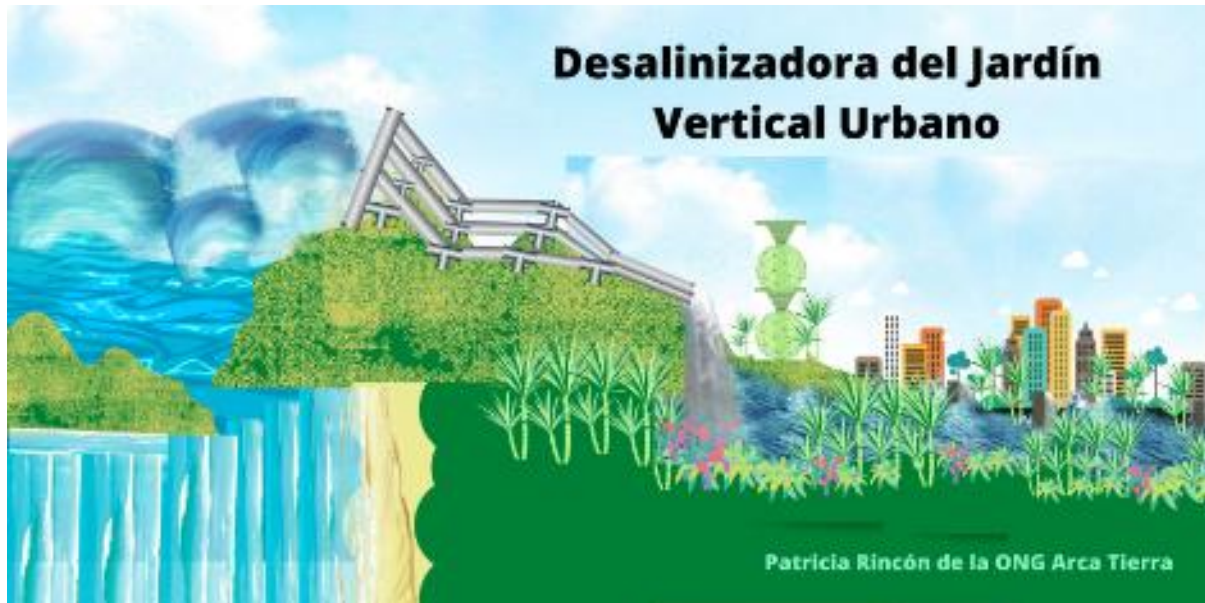
Surface Aquifers



The surface aquifer system of the Urban Vertical Garden would have two reservoirs, that is, two artificial lakes on the earth's surface, one upstream and the other downstream, interconnected by a river that would have several waterfalls. The waterfalls will consist of a large one to promote the descent of the water at the beginning of the descent, and the subsequent ones during the descent, to fulfill the function of producing ozone naturally, to purify the air and water nearby, oxygenate the water of lakes and rivers.

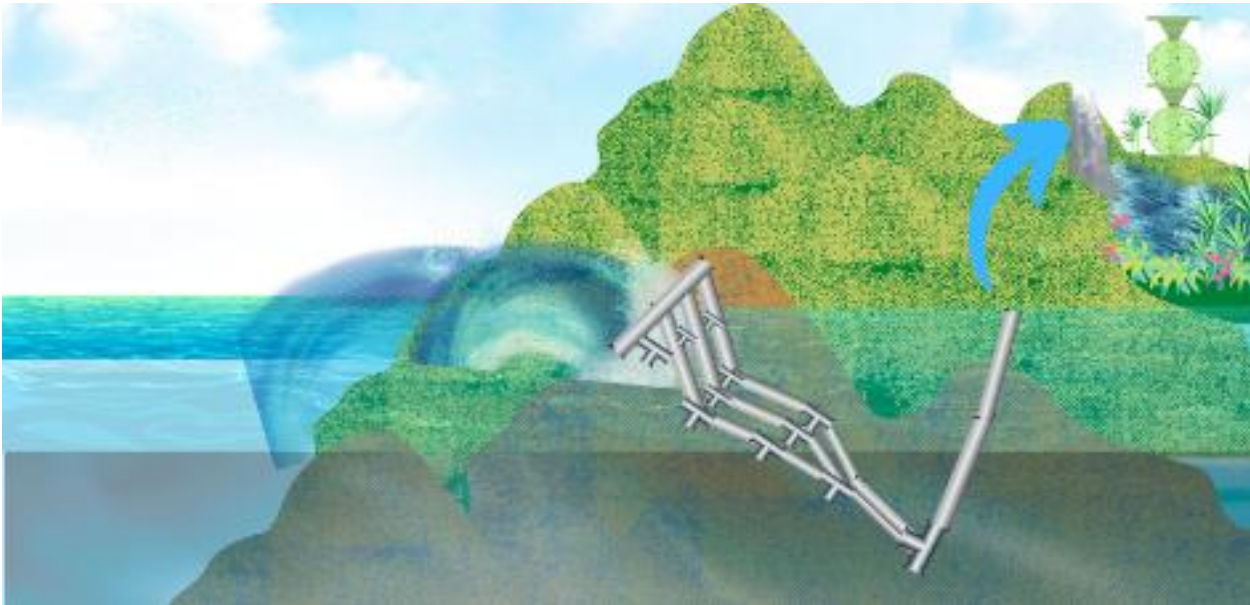
It was explained in the components of the garden, that at the base of the artificial lakes there should be rocks, sand, moss, vegetation and freshwater algae according to the biome, at the surface level of the water other floating plants and natural mosses could be consider adding the floating petals, the technological development that contains microalgae for the continuous purification of the reservoir; Around the reservoir there must also be vegetation to help clean it. The lake will produce a waterfall to generate a river, which, like the lake, must be prepared so that by means of rocks, sands, sand, vegetation and technology, it continuously purifies the water, which will fall along the way in various waterfalls, to the continuous production of ozone in a natural way, with UV ray screens to be activated periodically and in case of attacks by biological or chemical weapons eliminate any toxicity. The ideal would be for the river to cross the city, to generate thermal comfort, aesthetics and sources of hydration for birds, or at least cross a large part of it and if possible reach areas that suffer from water scarcity, to supply rivers and lakes with low water levels. On its way, ecological, passing hydroelectric plants may be placed to generate electricity and reduce electrical wiring in the electricity supply through which it transits.

Desalination



If the area where the Urban Vertical Garden is located lacks water sources and is near the sea, the hydroelectric system, water battery, surface and underground water sources, filtering and wastewater treatment described above could be installed, but under the sea level. Various nations or regions are below sea level such as the Netherlands, or as in my region of Zulia, the Eastern Coast of the Lake, or through engineering, this system can be made below sea level, with the purpose of install a desalination plant, which makes the seawater fall in cascade, with a lot of pressure, through the reverse osmosis membranes, since for the reverse osmosis desalination process a pressure pump is necessary located previously to the pipes where they are located the membranes that remove salts from the water, which would save the energy necessary to implement pressure, in addition to the Energy Recovery Device (ERD), it is also possible that before or after the desalination process this water fall of sea also serves for the generation of hydraulic energy, adding even more electricity available to all the systems of the Urban Vertical Garden. sion by the fall and the pressure pumps, the water would be led to the reverse osmosis process, we observed in the class of garden components how to use algae, magnetic nanomaterials and graphene membranes for wastewater treatment and desalination, for which would be important to consider to improve the process, the raw materials used should be reused by the desalination plant and / or for other industrial purposes mentioned above. The pressure pipes where the meshes that will filter the water would be inserted, would follow the inclination of the fall so that the pressure continues, at least 3 or more membrane models would be located in the path of the pipe, which in gradient would filter in stages , progressively reducing its diameter so that, in the last stage, it is the least pressure necessary and drinking water is guaranteed, with the improved membranes the necessary energy would also be reduced, the amount and location of magnetic nanomaterials, graphene and microalgae would be designated according to the stage, as well as the diameter of the meshes. The diameter and the number of pressure tubes and membranes will be in proportion to the magnitude of the flow. This system and membranes would also make the process more environmentally sustainable since it would not be necessary to use chlorine or copper, as they are commonly used in current desalination processes and for

which it has been pointed out as a highly polluting process, because it produces brine. extremely salty that affects the oceans, because in this way it would no longer be.



If a desalination plant is needed in a coastal area bordered by mountains at sea level, it would be very expensive to create an area below sea level, so the desalination plant could be built in the same way, but underground, reducing the environmental impact, to create aquifers and underground flows for the generation and distribution of water sources that fall like waterfalls. This is possible, in fact, nature does it through submerged and semi-submerged sea caves, which are formed by the erosion of rocks, especially limestone rocks by the action of sea water, the water enters under great pressure from the tides, and travels through natural underground channels, in environments dominated by filter feeders and detritivores, which feed on decomposing organic matter. Sponges, anemones, bryozoans that also filter water and feed on tiny organisms and corals that have demonstrated their high capacity to filter water except for microplastics, along with rocks, are responsible for purifying and desalinating the water, this can be observed in the Canary Islands where water seepage through volcanic rocks occurs. Hawaii, a region of much volcanic activity, has a large number of surprising sea caves and therefore with a large number of waterfalls, springs and hot springs, since the filtration of water through certain volcanic rocks heats them and creates hot springs and geysers. I have not yet found studies that support that nature performs desalination processes, but it is logical to consider that it is feasible according to the aforementioned, since the actions that are presented in it are similar to those that are carried out in a desalination plant, such as the water under pressure and filtered. What is well known is that the fresh and salty water circulating on the planet, in certain places intermingle and in certain places they can come to noticeably differentiate into two levels, as in the Cenotes of Mexico, fresh water being less dense is located in the upper part of the cavernous cavity, while the heavier salt water is located in the lower levels. Generally these vertical columns of salinity change occur gradually, but their division can be seen markedly where low pressures are combined with cold temperatures, drastically fresh water remains at the surface level and salt water at the bottom. Considering these processes that take place naturally, desalination processes can be developed at underground levels; The desalination plant in a semi-submerged cave would also consist of desalination and purifying membranes in piping systems, such as those previously described, except that in this process, depending on the natural mechanism of water

desalination, it may be necessary to apply thermal and water systems. pressure variation to facilitate desalination, as well as the use of aqueducts or pipes and ponds made of limestone and volcanic rocks. If the generation of electrical energy is necessary for the operation of the desalination plant, the underground water battery system could be used, so that in certain stages of the process hydroelectric turbines are installed, although there are different alternatives to produce energy through the forces of the sea, floating solar panels and the so-called blue energy.

It should be noted that in both construction processes, the extracted rocks and sands can serve for the filtration of water into lower levels of aquifers, as well as for the production of graphene, because the desert areas or coasts, generally according to their geological history, were submerged under the sea and have undergone volcanological processes, so it is logical to assume that they have high concentrations of carbon, therefore they would be a low-cost raw material to be used for the production of graphene, modes of extraction of sand and rocks rich in carbon, as well as recycling for the production of graphene in our 5 Coasts Plan.

In the technologies observed above, we take a look at blue energy, the energy generated by fresh and salt water, for which it would be possible to add another option of electricity generation, apart from photovoltaic and hydraulic; The wastewater, previously treated from the first wastewater treatment process, could be channeled to the blue power plant, strategically located, for the functionality of the systems. In the coasts there is generally a great solar radiation and force of the winds, it would be beneficial to establish in its vicinity, generating plants of various clean energies, since the Urban Vertical Garden system will create a water battery, to reserve the energies and distribute it to through flows that will reduce the electrical wiring and the impact that their installation causes.



This project has been specially designed for the Venezuelan and Colombian Guajira, close to the sea, of a desert geography, with rainy seasons, but due to global warming, up to two years can go by without rain, which is why it is a region hit by the drought, hunger and crime due to the scarcity of sources of employment, since it is impossible to carry out the main economic activity in the region, agriculture; In short, a good quality

of life is unsustainable, many villages do not have drinking water. In this region it would generate a great environmental impact, which would affect a lot of rocks and cacti, desertified and unproductive lands due to global warming and would turn them into productive valleys with lakes, rivers and underground aquifers to guarantee the availability of water and the possibility of Establish Tree, Globe and Galaxy cities, adjusted to the Wayú culture, to guarantee respect for their human and environmental rights, with a quality of life without malnutrition, children would stop dying due to lack of water and food, since the mortality rate According to Verdad Abierta, about 30,000, among the 66,000 children under 5 years of age in La Guajira, are in a state of malnutrition, children and the population in general who are lucky take two glasses of water a day and 97.7% of the population drink water from contaminated sources. The underground wells that supported the vital liquid are mostly dry. The creation of these systems with security, democracy and transparency will be possible to carry out, training and integrating the inhabitants and local authorities to the construction, operation and administration of water and air purification systems, wastewater treatment, generation and reserves of water resources and clean energy, as well as in the construction and operation of sustainable cities. In the case of La Guajira, where they have low levels of atmospheric pollution, the process of purifying the air in the Vertical Gardens would be replaced by a system for capturing water from the air.



Despite all these benefits, it is important to consider that the unfavorable impact on the environment must be continually reduced and the quality of processes and systems improved for optimal performance. The Desalination System traps salts, nutrients, minerals and the algae would retain the toxic elements. With the exception of toxic elements, the rest must be reused for other industrial activities, such as agriculture and others carried out in the region, as well as for the recovery of desertified soils, which have become unproductive due to climate change. the cutting and burning of vegetation, pollution and depletion of water sources. Since the Urban Vertical Garden will produce large freshwater tributaries, including rivers, if these must flow into the sea, they should be returned with the appropriate levels of nutrients, oxygen and salts to improve ocean conditions, an activity that It could be self-sustaining through wastewater treatment and blue power generation.



In the same way, it is important to consider whether when changing desert biomes for biomes with large concentrations of vegetation and water, we must predict their impact on the global climate, since a certain amount of deserts and glaciers create a climatic balance of hot and cold air currents. that act in the carbon cycle; However, it is important to consider that global warming is breaking this balance, desertification is progressing 35% faster, according to National Geographic, around 2 billion people live in drylands, for which an estimated 50 million of people would have to migrate to non-desertified areas by 2030. Desertification is a problem that we are facing today, about 100 countries already suffer from its consequences, increasing poverty, since agriculture and their means of subsistence are disabled. Currently 75% of the land area is degraded, according to the European Commission's World Atlas of Desertification and more than 90 percent could be degraded by 2050. The Commission's Joint Research Center found that a total area of half the size of the European Union (4.18 million square kilometers) is degraded annually, Africa and Asia are the most affected. These figures demonstrate the inclement need for the recovery of desertified areas, the desalination system and all the other systems of the Urban Vertical Garden will contribute to it effectively, in a socially, economically and environmentally sustainable way. We will continue making improvements, our strategic plan 2 Oceans will promote the improvement and development of desalination processes, our plans 14, 15 and 16 will improve the recovery, creation and conservation of water sources, emphasizing the restoration of ecosystems destroyed by desertification.

These would be the systems related to water resources and renewable energies of the Urban Vertical Garden, proposed by the NGO Arca Tierra, it should be noted that it should be ensured that the artificial water sources created and recovered natural are not contaminated again by industrial or residential waste, Sewage must be directed to the water battery to receive the different treatment and filtering processes for reuse. In the event that certain urban and industrial areas cannot redirect the wastewater to the water battery, they should be required by construction and operating ordinance to treat the wastewater before discharging it into water sources and avoid its absorption by the soils, because So many efforts to ensure available and clean water sources would be sabotaged.

Class 9 Function of Providing Food and Shelter for Birds, Butterflies and Bees

The process of creating habitats for birds, butterflies according to their migratory routes and for bees will be described through living sculptures made with live flowers and landscaping.

The Urban Vertical Garden in its interior will contain vegetation, which will be selected for its great benefit to the environment and to the quality of human life, if ornamental plants are selected, it is so that they fulfill the purposes of recovery or conservation of ecosystems, of species that need of a special biome for their rapid growth or if they are plants for agriculture, they will be chosen according to nutritional needs, supply and demand statistics, projections of population growth and migratory movement, the surpluses will be processed in order to produce food with high nutritional value and of long duration to be able to store them and that these are used in cases of emergency.



Outside the garden, there will be vegetation according to the biome and around the water sources to ensure oxygenation and purification, trees and shrubs will be planted to provide habitats for birds. Rainwater harvesting and irrigation systems will be installed to maintain vegetation, such as those used in the Singapore Garden by the Bay. In landscaping, it is important to consider the integration of fungi and wild flowers, many species are in danger of extinction, many forests and jungles have suffered their disappearance and decline, because they have affected the maintenance of their ecosystems. If the Urban Vertical Garden produces them, it would be necessary to consider the possibility of their integration into the landscape, their large-scale production would serve to supply non-governmental organizations or agencies in charge of reforesting jungles and forests, since they are very important elements for the sustainability of ecosystems and to help regions recovering from desertification.

Butterflies are becoming extinct because we have hampered their reproduction habitats and migratory routes with our activities, so it is important to integrate large sculptures of living flowers, very tall. Butterflies like birds migrate according to the seasons of the year, in buildings up to 15 stories high I have observed how they struggle to climb through these

buildings, they can fly to more than 1000 meters high and up to a speed of 48 kilometers per hour, according to Rothamsted Research of the United Kingdom, they determined it by observing through radar systems the migration of the Vanessa butterfly. The scientists found that it could take up to six successive generations of butterflies to complete a 14,400-kilometer journey from tropical Africa to the Arctic Circle; On their way, butterflies must find plants so that their caterpillars can eat and give rise to other generations. Their journey is much longer than the one undertaken by the famous 4,500 km monarch butterfly, which migrates between Mexico and Canada.

In short, it has been shown that butterflies must migrate and, being part of the pollination process, are essential for ecosystems, they are part of the trophic chain, a biological circuit that includes a food chain, if a link is missing the other species are in Danger of extinction. Therefore, butterflies are the best ecological indicators of the diversity and health of ecosystems more than any other animal, according to the Enebro Group, an NGO in charge of studying biodiversity and ecosystems.

In their migratory routes, safe habitats, plants and flowers that provide them with food and shelter have been disappearing, as well as being affected by the levels of toxicity in the air, reasons why many species of butterflies are in danger of extinction. For example, the monarch butterfly needs flowers rich in nectar, it reduced its population by 86%, from 2017 to 2018, according to National Geographic. Faced with the shortage of food caused by human intervention, the increase in temperatures and the toxic air, they modify their routes, becoming increasingly long and intricate, so many of them die on the way. In turn, the destruction of the habitats where they reproduce has been affected, being another factor in their reduction. Considering these facts, it is important to repopulate wildflowers, migratory routes and areas where butterflies breed. Because the butterflies have modified their journey through obstacles, it is important to establish the ideal migratory routes for each species of butterfly and according to this, ensure the provision of Urban Vertical Gardens, the landscaping that will surround them, will provide them with fresh environments , with low levels of toxicity, food and shelter.



Jardín Botánico de Montreal Canadá



Una historia real, representada en Shanghai, China



Jardín Botánico de Atlanta, Dubai y México



Artists and florists have created surprising and beautiful living sculptures, that is, structures that contain wild flower plants that are kept alive by irrigation systems integrated into the structure, this in addition to creating an aesthetic environment will fulfill a fundamental function for the survival of bees, butterflies and birds. Many consider that it is possible to save butterflies, but they do not believe in the will to do so, because in the face of so many species in danger of extinction due to global warming, large species attract more attention and they forget about the small species that make all flora and fauna may survive. In addition, the innumerable and dire consequences of climate change make it impossible to attract attention for the salvation of this tiny insect, but it should be noted that the most devastating consequences of climate change are food shortages and the desertification of soils that would make of humanity an endangered species, which is why the salvation of butterflies, birds and bees is essential, since they are key in the pollination processes that keep ecosystems alive.

Many species of butterflies, bees and birds are in danger of extinction, it is therefore convenient that, when planning the layout of Urban Vertical Gardens on maps, in addition to considering the needs of electricity, water, food and clean air in cities , are located to facilitate their migratory routes and offer them safe habitats that guarantee their survival, or what is the same, that guarantee the survival of humanity. Given this vital importance of having these gardens in specific locations, nations must coordinate considering the migratory routes of these insects that involve several nations, for example, in the migration of the monarch butterfly, Mexico, the United States and Canada must agree routes appropriate migratory areas and establish the Urban Vertical Gardens at strategic points.

Class 10 Function of Providing Safe Spaces in Cases of Toxic Air, Biological and Chemical Weapons

It will be explained how the Urban Vertical Garden can provide safe spaces to provide shelter to the population, their food reserves, plants, birds and insects and how it can be part of a system to protect the city against toxic air and attacks with biological weapons or Chemicals.

The Urban Vertical Garden must have ozonizers in its structure and in the rest of the garden, which would be activated in case of high levels of toxicity due to pollution, attacks with biological weapons, spreading viruses or attacks with chemical weapons, to purify the water and air in its surroundings.

This is a necessity, most of the world's cities have high levels of air pollution that make them susceptible to the spread of viruses, they generate respiratory and cardiovascular diseases that cause around 8.8 million deaths a year globally. In some cases, the poor air circulation and thermal conditions can further aggravate the situation, as happened in December 1952, in London, in a very cold winter the population burned a lot of coal for the heating systems, pollution The atmosphere was aggravated by a greater thermal inversion caused by the intense cold, that is, CO₂ emissions were trapped in the city at ground level for several weeks, it is still difficult to estimate the death figures but the death of some is estimated. 12,000 people. This event of smog has occurred in various cities on several occasions, in Mexico DF, Beijing, Santiago de Chile, Tehran, Los Angeles and El Valle de San Joaquín, Ulaanbatar, Southeast Asia, Pakistan, ... And in other cities with air circulation problems, in fact, it is estimated that more than 80% of the people who live in cities breathe air that exceeds the limits of air pollution, that is, 80% of the population that lives in cities is at risk of suffering diseases and dying from this cause. In conclusion, no city is exempt from the need to establish systems to improve air quality, for example, the city of Bogotá is in position number 44 of the cities with the worst air quality and even so it has to decree about 3 times a year environmental emergency due to poor air quality.

These numbers of deaths and health risks exceed COVID-19, COVID-19 has brought catastrophic consequences to the survival of humanity, because the Director of the WHO has enforced total confinement, thousands of companies have declared themselves in bankruptcy, millions of people have been left without jobs, without sources of income, many have been forced to live on the streets because they cannot pay rent and suffer from hunger, instead of promoting the successful actions that countries such as Israel and Japan have taken , which have emphasized the prevention and preventive isolation of those infected and possible infected, for the effective containment of the virus, as explained in section 1, there is technology and mechanisms to restore activities with security measures, because according to the COVID19 death rate, the majority of the population is more likely to die of hunger or cold in countries where the winter season is due to being destitute. And despite the catastrophic consequences of confinement, I have watched the good things that COVID19 has done to the environment as it rolls intensely on social media, as if it were driven to understand and accept that confinement is the solution to air pollution and to climate change, THIS IS TOTALLY FALSE, pollution is also emitted from homes, and southern countries that go through winters have a greater need for heating. To affirm that the confinement of humanity is the solution, is to affirm that the extermination of the human population due to hunger and disease is the solution, a very communist statement, in Russia, where you suffer from cold and hunger, the solution is to stay locked up and winter so as not to die of starvation, if we all came to agree with this falsehood, all countries would be like my country Venezuela,

where the population is exterminated with hunger and diseases and the environment destroyed.

We have enough technology to solve this problem, to generate sustainable development with social, economic, environmental and political balance, that is, with democracies, respect for human and environmental rights, we must not surrender to succumb as a species, we must rise up and assume RESPONSIBILITY , a species contracts until it disappears or expands, what do you decide? Are you going to give up? Let's Assume Responsibility, in this textbook the knowledge, the technology that humanity has developed or is developing and that we consider to make our proposals from the NGO Arca Tierra, so that each citizen, each country, continent and the world assumes responsibility. and control of this situation to solve it by acting for the benefit of humanity and the planet, because even if we become extinct without solving it, we already spread enough pollution in the atmosphere, oceans, soils, rivers, lakes to make it impossible for the planet or life to survive as we know it, so it is not time to give up, it is time to be responsible and act to compensate for the damage we have caused to nature and evolve towards sustainable development.



Then, the Urban Vertical Gardens would provide safe spaces and contribute to avoid or disperse toxic fogs, but if all the buildings or at least most of the buildings integrated microalgae, they would have microalgae windows, described in section 1 and in this section, They would help to collect microparticles from atmospheric pollution, as well as to reduce electricity consumption or the burning of fossil fuels for cooling or heating buildings. These technologies will provide us with various options to increase the use of clean energies and gradually reduce the consumption of fossil fuels, however, we must continue to make improvements in order to reduce air pollution, restoration and conservation of natural resources, until the solution of climate change , to ensure the survival of the Earth and humanity.

So, what COVID19 has taught us is our vulnerability to biological weapons, to pandemics, which is why efforts must be made to reduce the chances of contagion, as explained in section 1, various studies highlight the possibility of that the virus is trapped in the microparticles of air pollution and it is safely stated that high levels of air pollution increase the spread of COVID19. For these reasons, the ozonator systems in the Urban Vertical Garden would serve to clean viruses from the air, reduce the chances of contagion and provide air quality to citizens. In the same way, this system can be assisted by having ozonators in key buildings of the city that work with ionization and laser rays, in strategic locations according to air circulation and pollution, so that they are activated in case of high levels alert of toxicity in the air, when activated they would emit ozone to the outside that will purify the air and then decompose into oxygen, accompanied by laser rays, it would make sure to reduce risks and improve air quality. This system should not replace the need to establish spaces for nature in cities and to reduce greenhouse gas emissions, since these systems represent a considerable investment that would not solve climate change, which does threaten the survival of the entire planet and of humanity, would be useful for these emergencies.

In cases of extensive and dangerous toxic clouds, intense bacteriological attacks or chemical weapons, additional measures must be taken to those previously explained, airplanes, manned or unmanned aircraft, drones, which at different heights depending on the direction of the toxicity, the circulation of the winds and the weight of the particles spread ozone, emit laser rays that are harmless to health, but very efficient to purify air and water, prior to this, the chemical or bacterial material spread must be

analyzed to determine the chemical reactions of the application of ozone and lasers, to establish the correct technology to use. The route of the aircraft would be estimated according to the scope of the toxic cloud, so that by means of ionization ozonators located in said ships they will purify the air. In the course number 2 of the NGO Arca Tierra, the way to develop various technologies was explained, among them, drones equipped with sensors that will allow them to scan the air quality and establish a network of these terrestrial sensors, which we call Atmospheric Buoys, which would detect the toxic cloud early and send the data to the Climate Prediction System proposed by the NGO Arca Tierra, which would have the Planetary Simulator mode of use, which would perform the exact calculations of where the toxic cloud would spread, so that the same Atmospheric Buoys, or other drones or airplanes fly over certain strategic places, to spread ozone and if possible laser and UV rays, to eliminate toxic components from the air. This would have been very useful in the face of the terrorist attack suffered in mid-2020 in Beirut, where a large explosion spread a toxic ammonium cloud that polluted air and water in various countries in the region.

In this way, cities and towns would be protected from toxic clouds, in the Urban Vertical Gardens, food production would be protected and long-term processed food reserves would be safe. The water sources would have systems installed to purify the water, especially by laser beams and other water treatment systems, if necessary according to water analysis, additional ozonation mechanisms or other technologies would be applied to guarantee its quality.



In our city models we recommend the construction of large central geodesic domes, a city within the city, called the Earth Globe that covers less space than the total city, but due to its design, it can house all or almost all of the city population, according to the population density it would be necessary to determine the number of Earth Globe Cities to build. The Earth Globes would be built with the techniques explained to build the Urban Vertical Gardens, but these would be used for the purposes of food production, storage and protection in case of catastrophes, within which, food, water, warehouses and units will be available. family members, so that citizens are protected. They would be located in strategic places according to population density and the natural disaster risk atlas of the region. These will be very useful whether or not there are catastrophes, because they can be used for the purposes of food production, research, education, entertainment, cultural and sporting events, religious events, since each religion would have its assigned place, because they are the experts in

assistance. Humanitarianism and freedom of belief is a human right and in any eventuality, faith, hope and love are the three most important things to preserve and as we are souls in bodies, we must ensure the nutrition of both. In short, the refuge would guarantee the human and environmental rights of the refugees should it be necessary to stay in it for a long time.

In this way humanity would be safe in the face of these eventualities.

Section 3

System to Clean Plastic Continents, Atmosphere and Oceans

You will be guided in how to develop a system to clean the continents of plastic through collection and recycling, the creation of mangrove islands, for the purification of the atmosphere and the oceans and provide shelter for birds and marine species, which in turn Instead, the formation of tropical cyclones and hurricanes decreases, since they generate high pressure systems and these systems prevent the formation of these phenomena.

Class 11 Cleaning of Plastic Containers

You will know the current conditions of the oceans and the urgency of rescuing them from pollution, the measures to avoid plastic waste will be described, the most outstanding techniques of today to collect plastic from the oceans, how we can integrate and improve the current proposals to create a System of Cleaning of the Plastic Continents and their recycling, which allows the self-financing and maintenance of the project, for the continuous cleaning for the economic, social and environmental benefit of the surrounding populations.

Current Ocean Conditions

The oceans urgently need rescue for various reasons:

Acidification of the Oceans



Since the industrial era, CO₂ concentrations have increased the acidity of the oceans by 30%. CO₂ emissions maintain an equilibrium range of approximately 40% in the atmosphere and 60% in the oceans, considering that in 2019 we emitted 36,800 million tons of CO₂ per year, 0.6% more, with an upward trend, compared to other years, according to the Global Carbon Project, a collaborative project that monitors CO₂ emissions, 60% of those emissions went to the oceans and thus year after year, generating greater acidity in the marine environment, which leads to the weakening of coral reefs, phytoplankton, which is the base of the marine food chain, and a variety of shellfish and mollusks, in

short, it affects a series of metabolic processes of different organisms, from food even breathing, and even reproduction. In the event that high levels of ocean acidification prevail, the marine pH will continue to decrease, ocean ecosystems will be less productive with less diversity, therefore, it is predicted that by 2050 marine life and seabirds will disappear, which which affects the balance of the planet and the extinction of humanity's main source of proteins and medicines.

Increase in Temperatures



In turn, marine life is endangered by the increase in temperatures of the planet, since the oceans absorb 80% of the global temperature, which is causing many species to migrate towards the poles, altering the general migration patterns, they are disappearing the natural habitats of different species at the poles, such as walruses and seals. As the phytoplankton that produces the albedo effect disappears (projection without absorption of the solar rays by the surfaces), the decrease in temperatures of the earth's albedo disappears through its effects on the oceanic cloud cover, thus worsening even more the increase in temperatures of the planet.

The solution to high concentrations of CO₂ and increased temperatures in the oceans is the reduction of greenhouse gases, current regulations and measures have failed despite the decreases achieved by some nations, evidenced by the upward trend in emissions of carbon dioxide from 2019, the 2020 figures would not be considered since COVID-19 affected the normality of our activities. In order to achieve the effective reduction of CO₂ emissions, the NGO Arca Tierra proposes the management policy: Law to Improve Air Quality, which in synthesis raises a sustainable economy, where the supply and demand of goods, products and services is encouraged carbon neutral, you can see a summary on our website in the management policies section. There are nanomaterials that absorb CO₂ from the oceans, they

should be evaluated as contingency measures, not as the solution, before being used, their impact on marine life must be measured, one of these nanomaterials was developed by the University of California, they designed some micromotors capable of eliminating 88% of carbon dioxide present in seawater in about five minutes, they plan to use it in the future as part of a water treatment system, in a decarbonation plant, it is still in the development and research phase .

Plastics in the Oceans



And as if they weren't enough problems, we have thrown away tons of plastic into the oceans, which decompose into microplastics, these also cause the death of plankton, which produces oxygen, marine species and birds are trapped in the garbage. Photodegradable floating plastic debris turns into smaller pieces each time, concentrating at the top until it disintegrates into microplastics, which are ingested by marine organisms, thus completely entering the food chain. It has been proven that more than 1,300 marine species have been affected by plastic, one in three species of marine mammals are trapped in the garbage and eat microplastics, more than 230 marine species have microplastics in their stomachs, which also affects the human health when ingested, plastic can reach the bloodstream contaminating our organs. Scientific studies point to more than 200 commercial species of shellfish and fish in which pieces of plastic have been found, a third of the fish caught in the English Channel contain microplastics in the bloodstream. It is estimated that eating mussels in Europe is equivalent to ingesting 6,400 pieces of microplastics a year. According to figures from the United Nations (UN), plastic kills around one million seabirds and 100,000 marine mammals a year and will degrade by itself in 400 years.



Less than 10% of the plastic that is produced is recycled, every minute a plastic truck is dumped into the oceans, 8 million tons of plastic end up in the ocean annually. Once in the oceans they form large pools of condensed plastic or "gyres" that rotate uncontrollably and are mostly carried by ocean currents, ocean dynamics have transported plastic to the poles and uninhabited islands, but most are concentrated in the ocean gyres where plastic continents are formed. There are 5 oceanic gyres and therefore 5 continents of garbage, 80% is plastic, one is located in the Pacific Ocean, two in the Atlantic and one in the Indian Ocean; the largest of them is located in the North Pacific gyre, its size is estimated at 3.4 million km², which represents seven times the surface of Spain and can contain about 100 million tons of waste, among the main waste there are plastic bags, bottles and straws.

These debris not only remain on the surface, they also pollute the seabed, plastic particles were found 5,000 meters under the sea, in deep-sea sediments, even in the Mariana Trench, the deepest place on Earth, a 10 km below sea level, a plastic bag was found. It is estimated that 80% of garbage comes from land areas, mainly from China, Indonesia, the Philippines, Thailand, and Vietnam, these countries discharge more plastic waste to the sea than all other countries in the world combined and 20% from ships from the ocean, in 2019, new scientific studies indicated that Chinese cargo ships could be one of the largest contributors of ocean litter. Streams carry debris from the west coast of North America to the vortex in about 5 years and debris from the east coasts of Asia in a year or less.

Measures to Reduce Plastics in the Oceans

Faced with the emergence of plastics in the oceans, different efforts have come together to present solutions, from public and private sectors, governmental and non-governmental, among which the following stand out:

- The ban on the use of plastics: only a few dozen nations have banned the use of plastic bags and a few the use of plastic bottles. Some countries like Chile are banning single-use containers and cutlery in restaurants.
- Circular Plastic Process: there are efforts to reuse plastics so that they do not end up in landfills or in the oceans, such as the Global Commitment for the New Economy of Plastics adopted in 2018, of the initiative open to all interest groups, promoted by the Ellen MacArthur Foundation and UNEP. To date, more than 400 signatories have committed to the vision of a

circular economy for plastic through three actions: eliminate all products of this material that are problematic or unnecessary, innovate to ensure that the necessary ones can be reused, recycled or composted, and in any case look for ways to circulate them in the markets so that they do not end up as waste, many companies have dedicated themselves to innovating in this regard, such as the creation of the reusable packaging of the Finnish startup RePack, offers packages of materials Recycled products designed for online purchases, when they are purchased they receive a discount coupon for future purchases. Once the packaging is used, it can be doubled to the size of a letter and deposited in any mailbox so that it can be returned to RePack. Another example of a 100% recyclable container is the Red de Lanjarón bottle, made entirely with recycled PET. Straws, cutlery and biodegradable bags have also been devised to replace plastic. Since 2015, the European Union has implemented the strategy of a circular economy for plastic to integrate circular activities of design, use, reuse and recycling in the value chains of plastics, their goal for 2030 is that all plastic packaging marketed on the EU market are reusable or recyclable.



But, the truth is that this does not solve the problem at all, because plastic production is forecast to double in the next 20 years, the fossil fuel and petrochemical industries invest billions of dollars in new plants that are intended to manufacture millions of tons of new plastics, so the only possible solution is to replace plastic products with biodegradable products. Despite the enormous global concern about plastic in the oceans, government and private sector efforts, the demand for products derived from plastic is still very high with a tendency to continue increasing, the reason is that they are cheaper and more accessible, I know

restaurants very interested in the environment, but when they see the difference in the prices of plastic products versus biodegradable packaging and bags, they end up buying plastics. The way to equalize prices to even make biodegradable packaging cheaper is through the application of tax rates to plastic products and that biodegradable products are tax free. Until these taxes are established, a momentary contingency is that non-profit NGOs sell biodegradable products, to finance themselves and in turn benefit the companies that produce them and can approach or equalize the prices of biodegradable products to those made of plastic, through the tax benefits that Non-Governmental Organizations have in different countries, that is why the NGO Arca Tierra will sell these products. The balance of prices would increase demand, but the supply of biodegradable products must also be strengthened, very good substitutes for plastic packaging have been developed, but investment is needed in the research and development of biodegradable packaging and in the production of industrial scales, so other tax incentives and subsidies should also be created to industries and companies in the production and marketing chain for the transition from the manufacture and marketing of plastic products to biodegradable products. This at the beginning, until the manufacture and production of plastic products is prohibited within a reasonable period of time, until at the end after a process of transition from the oil, petrochemical and coal industries towards the production of clean energy products and that benefit the environment, would lead to a ban on oil extraction and the production of all its derived products. The transition of these industries would be very easy and more profitable, the profits of the oil industry are less and less, because the reserves are being depleted and

their extraction is more costly and harmful for the environment. For example, these industries with the facilities, machinery and available capital could be dedicated to the industrial production of graphene, the petrochemical industries to produce biodegradable packaging and bags, to the construction of water batteries, to produce solar energy, to extract CO₂ from the atmosphere. and the oceans and generate electricity The way to achieve this transition is described in our book Plan 1 The Climate, in the section Legislation for the Transition towards a Carbon Neutral and Sustainable Civilization and that in the next course will be explained.

Techniques for Cleaning Oceans and Coasts

So, replacing plastic with biodegradable materials is the solution to stop disposing of plastics into the oceans, but even if we stop throwing plastic, we already have millions of tons of plastic and microplastic in the oceans that will not degrade until 400 years have passed and It will kill marine organisms and seabirds in about 30 years. So we cannot wait for them to degrade, we must collect the garbage from the oceans and reuse it in such a way that it does not return to the sea.



There are several

proposals to collect garbage from plastic continents, until now the one preferred by specialists is that of the Dutch Ocean Cleanup Foundation, developed a solid waste collection system, designed by the young Boyan Slat, the project is focused on the installation of a series of fixed floating barriers and processing platforms, in the oceanic gyres where the garbage continents are accumulated, the barriers will act as a funnel, concentrating the waste and whose attraction process will be driven only by winds and currents marine. Avoid the capture of marine organisms, since no type of net is used for garbage collection. In addition, the floating barriers move with the rhythm of the waves, so the organisms will not be pushed onto the processing platform. The only limitation that the project presents is the collection of plastic particles smaller than 0.01 mm in diameter that are distributed in the depths. Once the garbage is collected, it will be distributed for recycling, which is successful in order to prevent it from returning to the sea and for the project to be financially sustainable. They monitor debris, winds and marine currents through satellite systems to establish collection strategies in each place, the collected debris is recycled and sold to finance the non-profit project.



Promoting the recycling of waste in the oceans is successful, the Adidas company in conjunction with the environmental organization Parley for the Oceans, assumed the challenge of using marine plastic waste as a raw material since 2015, they make clothes and footwear with threads and filaments made from plastic waste found in the sea and illegal fishing nets recovered from deep waters, from plastic waste intercepted on remote islands, beaches and coastal communities around the world; the plastic is recovered by Parley and her global network of activists. In this way, they have prevented more than 1,400 metric tons of plastic

from reaching the sea. Adidas is committed to replacing plastic in its materials and gradually banishing virgin polyester from its products (provided alternatives exist) by 2024. They eliminated the use of plastic bags from their stores, they stopped using plastic to manufacture microbeads. of their shower gels and banned the use of single-use plastics in all their offices around the world and educate to combat plastic pollution. Since 2017, they have carried out the annual race for the oceans, “Run For the Oceans”, so that through sport they raise awareness about the threat posed by plastic pollution of the oceans and inspire positive actions around the world, with each mile run by participants, adidas contributes one dollar to support Parley Ocean School's educational programs. The program prepares future generations to fight for healthier oceans and a cleaner planet. Educate young people about the importance of protecting the oceans, the threat posed by plastic litter, and the actions they can take to live in harmony with the environment around them.

This business vision is admirable, they are really thinking ahead. With this approach to sustainability, each company and consumer in the world must establish their present and future goals, so that the planet and humanity really have a future.

Therefore, the substitution of plastic for biodegradable products must be promoted, garbage collected from the oceans and coasts, so that they are reused in products that do not have the risk of being returned to the sea, although it is true that clothing, footwear, they are less likely to return to the sea, we must also consider other products, such as sculptures for public spaces, games for playgrounds, structures that are less likely to return to the sea, as well as for the production of graphene, if its production is carried out industrial as described in the previous section, it will be a product widely used to build sustainable and resistant buildings, it would even replace cement, a highly polluting product of the atmosphere and the oceans, it is considered one of the most harmful and used products on the planet , due to its high CO2 emissions and excessive consumption of drinking water. In short, we would have a way to collect solid waste of considerable size and reuse it. In our 2 Oceans and 5 Coasts plans we will develop other solutions in this regard.

Class 12. Mangrove Islands for the Purification of the Atmosphere and Oceans and the creation of Anticyclone Zones

You will learn how to replace ocean pollution systems with ocean and atmosphere decontamination systems, possible mechanisms to bury microplastics and how to avoid the formation of cyclones.

Mangrove Islands and Natural Anticyclone Barriers



Mangroves are excellent for decontamination of the air and the sea, they are very important to reduce greenhouse gases in the atmosphere of methane, nitrous oxide and CO₂, mangrove forests absorb 6% more CO₂ than any other forest and help to reduce the high concentrations of these and other pollutants in

the seas, such as heavy metals, mercury, pesticides, oils among others, and will help to bury the captured CO₂, the ones in charge in the oceans to bury the CO₂ is zooplankton, which make up the Biological carbon bomb, CO₂ is captured by the cytoplanton, which is eaten by the zooplanton and its feces settle in the water columns and go to the bottom, according to the Chilean oceanographer Humberto González, who directs a research related to the bomb. biological carbon that pumps CO₂ deep into the oceans in the carbon cycle; which is about to collapse due to the high levels of contamination explained above. So we must strengthen the biological CO₂ pump in the oceans to reduce acidification levels and the most effective way to achieve this is through mangrove barriers close to the coasts, at strategic points in the oceans, especially in the oceanic gyres or in its adjacencies, through which the marine currents circulate, in such a way that they are used for the mangroves to purify the oceans and the atmosphere. The high capacity to bury sediments of mangroves is very high, so to speak they are a powerful and natural CO₂ pump, which could help pump microplastics to the bottom of the oceans to accumulate them and facilitate their collection or keep them buried for 400 years, in which there is an alternative to remove them completely, but in this way they would no longer be affecting the food chain and annihilating marine species and birds, nor affecting human health. In turn, the mangroves would serve to protect birds and marine life by providing them with habitats and food. Of course, the location of mangrove forests should help the survival and rescue of coral reefs, that is, mangroves should not replace coral reefs, on the contrary, it would help them to recover by reducing the acidification of the oceans. In addition to reducing CO₂ and microplastics pollution, it would provide food and shelter for marine life and birds.



Mangroves generate high pressure systems, which is why they are well known as anticyclone and anti-tsunami barriers because they protect the coasts from the erosion of winds and floods, which is why they can be used to create effective natural anticyclone barriers for the protection of the coasts and decrease in air and ocean pollution. They are effective barriers because they create the main factors to reduce or divert cyclones and hurricanes, they generate high

pressure zones and their forests tend to absorb moisture from the air. According to the scientific journal Science, the protection they offer against storm surges has been evidenced in different latitudes of the world, for example, in the villages hidden behind the mangroves on the southeast coast of India were unharmed by the devastating tsunami of 2004, while other areas were completely devastated, as in Hurricane Katrina in New Orleans, damage was reduced in areas with mangrove forests. Global warming generates more extreme storms, which increases the need for protective mangroves, but they are disappearing at a dizzying speed, due to human intervention, more than 50% of these forests in the world have been reduced.

Stages for the Installation and Commissioning of Atmospheric and Ocean Purification Systems



In order to achieve the rescue of the oceans, we must plan the installation and start-up of the systems that will absorb pollution from the atmosphere and the oceans, this process will be carried out in different stages:

Stage 1 Classification of Critical Zones to Establish Atmospheric and Ocean Purification Systems.

In this stage we will dedicate ourselves to establishing the location of the systems, to selecting the ideal purification system to use according to the location, to selecting the mangrove planting and reforestation methods, to establish the way to collect waste in the oceans according to the area, establish the chain of commercialization of waste and its distribution to networks created for recycling, integrating, in addition to commercial activities, cultural activities, for the use of waste for works of art and entertainment. Once this is established, we can estimate the times for the subsequent stages and make a schedule of activities so that they can be carried out as soon as possible.

1.1 Selection of the Location of the Atmospheric and Ocean Purification Systems

Mangrove islands should be created in the oceanic gyres and mangrove barriers in the vicinity of the coasts that will act as anticyclone and purifying barriers of the atmosphere and the oceans. The latitudes of the strategic and critical points will be established, considering the marine circulation and the winds, in the locations of the plastic continents or in their adjacencies. Considering this, an international group of international experts must determine the exact locations for mangrove forests to more effectively fulfill the functions of:

- Purify the atmosphere and the oceans of greenhouse gases, heavy metals and mercury, which contribute in the best way to the biological CO₂ pump to reduce the levels of acidification in the oceans and accumulate or bury microplastics.

- Avoid or reduce the formation of typhoons, cyclones and hurricanes in the oceans and protect coasts from these atmospheric phenomena, since it is forecast for 2050 they will be 300% more powerful and recurrent and in the present without this power and recurrence they cause quite a lot of damage ecosystems and human settlements on the earth's surface.

- Rescue and conservation of birds and marine life, providing them with food and shelter through mangrove forests.

In our course number 2 Technological Innovations to Create the Tools to Save the Earth, we explained how to create an improved Climate Prediction System, which could be used in Planetary Simulator mode, to determine effective actions to solve climate change, in this activity It would be useful to simulate ocean currents, atmospheric circulation and greenhouse gas circulation to determine the ideal locations of mangrove forests and forecast their effects on the atmosphere and oceans, although these technological advances are not yet available. use currently accessible simulation methods.

In this way, we would have the locations of the mangrove islands, the natural purifiers of the atmosphere and the oceans, which will contribute to normalize the levels of carbon dioxide and oxygen in the atmosphere and in the oceans, to normalize the climate and the global temperature, saving birds and marine organisms and contributing to the survival of humanity, by guaranteeing its main source of proteins and medicines, as well as the containment of typhoons, cyclones and hurricanes.

Then, we would know where to place the mangrove islands, which will provide us with wind data for each location, the strength of the sea currents and the depth of the seas and oceans, in order to program the systems to be used for each location, establishing prudential times for all remaining stages of the project: waste collection, recycling, mangrove planting, installation of mangrove islands

1.2. Establishment of Atmospheric and Ocean Purification Systems to be Used According to Selected Locations

According to the depth characteristics of the oceans, winds and marine currents, the ideal system will be selected, below are some suggestions to be taken into account, which can be combined or improved according to the environmental conditions of the selected geographical locations.

1.2.1. In Shallow Areas

In



the coasts or shallow waters, the creation of mangrove islands as coastal protective barriers would be facilitated at a reasonable distance to protect from tsunamis and avoid the proximity or the passage of typhoons, cyclones and hurricanes to land, the ideal technique to do so now exists, we have the TetraPots, designed by Sheng-Hung Lee, winner of multiple awards and recognitions for the genius and functionality of his invention, the TetraPOT is a sustainable maritime defense system made of concrete, organic materials and mangroves. Comes with mangrove seeds in a decomposable pot. TetraPOTs randomly distributed along the shores will eventually interlock to create a durable maritime defense of growing trees and roots that help keep the blocks in place. As the plants grow upside down from TetraPOT, the roots will entwine and gradually become a natural defense of the sea. The shape and location will allow the TetraPOTs to interlock with each other and form a structured network. Not only does the design prevent soil erosion, it also helps protect and create a natural habitat. It is not only a defense, but also an ecosystem. A home for other lives.

Due to the urgency of the availability of biological CO₂ pumps, it is important to consider that, instead of seeds, mangroves should be placed with a prudential size for their optimal growth and adaptation to the TetraPot, there are various foundations and government efforts for the reforestation of mangroves, which grow mangroves in hatcheries, Vertical Gardens, explained in section 2, could assist the rapid and healthy growth of mangroves on a large scale.

1.2.2 In Deep Water

TetraPots have also been considered to be established in deep waters, they would increase their size according to the depth, their geometric shape guarantees a lot of stability despite the intensity of the marine currents and winds, it would only be necessary to guarantee that the roots of the mangrove reach up to the background.

Mangroves sink their roots in semi-liquid mud or soft sand, their roots are robust and intertwine creating systems that provide them with a lot of resistance and stability, which are

buried in the depths for several meters, they would have to be established exactly, depending on the species or selected mangrove species. In addition to having a branching root system in the mud, you can have stilt roots, which grow above the surface to further strengthen your rooting system. Its stems can reach three to four meters in height, although sometimes it reaches 15 meters or more and its branches can reach up to 30 meters in height, considering this according to the mangrove species and the characteristics of the location, the TetraPot would be designed, to provide strength and stability. In case the roots do not reach the desired depth, it would be necessary to make adjustments to the TetraPot, to combine the natural root of the mangrove with artificial roots that would consist of hoses from a pumping system, to pump CO₂ and microplastics to the depths or to a plant treatment.

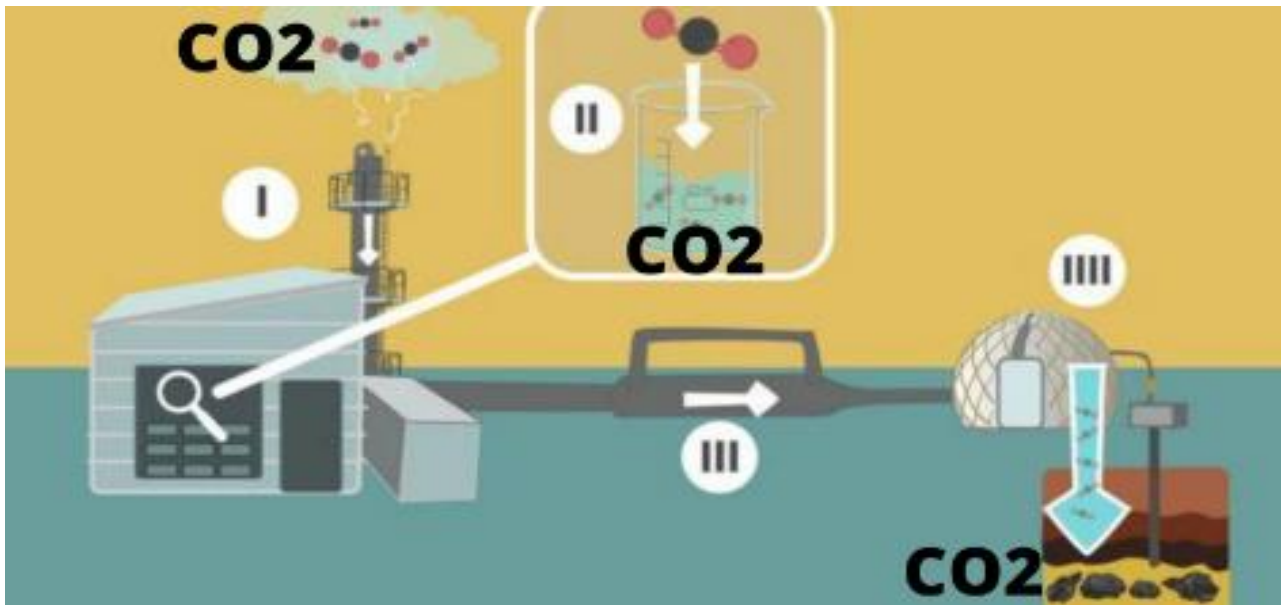


This is possible, if there is enough engineering to pump fluids and extract oil from the depths of the most inaccessible oceans on the planet, you can also apply engineering for the pumping of CO₂ to save marine life and humanity. Through systems of hoses and pipes in mud, the pumping of CO₂ to the depths would be assisted, to solidify them in volcanic rocks and generate electricity in the process, as we observed in section 2, the Hellisheidi geothermal power station in Iceland performs it, it traps CO₂ from the atmosphere and then pumps it with water, to solidify carbon dioxide into volcanic rocks, rocks that can remain in the depths as part of the carbon cycle or be mined for graphene

production. This would be an option for use for offshore oil platforms to transition to clean energy generation, while reducing ocean acidification. For this reason, I confirm that it would be very easy for the oil industry to make a transition towards more sustainable economic activities, which instead of harming the environment, rescue it with their facilities and experience.

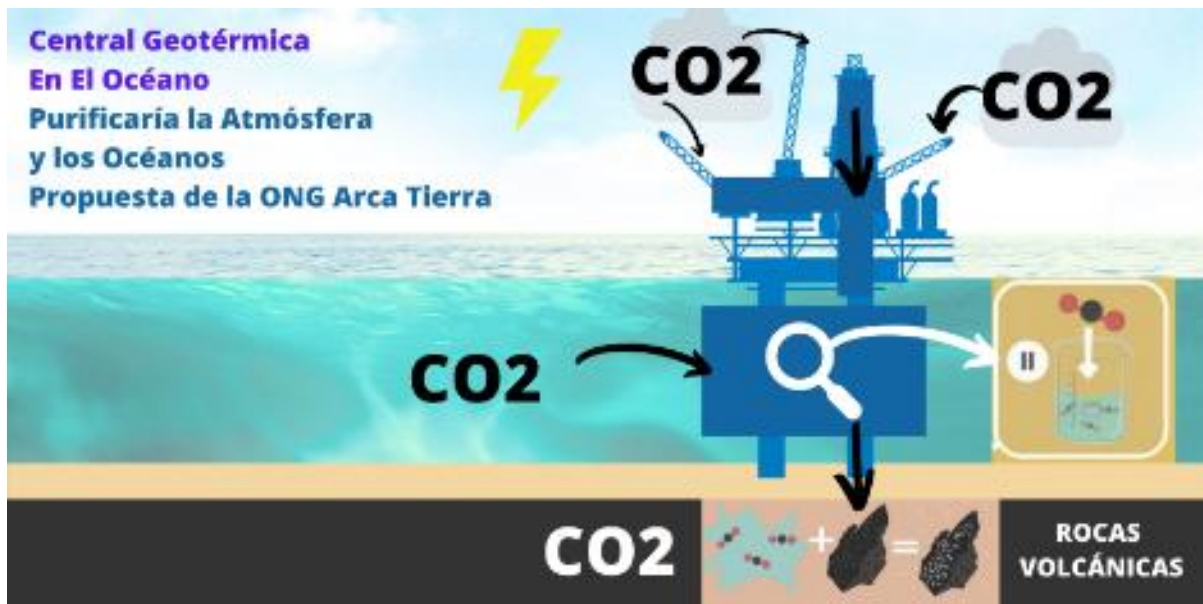
In the depths, the TetraPot would serve as a habitat for marine species, we observed how sunken ships harbor a large amount of marine life, reefs and corals, because they provide protection from ocean currents and predators. Therefore, it should be used so that in addition to planting mangroves, in their lower part they harbor algae and corals, so that the natural pumping of CO₂ is re-established.

1.2.3. In Extremely Deep Waters



The only possible option would be the pumping of CO₂ from the atmosphere and the oceans into the depths, an activity that can be carried out while generating energy. So far, the best, most effective and fastest method is carried out by the CarbFix project, led by an international consortium of researchers, with the Reykjavik energy company, the French National Center for Scientific Research, the University of Iceland and the University of Columbia and New York, in addition to funding from the European Union, have created the Hellisheidi Geothermal Power Plant in Iceland, a country where 100% of its energy comes from renewable sources. The mechanism for the capture and storage of carbon "(CCS, for its acronym in English) of the Geothermal Power Plant consists, according to its administrator Edda Sir Aradóttir, in capturing CO₂ from the air, which travels as vapor in the atmosphere, then dissolves it in large volumes of water, through a machine that is similar to a soda machine, it works exactly like the one used to add bubbles to water and make soft drinks, then the effervescent liquid is sent through a network of pipes to the injection site and from there it is pumped at high pressure up to a thousand meters below the ground, it comes into contact with the basalt volcanic rock and chemical reactions make the CO₂ mineralize, the resulting carbonate lodges in its pores, until it solidifies, in a matter of months; the conversion is carried out by the basalt base, which contains high levels of calcium, magnesium and iron, which help the injected CO₂ to solidify in rock, therefore, the CO₂ will not return to the atmosphere in at least about two million years. Geologist Sandra Snaebjörnsdóttir explains that basalt is a very common rock in Iceland, it is rich in young basalt that acts like a sponge to absorb carbonate. Therefore, consider that where there is water and basalt this model could be applied. Basalt is present in only 10% of the earth's surface, but much of the ocean floor contains it, which is why this rock is so abundant on the planet as to be able to store a large part of CO₂ emissions.

However, the vast CO₂ emissions make the benefits of this geothermal plant imperceptible, which began to operate since 2014, in that first year, CarbFix processed 250 tons of harmful gases. Since then, the amount of CO₂ it is able to digest has steadily increased, reaching 10,000 tons in 2017 and they plan to continue scaling the amounts. Compared to CO₂ emissions, it is a negligible amount, it is the absorption of the annual emissions of only about 2,200 cars, which shows that more of these geothermal plants would be needed.



Therefore, this process must be adjusted to absorb CO₂ from the air and the oceans to assist nature in absorbing CO₂ and at the same time generate renewable energies, which would serve to supply electricity to surrounding regions, to workstations for the collection of garbage in the oceans and installation of mangrove islands, supplying electricity to electric boats and even to supply electricity to submarine trains traveling through submarine bridges, to underwater cities, and to Japan has progress in this regard and the NGO Arca Tierra will make progress in its Plan 2 Oceans, these developments are important because global warming is raising the sea level, at present many coastal cities are already losing territory and by 2,050 some 150 million people will be displaced, according to a study For Climate Central, a New Jersey-based scientific organization, 110 million people already live in places that are below the high tide line, research shows that countries should start preparing now for more citizens to relocate and even if we solve climate change, Earth's geological cycles demand us to think about underwater cities for the future , the movement of tectonic plates and rotation, move the continents, geologists are able to measure the speed of the displacement of the continents from space using high precision GPS systems, with antennas located in very stable terrain, this supposes a variation in the availability of land area for human settlement and ecosystems.

It should be noted that any building built in the ocean must ensure the reduction of environmental impact, that is, that it is of greater benefit to the environment in proportion to the impact it causes. For example, it must be ensured that buildings do not interfere with the migratory routes of marine species, that these facilities instead of harming them help them to survive on their journey, with centers for the attention of marine life, if the seabed is affected should ensure its recovery, if a geothermal power plant affects a kilometer of the oceans, it must be ensured that hundreds or thousands of kilometers of the oceans will benefit and that marine life will also receive benefits, with its processes of purification of the atmosphere and the oceans of CO₂. If there is a reef, which are in danger of extinction, of course a geothermal would not be built on it, these constructions must ensure a socio-economic and environmental balance that benefits the region.

1.2.4. Floating Purifiers



Both in very deep places and in not so deep waters, where the sea beds must be protected, floating mechanisms must be used to extract CO₂ and other pollutants from the oceans, for this we have several options, among which floating microalgae solar panels stand out, to help purify the oceans, since the algae in the oceans cannot cope with the high levels of acidification. In different parts of the world, floating solar plants are being built, although large systems on the sea are not yet carried out, in Holland it is being developed, Zon-op-Zee, which translates as 'The sun in the sea', they represent a 15% improvement compared to those located on land.

These floating solar plants would increase their performance and collaborate even more with the environment if they integrated microalgae. Another option is floating islands of plants capable of surviving in the oceans and helping to absorb CO₂ from the oceans, which can be assisted with the technologies observed in section 2 of this course.

Then with these techniques the oceans can be purified, the ideal technique or techniques to be used should be established according to the location established in step 1.1 Selection of the Location of the Mangrove Islands for the installation of the ocean purification system to be used.

1.3. Select Methods of Mangrove Planting and Mangrove Forest Reforestation

Given the importance of mangroves, considered a key factor in solving climate change and the fact that they are disappearing, FAO has highlighted their importance for the environment, to generate sources of food and economic activities that produce many benefits to Nearby communities, different foundations and governments have taken on the task of recovering them, among which the NGOs Seacology and Wetlands International stand out, which involve governments and communities by generating jobs for them and granting them microcredits for the recovery of mangrove forests. This has been done successfully with the Sri Lankan government.



The method consists of planting mangroves first in nurseries, so that they are later reforested in areas that favor their growth and development. In the large-scale production of mangrove shoots, the Vertical Gardens explained in section 2 of this textbook would be very useful for their rapid germination, growth and development, for reforestation on the coasts and for the supply of suitable mangrove species. according to the geographic location of the islands and mangrove barriers to be used as the main air and ocean purification systems.

Other initiatives to rescue mangroves is the Blue Carbon Project or also called Blue Forests, it is promoted by the United Nations Environment Program (UNEP), with the support of the Global Environment Facility (GEF), GRID Arendal, Blue Ventures, along with eight partner countries; The Dominican Republic, Ecuador, Kenya, Indonesia, Madagascar, Mozambique, the United Arab Emirates and the United States, in alliance with local institutions and foundations, aims to retain carbon, combat climate change, promote conservation and provide sustainable livelihoods. , the rescue of mangrove forests will help meet the objectives of the Paris Agreement.



"Mangroves and other blue carbon ecosystems, such as seagrasses and salt marshes, are incredibly efficient at storing carbon," says Isabelle Vanderbeck, an international water expert at the United Nations Environment Program (UNEP).

Its system consists of carbon financing based on mangroves, using carbon credits to support communities to conserve and restore mangroves, the project profits obtained from the sale of blue carbon, are also used to support activities of community development, such as the construction of fresh water wells, improvement of schools, that is, projects to improve the quality of life in the regions. They have managed to recover more than 1,500 hectares of mangroves.

There is a wide variety of species to choose from, depending on the environmental conditions where they will be established, the red mangrove stands out for its high resistance to salt water and to be located in deeper areas than the rest. In this activity, the mangrove species to be used in each zone should be selected, along with other species of vegetation, such as marine grasses and marshes, as well as the sowing and reforestation methods, considering the successful actions mentioned. Of course, it must be ensured that the nurseries and vertical gardens are located as close as possible to the areas where islands and mangrove barriers will be created, generating socio-economic and environmental development for the regions.

1.4. Establish the System to Collect Waste from the Oceans and Coasts according to the Area

Methods for collecting waste will vary depending on the area where it will be collected. In the oceans we have observed that the ingenious proposal of Ocean Cleanup would be very functional, but it could also be combined with other proposals to help the waste collection process, since it would take time to clean the largest plastic continent, located in the Pacific 20 years, that if we stop dumping waste into the oceans, that is until 2040, until then we would not know that marine species still survive.



Rueda Solar

The Ocean Cleanup process, at the time of collecting the waste, for the transfer to boats, could be streamlined by The Inner Harbor Water Wheel, "The Inner Harbor Water Wheel" is a giant wheel that lifts the garbage from the water thanks to energy solar or running water. Subsequently, this garbage goes to a conveyor belt to end up in a large garbage dump. When the container is full, the garbage is towed to a ship and a new container is put in. So far it is only installed at the mouth of a river in Maryland, but experts say that it is one of the best ways that have been proposed so far for cleaning the sea, due to its low cost and its great capacity to process garbage. 25 tons per day. Therefore, it would be necessary to consider the possibility of adjusting the water wheel so that it works in the oceans, if possible increase its capacity in relation to the amount and time to process garbage and thus more quickly and economically transfer the waste.



Clean-up work must be carried out on the coasts, so that garbage does not return to the oceans, various non-governmental organizations around the world have dedicated themselves to this work through the volunteerism and innovation of Australian surfers, Andrew Turton and Peter Ceglinski created the Seabin Project, which easily collects litter from the shores in a floating garbage can that sucks up debris, which can collect large amounts of plastic bottles, paper, oil, detergent, and even fuel that it is found in our seas. By absorbing the debris on the surface, it accumulates it inside the bucket. Once inside they are filtered and a pump returns the clean water to the sea. It is functional in bays,

fjords, boats or tourist places. It is a very cheap and comfortable alternative for cleaning the sea, compared to cleaning boats, which can continue to be used if the means are available. On the coasts and bays the Seabin and the Solar Wheel would be useful.

It should be noted that the different NGOs observed that help to clean the coasts, carry out a successful action, the integration of athletes from the sea, integrating them to be part of the collection and to motivate others to participate in cleaning the beaches, also they integrate athletes on land, as does the Adidas company with its marathon for plastic-free oceans. Another successful action is the creation of a network for the collection and processing of collected waste, so that it can be marketed and reused. Education is also an important part of the campaigns to clean up our coasts and oceans, the Parley For The Oceans Foundation in addition to its work of collecting waste and creating networks to produce threads of waste, with the support of Adidas, have Parley Ocean School. They educate for healthier oceans and a cleaner planet, highlight the importance of protecting the oceans, the threat posed by plastic garbage and the actions they can take to live in harmony with the environment that surrounds them.

These successful actions must be continued and reinforced, that is to say continuously improved, one of the ways to do it is by integrating athletes, public and private organizations and foundations to educate the young and adult community, mainly those responsible for making purchases in the companies and homes, to avoid the consumption of plastics and that they do not pollute the coasts, to promote legislation that protects the oceans from pollution, such as legislation that prevents and sanctions waste from boats and other industries that They make life in the sea and prevent them from harming marine life, because so many efforts would be useless if we continued polluting, destroying reefs, killing whales, which absorb large amounts of CO₂, we would continue to make the survival of marine ecosystems impossible. For this reason, the garbage collection processes must be accompanied by the monitoring of garbage on the coasts and in the oceans, Ocean Cleanup, relies on satellite systems, which is very useful, but monitoring must be strengthened and improved to guarantee that the laws that protect the oceans are complied with, or we will continue to leave all the work to the exhausted Green Peace, who with their two vessels try to save all the marine species in the world, risking their lives with pirates and hunters of whales.



Therefore, the NGO Arca Tierra in its online course number two, Technological Innovations to Create the Tools to Save the Earth explains how to improve drones to be used as ground sensors, atmospheric buoys, with established routes that would fly over the oceans and serve to the surveillance and conservation of habitats and marine species.

1.5 Establish Marketing Channels for Waste and its Distribution to Networks Created for Recycling

Marketing channels for the waste collected in the oceans should be created for each plastic continent that will be collected simultaneously, according to its geographical location. First, considering the existing recycling industries in the region and their installed capacity for waste processing, to establish the tons of waste from the oceans that would have safe buyers and at what price per ton. Create new industries, large, small and medium-sized companies to recycle waste to manufacture products that are highly unlikely to return to the sea.

Textiles and fashion are a good option, various dressmaker artists have become aware and have created various dresses, accessories, footwear, watches, bags ... To be part of the plastics recycling solution, so they can also get involved with fashion artists.

Modistas y Costureras por el Reciclaje, organizaciones en Chile y en todo el mundo



Vestido hecho con bolsas de basura



Moda de la Diseñadora Elena Funes de Adra, una localidad costera situada en medio del conocido como "mar de plástico"



Francisca Sánchez, diseñadora gráfica junto a Pía Aspillaga, diseñadora de vestuario diseñan productos altamente innovadores y comprometidos con el medio ambiente.



Zoe Company jeans desarrollados con polietileno tereftalato presente en los envases plásticos (PET). De Medellín Colombia "El Huevo"



Accesorios con plástico reciclado

In the textile industry there are many variations of products that can be produced for plastic recycling, so all options should be considered in this area.



Alfombras con Plástico Reciclado



Equipos como Brasil, Portugal, Holanda y Estados Unidos en el mundial de Sudáfrica 2010 fueron fabricadas por Nike a partir de poliéster reciclado de botellas usadas.



PET reciclado para la fabricación de fibra textil poliéster



Chaquetas con forro polar, material cálido, ligero y económico con PET reciclado



Luego de sismo en México ECOCE y la empresa Morphoplast hicieron alianza para fabricar cobijas con material reciclado



Tela para Muebles. Ecosofá creado por estudiantes del Instituto Politécnico Nacional de México a partir de botellas de PET, cartón, tela, esponja y plástico duro.

No plastic straws, bags or bottles would be manufactured since they are the main waste that goes to the oceans. If the graphene factories described in section 2 are created, it would be very appropriate to sell the waste to them, because it would guarantee that they would not return to the sea, since the graphene would be used mainly to build buildings and solar panels.

In the same way, waste can be reused, also integrating cultural activities, for the creation of works of art, such as large sculptures that will remain on land as a reminder of our triumphs in cleaning the oceans and to create awareness to stop pollution. Many artists and cultural institutions have devoted themselves to carrying out this very successful and admirable activity around the world. They could also be used for entertainment, for the manufacture of benches, tables and playgrounds for parks, furniture for homes and industries ... An example of this is the project called "Print Your City", born of collaboration between New Raw and Coca-Cola to create Zero Waste Lab in charge of this project, they use plastic waste to turn it into urban furniture through 3D printing. The Greeks Panos Sakkas and Foteini Setaki, founders of New Raw, created the Print Your City website, any citizen of Thessaloniki can design new furniture for their neighborhood. First of all, you must choose the area of the city in which you live; then you can choose the object type, shape and color. Once these steps have been carried out, you will be able to observe the final design and the kilograms of plastic necessary to create the object, these will be displayed in parks



Proyecto Imprime Tu Ciudad Grecia, Muebles Urbanos de Plástico Reciclado



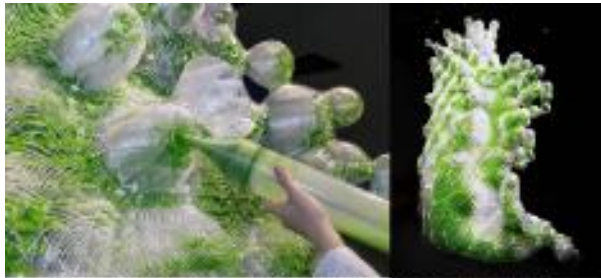
Parque flotante elaborado de plásticos recogidos del agua Holanda, para el esparcimiento y purifica agua. Arquitecto Ramon Knoester



Estados Unidos y España es la fabricación de suelos para parques infantiles, generalmente compuestos por hule de llantas. Son utilizados también en pistas para correr o canchas deportivas.

In buildings, several proposals have arisen to create coatings from 3D printing with recycled plastics and microalgae, integrating these materials such as skin or the covering of buildings, due to, as explained before, these can generate oxygen, energy and reusable compost for many industrial uses, including the manufacture of graphene. Claudia Pasquero and Marco Poletto, created In Humans Gardens, (Human Gardens), two living sculptures printed in 3D, to create a proximity to bioartificial intelligence, with living organisms, more specifically with colonies of photosynthetic cyanobacteria, H.O.R.T.T.U.S. XL Astaxanthin.g, and an Asian tarantula collective, XenoDerma, to study biological models of endosymbiosis, these structures are algorithmically designed and produced using large-scale high-resolution 3D printing technology, a trend of creating living architectures, thick generation leathers of biophilic architecture receptive to urban life. Another example that should be taken into account is the SmartCity Project, for the capital of France by 2050, green buildings that are inspired by honeycombs and bamboo flora, trap smog and produce biofuel and their own energy. They are

similar to Urban Vertical Gardens, because they can be used both for urban agriculture and for homes. The Smart City towers could be manufactured with recycled plastic and microalgae, although of course the ideal is to be printed with the technology of the Urban Vertical Gardens explained in Section 2, with modular graphene triangles and microalgae solutions.



Claudia Pasquero y Marco Poletto, crearon In Humans Gardens, (Jardines Humanos)



Smart City La Ciudad Verde, Proyecto de Francia para el 2050

Istituto Europeo di Design (IED) Madrid Ciudad en Marte

The Istituto Europeo di Design (IED) Madrid, led by Manuel Monterresís, has made a similar approach to build a city on Mars, the work baptized as Algi, won the HP contest in collaboration with NASA so that a million human beings inhabit the planet. They designed a dome composed of a microalgae facade, selected for their already mentioned properties. They plan to use plastic recovered from the oceans, to transport them to Mars and to be able to use their filaments to print these facades, to which they would integrate microalgae, according to Lucía de Anco, a graduate in Interior Design and a participant in the project. The microalgae would also serve for food, although they added another biological factor to the building, the bees, they are one of the few animals that would resist space travel and their honeycombs have the essential nutrients for humans to survive. Through tubes arranged throughout the city, they would move through the areas reserved for them. Then the city would have water, microalgae and honey available to cover the basic diet of its inhabitants. This seems very ingenious to me, what I would not agree on is that the structures on other planets are made of plastic, because they must have high resistance, the material should be graphene and the way to build them would be through 4D printers to self-assemble and self-repair. The NGO Arca Tierra differs from launching ourselves to live on Mars if we have not even managed to inhabit the moon, so we propose to first establish a lunar base, described in our Plan 21 Moon. Returning to Earth, because before inhabiting the moon we must learn to live in a sustainable way on our planet, which despite global warming has abundant resources; I think this proposal is very valuable for our planet, for places where extreme climates make life unviable, for this use I would recommend recycling plastic for architecture.

In short, there are many possibilities for the reuse and commercialization of the plastic that is collected in the oceans, which will generate sources of employment and socio-

economic and environmental development, once this is established we can estimate the income that will be obtained from the commercialization of waste for the financing of the project to clean the oceans, which together with the investment in the generation of clean energy in the oceans could be a self-sustaining project.

So many options to reuse plastics, you should not assume that plastics manufacturing will continue, as mentioned above there are several options to make plastic substitutes and get rid of that problem forever. Through the 3 sections of this book, we have observed the use of microalgae, its wide use implies great availability of its compost, compost that, in addition to being useful for the production of graphene, is very useful for the manufacture of substitute products for plastics. Among many projects, the Green Carbon technology project of the Technical University of Munich (TUM, for its acronym in German) is exploring this possibility, to manufacture plastic substitutes through microalgae compost, even for manufacture bioplastic bags. They develop polymers and lightweight carbon-based building materials that use algae as the main element. One of their techniques is to use yeasts capable of generating oils from biomass, to be the basis for new plastics. Another technique is to use enzymes to break this oil down into glycerin and free fatty acids. The first is one of the materials used to manufacture carbon fiber, the second can be used as precursors of high-quality additives for lubricants. They intend through these techniques to develop new materials for the aeronautical, automobile and cosmetic industries. Algae are also considered to replace palm oil, which is harmful to health and the environment, scientists from Abu Dhabi consider the *Chloridium* microalgae capable of replacing it, it grows in both fresh and salt water and produces oils in its metabolic processes, algae that grows in abundance in the United Arab Emirates. The British company Ecover launched the first detergent without palm oil, also based on algae oil, although they resorted to genetic modification. In short, if all the buildings in all the cities use microalgae, we will have many uses for compost, to make human activities more and more sustainable. Petrochemicals and plastic-related industries should begin to invest and make the transition towards the production of these ecologically sustainable materials, which are the materials of the future, if we have a future, if we can evolve towards sustainable development with equal human rights and environmental, we rescue and conserve our natural resources for the solution of global warming, among which the oceans and mangrove forests play a very important role in the survival of the planet and humanity.

1.5 Establish Times for Subsequent Stages

Then, once the locations and the different procedures have been established, a schedule of activities can be made to be carried out as soon as possible. A step-by-step project must be carried out for the cleaning and installation of purification systems of the atmosphere and oceans for each plastic continent, these 5 projects would be carried out simultaneously, each project will consist mainly of the following subsequent stages:

Stage 2 Garbage collection, starting at the established locations where the Atmospheric and Ocean Purification Systems will be established, starting in the most critical areas that will create a beneficial impact for the rescue of the oceans. This stage will continue until the complete cleaning of the plastic containers.

Stage 3 Establish a protective barrier so that debris does not reach the areas that have been cleaned, such as those used by Ocean Cleanup.

Stage 4 Preparation of the Atmospheric and Ocean Purification System, such as, design, manufacture of components, prepare in such a way that in the oceans they are quickly

assembled and installed. In the case of islands and mangrove barriers, large-scale planting with the methods described above should be foreseen.

Stage 5 Installation of the ideal Atmospheric and Ocean Purification System in the cleaned and protected area, it should be noted that priority will be given to the use of mangroves due to their proven effectiveness in purification.

Stage 6 Marketing and Recycling to produce products, works of art and buildings that do not return to the sea.

Stage 7 Dissemination of the activities and achievements of the 5 Ocean Cleaning Projects, zoned according to their proximity to the plastic continents, which will mainly be in charge of dissemination will be the journalists ', media and filmmakers' colleges, will promote educational and motivational activities through art and sport and will integrate institutions and companies from different fields to participate in campaigns, such as tourism, so that they are part of the movement and pollution caused by tourists is avoided.



These will be the main actions to be carried out divided into stages, a schedule must be established that saves time and resources, which are carried out effectively and simultaneously, in such a way that in the short, medium and long term results are obtained, in a beneficial impact For the enviroment. Aimed at achieving the goal of waste-free continents with appropriate CO2 levels in a decade, as a maximum cap. The way to finance these projects could be investment, job creation, business creation, electricity generation, commercialization of the waste extracted from the oceans, funds directed to solve global warming and the systems used in the Blue Forest Projects.

Class 13. How can you help the development and implementation of this system and make it available to everyone



In carrying out the stages, organization is needed, people assigned to direct each stage, our organizational model of the Department of Natural Resources expresses the way to integrate and coordinate all governmental and non-governmental efforts and civil society in In general, this model is explained in a general way in our course number 1 The First Steps to Solve Climate Change and in detail in our book Plan 1 The Climate. It is important to designate responsibilities and act together as a team to save the oceans. This is possible, when international cooperation has been needed, even between sectors and nations that disagree with each other, it has been achieved, such as the event that occurred in the late 80's that inspired the movie The Great Miracle, Big Miracle, the rescue of 3 whales that were trapped by ice formation in the Arctic Circle, outside an extreme town in Alaska. For this rescue, NGOs, Green Peace, an organization that mainly promoted the rescue, were integrated, work that gained strength by journalists and the media, they worked with the cooperation of their "arch enemies" the oil companies, governments faced at the end of the war Colds cooperated, joined locals, scientists and international unions who kept the whales alive until their rescue, for which millions and millions of dollars were spent. If we could do this to save 3 whales, what can't we do to rescue all the whales and marine species?



We observe how serious the oceans are because of us and only because of us will they recover, because the levels of pollution and CO2 exceed the capacity of nature to rebuild itself. The way to achieve this is first of all to assume responsibility, each nation must assume it, their waste is in one of the plastic continents or in all, depending on the geographical location, international and intercontinental work teams would be created led by their continental organizations or a transparent entity and competent authority of the United Nations accompanied by the Intergovernmental Panel on Climate Change IPCC. These teams would include public and private organizations, related government entities, especially fleets of naval and air forces that are at the service of rescuing the oceans, of each country according to its sovereignty over the seabed, if cooperation from another is needed. Country or countries must do so by established treaties, for which UN blue or green helmets could also be created to operate in the face of natural disasters and environmental recovery. Private companies that make life in the sea, such as the fishing industries, tourism, oil, industries dedicated to recycling and production of products that can reuse plastics and other waste extracted from the oceans, to Non-Governmental Organizations related to the stages of the projects, the NGO Arca Tierra will be ready to collaborate, with civil society residing near the plastic continents to help collect, prepare and install purification systems for the atmosphere and oceans, and in cities to promote the reuse of collected waste, Professional Guilds and Universities to bring together researchers, related scientists, naval engineers, marine biologists, botanists, industrial engineers ... Religions with their volunteers could also help the activity, artists for design and creation of sculptures built with waste, dressmakers, interior and exterior designers, college of periodistas, mass media, artists of the television and cinema, athletes in general to motivate the activity at a global level until the last plastic is removed from the oceans. In this way, multidisciplinary teams would be created for each plastic continent, from each sector they will appoint a representative who will make up the board of directors, who will plan the project, the schedules and direct the execution. The Teams of each plastic continent must coordinate, to share successful actions and correct mistakes, to cooperate with each other.

It is recommended if our proposal will be used, with the same or similar Ocean Clean Up collection mechanism or the TetraPots systems and all the other processes

recommended here carried out by other companies and NGOs, an advisory team should be formed to assist each team of the plastic continents. Each Continental Team will keep records and statistics of the activities carried out, documenting the activities and achievements achieved by film and television media, to keep the world involved in rescuing the oceans and games could be established between the teams to motivate the achievement of quotas. or monthly or quarterly goals, in this way we would achieve it, all assuming responsibility in the game of rescuing the oceans.

You can help make this a reality, helping to spread this proposal in all the aforementioned fields, until it becomes a reality before marine life becomes extinct, that is, you have to start NOW! Support us! Write to us ongarcatierra@gmail.com