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MESSAGE FROM THE PRESIDENT

2019 was a year in which the consequences of climate change, air pollution and overall deterioration of our national and global natural resources were made even more evident. In view of this reality, in the Mario Molina Center (MMC) we continued working optimistically in favor of: recuperating environmental resources, the efficient use of energy, adopting urgent measures to mitigate climate change, contributing to strengthen public policies which allow improving air quality, and building and transforming sustainable cities.

We evaluated strategies and technologies to carry out efficient and low carbon development in Mexico, especially in the national electric industry. We created partnerships with different states in order to carry out local monitoring of public transport, urbanization and air quality, which will thus translate into more efficient and free flowing, better planned, and less polluted cities.

In the Center, with great responsibility and commitment, we focused on environmental and climate change education. 2019 was a particularly productive year for carrying out activities with teachers and students, with who we worked in person and virtually to transform the way students learn, so they understand and develop abilities to garner knowledge. Also, we strived to endow teachers with tools to improve teaching experimental sciences by applying the pedagogical inquiry model.

Children and youths are attentive with greater openness and receptivity to the new concepts and environmental challenges we face, as well as to the collective global action required to rectify and remedy the current path we are in. The future of the planet depends on the immediate actions that society undertakes and on the consciousness that we embed on new generations to respect our planet.
We still have time to act and put in place national and international policies to combat climate change, for which economic and social adjustments will be necessary to give way to an improvement in global well-being. It’s important that governments, academia, businesses, international organizations, social institutions, civil society and each one of us unite forces within our individual and collective scopes of action in favor of the environment.

On our part, the Mario Molina Center will continue to work on finding practical solutions on energy and the environment to promote vigorous sustainable development, while generating consensus amongst different sectors of society to allow instrumenting our proposals.
During 2019 we carried out workshops to strengthen knowledge dissemination and good practices regarding air quality, mobility and education in Mexico, financed by the French Development Agency in Mexico.

The first one, “The role of big data in favor of sustainable mobility”, took place in March in Mexico City with the intention of giving examples of Information and Communications Technology usage to optimize mobility in cities, reduce congestion and pollutant emissions.

Three working tables were set up, focused on distinct problematics to be solved regarding mobility in cities, with the intention of proposing priority projects and their respective action plans to guarantee their implementation.

The second workshop, “Measuring air quality in complex urban systems: the challenge and opportunities of new available technologies” was carried out in March to explore different methodologies and methods of operation and management of air quality monitoring networks and to share experiences in order to broaden and improve monitoring networks in our country.

On January we participated in the presentation of the “2018 Sustainable Cities Index”; an analysis by Citibanamex of sustainable development for metropolitan areas in Mexico on their way to 2030, in partnership with the National Laboratory for Public Policy of the Center for Economic Research and Teaching (CIDE), and the Mexican Institute for Competitiveness (IMCO).

The study measures the advancement of metropolitan areas in Mexico in complying with the 17 Sustainable Development Goals which make-up the 2030 Agenda of the United Nations.
There were three analysis groups: the first one on “Methods and practices for operating and managing monitoring networks” focused on exploring the distinct alternatives which exist in the world to operate and finance conventional air quality networks. In the group “How to integrate new technologies for collecting and analyzing data for air quality management in cities”, we analyzed synergies and significant improvements in monitoring coverage which may arise from the use of new technologies. Finally, in the group “Network operating proposal for monitoring networks in Mexican urban areas integrating data gathering technologies”, we evaluated the viability of using low cost sensors to allow assessing mobility of people with regards to air pollution.

In April we carried out the third workshop of this series, entitled “Transforming science education” in collaboration with the Ministry of Public Education, the National College, and the French Development Agency.

Teaching science is a basic component to create citizens who better understand and who participate further in solving the problems of the world in which we live in. With this in mind, during the event several conferences took place that centered on initiatives for climate change education in the framework of the Paris Agreement, the international experience; challenges to transform active science teaching through high school teacher training; and education on climate change.

Afterwards, a workshop took place for teachers from various states with the objective of recognizing why a paradigm change on teaching science is necessary to achieve a more effective scientific education based on evidence; informing key players of the education sector of the challenge posed by climate change to society at local and global levels; identifying global efforts on climate change education and the active learning inquiry-based teaching methods; and presenting the project “Teaching Climate Change in Mexico”.

TEACHER TRAINING

On October the Center participated in the XX National Colloquium for Teacher Training for Middle and High Schools of the National Association of universities and Colleges (ANUIES), to promote the course on “Strengthening science teaching”.
Electricity generation is the second source of greenhouse gases, after the transport sector, and any policy seeking mitigation goes through, forcibly, adopting measures in this sector. Due to several technological, environmental and political factors, the productive chain of the electric sector has reduced emissions within its production group, also in losses in transmission and distribution, and has made more efficient its dispatch. In connection with consumption, there are technological improvements which contribute to a more efficient and competitive productive sector. Nevertheless, in subsidized areas of the agricultural and domestic sectors, the end user doesn’t have a price alarm to incentivize efficiency. Thus, this study analyses both consumption and production as means of identifying opportunity areas in the electricity sector’s productive chain.

Regarding production, this study mainly explores two mitigation strategies; on one side, it explores reducing the emission factor by increasing production capacity of intermittent renewables (wind and solar), which would represent an increase in flexible capacity to deal with intermittence. This study examines administering this requirement with storage. And on the other side, the study evaluates maintaining flexibility and support of intermittent sources reducing emission factors with clean production capacity, which translates into more nuclear power plants.

To finalize, during 2020 this study will compare both scenarios to then define an optimum scenario which allows combining the best of both alternatives.

This project is made possible due to financing given by the National Council for Science and Technology (CONACYT).
The Sustainable Cities Index, since its inception in 2014, had the objective of generating a baseline for measuring advancement of Mexican cities with relation to goals set on the 2030 Agenda, incorporating the Sustainable Development Goals, with the purpose of focusing efforts in creating worthy surroundings for the people who inhabit them and with the clear intention of environmental protection.

For this reason, in collaboration with the National Laboratory for Public Policy of the Center for Economic Research and Teaching (CIDE), and the Mexican Institute for Competitiveness (IMCO) and financing by Citibanamex, this year we elaborated Phase I of the Index for Sustainable Cities 2020. It included updating a first group of environmental indicators regarding air quality, mobility, urban development, waste management, climate change and biodiversity.

This updating exercise incorporated results for new metropolitan municipalities in accordance to the official delimitation set by government agencies in charge, and also included the 15 metropolitan areas added during the last edition, going from 57 to 72 cities.

The metropolitan areas analyzed have satisfactory levels on indicators such as “Population affected by natural disasters”, “Adequate disposal of urban solid waste” or “High exposure to concentration of PM$_{2.5}$ in interiors”. On the other hand, there are indicators with high deficiencies, such as “Protection of important ecosystems for biodiversity”.

*This project was made possible due to financing given by Citibanamex.*
Considering air quality monitoring infrastructure in the Metropolitan Area of Monterrey, we proposed using internationally proven methodologies for evaluating their pertinence and compliance with prerequisites of distribution, location, special scale, precision and measuring, bias, data integrity, and representativeness of places where people carry out their daily activities.

The project formally started on October 2019, in partnership with the National Institute of Ecology and Climate Change to analyze the current situation of the atmospheric monitoring network of the MAM, with the purpose of revising its present representativeness based on the areas growth and population in order to propose a new distribution of stations which maximizes the representativeness and usefulness of the measurements.

The project is scheduled to finalize on September 2020.

This project is made possible due to financing given by the Government of the State of Nuevo Leon.
We developed a pilot monitoring campaign for atmospheric pollutant concentrations in a significant sample of public transportation networks and a few bicycle routes in the Metropolitan Area of the Valley of Mexico (MAVM), using “low-cost” sensors which the Mario Molina Center has previously used in other projects.

For monitoring campaigns we included continuous measurements aboard public transportation to find out the personal exposure by users, as well as air quality in terminals or bus stops during the different paths or routes taken by diverse public transport (rapid transit buses/ confined lane buses such as metrobus; electric transport systems such as metro in Mexico City and light train; and licensed transportation routes). Additionally, we carried our joint measurements for pollutant gases for users of several bicycle routes in Mexico City as part of a collaboration that the Mario Molina Center has with the National Institute of Ecology and Climate Change and the Center for Atmospheric Sciences of the National University.

The development of this project started on October 2019 and it’s expected to conclude by June 2020. Results will allow constructing a baseline for pollutant profiles in these microenvironments that will be useful as references for evaluating effectiveness of measures and control policies regarding atmospheric pollution implemented in the future.

This project is made possible due to financing given by the National Council for Science and Technology (CONACYT).

The Metropolitan Area of Monterrey (MAM) is the third most populated area of the country with almost 5 million people, and it presents such demographic dynamism that it has incorporated over 120,000 new inhabitants per year over the last five years. Also, its strong industrial drive and its vast urban surface, make it the 131 biggest city in the world. These characteristics coupled with environmental surroundings with orographic and hydrological restrictions, make Monterrey one of cities with greater sustainability challenges in the country.

Despite its thriving economic situation, the city faces problems which threaten the benefits obtained due to economic development. Thus, and by request of the Sustainable Development Ministry of the Nuevo Leon Government, during the last trimester of 2018 we
started work on a study focused on generating solutions to counter some of the main urban sustainability problems in the MAM, particularly regarding urban development.

The study had the objective of generating and evaluating the potential of concrete actions to improve urban sustainability in Monterrey, through land and mobility management tools designed in accordance to managing capability and development objectives of the governments pertaining to the metropolitan area. Furthermore, we estimated the social, economic and environmental benefits stemming from the implementation of these tools. Finally, in coordination with authorities we designed strategies aligned to planning instruments that are currently in the process of being developed by the Sustainable Development Ministry (such as the Urban Development Program for the Metropolitan Area of Monterrey 2040, and the Integral Program for Sustainable Urban Mobility 2021).

During this first stage of the project, we collected and revised existing data in addition to determining new specific information requisites. As part of the documentation process, we carried out several working sessions with public government personnel and specialists on environment, urban development and mobility.

This project is made possible due to financing given by the Government of the State of Nuevo Leon.

DESIGNING AN EMISSIONS STANDARD AND A VERIFICATION SYSTEM FOR CIRCULATING DIESEL VEHICLES

Currently, the standard which regulates emissions for circulating diesel vehicles has a low efficiency for detecting cars in bad mechanical shape because testing is based only on opacity. Also, this norm doesn’t adhere to new technological tendencies of the auto industry.

At the moment, emission control technologies for diesel vehicles have improved, making it necessary not only to insist on the importance of public policy directed towards promoting renewal of the diesel vehicle fleet, but also, to establish techniques and procedures for better measuring NO\textsubscript{x}, PM and other pollutant emissions which are being emitted by circulating diesel vehicles in roads across the country.

According to information published by the World Health Organization, reducing the levels of pollutants to which the population is exposed to, contributes to on the improvement of public health. It is especially important to pay attention to particle pollution, particularly those less than 10 microns (PM\textsubscript{10}); and particles smaller than 2.5 microns (PM\textsubscript{2.5}) which due to their tiny size are able to reach finer respiratory passages and the alveoli.

Thus, it’s imperative to intervene in this matter through a regulatory instrument whose objective is to measure and characterize emissions and particle pollution from diesel vehicles circulating nationwide with the purpose of reflecting with certainty the amount of pollutants that these mobile sources are emitting in real operating conditions.
The Project formally initiated on October 2019 in collaboration with the National Institute of Ecology and Climate Change and we estimate concluding by June 2020.

*This project is made possible due to financing given by the National Council for Science and Technology (CONACYT).*

**PROPOSAL FOR IMPLEMENTING A VEHICLE INSPECTION PROGRAM FOR PHYSICAL-MECHANICAL CONDITIONS AND EMISSIONS IN THE STATE OF NUEVO LEON**

Nuevo Leon is one of the states faced with bigger challenges regarding atmospheric pollution, traffic, road mobility and security; given that it has more than 2 million registered vehicles and it’s considered one of the most polluted cities in Mexico according to an air quality analysis by the World Health Organization. Additionally, it’s ranked number one in the country for traffic accidents.

The “integrated” vehicle inspection programs, which make-up joint verification on security and emission elements, are fundamental for guaranteeing a vehicles optimum performance throughout its lifespan.

Although the relevance is evident for vehicle inspection and the protection of public health and road security, due to the numerous economic and social benefits associated to preventive measures, many countries, regions and cities lack these programs.

The World Health Organization has guided the adoption of higher and stricter levels of air pollution to guarantee the health of population in congested urban areas.

This study, which started at the end of 2019, contemplated the design of a method and model to determine the minimum requirements to carry out an emissions and physical-mechanical vehicle inspection program. A legal analysis is also being carried out of the current normativity for environmental and security matters being applied to circulating vehicles in the State of Nuevo Leon.

*This project is made possible due to financing given by the Government of the State of Nuevo León.*
Mexico has air quality standards whose success greatly depends on the implementation of equivalent Maximum Permissible Limits (MPL), which need to be established as objectives with specific compliance periods, in addition to provisions to establish a) air quality programs with improvement goals for those cases where the MPL are infringed, and b) prevention programs in areas where MPL are met.

As part of the country’s commitments to nationally determined contributions (NDCs), Mexico agreed to reduce by 51% its black carbon emissions by 2030. Given the close link between combustion processes and black carbon emissions, introducing normativity to improve these processes (combustion, better operating practices and control systems) is fundamental for complying with these goals and also reducing emission of atmospheric pollutants.

This study, which started at the end of 2017, is focused on studying air polluting mobil sources in order to develop two standards, as well as the specific regulatory impact on two matters in order to continue improving air quality in the Megalopolis:

- **Official Mexican Standard Draft**, which establishes maximum permissible limits for carbon monoxide emissions, hydrocarbons, non-methane hydrocarbons, hydrocarbons plus nitrogen oxides, non-methane hydrocarbons plus nitrogen oxides, nitrogen oxides and particles, stemming from new motor exhaust pipes of vehicles out of road which use diesel as fuel.

- **Official Mexican Standard Draft**, which established the maximum permissible limits for carbon monoxide emissions, hydrocarbons and nitrogen oxides, as well as evaporative emissions stemming from new motorcycle exhaust pipes equipped with a gasoline combustion motor.

Currently this project is being reviewed by the Ministry of the Environment and the Ministry of Economy. Both standards are part of the measures to improve air quality in the Metropolitan Area of the Valley of Mexico announced on December 20, 2019 by the Ministry of the Environment, the Environmental Commission of the Megalopolis and the governments of the State of Mexico and Mexico City.

*This project is made possible due to financing given by the Environmental Commission of the Megalopolis.*
Globally, environmental and health impacts associated to PM$_{2.5}$ particle emission have ignited interest in analyzing the chemical components which makeup this pollutant so the main emission sources may be clearly identified.

This will allow designing control strategies specifically directed so concentrations of pollutants are reduced in a cost-effective manner and maximize the protection of human health and ecosystems.

In the Metropolitan Area of Monterrey the problem of air quality stemming from emission of PM$_{2.5}$ particles and its precursors generates environmental impacts and damage to human health, which cause economic losses due to work days not attended and medical treatments of health patients with chronic and degenerative illnesses. Activities from industry, mining and transport sectors contribute to the emission of PM$_{2.5}$ particles in the entire region, (primary emissions and precursors of the second component), mainly stemming from liquid fossil fuels, which in some proportion contain high volumes of sulfur and produce greater emissions to those coming from cleaner fuels like natural gas, in addition to the lack of legislation for prohibiting their use.

For this Reason, this project focuses on understanding in which proportion these poor quality fuels are contributing to high concentrations of ultra-fine suspended particles in the area, and on identifying their main sources to be able to propose effective strategies and policies which efficiently and directly reduce emissions.

The project formally started on October 2019 in collaboration with the National Institute for Ecology and Climate Change to recollect samples of PM$_{2.5}$ particulate matter in different areas of the city, to be later chemically analyzed and determine the main source for each component.

The project is expected to be finished by September 2020.

This project is made possible due to financing given by the Government of the State of Nuevo León.
This study gives continuity to the project with the same name carried out during 2018, where we evaluated the quality and representativeness of measurements from four low-cost sensors fabricated by the Massachusetts Institute of Technology (MIT), which monitor concentrations of SO$_2$, CO, O$_x$ (resulting from the sum of O$_3$ + NO$_2$), NO$_2$, PM$_1$, PM$_{2.5}$ and PM$_{10}$, during a 24 hour continuous period.

Each of the four devices were installed contiguously to the monitoring station at the Atmospheric and Science Center of the atmospheric monitoring network of the Mexico City Government, located at the south of the city within the National Autonomous University of Mexico (UNAM). Given the results from Phase I, where serious problems arose from the operation of the equipment due to electronic failures, in this Phase II we reassembled with more robust electronics based on printed circuits. This gave way for a more reliable operation which allows carrying out comparisons of other concentration measurements with those registered in the referenced monitoring station.

Low-cost sensors allow monitoring atmospheric pollutants at a much lower cost in places where certified monitoring networks cannot be placed. Nevertheless, in some cases they are not as reliable, and it’s precisely this reliability which we are looking to test during this new phase of the project, as well as calculate the specific correlation for each of the measured pollutants between both devices.

The new campaign for collecting data was carried out during March and November 2019. With data collected during those nine months, we will proceed to carry out comparisons between concentrations from both devices to verify and validate the operation of the MIT devices with new electronics and revise and validate the data compiled.

_This project is made possible due to financing given by the National Council for Science and Technology (CONACYT)._
Ozone is an important pollutant generated from chemical reactions between nitrogen oxides and volatile organic compounds (VOC), so it’s essential to analyze and propose measures that might reduce VOC emissions. As part of the 2018-2024 Government Program for Mexico City, changing the existing strategy for air quality was established, and one of the key factors was to control liquefied petroleum gas (LPG) leaks coming from fuels in the city.

Although programs were implemented in the past, like substituting LPG container tanks and leaks from storage and distribution systems got under control, VOC emissions stemming from fuels are still considerable. We point out that based on the most recent pollution inventory, 23% of VOC compounds are due to the use, distribution and storage of fuels.

This project proposes the design of specific measures that may help improve air quality for the Metropolitan Area of the Valley of Mexico, in a way of maintaining efforts carried out from two decades ago for addressing the problem of atmospheric pollution. Furthermore, we’re seeking to considerably reduce emissions of ozone precursor compounds, which are produced daily from liquefied petroleum gas focusing on an approach that substitutes its use by existing alternative technologies.

Finally, this project reviews international experience on measures for reducing LPG consumption, analyzes economic feasibility for implementing measures, and proposes plans for its implementation in the Metropolitan Area.

This project is made possible due to financing given by the National Council for Science and Technology (CONACYT).
By the request of the Ministry of Environment and Land-Use Planning of the State of Jalisco, the Mario Molina Center prepared an update of the State Inventory for Greenhouse Gases (GHG) and Compounds in the State of Jalisco, base year 2017. This Inventory was prepared in accordance to IPCC’s guiding principles for national greenhouse gas inventories published in 2006 and its amendments of 2019. The guidelines classify emission sources in the following sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Residues.

In 2017, GHG emissions in Jalisco, without considering the Earth category, amounted for 31 million CO$_2$e. Net emissions, which include GHG emissions and uptakes from the Earth category, represented 29 MMt CO$_2$e. The Energy sector contributed with 54% of emissions; Industrial Processes and Product Use, 6%; the Livestock category within the AFOLU sector contributed with 21%, and the categories Aggregate Sources and Non-CO$_2$ Emissions Sources on Land generated 8%, and finally the Residues sector reported 11% of total emissions.

The subcategory with more GHG emissions was Transport, with 43% of GHG emissions, followed by the Enteric Fermentation category with 18% of emissions.

For the 2010-2017 period, GHG emissions in the State of Jalisco increased by 1% average annually. The subcategory with the most increase was Oil and Natural Gas with an annual average of 14%. On the contrary, the category with the most reductions on their contribution to GHG emissions was Incineration and Open Waste Incineration, with a decrease of 10%. It’s important to highlight that carbon absorption capacity carried out by sinks such as forests and green areas also had a reduction of 17% during the same period. GHG emissions from the State of Jalisco during 2015 amount to 4% of national emissions accounted for CO$_2$ e for 2015 by the State Inventory.

Per capita emissions from the State are estimated at 3.5 tones (t) of CO$_2$ e per inhabitant (2015 data, including permanencies). Both figures are well below the world average of 6.6 t CO$_2$ e per person for the base year, according to the European Union.
Regarding greenhouse compounds, for 2017 there is an estimate of 7,000 tons of black carbon, mainly due to energy consumption which represents 81% of total state emissions of this compound. The AFOLU sector generated 19% of emissions, and a very small percentage related to the Residues sector. At a subcategory level, Terrestrial Transport contributed with the greatest proportion of black carbon emissions with 35% of the total in the State.

During the 2010-2017 period, black carbon emissions registered an annual average increase of 2%. The subcategories with the most increments in emissions through this time period were biomass burning and agricultural burning, with a rise of 13% per year.

In conclusion, measures to mitigate greenhouse gases and compounds in the State of Jalisco need to focus on reducing emissions within the terrestrial transport sector due to burning fuels and diesel, as well as on agriculture because of gases stemming from enteric fermentation and land use changes, mainly.

This project is made possible due to financing given by the Government of Jalisco.

EMISSIONS INVENTORY FOR GREENHOUSE GASES AND COMPOUNDS IN THE MUNICIPALITY OF LEON 2017

By the request of the Ministry of Environment and Land-Use Planning of the Municipality of Leon in the State of Guanajuato, the Mario Molina Center prepared an update of the State Inventory for Greenhouse Gases (GHG) and Compounds in the Municipality of Leon and its Metropolitan Area, base year 2017.

This Inventory was prepared in accordance to IPCC’s guiding principles for national greenhouse gas inventories published in 2006 and its amendments of 2019. The guidelines classify emission sources in the following sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Residues.

GHG emissions in the Municipality of Leon are estimated at 2.6 million tones (MMt) of CO₂ e for 2017, without considering the Earth category which registered uptakes of 20 thousand tones (t) of CO₂ e by carbon sinks such as forests and other green areas. If we consider both emissions and uptakes, we get net emissions, which came out to 2.6 MMtCO₂ e.

The Energy sector contributed 79% of total emissions, followed by the Residues sector with 11%, while the AFOLU sector contributed 9%, and the IPPU sector 1% of emissions.
The main source of GHG emissions is the subcategory Transport, with 74% (MMtCO₂e).

By type of greenhouse gas, CO₂ emissions dominated with 74% of total emissions, followed by emissions from CH₄ with 17%, N₂O in third place with 6%, and finally HFC emission with 1%.

For the 2010-2017 period, GHG emissions in the Municipality of Leon increased by 1.3% average annually GHG emissions from the Municipality of Leon during 2015 amount to 0.4% of national emissions accounted for CO₂e for 2015 by the State Inventory.

Per capita emissions from the Municipality are estimated at 1.7 tones (t) of CO₂e per inhabitant. Both figures are well below the world average of 6.6 tCO₂e per person for the base year of 2015, according to the European Union.

Additionally, for 2017 there is an estimate of 288 tons of black carbon, of which 99% stems from the Energy sector, 1% from the AFOLU, and a very small amount contribution from the Residues sector.

Black carbon emissions Registered an increase of 1.2% from 2010 to 2017. The year with the highest level of emissions was 2014. Emissions stemming from burning fossil fuels in the manufacturing industry and construction, as well as the commercial sectors, residential and agriculture, experienced the highest increases with 5% on average annually.

Measures to mitigate greenhouse gases and compounds in the Municipality of Leon need to focus on the reduction of emissions within the terrestrial transport sector, as well as on those produced by residues and agriculture.

*This project is made possible due to financing given by the Government of Guanajuato.*
The education on climate change project in the Mario Molina Center intends to communicate objectively and based on evidence, the causes and solutions related to this phenomenon, while integrating diverse pedagogical tools by which we seek to transform the way in which students learn, so they may understand and develop abilities for appropriate knowledge and use science just like scientists do.

To implement these new methodologies for active teaching, the Center uses technology for distant education and for offering the most current tools such as simulators, real-time data analysis on Earth indicators, as well as an array of scientific information, which allows reviewing these topics with confidence.

During 2019 the Mario Molina Center continued developing and implementing courses to communicate the basics on climate change by integrating diverse pedagogical tools for active teaching and learning.

The purpose of this project is to give teachers tools to improve the way in which they teach experimental sciences by applying the inquiry-based teaching method through an inclusive topic such as climate change.

During this year, more than 10 thousand teachers at a national level participated on an online teaching course to strengthen their education tools for sciences with the support of the Ministry of Public Education. Furthermore, we expanded the offer with courses for the public in general through a partnership with the Government of Mexico City.

This project is made possible due to financing given by Ministry of Public Education.
During 2019 we responded to a call by the Sectorial Coordination for Academic Development of the Under-Secretary of Middle-Upper Education and we won the bid for carrying out online courses entitled “Strengthening teaching for teaching sciences through climate change as an integrating topic”, intended for teachers affiliated to the Ministry of Public Education with 10,500 middle-upper education teachers from all over the country. Close to 8,000 participants approved the course and acquired tools for improving their teaching practices amongst students.

The teacher training was divided into two parts: a basic segment and an advanced one. In the first one, we introduced the inquiry-based learning model applied through the 5 Es instructional model (Engage, Explore, Explain, Elaborate, and Evaluate) and the basics on how the climate works. In the advanced course, we focused on the causes and consequences of climate change, as well as on the solutions to confront it, while establishing procedures to adjust lesson plans to review disciplinary concepts for the instructional model of the 5Es.

In collaboration with the Ministry of Education, Science and Innovation (SECTEI) of Mexico City’s Government, we carried out the Course on “Strengthening teaching for teaching sciences through climate change as an integrating topic. It was directed to teachers from high school levels of the 16 municipalities in Mexico City. The objective was to promote science and a better understanding of the causes, consequences and solutions to climate change.

We also carried out the 1st edition of the course entitled “Sustainability for all”, offered by Spots for Innovation, Liberty, Arts, Education and Knowledge (PILARES), for the public in general.
Finally, we carried out the design of a STEM course in Chemistry and Climate Change for students at digital high schools. STEM education is an interdisciplinary learning approach that removes traditional barriers to four disciplines (Science, Technology, Engineering, Math). During the last four years, this type of education has been extremely relevant; it seeks to develop amongst students abilities like research, critical thinking, problem solving, and others, which combine with the materials developed by the Mario Molina Center and will be in a couple of years the new tendency for education models across the world.

COLLABORATION WITH AVSI

Through the Education Coordination for the Tehuantepec Isthmus project of the Fondazione AVSI and the Mario Molina Center, we carried out the “Climate Change Education Course”, directed to teachers for high school levels in areas such as Chemistry, Physics, Ecology and related topics within the municipalities of El Espinal, Heroica Ciudad de Juchitan de Zaragoza and Asunción Ixtaltepec in the State of Oaxaca.

By working with 30 teachers from the reconstruction Project of the Tehuantepec Isthmus we benefited more than 1,500 students from the region.
The Mario Molina Center has more than 40 professionals that specialize in diverse fields such as engineering, public policy, business, law, social and environmental sciences.

We work in a cross-sectional manner on multidisciplinary fields so the results of our projects and proposals contain an inclusive and multidimensional perspective.

Financing our areas of research stems from contributions from the Mexican government through the National Council for Science and Technology (CONACYT), the Ministry of Public Education, State governments, foundations, different public and private businesses and institutions in the country, as well as international sources. These contributions legitimize and guarantee absolute independence in our actions.