Patents and Climate Change

Patents and Climate Change:

There's No Place Like Home

By

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CONTENTS

PREFACE

As we discover more about climate change and attempt to reduce global warming, science and innovation will guide our success. With respect to global warming-related patents, I wrote this book to capture some of mankind's effort to sustain and protect life on the planet Earth. These inventions clearly show that many are proactive, and change their life style, to benefit the well-being of future generations. The book *Patents and Climate Change: There's No Place Like Home* has taught me that climate change is manageable.

ACKNOWLEDGEMENTS

Billy Dochniak, you are a preferred indoor climate-change professional.

INTRODUCTION

Exploring and colonizing Mars can bring us new scientific understanding of climate change, of how planet-wide processes can make a warm and wet world into a barren landscape. By exploring and understanding Mars, we may gain insights into the past and future of our own planet.
—Buzz Aldrin (American engineer and former astronaut)

I believe that global warming is a myth. And so, therefore, I have no conscience problems at all and I'm going to buy a Suburban next time.
—Jerry Falwell, Sr. (American Southern Baptist pastor, televangelist, and conservative activist)

Will climate change prompt future generations to inherit a paradise on Earth or a place of great suffering?

After 4.5 billion years of change, is the planet Earth a complex and delicate ecosystem? It is well-known that some human activities may be part of a climate-change process that affects global warming. Environmental scientists continue to make substantial progress in advancing our understanding of how such activities affect climate change. Since the year 1989, hundreds of global-warming related patents have been granted by

the United States Patent and Trademark Office. This original and important book thus provides an easy-to-read summary of such patents. Within many of the summaries, there are inventor profiles and news articles that are insightful and thought-provoking. Pioneering inventors hail from many locations including Brazil, Great Britain, India, Japan, Mexico, and Taiwan. At the beginning of several chapters, contradictory opinions on climate change are provided in the form of quotes. Chapter Seven offers an example of a fascinating application that failed to gain US patent protection. In the final chapter, several significant climate-change issues that continue to be addressed are outlined.

CHAPTER ONE

US PATENTS THAT TEACH CLIMATE CHANGE

> *I would like nuclear fusion to become a practical power source. It would provide an inexhaustible supply of energy, without pollution or global warming.*
> —Stephen Hawking (English theoretical physicist, cosmologist, author and Director of Research at the Centre for Theoretical Cosmology within the University of Cambridge)

> *I'm saying, Come on, the global warming thing? How did the ice melt during the ice ages? Was the dinosaurs driving SUVs around back then?*
> —Larry the Cable Guy (Daniel L. Whitney is an American stand-up comedian, actor, country music artist and former radio personality)

Environmental scientists continue to make substantial progress in our understanding of climate change. Currently, there are about 200 scientific organizations that hold the position that climate change has been caused by human activities. [1]

Early warning signals of global warming: As water gets warmer, it takes up more space. Each drop of water only expands by a little bit, but when you multiply this expansion over the entire depth of the ocean, it all adds up and causes sea level to rise. Sea level is also rising because melting glaciers and ice sheets are adding more water to the oceans. Over the past 100 years, the average sea level around the world rose by nearly 7 inches. [2]

From the year 1989, hundreds of global-warming related patents have been granted by the United States Patent and Trademark Office. The quote below provides a simple explanation of a patent:

> *A patent, or invention, is any assemblage of technologies or ideas that you can put together that nobody put together that way before. That's how the patent office defines it. That's an invention.*
> —Dean Kamen (holds more than 440 US and foreign patents and is the inventor of the Segway, the first drug infusion pump, and many other innovations).

The United States Patent and Trademark Office (USPTO) is the federal agency for granting patents. The USPTO fulfills the mandate of Article I, Section 8, Clause 8, of the Constitution. This effort promotes the progress of science by securing for limited times to inventors the exclusive right to their discoveries.

The first US Patent with the word “Global Warming” in the title was issued on March 26, 1991. Twenty-six years later (March of 2017), a total of 24 such patents have been granted. Not surprisingly, there are more than 8,500 patents with the word “global warming” somewhere therein.

The world is a better place when ideas are disclosed, patented, and attain financial success. If you have a novel and useful idea on how to help alleviate global warming, the USPTO will reward you with patent protection. A well-earned patent can be part of a strategic business plan that allows you to exclude others from making, using, offering for sale, or selling your invention throughout the US. If you’re the assignee (i.e., owner) of a pioneering patent, you may obtain twenty years of legal protection to acquire exclusive financial-gain.

Introduction References

1) The Governing Office of Planning and Research, “List of Worldwide Scientific Organizations” Accessed June of 2017. https://www.opr.ca.gov/s_listoforganizations.php
2) Union of Concerned Scientists. “Early Warning Signs of Global Warming: Heat Waves” Accessed April of 2017. http://www.ucsusa.org/global_warming/science_and_impacts/impacts/early-warning-signs-of-global-6.html#.WN_ra1XyvIV

CHAPTER TWO

YEARS 2017 TO 2010:
GLOBAL WARMING IS IN THE PATENT TITLE

The shift to a cleaner energy economy won't happen overnight, and it will require tough choices along the way. But the debate is settled. Climate change is fact.
—Barack Obama (American politician who served as the 44th President of the United States from 2009 to 2017)

Most climatologists agree that, at best, global warming is a theory about future climatic conditions and cannot be proven based upon the historic record.
—Mike Pence (American politician, lawyer, and the 48th Vice President of the United States)

Early warning signals of global warming: Glaciers are large sheets of snow and ice that are found on land all year long. They're found in the western United States, Alaska, the mountains of Europe and Asia, and many other parts of the world. Warmer temperatures cause glaciers to melt faster than they can accumulate new snow. Glaciers all over the world

have been melting for at least the last 50 years, and the rate of melting is speeding up. Many glaciers in Alaska and other parts of the United States have shrunk dramatically. [1]

Compositions and methods to reduce global warming caused by gasoline and spark ignited internal combustion engines

(*Talbert in Patent number 9,540,991 - January 10, 2017*)

The inventor explained that the modified gasoline has a lower energy density than current gasoline yet provides equivalent power with less gasoline because more of the fuel is burned in the engine.

William L. Talbert (inventor and assignee) is the founder of Talbert Fuel Systems Inc. of Allentown, Pennsylvania.

In an article from The Morning Call (July 9, 2000) titled, *Talbert Researches Clean Fuel Allentown Company Has Been the Driving Force Behind New, Reformulated Gasolines for Cars* author Hermione Malone writes, “At its simplest, the concept behind the latest revolution in fuel processing is easy to understand. If fuel is lighter, it burns more quickly. The more quickly it burns, the more efficiently it is used. While that may help the cars, people drive, what could really help their owners these days is lower gas prices. Lighter gas translates into less costly production, which equals savings at the pump. For about 20 years, William Talbert of Talbert Fuel Systems Inc. of Allentown has been the driving force behind reformulated gasoline -- the clean-burning fuel mandated by the California state legislature in 1996. Late last year his company filed patents on E-Gasoline II, an improvement upon its 1991 predecessor which only removed most of the oil in gas. The newest version removes all oil, lowers octane -- a measure of `knock` rating in engines -- to 75.7, and could lower costs at least 10 cents per gallon. `The biggest savings is going to be because of the equipment needed to make this gasoline.’ said Charles Jones, president of TFS Inc. ‘We don't need expensive equipment or additives.’ And the potential savings don't stop at the pump, Jones said. `You could get better mileage, and the car will run at a lower temperature than with current gas, which means you could use less expensive lubricant oils or at least change them less often.’ he said. Making gasoline lighter by removing the oil seems like a simple idea, but the road between realization and product development was a long one. In 1974, Talbert -- who holds

dual degrees in chemical engineering and business from Lehigh University -- was working on project with coal. By removing the non-combustibles from coal, he found it burned faster. Could the same be said for gasoline? `I saw that the gasoline of those days didn't have time to burn completely in (car) engines. So, I took a lot of the heavy oils out and found that I got more power from using three-quarters of the gasoline than from using all of it,' he said. That discovery led to a method of reducing the emissions from fuel that were causing smog. By taking off the heavy end of the fuel, Talbert reasoned that he could take off the light end, which was contributing to emissions. `It was a huge breakthrough. For years, before, everyone was saying we don't know what we're going to do about the emissions.' he said. Only last year, he said, did his company TFS Inc. discover that taking out heavy oils makes fuel burn faster. And the removed oil can be used for kerosene or recycled into gasoline production. When low-octane gasoline tops $2.36 in the Midwest, it would seem that E-Gasoline II is just what American drivers need. So why can't they buy it? `We need refineries that will make this for us.' Jones said. `Automobiles have to be modified slightly to run on our fuel. We're working on it, but we're not there yet.' Currently, the company is monitoring the fuel on a test vehicle and has applied for state and federal funding to continue tests and conduct vehicle research. Though American refineries have yet to buy the new lighter fuel from TFS Inc., the company is forging ahead to find clients in foreign countries. They have efforts under way in India, China and South Korea. In the future, they would like to sell E-Gasoline II to Malaysia and South Africa as well. Already the company has filed patents for E-Gasoline III, which is designed to fuel cars without the need for modifying the vehicle. `We feel we're right now ahead of what's being done out there in the research field, and we intend to stay ahead,' Talbert said." [2]

Reducing global warming

(*Elmaleh in Patent number 9,138,681 - September 22, 2015*)

Abstract – This describes the reduction of carbon dioxide gas (CO_2) in the atmosphere using a container of metal hydroxides.

The inventor explained that excess greenhouse gases contribute to global warming by raising the temperature of a planet to dangerous levels. Since the beginning of the Industrial Revolution, the concentrations of many of the greenhouse gases have increased. The concentration of CO_2 has increased by about 100 parts-per-million (ppm). The first 50 ppm increase

took place in about 200 years, from the start of the Industrial Revolution to around 1973; the next 50 ppm increase took place in about 33 years, from 1973 to 2006.

David R. Elmaleh (inventor and assignee) received a BSc in physics and chemistry, and an MS and PhD in organic chemistry from the Hebrew University of Jerusalem. In 1976, he became an associate professor at Harvard Medical School and Director of Contrast Media Chemistry at the Massachusetts General Hospital. He is a co-author on more than 130 publications and book chapters, a contributor of at least 116 issued and pending patents in a range of disciplines, including molecular imaging and pharmaceuticals. [3] In 2011, he co-founded the firm AZ Therapies, a developer of Alzheimer's disease drugs, where he currently serves as Executive Chairman, and Chief Scientific Advisor. He has been named by *Genetic Engineering & Biotechnology News* as one of the biotechnology industry's top thirteen serial entrepreneurs.

Dynamic cooling of human skin using a nontoxic cryogen with no ozone depletion and minimal global warming pot

(*Nelson, et al. in Patent number 9,050,117 - June 9, 2015*)

Abstract – This describes cooling irradiated skin with liquid carbon dioxide (CO_2).

The inventors explained that there is a need to find an efficient substitute for tetrafluoro-ethane that is compatible with requirements for low global warming potential.

J. Stuart Nelson (first inventor listed with a co-inventor) is the medical director of the Beckman Laser Institute and Medical Clinic, and professor of surgery and biomedical engineering at the University of California Irvine, located in Southern California in Orange County. Dr. Nelson specializes in the diagnosis, clinical management and treatment of infants, young children and adults with port wine stains, hemangiomas and other vascular malformations. Dr. Nelson's university-based clinical practice and research combines his expertise in engineering, optics, medicine and surgery. In addition to Dr. Nelson's faculty, research, teaching and clinical responsibilities, he is the director of the Port Wine Stain Vascular Birthmarks and Malformations Diagnostic and Treatment Center at the University of California Irvine Medical Center. Dr. Nelson and colleagues developed the "Dynamic Cooling Device" which in conjunction with

pulsed dye laser technology has become the treatment of choice for the treatment of port wine stain birthmarks, hemangiomas and other vascular malformations. Worldwide, this methodology developed by Dr. Nelson has now been incorporated into more than 20,000 laser devices. Because of Dr. Nelson's expertise and the program's reputation for providing high quality care with the latest technology, patients with port wine stains, hemangiomas and other vascular malformations travel from all over the world to the Beckman Laser Institute to seek treatment. Dr. Nelson has published more than 300 scientific articles and 13 book chapters. Dr. Nelson served as President of the American Society for Laser Medicine and Surgery (ASLMS) 2001-2002. He assumed the position of Editor-in-Chief of the ASLMS journal Lasers in Surgery and Medicine in April 2005. Dr. Nelson is internationally recognized in the field as an expert in port wine stains, hemangiomas and other vascular malformation. As such, he has been invited to Belgium, Canada, China, Germany, Hong Kong, Indonesia, Israel, Italy, Japan, Malaysia, Netherlands, Norway, Russia, Saudi Arabia, Slovenia, Spain, United Kingdom and Vietnam to address major international meetings. [4]

The Regents of the University of California (patent assignee) is the governing board of the University of California system. Chartered by the California Constitution, the board has 26 voting members. [5]

In an article from The Orange County Register (March of 2011) titled, *Program erases ex-cons' tattoos* author Vik Jolly writes, "The blasts of a laser repeatedly hit Randy Perez's neck and chest. He winces. He exhales deeply during a break when the doctor asks him to switch positions so the laser beam can be focused from another angle at an Aztec calendar tattoo and the words 'Brown Pride' covering the front of Perez's neck. Perez, 37, of Santa Ana, under the supervision of the U.S. District Court Probation Office, is among 30 some ex-cons who for about the last two years have volunteered to endure the pain to remove ink from their bodies that frequently prevents them from getting jobs and make a transition back into society. In partnership with the clinic at UCI, district court Judge David O. Carter in Santa Ana is duplicating in federal court a tattoo removal program he first launched in the early 1990s in Orange County Superior Court for ex-cons and gang members. Carter's philosophy: those who get rid of their tattoos will become walking billboards in their communities, having a ripple effect not only on their own lives but potentially on the lives of wannabe gang members. Dr. J. Stuart Nelson, the medical director of the Beckman Laser Institute Medical Clinic and professor of surgery at UCI, says the feeling is akin to a rubber band snapping against the body.

The convicted felon calls the pain very intense, like a third-degree burn." [6]

Non-ozone depleting and low global warming potential refrigerants for low temperature refrigeration

(*Poole, et al. in Patent number 9,023,231 - May 5, 2015*)

The inventors explained that the present invention enables the replacement of R404A and R507, the most commonly used refrigerants in lower temperature refrigeration to be made with a substantial reduction in Global Warming Potential but without any reduction in performance including energy efficiency and capacity. The invention further facilitates the replacement of Ozone Depleting Substances HCFC22 and CFC502 at low cost without the need to change either the lubricant in the system or make any alterations to the hardware while also being non-ozone depleting and non-flammable in accordance with ASHRAE Standard 34.

Richard Powell (second inventor listed with a co-inventor) is from Bunbury, Great Britain.

RPL Holdings Limited (patent assignee) is based in Road Town, British Virgin Islands. [7]

In an article from the University of Leicester (2006) titled, *A case study in Green chemistry: Developing replacements for CFCs* Richard Powell et al. write, "Chlorofluorocarbons, CFCs, were developed in the late 1920s for use as safe refrigerant alternatives to sulphur dioxide and ammonia. They were welcomed by industry because of their low toxicity, chemical stability, low flammability, low cost and ease of synthesis. They found wide application as refrigerants, blowing agents, propellants and cleaning agents. Over more than 40 years, applications of CFCs expanded into a wide variety of areas, and grew into a multibillion-dollar industry. Unfortunately, CFCs are not ecologically benign. It became increasingly clear that CFCs were responsible for ozone depletion. In the early 1970s the leading manufacturers of CFCs met to discuss the possible environmental impact of their products. This case study uses a problem based learning approach to take students through the development of replacements for CFCs from the 1970s to today. They investigate the background to the CFC problem and consider data that leads to the decision to investigate possible replacements. They must select and design replacement molecules (HFCs), devise syntheses and then consider the

challenge to develop the replacements in a socio-economic and political framework. They also consider the problems posed by existing CFCs, the 'fridge mountain' and possible disposal and containment alternatives. The case study brings the story up to date with an investigation of the problems now being associated with HFCs and the search for new alternatives. This activity successfully teaches applied and 'green' chemistry via a real-life context. The chemistry encountered is of an applied/industrial nature and is set in a socioeconomic context. The influence of political pressures is also brought in when appropriate. Because the activity adopts a problem based approach it is also successful in developing a range of transferable skills, particularly problem solving, teamwork plus verbal and written communication." [8]

Use of low global warming potential (LGWP) solvents for finger print development applications

(*Nalewajek, et al. in Patent number 8,652,244 - February 18, 2014*)

Abstract – This describes the use of fingerprint detection compositions comprising organic solvents classified as low global warming potential molecules.

The inventors explained that fingerprints can be used to link a criminal suspect to a crime and, therefore, are one of the most valuable pieces of evidence that can be gathered at a crime scene. Fingerprints generally are classified into three categories: visible, impression and latent. While visible and impression prints can be readily seen with the unaided eye and can be documented by photography, latent fingerprints are visually undetectable without the aid of chemical, physical, or electrical processing techniques. Most latent fingerprints are invisible deposits of natural secretions of skin on the surface of an article which typically occur as impressions corresponding to the friction ridges of the skin. These secretions, which are produced by the eccrine glands, typically comprise water, soluble amino acids, peptides, salts, lipids, and the like. It is possible to transform these deposits into a visibly detectable image. When the impressions form patterns that correspond to the unique friction ridges of a person's finger, palm, etc., the latent fingerprint can be useful in dactyloscopy. The present technology relates to C_3-C_4 hydrofluorocarbon olefins and hydrochlorofluorocarbon olefins that can be effectively used as carrier solvents in compositions used to detect latent fingerprints and other biometrics.

David Nalewajek (first inventor listed with three co-inventors) received a PhD from the University of Buffalo in 1978. In 2016, Dr. Nalewajek received the Crowdle Award from Canisius College honoring his research efforts in fluorine chemistry, especially the development of environmentally safer fluorocarbons. [9]

Honeywell International Inc. (patent assignee) is an American multinational conglomerate company that produces a variety of commercial and consumer products, engineering services and aerospace systems for a wide variety of customers, from private consumers to major corporations and governments. [10]

In an article from ASC (October of 2016) titled, *Green Chemistry and the Canisius College* it is written, "First, we invited David Nalewajek, PhD, Research Fellow at Honeywell International's Buffalo Research Laboratories, to present a seminar to our Department of Chemistry and Biochemistry. Dr. Nalewajek's seminar illustrated how Honeywell's development of CFC replacements was a clear example of a chemical company protecting the environment through green chemistry. Another commented, 'It was interesting to hear that global responses to climate change, not just U.S. policy, can drive the standards which a global company such as Honeywell must take into account when developing and selling chemical products.' One student summed up the event by saying, 'It was great to learn about environmentally important and innovative chemistry being done in our own backyard.'" [11]

Method and equipment for improving global warming and air pollution

(*Chu in Patent number 8,454,725 - June 4, 2013*)

Abstract – This describes processing hot exhaust gas generated by various kinds of thermal machines.

The inventor explained that the hot exhaust gas generated by a thermal machine is injected into an exhaust boosting unit to be compressed so that the hot exhaust gas can be mixed with a liquid medium for atomization and evaporation. Tiny pollution particulates and powders in the hot exhaust gas can thus be adsorbed and removed by the liquid medium to achieve the object of cleaning the air. Moreover, humid and hot clean air discharged to the atmosphere can speed up heat circulation and water circulation to improve the situation of gradual warming of the Earth.

Rey-Chin Chu (inventor and assignee) is from Taipei, Taiwan.

In an article from The Diplomat (November 04, 2016) titled, *Taiwan Should Be Part of Global Fight Against Climate Change* author James K.J. Lee writes, "While the world seems to be on the right track toward controlling global warming, Taiwan has been left out. Located on an island subject to frequent typhoons and other extremes of weather, Taiwan has experienced firsthand the effects of climate change. This past June, the temperature in Taipei reached 38.7 degrees Celsius, more than 100 degrees Fahrenheit, the highest in 100 years. Weather patterns that once included steady rains have now been replaced by torrential downpours causing flash floods, with significant economic impacts. Conditions in Taiwan parallel record-breaking temperatures and extreme weather events elsewhere around the globe, which most scientists attribute to rising ocean temperatures resulting from increased levels of greenhouse gases in the atmosphere. As a nation of 23 million people, the world's 22nd-largest economy, and the 22nd-largest emitter of carbon dioxide, Taiwan has a stake in participating in the global effort to fight climate change. Despite not being a UNFCCC member, Taiwan began working independently on a plan to reduce its greenhouse gas emissions back in 1998 and is one of only a few countries in the world that has passed its own law reducing greenhouse gas emissions. Taiwan has much to offer to the UNFCCC. It has developed green technologies for reducing greenhouse gases that can be shared with other countries. Over the decades, Taiwan has undertaken numerous cooperative projects with developing countries in a wide array of fields related to climate change, including renewable energy, LED street lighting, environmental protection, etc. Taiwan has also partnered with the United States in the Global Cooperation and Training Framework (GC TF), through which both sides seek to share financial resources and expertise with other countries in combating various future challenges including global warming. By becoming part of UNFCCC and participating in its multilateral efforts and financial mechanisms such as the Green Climate Fund, Taiwan could increase the impact of its contributions. Climate change is not confined by national boundaries or political systems. Taiwan's participation is a matter of climate justice, a concept recognized in the Paris Agreement that calls on all states to address this critical global issue. By not being included as a member of the UNFCCC, Taiwan is, in some respects, being left to face climate impact on its own. This contradicts the UNFCCC principle that calls for "the widest possible cooperation" in combating global warming challenges. As a significant global economic actor and a pioneer in green technology, Taiwan and its 23 million people deserve a seat at this vital climate forum.

It is time to carry out the UNFCCC's utmost goal for the sake of human welfare by welcoming Taiwan in the global efforts to curb the climate change." [12]

Emission purifiying system and device for slowing global warming

(*Caraveo-Martinez in Patent number 8,454,001 - June 4, 2013*)

Abstract – This describes an emission purifying system and to a device for slowing global warming in the field of pit burners and elevated burners in the oil industry, including incinerators, open air burnings and other industries where suspended polluting particles are produced.

The inventor explained that the pollutant removal systems can transform the heat into reusable energy.

Miguel Angel Caraveo-Martinez (inventor and assignee) is from Tabasco, Mexico.

In an article from Salon (June 6, 2015) titled, *Climate change is making Mexico City unbreathable* author Ioan Grillo writes, "On a sweaty May morning in this sprawling mountain capital, residents heard a painfully familiar warning on the radio and TV. Air pollution was at dangerous levels, environmental authorities said. People were advised to stay indoors as much as possible and avoid exercise. Asthma sufferers should take particular care. On the city streets, this pollution could be seen in dirty clouds hanging amid grid-locked traffic. The 'environmental pre-contingency' on May 9 was the fourth so far this year, compared to three in all of 2014. The warnings are a reminder of the long uphill battle against dirty air in North America's largest city — which has been a laboratory for pollution in megacities around the planet. This rise comes after years in which Mexico City air has been getting cleaner, thanks to concerted campaigns. But while some problems have been resolved, others appear. One issue is that Mexico is getting steadily hotter, apparently due to global warming. Last year was the hottest in Mexico since records began, with average temperatures of 71.78 degrees Fahrenheit. Higher temperatures mean that pollutants release faster into the air. 'The rate of emission of certain types of pollutants goes up. … Secondly, chemical reactions tend to be faster," says Christopher Cappa at the Air Quality Research Center in Davis, California. "This makes existing problems more challenging.' Last year, Stanford scientists published a paper predicting

that global warming will increase air pollution levels in cities around the world. It highlighted Mexico, along with India, as places of particular concern. Back in 1992, the United Nations declared the Mexican capital the world's most polluted city. Birds dropped dead in midflight, visibility was low, respiratory problems rampant. However, a titanic effort reduced pollution drastically. Factories and a gas refinery were relocated, dirty old buses were replaced by an electric Metrobus system, leaded gas banned. By 2010, when Mexico City hosted a UN climate change conference, it was hailed as a poster child for anti-pollution measures. Lead in the air had dropped by 90 percent over two decades, environmental authorities reported. Yet despite the giant steps, pollution persists and is exacerbated by new problems, including the rising temperatures. 'The hottest times of the year are often when the pollution levels are most dangerous,' says Jose Agustin Garcia of Mexico's Center for Atmosphere Science. But Garcia cautions that other factors are also in the mix. While cars have gotten cleaner they have also gotten more numerous. There are now 275 cars per 1,000 people in Mexico, according to the World Bank. In the Mexico City urban sprawl with 20 million residents, this would mean about 5.5 million automobiles. Mexico's geography is also problematic. It is in a valley, which can trap pollution, and is more than 7,000 feet above sea level, so the sun hits with dangerous rays. The chemical mix in the air not only includes ozone, carbon monoxide and nitrogen dioxide, but also anything from solvents released by house paints to perchlorates from fireworks. Pollution also blows in from nearby cities like Toluca and Pachuca, where there are still many factories. 'Air is very democratic,' Garcia says. 'The same air goes into rich and poor neighborhoods alike.' Clouds of dirty gases not only look horrible. They can also mean death. A 2013 study by Mexico Competitiveness Institute found about 1,700 deaths in Mexico City were likely related to pollution in one year. It also caused 4,200 hospitalizations and 234,000 doctor's appointments. Together, this cost the economy about 1.3 billion pesos or $850 million. 'While Mexico has made some progress, it still has a long way to go on cleaning up its air,' author Fatima Masse says. The city needs to improve public transportation much more and clamp down on diesel-spitting transport trucks, she adds. 'The issue of clean air and issue of global warming are mixing together,' Masse says. 'They are going have to be at the center of public policy in the years ahead' Mexico's federal government recognizes this challenge — or at least it claims to. In March, Mexico became the first developing nation to formally pledge to cut global warming pollution. It promised to cut greenhouse gas emissions by 22 percent by 2030. Environment Minister Juan Jose Guerra said it would achieve this by shifting to produce a third

of Mexico's energy from renewable resources — up from just 3 percent now. 'It's obvious that global warming is already a reality,' Guerra said. 'It's without a doubt the principal challenge for humanity in the 21st century.'" [13]

Method for manufacturing artificial paving that help improving global warming

(*Chen, et al. in Patent number 8,267,618 - September 18, 2012*)

Abstract – This describes a method for manufacturing artificial paving that helps improve global warming and allows for construction of concrete paving that shows water permeability and environmental protection features to allow underside gradation layers to become an ecological gradation layer to activate organic substances contained in soil and improve the global warming problem.

The inventors explained that without efficient water permeability, rainwater drainage on ground surface will become poor. Thus, it is of importance to construct a gradation layer that is effective in maintaining water permeability and preservation of water. Furthermore, to improve the Earth and ecological environment in the Earth, an environment that is beneficial to microorganisms and the Earth protozoa inhabiting in the Earth. The microorganisms inhabiting in the Earth generally include bacteria (eubacteria and archaea), fungi (filamentous fungi and yeasts), and algae. The Earth protozoa include for example amoeba and ciliates. There are a huge number of ciliates existing in the Earth, and they make a great contribution for decomposition of organic substances. Insects, including ants, centipedes, aphids, and mites, help moving soils or digests residual body portions of organisms and thus providing organic substances. Earthworms may help formation of soil pellets, which are good for air ventilation and water draining. Nematodes help digesting organic matters or other small creatures. There are also vertebrates inhabiting in the Earth, such as mice, which dig and loosen soil, and provide excrements for fertilizing the Earth. They are also a member of an underground food chain. Thus, constructing a good environment for mass propagation of the Earth's microorganisms is beneficial for improvement of the Earth. Further, formation of a water preservation gradation layer under an artificial paving layer allows for mutual contact with a top surface of the water permeable paving layer. Through mutual contact between soil and the atmosphere, heat exchange due to humidity and

temperature is conducted just like respiration, helping to realize efficient water drainage and eliminating potential risk of surface accumulation of water, thus providing a practical effect.

Jui-Wen Chen (first inventor listed with a co-inventor) is from Shulin, Taiwan.

In a communication from JW Corporation (2013) titled, *About JW Corporation* it is written, "JW EcoTechnology is a product of the Ding Tai Co., Ltd., and a 10-year pioneering effort in eco-friendly pavement landscaping. Our mission is to bring a new hope to combat the deleterious and grim effects of decades of urban/suburban sprawl, an unbridled spread of stifling concrete and pavement that produces runoff flooding, drought, greenhouse gas, heat island phenomena and rampant pollution. JW Ecotechnology allows private and city planners to landscape roads, plazas, parks, sidewalks with truly permeable, breathable surfaces that provide a harmonious cohabitation with the earth's natural subsurface to sustain a living and breathing eco-system. JW Ecotechnology is the brainchild of Jui Wen Chen, a highly decorated and respected innovator in EcoTechnology who has spent years developing a unique surface technology that has been acknowledged and hailed as one of the most significant 'Green' achievements of our time. JW EcoTechnology also answers the call that other pervious pavement methodologies fail to address - and that is long-term performance and low maintenance under heavy-loads, as well as providing a suitable eco-habitat with the Earth subsurface. It's a new day, new hope, with new directions. JW is already on that road with hundreds of installations, with maintenance-free performance exceeding 10 years. We invite you to visit our 'Case Studies' and see why our Passion makes Perfect." [14]

Gaseous dielectrics with low global warming potentials

(*Luly, et al. in Patent number 8,080,185 - December 20, 2011*) and

(*Luly, et al. in Patent number 7,807,074 - October 5, 2010*)

Abstract – This describes dielectric gaseous compounds that are useful as insulating-gases for use with electrical equipment, such as gas-insulated circuit breakers and current-interruption equipment, gas-insulated transmission lines, gas-insulated transformers, or gas-insulated substations.

The inventors explained that the inventive gaseous dielectric compounds are a substitute for SF_6 (Sulfur Hexafluoride). SF_6 is an efficient absorber of infrared radiation, particularly at wavelengths near 10.5.mu.m. Additionally, unlike most other naturally occurring greenhouse gases (e.g., CO_2, CH_4), SF_6 is only slowly decomposed; therefore, its contribution to global warming is expected to be cumulative and long lasting. The strong infrared absorption of SF_6 and its long lifetime in the environment are the reasons for its extremely high global warming potential which for a 100-year time horizon is estimated to be approximately 22,200 times greater (per unit mass) than that of CO_2, the predominant contributor to the greenhouse effect. The concern about the presence of SF_6 in the environment derives exclusively from this very high value of its potency as a greenhouse gas.

Matthew H. Luly (first inventor listed with a co-inventor) is from Hamburg, New York.

Honeywell International Inc. (patent assignee) is an American multinational conglomerate company that produces a variety of commercial and consumer products, engineering services and aerospace systems for a wide variety of customers, from private consumers to major corporations and governments. [15]

Molecular conversion processing of greenhouse gases of global warming effect and conversion units employing a solid particle trap

(*de Souza, et al. in Patent number 7,964,169 - June 21, 2011*)

Abstract – This describes using a molecular conversion unit with a solid particle trap consisting of plasma combustion chamber and an electrostatic filter for the collection of solid particles.

The inventors explained that the process degrades carbon dioxide (CO_2), which is one of the main components of greenhouse gases, into solid carbon and gaseous oxygen (O_2).

Nito Angelo Debacher (second inventor listed with a co-inventor) received a PhD from the University of Bristol, England in 1991. Dr. Debacher is a professor of physical chemistry at the Federal University of Santa Catarina in Florianopolis, Brazil. [16]