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Press Release

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For Immediate Release
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Subject: WaterSmart Cosmology, a Division of *WaterSmart Environmental, Inc.* announces the scientific validity of Newtonian Science as applied to cosmology.

Sir Isaac Newton

Sir Isaac Newton was an English physicist, mathematician, astronomer, natural philosopher, alchemist, and theologian who is considered by many scholars and members of the general public to be one of the most influential men in human history. His 1687 publication of the *Philosophiæ Naturalis Principia Mathematica* is considered to be among the most influential books in the history of science, laying the groundwork for most of classical mechanics. In this work, Newton described universal gravitation and the three laws of motion which dominated the scientific view of the physical universe for the next three centuries. Newton showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws by demonstrating the consistency between Kepler's laws of planetary motion and his theory of gravitation, thus removing the last doubts about heliocentrism (that says planet Earth and other planets rotate around the Sun) and advancing the scientific revolution.

The famous three laws of motion (stated in modernized form): Newton's First Law (also known as the Law of Inertia) states that an object at rest tends to stay at rest and that an object in uniform motion tends to stay in uniform motion unless acted upon by a net external force.

Newton's Second Law states that an applied force, $\vec{F}$, on an object equals the rate of change of its momentum, $\vec{p}$, with time. Mathematically, this is expressed as

$$\vec{F} = \frac{d\vec{p}}{dt} = \frac{d}{dt}(m\vec{v}) = \vec{v}\,\frac{dm}{dt} + m\,\frac{d\vec{v}}{dt}\,.$$

Since the second law applies to an object with constant mass (dm/dt = 0), the first term vanishes, and by substitution using the definition of acceleration, the equation can be written in the iconic form

$$\vec{F} = m\,\vec{a}\ .$$

The first and second laws represent a break with the physics of Aristotle, in which it was believed that a force was necessary in order to maintain motion. They state that a force is only needed in order to change an object's state of motion. The SI unit of force is the *Newton*, named in Newton's honor.

Newton's Third Law states that for every action there is an equal and opposite reaction. This means that any force exerted onto an object has a counterpart force that is exerted in the opposite direction back onto the first object. A common example is of two ice skaters pushing against each other and sliding apart in opposite directions. Another example is the recoil of a firearm, in which the force propelling the bullet is exerted equally back onto the gun and is felt by the shooter. Since the objects in question do not necessarily have the same mass, the resulting acceleration of the two objects can be different (as in the case of firearm recoil).

Unlike Aristotle's, Newton's physics is meant to be universal. For example, the second law applies both to a planet and to a falling stone (or falling apple).

The vector nature of the second law addresses the geometrical relationship between the direction of the force and the manner in which the object's momentum changes. Before Newton, it had typically been assumed that a planet orbiting the sun would need a forward force to keep it moving. Newton showed instead that all that was needed was an inward attraction from the sun.

Newton's Now Famous Apple Tree

The next scientist to have an impact on cosmology was Albert Einstein. Scientists say Einstein's theory applies beyond the solar system itself. Scientists' analysis of more than 70,000 galaxies demonstrates that the universe plays by the rules set out by Einstein in his famous theory.

Princeton University scientists (from left) Reinabelle Reyes, James Gunn and Rachel Mandelbaum led a team that analyzed more than 70,000 galaxies and demonstrated that the universe -- at least up to a distance of 3.5 billion light years from Earth -- plays by the rules set out by Einstein in his theory of general relativity. ***Princeton University, Office of Communications, Brian Wilson***

March 15, 2010

After two years of analyzing astronomical data, scientists have concluded that Einstein's general theory of relativity, which describes the interplay between gravity, space and time, works as well in vast distances as in more local regions of space. A team led by Princeton University scientists, Reinabelle Reyes, Rachel Mandelbaum, and James Gunn, conducted the test.

The scientists' analysis of more than 70,000 galaxies demonstrates that the universe — at least up to a distance of 3.5 billion light-years from Earth — plays by the rules set out by Einstein in his famous theory.

Ever since the physicist Arthur Eddington measured starlight bending around the Sun during a 1919 eclipse and proved Einstein's theory of general relativity, the scientific world has accepted its tenets. But until now, according to the scientists, no one had tested the theory so thoroughly and robustly at distances and scales that go beyond the solar system.

Other scientists collaborating on the research include Tobias Baldauf, Lucas Lombriser and Robert Smith of the University of Zurich and Uros Seljak of the University of California-Berkeley.

The results shore up current theories explaining the shape and direction of the universe, including ideas about "dark energy," and dispel some hints from other recent experiments that general relativity may be wrong.

“All of our ideas in astronomy are based on this really enormous extrapolation, so anything we can do to see whether this is right or not on these scales is just enormously important," Gunn said. "It adds another brick to the foundation that underlies what we do."

First published in 1915, Einstein's general theory of relativity remains a pivotal breakthrough in modern physics. It redefined humanity's understanding of the fabric of existence — gravity, space and time — and ultimately explained everything from black holes to the Big Bang.

The groundbreaking theory showed that gravity may affect space and time, a key to understanding basic forces of physics and natural phenomena, including the origin of the universe. Shockingly, the flow of time, Einstein said, could be affected by the force of gravity. Clocks located a distance from a large gravitational source will run faster than clocks positioned more closely to that source, Einstein said. For scientists, the theory provides a basis for their understanding of the universe and the foundation for modern research in cosmology.

In recent years, several alternatives to general relativity have been proposed. These modified theories of gravity depart from general relativity on large scales to circumvent the need for dark energy, an elusive force that must exist if the calculations of general relativity balance out. But because these theories were designed to match the predictions of general relativity about the expansion history of the universe, a factor that is central to current cosmological work, it has become crucial to know which theory is correct, or at least represents reality as best as can be approximated.

“We knew we needed to look at the large-scale structure of the universe and the growth of smaller structures composing it over time to find out," Reyes said. The team used data from the Sloan Digital Sky Survey, a long-term, multi-institution telescope project mapping the sky to determine the position and brightness of several hundred million celestial objects.

By calculating the clustering of these galaxies that stretch nearly one-third of the way to the edge of the universe and analyzing their velocities and distortion from intervening material, the researchers have shown that Einstein's theory explains the nearby universe better than alternative theories of gravity.

The Princeton scientists studied the effects of gravity on these objects over long periods of time. They observed how this elemental force drives galaxies to clump into larger collections of themselves and how it shapes the expansion of the universe. They also studied the effects of a phenomenon known as "weak" gravitational lensing on galaxies as further evidence.

In weak lensing, matter — galaxies and groups of galaxies — that is closer to viewers bends light to change the shape of more distant objects, according to Mandelbaum. The effect is subtle, making viewers feel as if they are looking through a window made of old glass. Studying data collected from telescope surveys of regions showing what the universe looked like 5 billion years ago, the scientists could search for common factors in the distortion of multiple galaxies. And, because relativity calls for the curvature of space to be equal to the curvature of time, the researchers could calculate whether light was influenced in equal amounts by both, as it should be if general relativity holds true.

"This is the first time this test was carried out at all, so it's a proof of concept," Mandelbaum said. "There are other astronomical surveys planned for the next few years. Now that we know this test works, we will be able to use it with better data that will be available soon to more tightly constrain the theory of gravity."

Astronomers made the discovery a decade ago that the expansion of the universe was speeding up. They attributed this acceleration to dark energy, which they hypothesized pervaded otherwise empty space and exerted a repulsive gravitational force. Dark energy could be a cosmological constant, proposed by Einstein in his theory of general

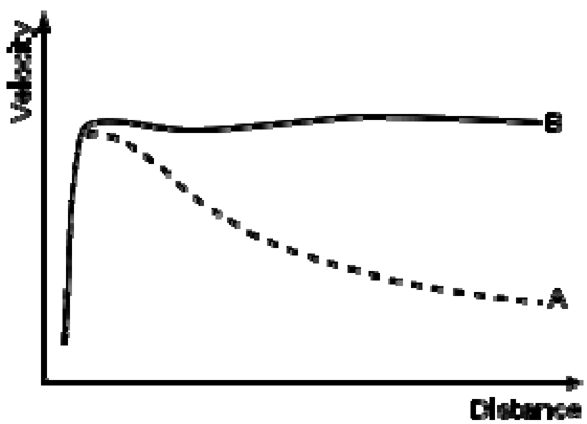
relativity, or it could be a new form of energy whose properties evolve with time.

Firming up the predictive powers of Einstein's theory can help scientists better understand whether current models of the universe make sense, the scientists said.

"Any test we can do in building our confidence in applying these very beautiful theoretical things but which have not been tested on these scales is very important," Gunn said. "It certainly helps when you are trying to do complicated things to understand fundamentals. And this is a very, very, very fundamental thing."

In the early 1920s it was believed by some astronomers that the universe was expanding. Other astronomers believed that the universe was static since it was created many billions of years ago.

Back in 1959, wannabe astronomer Louise Volders attempted to demonstrate that spiral galaxy M33 does not spin as expected according to Keplerian dynamics, a result which was extended to many other spiral galaxies during the seventies. This is the very first time in history that a modern day astronomers felt OK about disregarding the pioneering scientific works of both Newton and Einstein.



Galaxy Rotation Problem

Rotation curve of a typical spiral galaxy: predicted (A) and observed (B).
The discrepancy between the curves is attributed to dark matter.

Ms. Volders simply *invented* the concept of dark matter because in doing so she was able to explain away the Galaxy Rotation Problem. She also believed that the universe itself was rotating. This is but another non-scientific invention. In the field of literature this is identified as creating a novel.

At the end of the day, there's nothing better than collapsing into a large, comfy chair for some rest and relaxation. But before you get too comfortable, have you ever wondered how much you're moving even when you are trying your best to remain an inert blob? The answer to this question is surprisingly complicated and might surprise you!

Daily Motion

Virtually everyone today knows that the Earth is round and spins once every 24 hours. It is this spinning that causes the daily motion experienced on our planet. If you were standing on the equator of Earth you would move at nearly 1,000 miles/hour (1,600 km/hr), but if you began walking towards the North or South Pole your speed would decrease. If you have trouble understanding why imagine spinning a ball on a stick: as you rotate the stick the “poles” on the stick will remain stationary, while a point in the middle of the ball has to move quickly to make it the whole way around. You don’t need to cover as much distance closer to the pole to make one circuit, so your overall speed would be slower.

Although most people on Earth are moving at several hundred miles an hour, we don’t feel this rotation much in everyday life. Yet this daily motion is observed very often by scientists in the form of what is known as the Coriolis effect. This is where objects that look like they are traveling in a straight line appear to curve when your frame of reference is rotating. Military artillery units first observed the Coriolis effect in the sixteenth century, when they noticed their cannonballs would veer off target when shot long distances. This is because Earth would rotate under the cannonball in flight, so from the ground the cannonball would appear to drift towards the side. It is this daily spinning which causes the Coriolis effect to be observed on Earth.

The Coriolis effect is also very important in the field of meteorology, as the rotation of the Earth determines how pressure gradients like hurricanes rotate. It differs for the northern and southern hemispheres: a system in the Northern hemisphere spins counter-clockwise, while a system in the Southern hemisphere spins clockwise. There is also an urban legend that the Coriolis effect determines which way water will drain in a bathtub or toilet, but on such a small scale the Coriolis effect is negligible.

A low-pressure system over Iceland spinning
counter-clockwise due to the Coriolis Force
Image courtesy NASA

Yearly Motion

The next bit of motion to consider is the yearly motion of the Earth around the Sun. The Earth is 93 million miles (150 million kilometers) away from the Sun and orbits once a year, so it is easy to calculate that we travel around the Sun at the brisk pace of 66,000 mi/hr (107 million km/hr). For comparison, if you were to fly in an airplane at this speed from New York to Los Angeles the journey would only take you just over 2 minutes!

Despite this breakneck speed, however, none of the forces listed from here on are observed at all in daily life on Earth.

The Sun’s Motion

The Sun may seem like a stable fixture to life here on Earth, but when you are looking at a scale as large as the galaxy it is obvious that appearances can be deceiving. Our Sun is just one of billions of stars in our Milky Way Galaxy, which has the shape of a flattened disk with a bulge in the middle. Our Sun is approximately 40,000 light years (the distance light travels in one year) away from the galactic center of the Milky Way.

All the stars in the galaxy have an individual motion relative to the other stars in their part of the Galaxy. By calculating the average motion of stars in our stellar neighborhood, astronomers have calculated that the Sun (and Earth!) are moving at 43,000 mi/hr (70,000 km/hr), which is a typical random motional speed for stars in this part of the galaxy. It is worth noting that this speed is actually slower than what Earth undergoes while orbiting the Sun- at this speed, our New York-Los Angeles trip would take three and a half minutes.

When it comes to going fast, though, the Sun's random motion relative to other stars around us pales in comparison to its rotation speed within the galaxy. Our galaxy is rotating like a giant pinwheel and like most other stars our Sun is rotating around the center of the galaxy. It takes the Sun a whopping 225 million years to orbit the galaxy once, a time scale so huge that the Sun has only done it 20 times since its formation. In order to do this, our Sun must be traveling at the incredible speed of 483,000 mi/hr (792,000 km/hr)! At this speed, traveling across the United States would take just 18 seconds.

So what happens to the planets orbiting their parent stars as they travel through the galaxy? If the Sun is going so fast, why isn't the Earth left behind? The answer is that the Earth is gravitationally bound to the Sun, the same way the Moon is gravitationally bound to the Earth. As a result, as the Sun moves all its planets are obliged to travel along with it, the same way the moon continues to orbit the Earth despite the Earth orbiting the Sun.

The Andromeda Galaxy, a nearby spiral galaxy similar to what our own galaxy is thought to look like.
Image courtesy APOD

Motion Through the Universe

As you may have guessed, our galaxy's speed must also be taken into account. In order to find out its speed, however, scientists encounter a problem. Up until now we have been careful to describe the various speeds in terms of how fast an object is moving relative to other objects. This is true with the speed of the Earth when compared to the Sun or the Sun compared to the center of the galaxy. But what would be the right frame of reference for the motion of our galaxy? We could always compare the Milky

Way's speed to that of another galaxy, but this doesn't work very well because that other galaxy would also be moving.

"It's a tricky problem," admits John Ruhl, a physicist at Case Western Reserve University. Ruhl studies the Cosmic Microwave Background (CMB), which is radiation left over from the early universe just a few thousand years after the Big Bang. Because this radiation fills all space, Ruhl said, "it provides a great frame of reference for calculating relative motion." This means if we compared the Milky Way's movement to the CMB and subtract all the other motion we already know about (such as the Earth orbiting the Sun), what we are left over with is the Milky Way Galaxy's motion through the universe.

When astronomers do this calculation, it turns out that the Milky Way is moving at an astounding 1.3 million mi/hr (2.1 million km/hr) through space. At this speed the New York City-Los Angeles flight would take just under 7 seconds, giving a new meaning to the phrase "zip across the country." Although this may sound astonishingly fast it is still much slower than the ultimate speed limit of the universe, which is the speed of light. A light beam making the same journey would leave everyone else in the dust, as it would make the journey in about a hundredth of a second.

The Milky Way Galaxy is currently rushing toward an area of the sky in the constellations of Leo and Virgo, which is called The Great Attractor by astronomers. It is thought that The Great Attractor is made up of several large groups of galaxies, and many neighboring galaxies are also being pulled in that direction.

What About Expansion?

The galactic motion is the last piece of the motion puzzle, but this often confuses people who think something is missing. "After all," the musing goes, "I have heard that the universe is expanding, so wouldn't this expansion make things in the Solar System and galaxy further apart and change their speeds as a result?"

It's a good question, but in reality it doesn't quite work that way. "The universe is expanding, but it only does so on homogeneous and isotropic scales," says Ruhl. This scale is one where everything looks uniformly the same in all directions, and you need to work on a very large scale to make the universe look the same everywhere!

Take a loaf of unleavened raisin bread, where the loaf is the universe, the raisins are the galaxies, and the dough is the empty space between the galaxies. If you put the loaf into the oven it would expand, and the raisins would be further apart, but the raisins themselves would remain the same size. The universe's expansion works similar to this model: as it expands the uniform dough expands, but the specific raisins keep their size and shape.

As an extension of this, if you look at one random part of our Solar System or galaxy it will look very different from another random part. This means fortunately you do not need to worry about the universe's expansion in our daily lives.

So what do all the speeds add up to? If everything were perfectly aligned in the same direction, your final speed would be 1.9 million mi/hr (3 million km/hr). By sitting in your chair you are traveling the distance across the country just a hair under five seconds, which is definitely something to ponder next time you find yourself lounging comfortably. What a pity you can't rack up frequent flier miles for this trip!

Above Article Written by Yvette Cendes
Reviewed by Nira Datta, Pooja Ghatalia
Published by Pooja Ghatalia.

Since 1959, additional wannabe astronomers have invented similar concepts such as string theory, super gravity, an 11th dimension, variable gravity, and a membrane theory that says the entire universe is but a continuing membrane. If Ms. Volders knew in 1959 that the Milky Way was moving at an astounding 1.3 million mi/hr (2.1 million km/hr) through space she would likely have been hesitant to disregard the then existing cosmology sciences produced by both Newton and Einstein.

News Release Number: STScI-1994-23

Hubble Confirms Existence of Massive Black Hole at Heart of Active Galaxy

May 25, 1994: Astronomers using the Hubble telescope have found seemingly conclusive evidence for a massive black hole in the center of the giant elliptical galaxy M87, located 50 million light-years from Earth in the constellation Virgo. Earlier observations suggested that the black hole was present, but they were not decisive.

This observation provides very strong support for the existence of gravitationally collapsed objects, which were predicted 80 years ago by Albert Einstein's general theory of relativity. This image shows a spiral-shaped disk of hot gas in the core of M87. Hubble measurements indicate that the disk's rapid rotation is strong evidence that it contains a massive black hole. A black hole is so massive and compact that nothing can escape its gravitational pull, not even light.

PRESS RELEASE

March 16, 2005

Italian, US cosmologists present alternate explanation for accelerating expansion of the universe: Was Einstein right when he said he was wrong?

Why is the universe expanding at an accelerating rate, spreading its contents over ever greater dimensions of space? An original solution to this puzzle, certainly the most fascinating question in modern cosmology, was put forward by four theoretical physicists, Edward W. Kolb of the U.S. Department of Energy's Fermi National Accelerator Laboratory, Chicago (USA): Sabino Matarrese of the University of Padova; Alessio Notari from McGill University (Canada); and Antonio Riotto of INFN (Istituto Nazionale di Fisica Nucleare) of Padova (Italy). Their study was submitted yesterday to the journal Physical Review Letters.

Over the last hundred years, the expansion of the universe has been a subject of passionate discussion, engaging the most brilliant minds of the century. Like his contemporaries, Albert Einstein initially thought that the universe was static: that it neither expanded nor shrank. When his own Theory of General Relativity clearly showed that the universe should expand or contract, Einstein chose to introduce a new ingredient into his theory. His "cosmological constant" represented a mass density of empty space that drove the universe to expand at an ever-increasing rate.

When in 1929 Edwin Hubble proved that the universe is in fact expanding, Einstein repudiated his cosmological constant, calling it "the greatest blunder of my life." Then, almost a century later, physicists resurrected the cosmological constant in a variant

called dark energy. In 1998, observations of very distant supernovae demonstrated that the universe is expanding at an accelerating rate. This accelerating expansion seemed to be explicable only by the presence of a new component of the universe, a "dark energy," representing some 70 percent of the total mass of the universe. Of the rest, about 25 percent appears to be in the form of another mysterious component, dark matter; while only about 5 percent comprises ordinary matter, those quarks, protons, neutrons and electrons that we and the galaxies are made of.

"The hypothesis of dark energy is extremely fascinating," explains Padova's Antonio Riotto, "but on the other hand it represents a serious problem. No theoretical model, not even the most modern, such as supersymmetry or string theory, is able to explain the presence of this mysterious dark energy in the amount that our observations require. If dark energy were the size that theories predict, the universe would have expanded with such a fantastic velocity that it would have prevented the existence of everything we know in our cosmos."

The requisite amount of dark energy is so difficult to reconcile with the known laws of nature that physicists have proposed all manner of exotic explanations, including new forces, new dimensions of spacetime, and new ultralight elementary particles. However, the new report proposes no new ingredient for the universe, only a realization that the present acceleration of the universe is a consequence of the standard cosmological model for the early universe: inflation.

"Our solution to the paradox posed by the accelerating universe," Riotto says, "relies on the so-called inflationary theory, born in 1981. According to this theory, within a tiny fraction of a second after the Big Bang, the universe experienced an incredibly rapid expansion. This explains why our universe seems to be very homogeneous. Recently, the Boomerang and WMAP experiments, which measured the small fluctuations in the background radiation originating with the Big Bang, confirmed inflationary theory.

It is widely believed that during the inflationary expansion early in the history of the universe, very tiny ripples in spacetime were generated, as predicted by Einstein's theory of General Relativity. These ripples were stretched by the expansion of the universe and extend today far beyond our cosmic horizon, that is over a region much bigger than the observable universe, a distance of about 15 billion light years. In their current paper, the authors propose that it is the evolution of these cosmic ripples that increases the observed expansion of the universe and accounts for its acceleration.

"We realized that you simply need to add this new key ingredient, the ripples of spacetime generated during the epoch of inflation, to Einstein's General Relativity to explain why the universe is accelerating today," Riotto says. "It seems that the solution to the puzzle of acceleration involves the universe beyond our cosmic horizon. No mysterious dark energy is required."

Fermilab's Kolb called the authors' proposal the most conservative explanation for the accelerating universe. "It requires only a proper accounting of the physical effects of the ripples beyond our cosmic horizon," he said.

Data from upcoming experiments will allow cosmologists to test the proposal.

"Whether Einstein was right when he first introduced the cosmological constant, or whether he was right when he later refuted the idea will soon be tested by a new round of precision cosmological observations," Kolb said. "New data will soon allow us to

distinguish between our explanation for the accelerated expansion of the universe and the dark energy solution."

INFN (Istituto Nazionale di Fisica Nucleare), Italy's national nuclear physics institute, supports, coordinates and carries out scientific research in subnuclear, nuclear and astroparticle physics and is involved in developing relevant technologies.

Fermilab, in Batavia, Illinois, USA, is operated by Universities Research Association, Inc. for the Department of Energy's Office of Science, which funds advanced research in particle physics and cosmology.

That in 1998 it was discovered that the universe is expanding at an accelerated rate is no surprise whatsoever. Even though the universe appears rather old at 13.7 billion years it is also surprisingly young at the same time.

Since we have been visiting the moon and mars we have learned that our own planetary system is still evolving. None of the planets are at the same stage of evolution.

That life on earth exists is no surprise since we belong to the Milky Way--the oldest of the galaxies yet observed by cosmologists.

It was Sir Isaac Newton that claimed we are held together by gravitational forces witness an apple falling on one's head. The further apart each body is to each other means the gravitational attraction diminishes between each body. This principle applies to two bodies that exist on earth as well as any other two bodies that exist within the cosmos itself.

About 100 new stars are created each year. Additional new galaxies are also being created. Existing heavenly bodies are crashing into each other every day while ordinary stars are evolving into white dwarfs. All above referenced creation merely a smaller component of the continuing creation of the universe itself.

While all this ordinary chaos is going on throughout the universe, ordinary planets keep on rotating around their respective suns due to gravitational attraction while ordinary moons keep rotating around their respective planets.

The two hundred billion galaxies likewise keep on rotating around their dark matter center of gravity as well. It appears that the gravitational attraction between bodies as first learned by Newton is still very much alive and doing quite well. Scientists have but scratched the outermost surface only of a total understanding of our quite old but yet quite young universe.

***WaterSmart Environmental, Inc.* marketing its Kyoto Protocol compliant wastes-to-energy technology on an economic development platform to concentrated animal feeding operators and to municipalities. Animal farmers benefit by purchasing biodiesel, electricity, and natural gas (methane) at a 20% discount from retail. Municipalities also benefit by making biodiesel, electricity, natural gas, and potable water available to its citizens and businesses at a 20% discount from existing prices. The technology is marketed on a build-own-operate basis thereby eliminating the necessity for local sales and property tax increases since project financing is entirely secured from the financial marketplace.**

Municipalities that embrace the waste-to-energy technology automatically become zero waste-to-landfill communities. The waste-to-renewable energy technology has been slowly developed over the last 10 years. It is just now being introduced to the interna-

tional marketplace. The technology has the clear potential for making every single city throughout the world energy and fuels independent while reducing oil and natural gas imports. The technology will also permit every single city throughout the world to improve water and wastewater treatment infrastructure while creating jobs and investment opportunities. The waste-to-energy technology can also be applied to Sugar Cane Mills as well as Pulp & Paper Mills with equal success. Both types of mills become energy, food, fuels, and water independent while significantly increasing profits from routine operations. In the case of Sugar Cane Mills temporary and seasonal jobs turn into full time better paying jobs. Widespread use of the technology carries with it the potential for contributing substantially to the reversing of global warming.