Nanomaterial Research Breakthrough - Electricity Produced Day and Night by Harvesting Atmospheric Ions

1) INTRODUCTION

IonPowerGroup.com
Aerospace
ELECTRICITY FROM ATMOSPHERIC IONS

Ion Power Group LLC is a collaboration of science, technology and business professionals from many countries who have formed an international 'think tank' dedicated to helping solve mankind's energy crisis. Ion Power Group is pleased to announce a patented breakthrough in nanotechnology called **Ion Harvesting Technology that generates clean high voltage electricity by harvesting the electric charge of naturally occurring atmospheric ions DAY and NIGHT.**

Research proof-of-concept tests demonstrate that harvesting and storing useable electricity from ions in the atmosphere is technically possible. Ions are microscopic atoms containing an electric charge that naturally exist in the atmosphere. The key to Ion Power Group's breakthrough is the discovery that special carbon nanomaterials are more effective than metal when used to extract electrical power from airborne ions.

Graphene is a special carbon nanomaterial known as *"the Wonder Material"* by scientists across the world because of its amazing unique set of properties. It is thinner, lighter, stronger and carries electric current more efficiently than other materials. Many large companies are working to incorporate Graphene into industries ranging from electronics, computers, power and communications to name only a few.

On May 3rd 2016, a groundbreaking US Patent 9,331,603 was awarded to Ion Power Group for the use of Graphene for ion energy harvesting promoting Ion Power Group into a select group of companies, including IBM and Samsung, that have acquired intellectual property rights related to Graphene.

Ion Power Group's mission is to help usher in a clean, bright energy future by expanding mankind's energy mix to include naturally renewable Ion Harvesting Technology in order to produce non-polluting electricity (and hydrogen gas from water) for the benefit of all people on Earth as well as the brave pioneers who will colonize Mars.

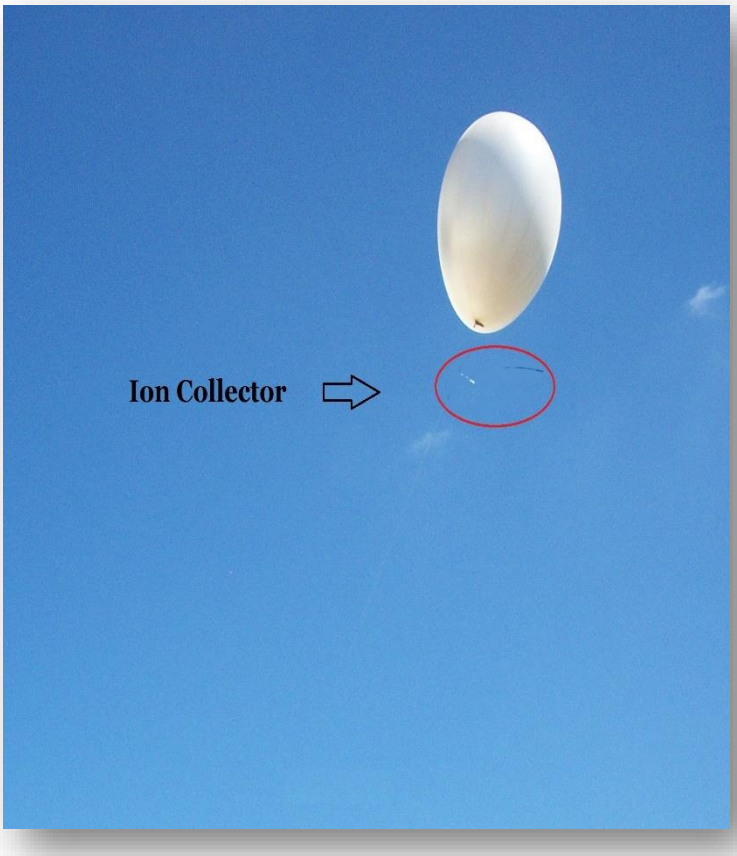
Ion Harvesting Technology should not be confused with other technologies that harvest manmade radio frequency (RF) energy or attempt to capture lightning bolts. Ion Harvesting Technology harvests electricity from physical microscopic objects known as ions that are present in the atmosphere.

MOVIE

← Click on this movie icon to view a brief video clip about Ion Harvesting Technology published by NextIP Intellectual Law Group

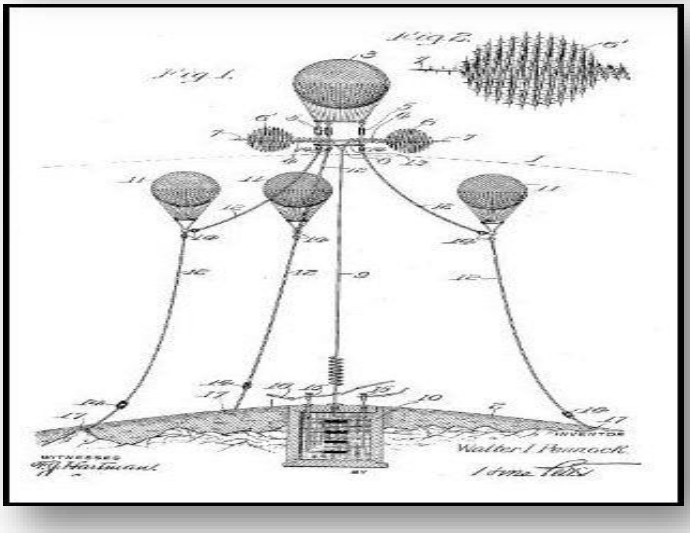
2) DISCOVERY – GRAPHITE/GRAPHENE EXCELS AT HARVESTING ELECTRICITY FROM AIRBORNE IONS

Ion Power Group discovered that by placing carbon nanomaterials Graphite at altitude on a long duration aerial platform (balloon or kite), high voltage electricity is *immediately* harvested from naturally occurring airborne ions and conveyed through a conductive tether to the ground. There is no waiting period. As soon as the ion collector reaches altitude, high voltage electricity flows through the tether to the ground. Using this technique, clean high voltage DC (direct current) electricity can be harvested day and night, good weather or bad. With a theoretical duty cycle approaching 100%, it has been demonstrated by Ion Power Group that this airborne electricity can be stored in high voltage capacitors, or low voltage ultra-capacitors (batteries) to conduct useful work such as power motors, lights, or produce hydrogen gas from water through electrolysis to a degree not previously thought possible.



An Ion Collector (weighs less than 28 grams or 1 ounce) is shown harvesting high voltage electricity from ions in the air day and night - elevated by kite or balloon.

3) AN OLD IDEA REVIVED BY NEW MATERIALS - GRAPHENE & GRAPHITE



Scientists have known for many decades that the atmosphere contains vast quantities of electricity. Electricity is *always* present in the atmosphere, day and night, good weather and bad, in the form of naturally occurring electrically charged ions. The greater the altitude, the more electricity is present. Nikola Tesla noted that atmospheric electricity will charge an electrically isolated conductor in his 1901 US patent, seen here. As far back as the mid-1700's and up to modern times, researchers have used tethered balloons and kites to raise metal probes high into the atmosphere to study this always "on" natural electrical current. However, the challenge has been to harvest this natural electricity in meaningful quantities. Modern Researchers realize that ions act as charge carriers responsible for propagating a global electric field throughout the entire atmosphere everywhere on Earth. Prior to Ion Power Group, previous researchers used metal probes or wires as the means of coupling to the charge carriers (ions) in the air. However, metal has been shown to be a limiting factor when used in ion harvesting.

Research Breakthrough:

Ion Power Group's patented breakthrough reveals that carbon nanomaterials, specifically Graphite and Graphene, are more efficient at harvesting atmospheric electricity than metal. This discovery has revitalized the centuries-old dream of harnessing atmospheric electricity as a power source. **The key behind this game-changing advancement is the use of carbon nanomaterials in the ion harvesting process (instead of metal) of which Graphene is the lightest and most electrically conductive.**

4) GRAPHENE PATENT AWARDED TO ION POWER GROUP

On May 3rd 2016, the United States Patent Office issued groundbreaking patent 9,331,603 B2 to Ion Power Group for the 'wonder material' **GRAPHENE** for ion energy production on airplanes, air and ground drones, blimps, balloons, kites, cars, boats, trucks (including automobile and other transportation conveyances), trains, motorcycles, bikes, skateboards, scooters, hovercraft (conveyances of any kind), hats, clothes, billboards, cell towers, radio towers, camera towers, flag poles, towers of any kind including telescopic, windmills, light poles, utility poles, water towers, buildings, sky scrapers, coliseums, roof tops, solar panels, space stations, moon and Mars structures, rockets, satellites, planetary drones and rovers including robots and artificial intelligence entities and all fixed or mobiles structures higher than 1 inch above ground or sea level. To view Ion Power Group's Graphene patent, **click this Patent icon** →

5) GRAPHENE – THE WONDER MATERIAL

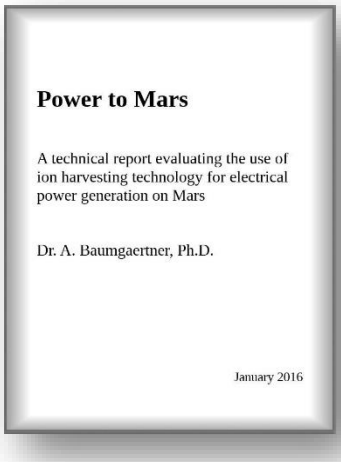
Graphene is >100x stronger than steel, yet flexible. Only one atom thick, it is the world's first 2d material. Although not a metal, Graphene conducts electrical current exceptionally well with very low resistance. Graphene has been labeled "the Wonder Material' by scientists around the world and is slated to revolutionize many industries. The two Physicists that discovered Graphene, Andre Geim and Konstantin Novoselov, were awarded the Nobel Prize in 2010. The use of carbon nanomaterials such as Graphite and Graphene are at the heart of Ion Power Group's clean energy breakthrough - providing a more efficient means of harvesting electricity from airborne ions, day and night, good and bad weather.

← **Click this Movie icon to learn more about Graphene**

(Graphene is an element patented by Ion Power Group for Ion Harvesting)

6) THE ORIGIN OF ION HARVESTING TECHNOLOGY

Designed as a reliable power source for future Mars missions, Ion Harvesting Technology is designed to provide around-the-clock electrical power (day, night, and during dust storms) to future robotic and human Mars settlements by harvesting electricity from ions continually present in the Martian atmosphere. **With a theoretical duty-cycle approaching 100% day, night, and during dust storms,** Ion Harvesting Technology is expected to become a staple of reliable electrical power generation for future Mars missions by NASA, SpaceX and many other space organizations and spacefaring countries.



Senior Scientist of Atmospheric Physics, Dr. Andreas J. Baumgaertner PhD **with the German Aerospace Center** recommends Ion Harvesting Technology as part of a reliable power source for future Mars missions in a ground breaking technical report titled **Power to Mars** published on Feb 10th, 2016.

← To view the PhD report, **click the Power to Mars icon**

7) INVESTMENT TREND – AEROSPACE STARTUPS

In 2015, venture capital groups invested $1.8 billion in commercial space startups, which is more than the last 15 years combined, and when debt financing is included, the total is over $2.7 billion. Because Ion Harvesting Technology can generate clean electricity on Earth and Mars, Ion Harvesting Technology has the potential to positively impact the aerospace industry.

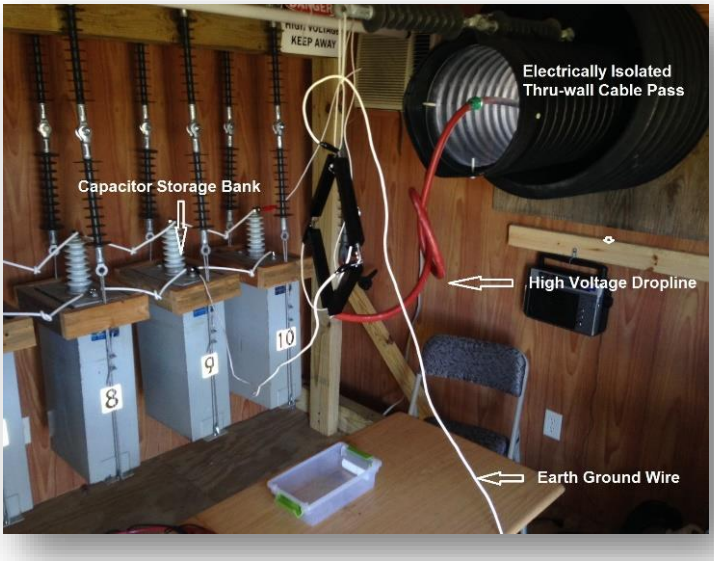
8) CLEAN ELECTRICITY ON EARTH – DAY & NIGHT

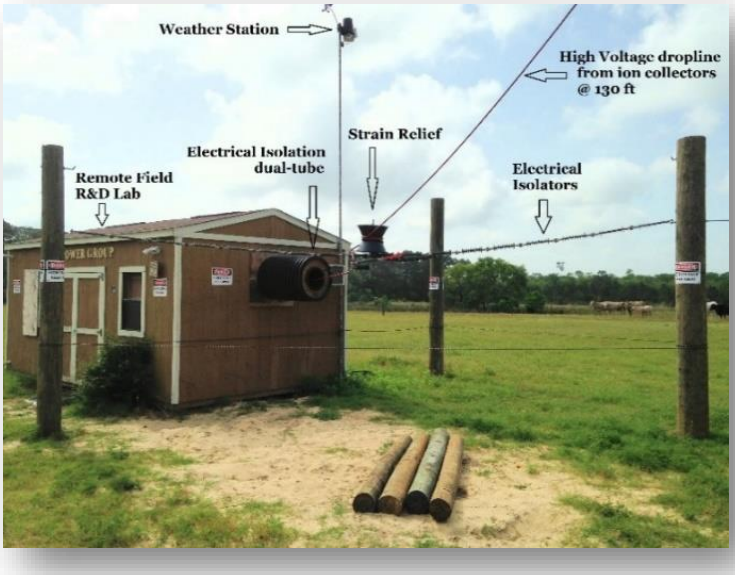
Because ions exist in the Earth's atmosphere, **Ion Harvesting Technology has been shown to work on Earth to produce clean high voltage electricity, day and night,** by harvesting the electric charge of naturally occurring ions in the Earth's atmosphere. Proof-of-Concept tests have demonstrated that useful quantities of clean electricity can be harvested from naturally occurring ions found in the Earth's atmosphere, day and night.

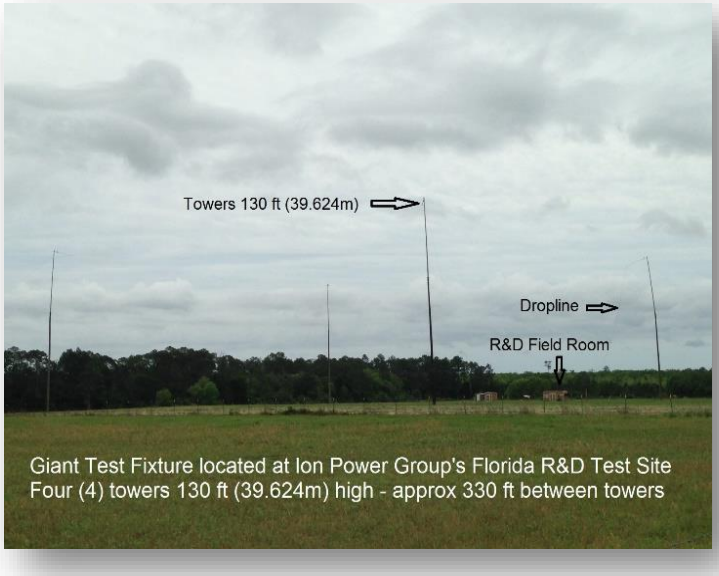
To view a report about the Earth's Electric Circuit
← **click the Earth icon.**

9) POWER MEASUREMENT

32,624 Joules of energy have been harvested by Ion Power Group from airborne ions during peak ion periods and stored in ten (10) General Electric capacitors (pictured below) during experimental tests. The energy stored in the capacitors has been used to, among other functions, power motors, power lights (including 32 feet of fluorescent lights), perform H2O electrolysis to produce hydrogen gas, and power a super capacitor/inverter circuit to produce 120vac/60 hz to power a house lamp. **1,236 Watts** of real-time peak harvested power (41,200 vdc @ 30ma) has been measured at Ion Power Group's Proof-of-Concept Florida test site during disturbed weather using four hundred (400) Graphite Ion Collectors elevated at 130 ft. on the giant test fixture (more about the giant test fixture below). To view a brief prototype test of 'house current' produced from stored electricity harvested from airborne ions, **click this MOVIE icon** →







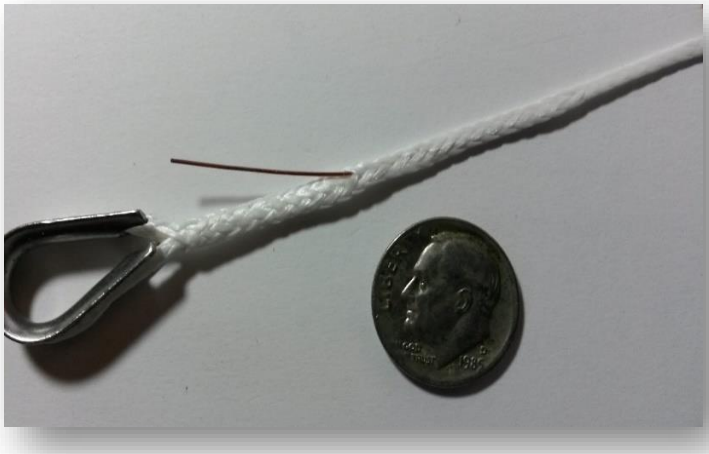
Click Images to Enlarge

10) PROOF-OF-CONCEPT CLIPS

Video clips demonstrate the technical feasibility of utilizing carbon nanomaterial to harvest high voltage electricity from ions in the air to power motors, lights and H2O electrolysis to produce hydrogen gas. **Click this MOVIE icon** →

11) One Ion Collector at >2x Altitude can do the Work of 400 Ion Collectors at 1x Altitude

During disturbed weather (peak ion periods) ion population densities near the Earth's surface increase by orders of magnitude allowing useable power to be harvested by Ion Collectors at only 130 ft. altitude**.** During clear sky conditions, preliminary research has indicated that a tethered balloon equipped with only one (1) Ion Collector located at slightly greater than 2x the altitude (approx. >260 ft. above ground level) provides the relative power output of 400 Ion Collectors located at 130 ft. altitude. This important preliminary finding supports other tests that confirm that the level of harvested power increases with altitude, suggesting that one (1) Ion Collector at greater altitude can replicate the harvesting output of many Ion Collectors at a lower altitude. Ion Power Group has commenced testing of balloons and kites to position Ion Collectors at higher altitudes where greater ion densities may be found. Long duration tethered balloons (or kites) are presently the most cost effective means of providing high altitude for lightweight Ion Collectors (one Ion Collector weighs < 1 ounce) to harvest high voltage electricity from airborne ions.

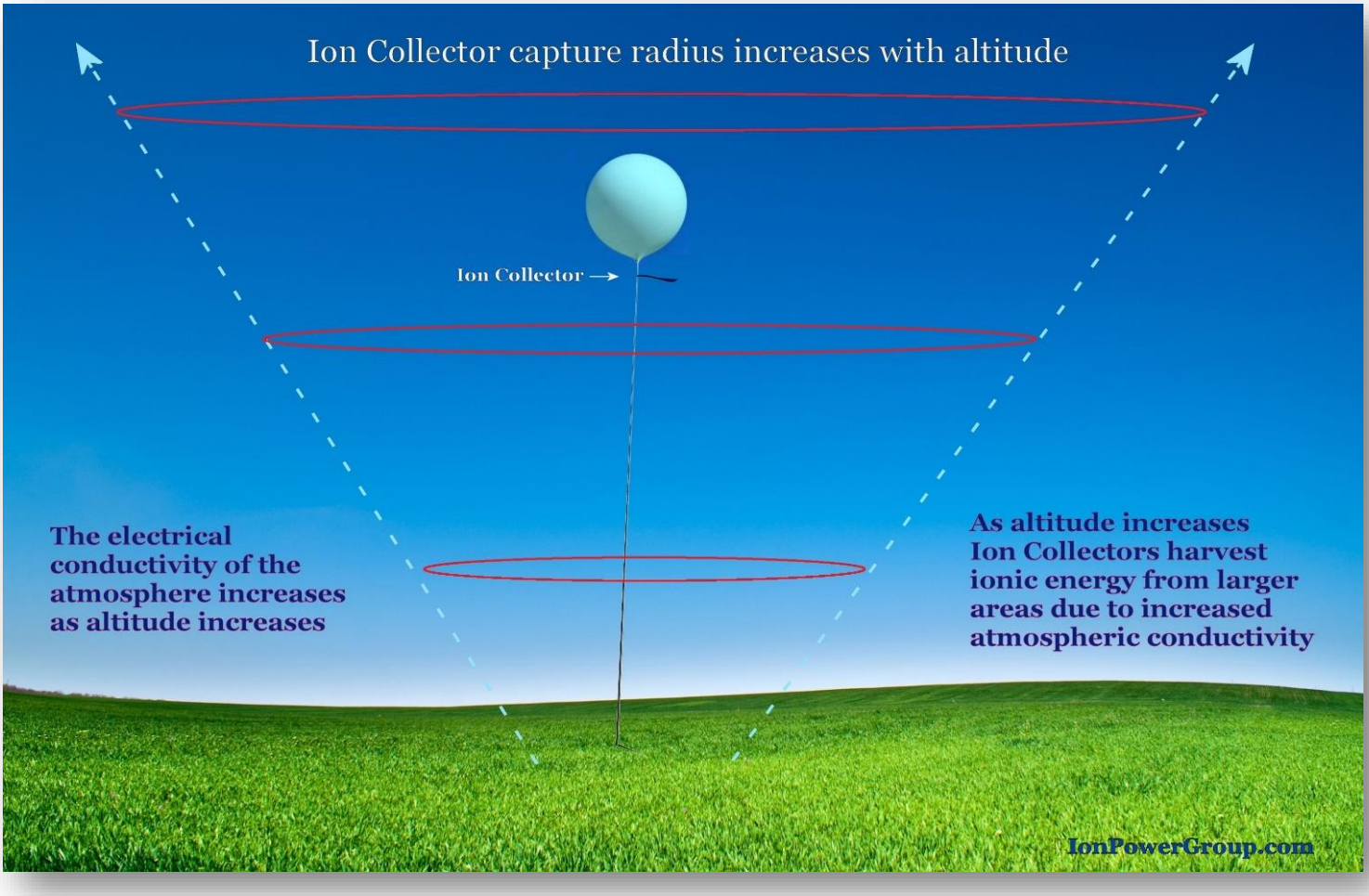


In early stage research, bare aluminum wire has been used to tether the balloons. Because the aluminum tether wire is bare, loss of electricity is experienced - due to a portion of the harvested high voltage electricity diffusing back into the air through the uninsulated aluminum wire - particularly near ground level. In conjunction with an outside subcontractor, **a special low-loss conductive tether has recently been developed which Ion Power Group intends to purchase in the future, seen above, decreasing loss and increasing efficiency, allowing accurate power measurements to be conducted in the future.**

12) VOLTAGE

During fair weather, atmospheric voltage increases generally at 80-300vdc/meter above ground or sea level, day and night, depending on local weather and time of season.

During cloudy, disturbed, or stormy weather (aka peak ion periods) atmospheric voltages can increase to 1,000-3,000.vdc/meter, day and night. Because the electrical conductivity of the atmosphere increases with altitude, the capture radius in which ion collectors harvest electricity also increases with altitude. For example, during fair weather conditions, ion collectors may harvest 7,500 volts DC (7.5kV) at about 92 meters (301 ft.) altitude. However, during stormy/disturbed weather (peak ion periods) 7,500 volts DC (7.5kV) might be harvested at about 6 meters (20 ft.). There are many variables that effect the level of electrical power harvested by ion collectors including humidity, temperature, geographic elevation, season, aerosol particles, and ground radon gas emissions; however, regardless where Ion Harvesting Technology is deployed on Earth, ions are always present in the atmosphere for electricity. To view a technical report regarding atmospheric electricity, **click on this REPORT icon →**



13) CURRENT

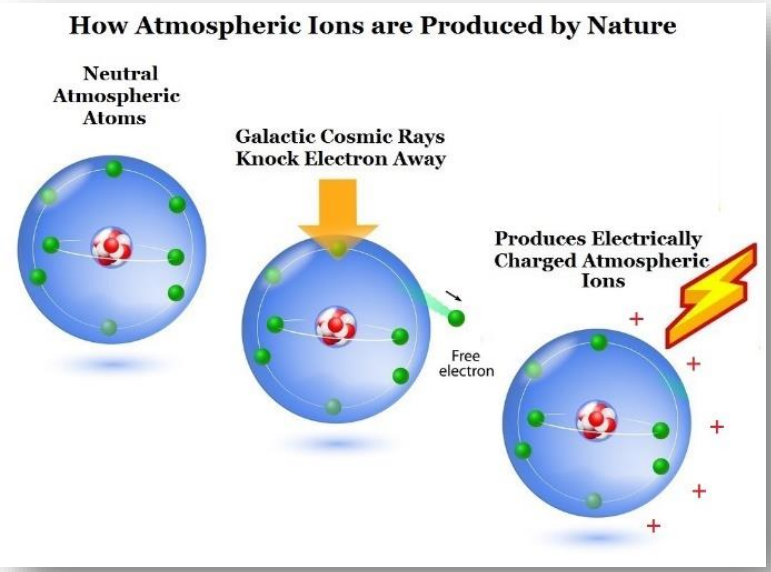
Atmospheric electrical current is low during local fair weather conditions but can increase many orders-of-magnitude during stormy conditions (peak ion periods). The solution to increasing harvested power during fair weather conditions is to provide greater altitude to the ion collector thereby increasing the harvested voltage. Because the effective capture-area increases as the Ion Collector is raised higher in altitude, voltage and current has been observed to increase in preliminary tests. However, assuming a situation in which the current stays constant while voltage increases (due to the ion collector being raised to a higher altitude) the result is a net power increase as shown in the formula outlined below.

P=VxI. Therefore, if I is constant, as V increases, P increases proportionately

Ion harvesting technology addresses the problem of low atmospheric current by increasing the altitude of ion collectors thereby increasing overall harvested power. Due to a significant increase in ionic density during localized disturbed/stormy weather, the altitude of the ion collectors can be reduced, in some cases near to ground level, thereby protecting the balloon (or kite) or relying on pole supported ion collectors during storms.

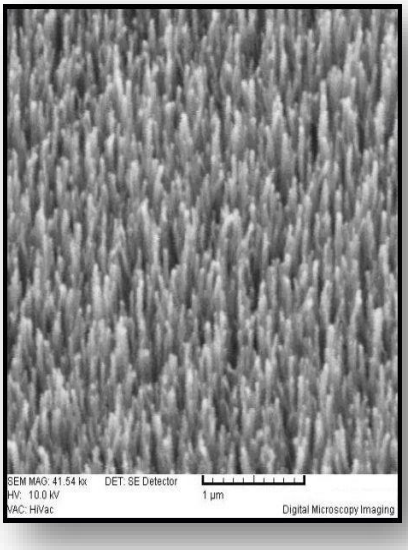
14) ATMOSPHERIC IONS – POWER OF THE FUTURE

Ions are consistently created in the Earth's atmosphere through a combination of natural processes. Galactic Cosmic Rays (GCRs) constantly bombard the atmosphere producing electrically charged ions, everywhere on Earth, around the clock. Additionally, Radon gas seeping up from the Earth's crust adds to localized ion populations. More than 4,000,000 lighting events occur every 24-hour period energizing the Earth's atmosphere while also adding to the ionic population. These natural processes are constantly at work creating and maintaining the ion population of the Earth's atmosphere. **Atmospheric ions are a natural resource available everywhere on Earth that cannot be depleted.**



To see a visual demonstration of Galactic Cosmic Rays (GCRs) constantly bombarding the Earth's atmosphere, view this clip by the Large Hadron Collider Project, **click Movie icon →**

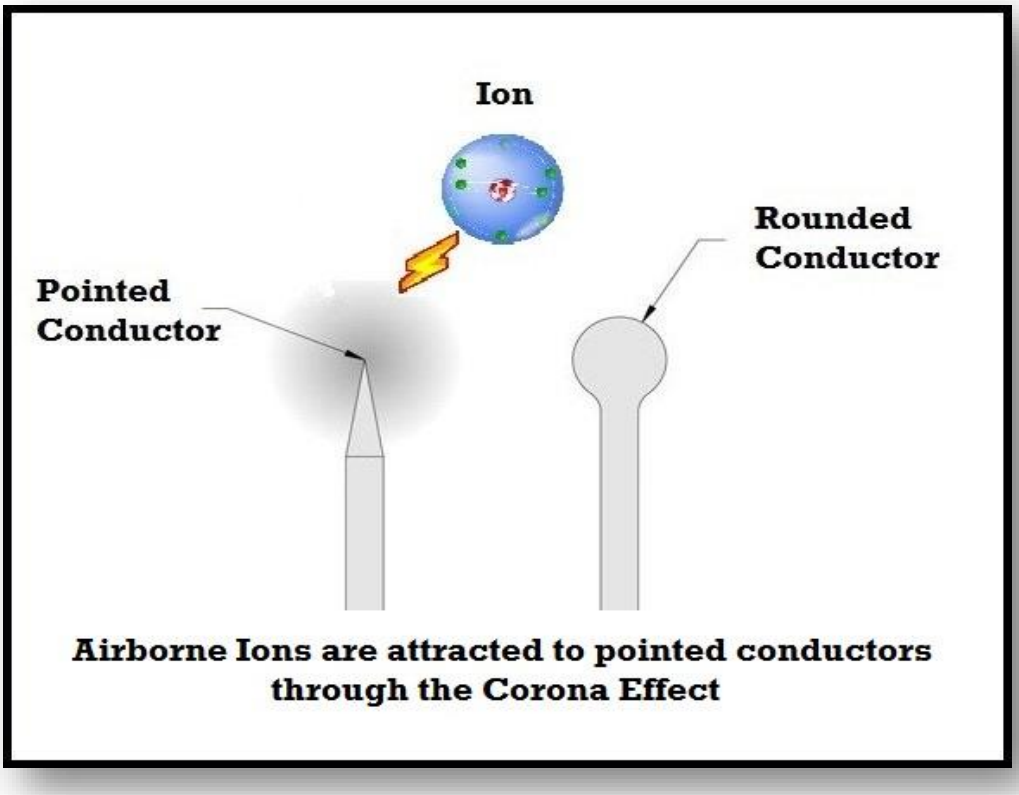
Click image to enlarge



Ion Power Group's new method of coupling to atmospheric electricity is vastly different from all previous techniques by virtue of our patented breakthrough revealing that carbon nanomaterials such as **Graphite (and Graphene) microscopic shown at left, macroscopic shown at right are significantly more effective at coupling to airborne charge carriers (ions) than metal.** The use of carbon based nanomaterials distinguishes Ion Power Group from all other researchers.

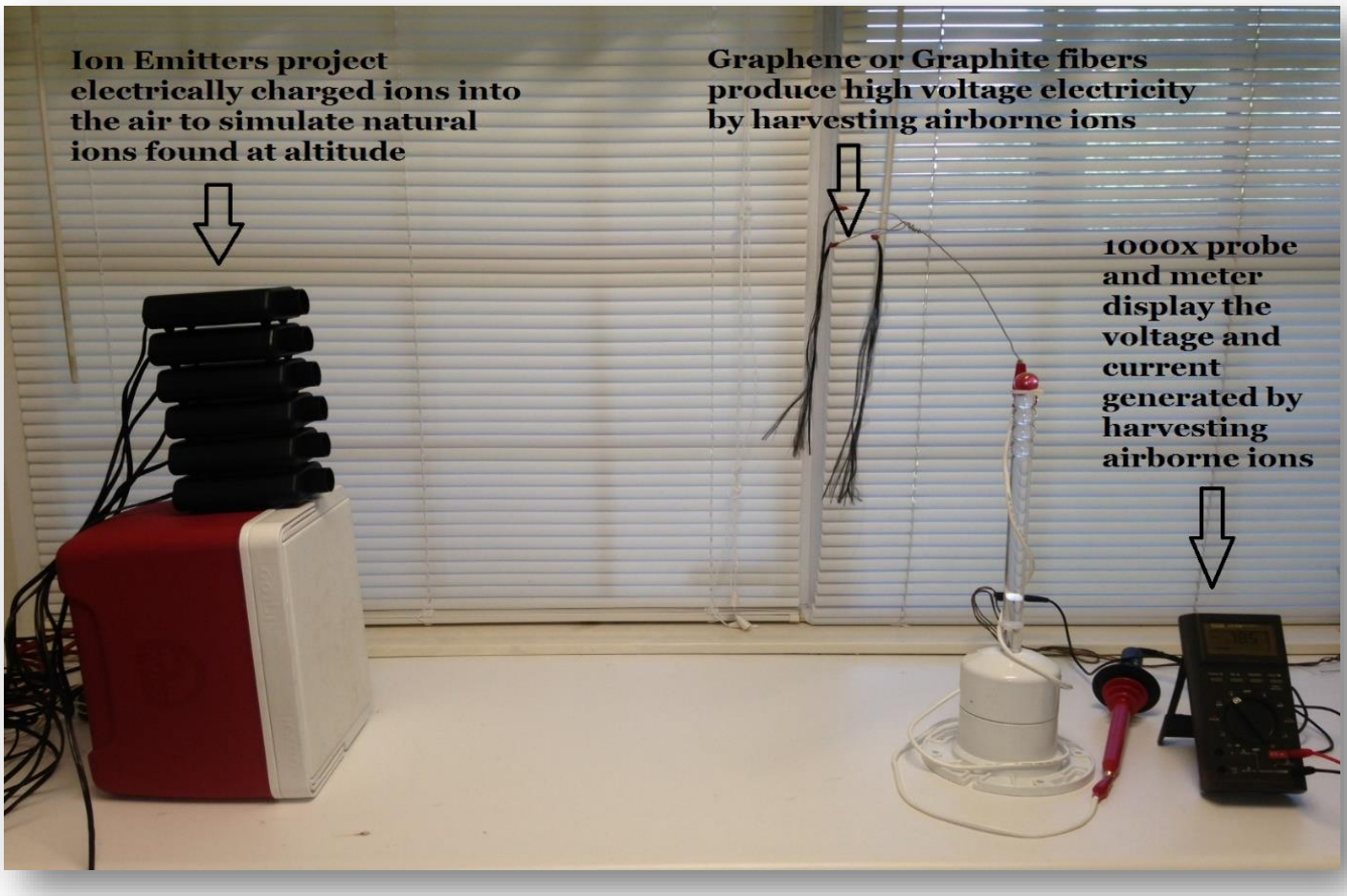
15) WHY CARBON NANOMATERIAL?

It is known within the scientific community that electric charges tend to become localized (gather) at conductive points due to the ***Corona Effect***. Given equal circumstances, an airborne ion will tend to be attracted to a pointed conductor rather than a non-pointed conductor. **Click on this REPORT icon to view technical report →**



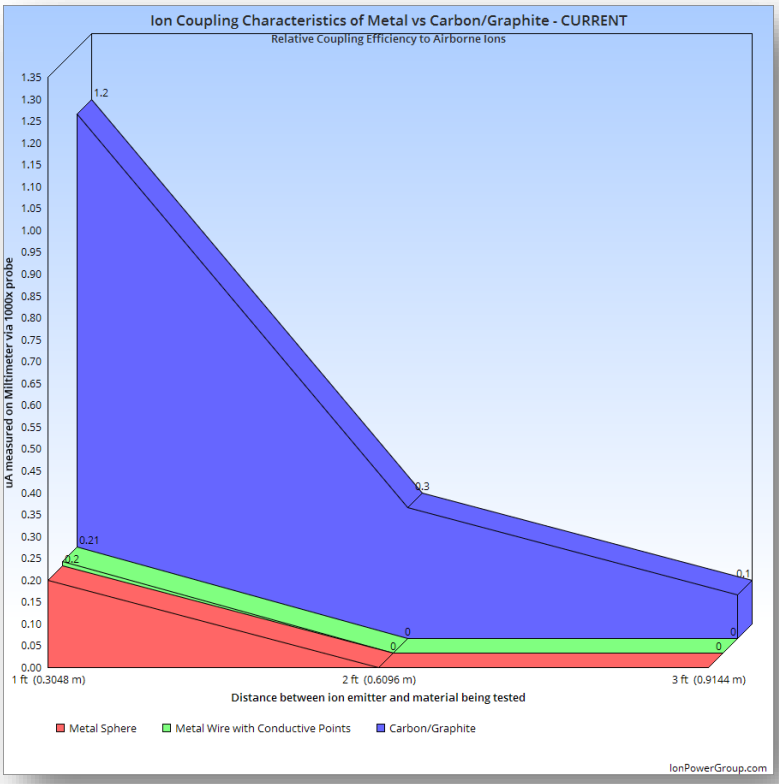
Graphite provides *millions* of microscopic pointed conductors which readily couple to electrically charged ions making it the best known material to harvest high voltage electric charges from airborne ions, significantly more efficient than metal, including pointed metal. **The Theory-of-Operation suggests that incorporating GRAPHENE into the Ion Collector will further improve harvesting efficiency due to Graphene's superior electrical conductivity properties. Including Graphene in the Ion Collector design is anticipated to provide additional improvement in harvesting efficiency** - an improvement already protected by Ion Power Group's patent portfolio.

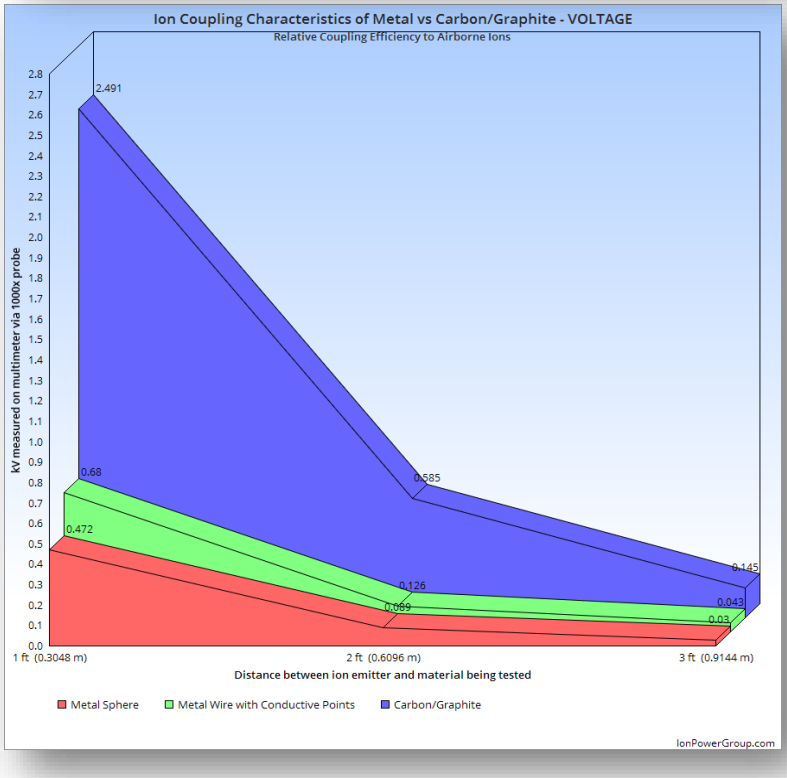
The below table top test fixture permits materials to be tested regarding effectiveness in harvesting electricity from airborne ions. Ion emitters are used as a fixed ion reference source to broadcast a steady level of ions into the local airspace to simulate conditions found at altitude. The material to be tested is positioned nearby affixed to an electrically insulated stand. A 1000x probe is electrically connected to the material being tested, in this case Graphite. A multimeter provides a voltage and current readout indicating a material's relative effectiveness.



Click on Image to Enlarge

The below graphs indicate the relative effectiveness of Graphite compared to metal when harvesting electricity from airborne ions. Red and Green represent metal's efficiency curve, Purple represents Graphite. **Click the graphs to enlarge.**





16) DEVICES TO BE POWERED AS DEMOS

During prototype tests using the Giant Test Fixture, Ion Power Group has successfully stored 32,624 Joules of energy harvested from ions in the air during Proof-of-Concept tests. The below depicts common appliances and the period of time each could operate on that amount of power. Assuming adequate funding is obtained in a timely manner to continue Ion Power Group's research momentum, it is completely feasible that Ion Power Group can demonstrate the below appliances, as well as others, powered by electricity harvested from airborne ions as solid demonstrations that airborne ions do indeed provide useable energy. Future demonstrations of consumer appliances powered by Ion Harvesting Technology will advance this breakthrough technology into the 'real world' in a manner that the average person can appreciate and the media can propagate.

17) ABOUT TECHNICAL REPORTS ON THE INTERNET

There are a number of professionally generated technical reports available for viewing on the internet that do an excellent job of characterizing the Earth's Fair Weather Electric Circuit. These reports tend to model the Earth's Fair Weather Circuit as a 'whole' averaging the energy produced by thousands of storms over the entire atmosphere. One might conclude from such reports that the atmosphere offers a maximum of **2 pA/m2** of electrical current. However, in practice, Ion Power Group has oftentimes measured many watts of harvested power – as great as 1,236 watts (41,200vdc @ 30ma) with ion collectors at 130 feet altitude.

What accounts for the very wide discrepancy between theoretical models and real-world measurements? **Answer:** Localized disturbed weather can greatly increase the electrical component of the *local* atmosphere thereby significantly increasing the level of electricity available to ion harvesting by many orders of magnitude. The complexity involved in modeling the localized disturbed weather (plus localized Radon gas emissions) to address selected locations around the globe would, understandably, increase the complexity and length of any report. Most researchers who have published reports about the Fair Weather Circuit intentionally do not focus on the local effects of disturbed weather or Radon gas components – some researchers even state this fact in their report. With regard to harvesting electricity from the atmosphere, the absence of modeling the beneficial effect of localized disturbed weather and the positive effects of Radon gas may lead readers to a conclusion that drastically underestimate the *actual* electrical power available to be harvested during localized disturbed weather. During real-world testing, Ion Power Group has repeatedly demonstrated that localized disturbed weather greatly increases the electrical power output of ion harvesting technology, many thousands of times greater than **2 pA/m2.**

Fair Weather Solution: The solution to increasing electrical power during fair weather conditions is to provide greater altitude to the carbon nanomaterial ion collector, via long duration tethered balloon, thereby increasing the harvested voltage. The electrical conductivity and voltage of the atmosphere increases with altitude, therefore, the effective capture-area is thought to increase as the Ion Collector is raised higher in altitude (see the above capture radius image on page 10). Voltage (and sometimes current) have been observed to increase as an ion collector is raised in altitude. However, assuming a situation in which the atmospheric current stays constant while voltage increases (due to the ion collector being raised to a higher altitude) the result is a net power increase as shown in the formula outlined below.

P=VxI. Therefore, if I is constant, as V increases, P increases proportionately

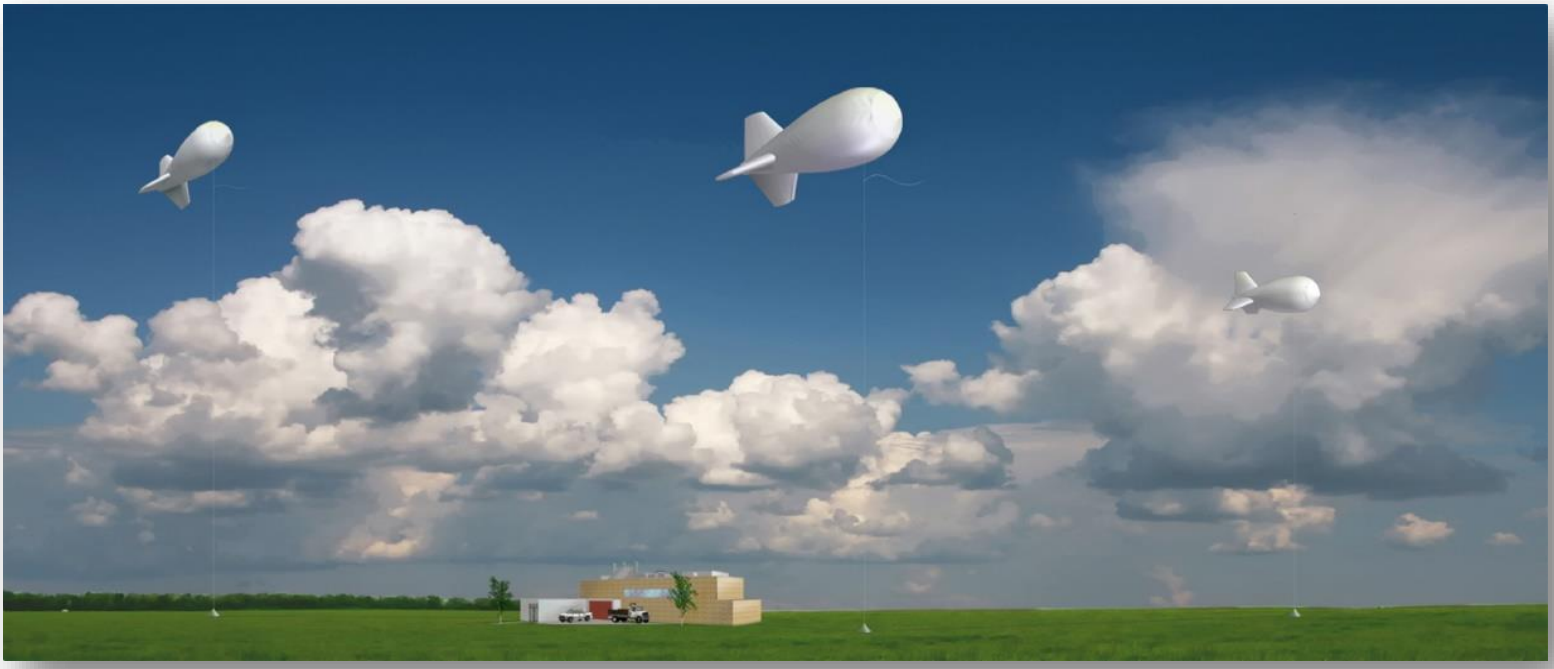
Ion Harvesting Technology addresses the problem of low atmospheric current during fair weather conditions by increasing the altitude of ion collectors thereby increasing overall harvested power. It is noteworthy that none of the reports presently available via the internet study the harnessing of atmospheric electricity for power production based on using more efficient carbon nanomaterials such as Graphite and Graphene. Therefore, those reports do not reflect the most recent technological advancements for harvesting atmospheric electricity. For the reasons stated herein, reports available via the internet (while most are very good when read in context) should not be considered an accurate representation of the *actual* electrical power available to advanced Ion Harvesting Technology because the reports do not model the beneficial effects known to be produced by a) localized disturbed weather and b) natural Radon gas emissions and c) the use of advanced carbon nanomaterials in the harvesting process.

18) A GIANT TEST FIXTURE

This giant test fixture was constructed in the early stages of Ion Power Group research to lift different materials up in the air to determine which materials electrically coupled most efficiently with airborne ions. Trucks and cranes were employed to transport and install four (4) 145 foot towers (95 ft. wooden, 50 ft. metal) at the Ion Power Group test site in Milton Florida. The four towers form a giant test fixture 130 feet high with approximately 330 feet distance between the four poles – in a square configuration. Hundreds of materials were tested over many months. **Click the images to enlarge.**

19) FUTURE ION HARVESTING FARMS

The below images are artist's depictions of how future Ion Harvesting Farms may appear with the exception that the long duration areal platforms (balloons or kites) will be much higher than shown in the images and therefore not easily seen. Because Ion Harvesting does not occupy much ground area, the ground can be multi-purpose and used for other productive purposes such as solar farms, animal grazing, farming or housing.



Future Ion Harvesting Farms can be located virtually anywhere that balloons can be anchored by tethers including deserts, fields, savannas, mountains, even over bodies of water such as lakes and oceans.

Tests have shown that greater altitude provides greater power and that high voltage electricity continues to flow as long as adequate altitude is provided to the ion collectors with a theoretical duty cycle approaching 100%.

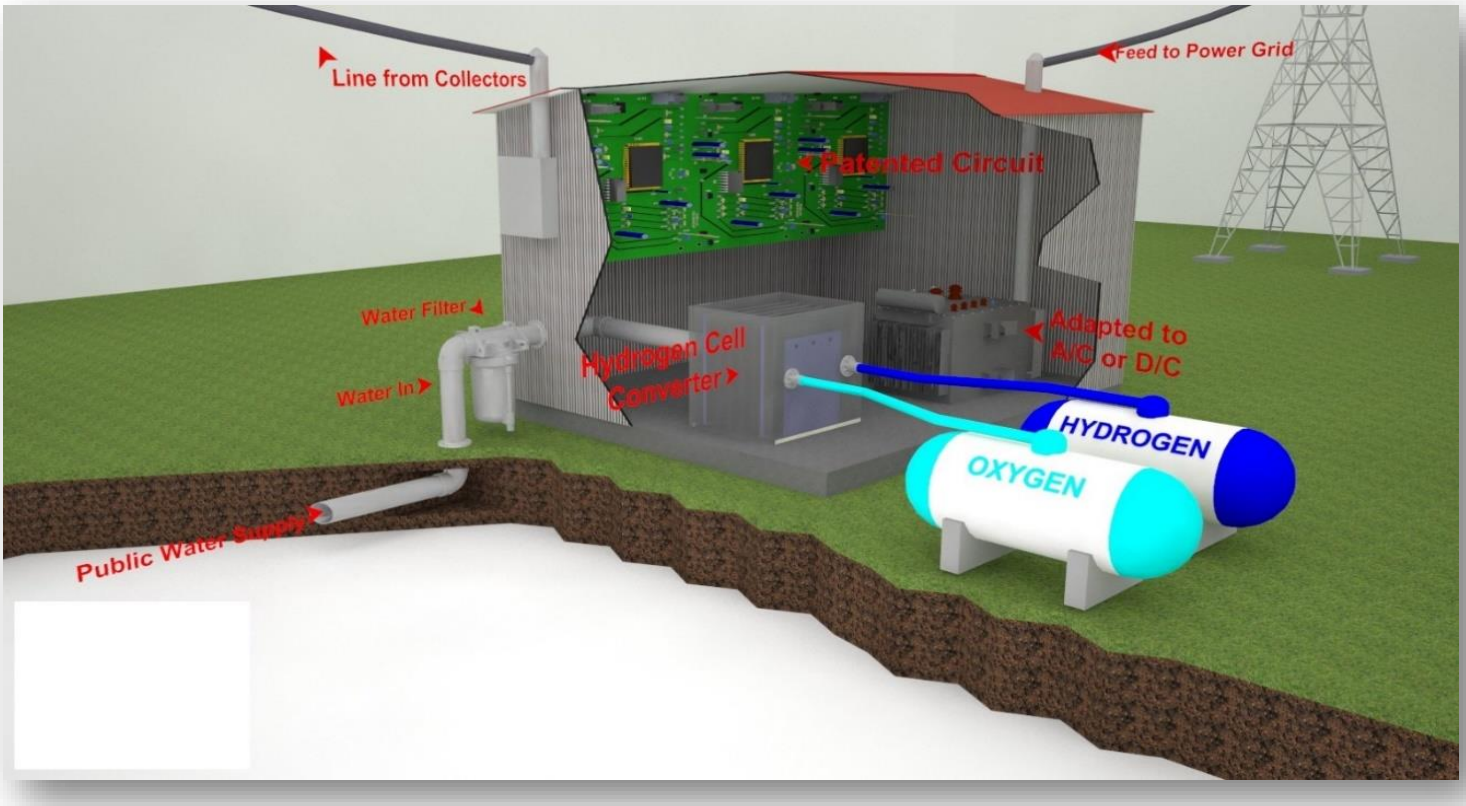
20) GRAPHENE IN SMARTPHONES & CLOTHES FOR ENERGY HARVESTING

US Patent 9,331,603 B2 granted to Ion Power Group covers the inclusion of Graphene in electronic cases, including SmartPhones, as a means of helping to charge the batteries for powering the electronic devices by harvesting locally available airborne ions or via the Triboelectric Effect. The patent also includes the use of Graphene in clothes to generate electric current via the Triboelectric Effect caused by the movement of the clothes or in some cases, airborne ions, helping to usher in the age of wearable electronics.

21) ION HARVESTING + WATER = HYDROGEN GAS

Proof-of-Concept tests have demonstrated that Ion Harvesting Technology can be utilized to power water electrolysis to produce hydrogen gas - the same type of hydrogen gas used to power hydrogen fuel-cell cars. To see a Proof-of-Concept clip, **click this Movie icon→**

In addition to producing clean electricity, it is conceivable that future Ion Harvesting Farms can be employed to convert water into hydrogen gas through water electrolysis on a larger scale.



Ion Power Group has been granted patents for the concept of applying Graphene and Graphite to automobiles and aircraft (and all modes of transportation) for the purpose of generating supplemental electricity as the vehicle is in motion due to the Triboelectric Effect. Preliminary tests on an automobile demonstrate that >500.vdc can be generated.

There are a multitude of potential aerospace, automotive, and commercial applications for Ion Harvesting Technology.

22) PATENTS

The most recent of Ion Power Group's nine (9) patents is US Patent 9,331,603 B2 issued to Ion Power Group on May 3rd, 2016 on **GRAPHENE** including carbon, graphite and silicene for ion energy production on **space stations, moon and Mars structures, rockets, satellites, planetary drones and rovers including robots and artificial intelligence entities, airplanes, air and ground drones, blimps, balloons, kites, cars, boats, trucks, (including automobile and other transportation conveyances), trains, motorcycles, bikes, skateboards, scooters, hovercraft (conveyance of any kind), billboards, cell towers, radio towers, camera towers, flag poles, towers of any kind including telescopic, windmills, light poles, utility poles, water towers, buildings, sky scrapers, coliseums, roof tops, solar panels, hats, clothes and all fixed or mobiles structures higher than one inch above ground or sea level. Click this PATENTED icon to view Ion Power Group's Graphene patent →**

Ion Power Group owns nine (9) patents on Ion Harvesting Technology including in the **USA, CHINA, RUSSIA, CANADA and JAPAN** as seen below. Patents are pending in dozens of other countries.

PATENTS ISSUED TO ION POWER GROUP for ION HARVESTING TECHNOLOGY (Clickable links)

- US 9331603 B2
- US 8686575 B2
- US 7478712 B2
- US7439712 B2
- US 8810049 B2
- CN 101390177 B
- RU 2430455 (not available online, hardcopy available upon request)
- CA 2647385
- JP5552236 B2

23) Potential Customers for Ion Harvesting Technology (short abbreviated list)

The following is a partial listing of companies that conceivably fall into the category of potential future direct or indirect customers and/or vendors-installers of Ion Harvesting Technology.

Company	Country
Bosch	Germany
BP Solar	Spain
	Australia
Greenshine New Energy	USA
Canadian Solar	Canada
China Sunergy	China
Conergy	Germany
DelSolar	Taiwan
	China
E-Ton Solar	Taiwan
Evergreen Solar[4]	USA
	Germany
	China
First Solar	USA
	Germany
	Malaysia
Free Solar Canada	Canada
Gintech	Taiwan
Grape Solar	USA
Isofoton	Spain
JA Solar Holdings	China
JUST Solar Co.,Ltd.	China
Kyocera	Japan
Mitsubishi Electric	Japan
Mitsubishi Heavy	Japan
Motech	Taiwan
	China
MX Group	Italy
Neo Solar Power	Taiwan
Ningbo Solar Electric	China
Photowatt	France
Photovoltech NV	Belgium
Q-Cells	Germany
	Malaysia
	Germany (Calyxo)
	Germany (Solibro)
	Germany (Sontor)
Renewable Energy Corporation	Norway
Panasonic	Japan
Schott Solar	Germany
	USA
Sharp	Japan
Solarday	Italy
SolarPark Korea	South Korea
SolarWorld	Germany
	USA
Solland	Netherlands
SunPower	USA
	Malaysia
Suntech	China
Sunways	Germany
Trina Solar	China
United Solar Ovonic	USA
Vikram Solar Pvt. Ltd	India
Yingli	China
Tamesol	Spain
Sova Solar Limited	India

- ABROS green GmbH, Stuttgart, Germany
- ABSOLAR, Brazil
- Anwell Solar, Hong Kong, China
- Ascent Solar, Tucson, Arizona, US
- DayStar Technologies, Inc., Santa Clara, California, US
- Dyesol,Canberra, Australia
- del2infinity Energy Solution, Wind & Solar forecasting & scheduling,
- Eurosolar, Germany
- Global Solar, Tucson, Arizona, US
- GreenSun Energy, Jerusalem, Israel
- HelioVolt, Austin, Texas, US
- IBC SOLAR, Germany
- International Solar Electric Technology, Chatsworth, California, US
- Isofotón, Malaga, Spain
- Konarka Technologies, Inc., Lowell, Massachusetts, US
- LDK Solar, Xinyu, China
- Miasolé, California, US
- Mitsubishi Electric, Tokyo, Japan
- Nanosolar, San José, California, US
- Odersun, Frankfurt Oder, Germany
- PowerFilm, Inc., Ames, Iowa, US

Potential Customers for Ion Harvesting Technology (short abbreviated list)

Company	Exchange place	Symbol
7C Solarparken	Frankfurt	FWB: HRPK
A2Z Group	Mumbai	BSE: 533292, NSE: A2ZMES
Abengoa, SA	Madrid	BMAD: ABG
Aleo solar	Frankfurt	FWB: AS1
Clean Power Investors, LTD	London	LSE: ALR
Alterra Power	Toronto	TSX: AXY
Americas Wind Energy Corporation	New York	OTCBB: AWNE
Anwell Technologies	Singapore	SGX: G5X
Ascent Solar Technologies, INC	New York	NASDAQ: ASTI
Aventine Renewable Energy	New York	NYSE: AVR
Ballard Power Systems	New York	NASDAQ: BLDP
Brookfield Renewable Energy Partners LP	New York	NYSE: BEP
Carnegie Wave Energy, LTD	Sydney	ASX: CWE
Canadian Solar, INC	New York	NASDAQ: CSIQ
Centrosolar Group, AG	Frankfurt	FWB: C3O
Centrotherm Photovoltaics, AG	Frankfurt	FWB: CTN
Ceramic Fuel Cells, LTD	Sydney	ASX: CFU
China Power New Energy	Hong Kong	SEHK: 735
China Sunergy Co, LTD	New York	NASDAQ: CSUN
Comtec Solar Systems Group Limited	Hong Kong	SEHK: 712
Conergy, AG	Frankfurt	FWB: CGY
Clenergen Corporation,	New York	OTCBB: CRGE
DayStar Technologies, INC	New York	NASDAQ: DSTI
DelSolar Co, LTD	Taiwan	GTSM: 3599
Dongfang Electric	Hong Kong Shanghai	SEHK: 1072 SSE: 600875
Dyesol, LTD	Sydney	ASX: DYE
Enel Green Power S.p.A.	Milano	BIT: EGPW
EnerDynamic Hybrid Technologies Inc.	TSX-V	TSX-V: EHT
Energiekontor, AG	Frankfurt	FWB: EKT
Enlight Renewable Energy Ltd.	Tel Aviv	TASE: ENLT
Enphase Energy	New York	NASDAQ: ENPH
E-ton Solar Technology Co, LTD	Taiwan	TWSE: 3452
EnviroMission, LTD	Sydney	ASX: EVM
EDP Renováveis, SA	Lisbon	Euronext: EDPR
Finavera Renewables, INC	TSX-V	TSX-V: FVR
First American Scientific Corp. (delisted)	New York	OTCBB: FASC
First Solar Holding, LLC	New York	NASDAQ: FSLR
Gamesa Corporación Tecnológica	Madrid	BMAD: GAM
Gevo,_Inc.	New York	NASDAQ: GEVO
Gintech Energy Corporation	Taiwan	TWSE: 3514

Gevo,_Inc.
Gintech Energy Corporation
Goldwind
Good Energy Group, PLC
Green Energy Holding Corporation
Green Plains Renewable Energy, INC
GT Advanced Technologies, INC
Iberdrola Renovables, SA
Innergex Renewable Energy Inc.
JA Solar Holdings Co, LTD
Jetion Solar Holdings LTD
Kedco PLC
LDK Solar Co, LTD
Liberated Energy Corp.
Longyuan Power
Suzhou Shenglong PV-Tech Co.Ltd
Mass Megawatts Wind Power, Inc.
Motech Industries Inc.
Neo Solar Power Corporation
Nevada Geothermal Power, INC
Nordex, AG
Ocean Power Technologies, INC
Ormat Technologies Inc.
Raya Group
Phoenix Solar, AG
PV Crystalox Solar, PLC
Ram Power, Corp.
ReneSola, LTD
Renewable Energy Generation, LTD
Renewable Energy Group, Inc
Renewable Energy Holdings, PLC
Renewable Energy Resources, INC
Run of River Power Inc.
Shear Wind Inc.
Sinovel
S.A.G. Solarstrom, AG
SMA Solar Technology, AG
Solar-Fabrik, AG
Solar3D Inc.
SolarCity Corporation
Solarfun Power Holdings Co, LTD

Potential Customers for Ion Harvesting Technology (short abbreviated list)

SolarWorld, AG
Solco, LTD
SunEdison, Inc.
SunPower Corporation
Sunrun
Suntech Power
Suzlon Energy
Synex International
Terna Energy
Tiger Renewable Energy, LTD
Trina Solar, LTD
Verenium Corporation
Vivint Solar
WaterFurnace Renewable Energy, Inc.
Western Wind Energy Corp. former symbol on WND was bought by Brookfields renewable energy Partner
Windflow Technology, LTD
Yingli Green Energy Holding Co, LTD

- Suzlon (India).
- Alstom Wind (Spain) - subsidiary of General Electric since 2014
- China Guodian Corporation (China) - turbine brand United Wind Power
- Clipper Windpower (USA)
- CNR (China)
- CSIC (Chongqing) HZ Wind Power (China)
- DeWind (Germany/USA) - subsidiary of Daewoo Shipbuilding & Marine Engineering (South Korea)
- Doosan (South Korea)
- DSTN (DSME Trenton) (Canada)
- Ecotècnia (Spain) - acquired by Alstom Wind (Later acquired by General Electric, now GE Power Conversion)
- Elecon Engineering (India)
- Enercon (Germany)
- Enessere (Italy)
- Enron Wind (now defunct) - wind-turbine manufacturing assets bought by General Electric in 2002
- Envision Energy (China)
- Gamesa (Spain) (previously known as Gamesa Eólica)
- General Electric (USA)
- Goldwind (China)
- Hanjin (South Korea)
- Hitachi (Japan) - acquired the wind turbine business of Fuji Heavy Industries in 2012[10]
- Hi-VAWT (Taiwan)
- Hyosung (South Korea)
- Hyundai Heavy Industries (South Korea)
- Japan Steel Works (Japan)
- Končar (Croatia)
- Leitner Group (Italy)
- Mapna (Iran)
- Ming Yang (China)
- Mitsubishi Heavy Industries (Japan)
- NEG Micon - now part of Vestas
- Nordex SE (Germany)
- Nordic Windpower (USA) - bankrupted in 2012
- Northern Power Systems (USA)
- PacWind (USA)
- QED Wind Power (USA)
- quietrevolution (United Kingdom)
- Raum Energy Inc. (Canada)
- RRB Energy Limited (India)
- Samsung Heavy Industries (South Korea)
- SANY (China)
- Scanwind (Norway) - bought by General Electric in 2009
- Schuler (Germany)
- Senvion (Germany)
- Shanghai Electric (China) (SEwind)
- Siemens Wind Power (Germany/Denmark)
- Sinovel (China)
- Southwest Windpower (USA) - closed February 20, 2013
- STX Windpower (South Korea / The Netherlands)
- Suzlon (India)
- TECO (Taiwan)
- TUGE Energia (Estonia) - small wind turbines
- Urban Green Energy (USA)
- Vergnet (France)
- Vestas (Denmark) - the world's largest manufacturer of wind turbines[1]
- WEG (Brasil)
- Windflow (New Zealand)
- WinWinD (Finland)

Rank	Group	Country	Total	Cars	LCV
1	Toyota	Japan	10,324,995	8,565,176	1,481,722
2	General Motors	United States	9,628,912	6,733,192	2,890,958
3	Volkswagen	Germany	9,379,229	9,259,506	119,723
4	Hyundai	South Korea	7,233,080	6,909,194	242,021
5	Ford	United States	6,077,126	3,317,048	2,667,220
6	Nissan	Japan	4,950,924	4,090,677	837,331
7	Fiat Chrysler Automobiles	Italy United States	4,681,704	2,163,040	2,350,697
8	Honda	Japan	4,298,390	4,263,239	35,151
9	Suzuki	Japan	2,842,133	2,452,573	389,560
10	Groupe PSA	France	2,833,781	2,445,889	387,892
11	Renault	France	2,704,675	2,347,913	356,762
12	BMW	Germany	2,006,366	2,006,366	
13	SAIC	China	1,992,250	1,685,392	231,374
14	Daimler	Germany	1,781,507	1,631,502	150,005
15	Mazda	Japan	1,264,173	1,175,443	88,730
16	Dongfeng	China	1,238,948	642,092	
17	Mitsubishi	Japan	1,229,441	1,090,571	
18	Changan	China	1,109,889	873,794	
19	Tata	India	1,062,654	650,708	
20	Geely	China	969,896	969,896	
21	BAIC	China	918,879	243,437	
22	Fuji (Subaru)	Japan	808,919	808,919	
23	Brilliance	China	782,904	479,335	
24	FAW	China	717,883	448,290	
25	Mahindra & Mahindra	India	584,534	407,563	
26	Great Wall	China	557,564	430,423	
27	Isuzu	Japan	532,966		
28	JAC	China	517,577	206,132	
29	BYD	China	510,950	510,950	
30	AvtoVAZ	Russia	507,242	495,013	

Potential Customers for Ion Harvesting Technology (short abbreviated list)

Country	Company name	Revenue 2015 (US$ billion)
	Saudi Aramco	478.00
	Sinopec	455.499
	China National Petroleum Corporation	428.62
	PetroChina	367.982
	Exxon Mobil	268.9
	Royal Dutch Shell	265
	Kuwait Petroleum Corporation	251.94
	BP	222.8
	Total SA	212
	Lukoil	144.17
	Eni	131.82
	Valero Energy	130.84
	Petrobras	*130.00**
	Chevron Corporation	129.9
	PDVSA	128.44
	Pemex	117.50
	National Iranian Oil	*110.00***
	Gazprom	106.3
	Petronas	100.74
	China National Offshore Oil	98.53
	Marathon Petroleum	97.81
	PTT	93.55
	Rosneft	91.72
	JX Holdings	90.67
	Engie	89.64
	Statoil	82.48
	Indian Oil Corporation	81.55
	Sonatrach	*76.10***
	Reliance Industries	73.10
	Pertamina	70.65
	Conoco Phillips	55.52
	Enterprise Products	47.95
	Repsol	47.29
	Centrica	45.29
	Bharat Petroleum	43.46
	OMV Group	43.09
	GS Caltex	40.26
	SOCAR	39.70
	Idemitsu Kosan	38.58
	Hindustan Petroleum	37.85
	Suncor Energy	34.66
	Hellenic Petroleum	31.28
	Motor Oil Hellas	28.98

Zebotec GmbH

Sunhydro

Sunnyside Technologies Inc

Synthetic Genomics Inc

The Hydrogen Company

The London Hydrogen Partnership

Trulite Inc

US BioGen LLC

US National Institute of Hydrogen Fuel Cell Commercialization

United Technologies Corp

University of Strathclyde Dpt of Electric Electrical Engineering Institute for Energy and Enviro

Vatgas

Versa Power Systems

Virent Energy Systems Inc

Waste2Tricity

- Renewable Energy Corporation, Norway
- Schott Solar, Germany
- Signet Solar, California, US
- Skyline Solar, Mountain View, California, US
- SolarEdge, Grass Valley, California, US[18]
- SolarGrid, Brazil
- SolarPark Korea, Wanju, South Korea
- SolarWorld, Bonn, Germany
- Solimpeks, Munich, Germany
- SoloPower, San José, California, US
- Spectrolab, Inc., Sylmar, California, US
- Sulfurcell, company has changed name to Soltecture in 2011, Germany
- SunEdison
- Suniva, Norcross, Georgia, US
- Sun Power Corporation, San Jose, California, US
- Targray Technology International, Kirkland, Quebec, Canada
- Tenksolar, Minneapolis, Minnesota, US
- Topray Solar, China
- Unirac, Albuquerque, New Mexico, US
- Wagner & Co., Germany
- Wirsol, Waghäusel, Germany

Potential Customers for Ion Harvesting Technology (short abbreviated list)

ANV Partners
AQWON Motors
ARRC H2 Alliance
Acumentrics Corporation
Ad-Venta
Aiken County Center for Hydrogen Research
Aiken Electric Cooperative Inc
Air Liquide Group
Air Liquide Hydrogen Energy
Air Products Chemicals Inc
AlumiFuel Power Inc
American Wind Power Hydrogen LLC
Amminex A S

Analytic Power LLC
Apollo Energy Systems Inc
Argonne National Laboratory US
Armstrong Teasdale Future Energy Group
Avalence LLC
Ballard Power Systems
Bar Gadda LLC
Beijing Jinfeng Aerospace S T Developments Company
BekkTech LLC
BlackLight Power Inc
Bryte Energy
C3 BioEnergy
CTP Hydrogen
California Fuel Cell Partnership CaFCP
California Hydrogen Infrastructure Project
Catacel Corp.
Catal International Ltd
CellTech Power Inc
Chai Energy
Chemical Consortium Holdings Inc ChemCon
Chevron Hydrogen Company LLC
Clean Energy Partnership CEP German Office
Clean Hydrogen Producers Ltd CHP
ClearEdge Power formerly Quantum Leap Technology
ClearEdge Power, Inc.
Collier Technologies Inc
Companhia Energetica de Minas Gerais Cemig
Conduit Ventures Ltd
Core Technology Ventures Services CTV
Cryogenic Technical Services Inc
Daesung Group
Dow Chemical Co
DynEco Corporation
EERC National Center for Hydrogen Technology
ET EnergieTechnologie GmbH
EUHYFIS Hydrogen Filling Station Consortium
El Ma Electronic Machining srl
Electrochem Inc
Energy Ventures Organization Inc
Eufinium Finance Ltd
Excess Group Ltd
Exxon Mobil QuestAir Plug Power Ben Gurion University Hydrogen JV
FST Energy
Florida Hydro Inc
Florida Hydrogen Initiative Inc
ForeverGreen Enterprises
Fuel Cell Markets Ltd
Fuel Cell Scientific LLC
Fuel Cell Store Inc
Fuel Cells Technology Transit
FuelCell Energy Inc
FuelCell Energy, Inc.
FuelCellsEtc
FutureCarbon GmbH
GEC Graeber Engineering Consultants GmbH
GEMZ Corp
Gaskatel GmbH
Genesis Fueltech Inc
Genesys LLC
German Hydrogen Association DWV
Gibbs Energy LLC
Global Energy Inc
Global Photonic Energy Corporation Inc GPEC
Golden Bridge Strategies
Green Hydrogen Company
GreenChek Technology Inc
GreenGen Co Ltd
H2 Energy LLC
H2 Energy Solutions Inc

Potential Customers for Ion Harvesting Technology (short abbreviated list)

H24
H24 Fuels
H2Gen Innovations Inc
H2Scan LLC
HCE LLC
HERA USA Inc formerly Ergenics Inc
Highline Hydrogen Hybrids
Hunan Corun New Energy Co Ltd
Hunterston Hydrogen Ltd
Hy9
Hy9 Corporation
HyRadix Inc
HydroGen
HydroGen Corporation formerly Chiste Corp
Hydrogain Technologies Inc
Hydrogen Car Co
Hydrogen Energy
Hydrogen Engine Center HEC
Hydrogen Power Inc formerly Hydrogen Power
Hydrogen Solar Ltd

Hydrogen company Hamburg E V
Hydrogenica Partners LP
Hydrophen
Hythane LLC
Hythane project by Hydrogen China Corporation
Independent Energy Corporation
India National Hydrogen Energy Board NHEB
Infinity Fuel Cell and Hydrogen
Infinity Fuel Cell and Hydrogen Inc
Innovative Energy Solutions Inc
International Development Consultants Inc
International Partnership for Hydrogen Energy IPHE
JV between Brehon Far East and Top Energy
Kansai Electric Power Co KEPCO
Kebaili Corp
L B Systemtechnik GmbH
Liaoning Oxiranchem Inc

Lilliputian Systems Inc
Lion Energy SA
MAHYTEC
MSA Apparatus Construction for Chemical Equipment Ltd
MVV Energie AG
Marine Hydrogen and Fuel Cell Association MHFCA
Medis Technologies Ltd.
MesoFuel Inc
Microcab Industries Ltd
Millennium Cell Inc
Mitsui Co Ltd
Mobile Energy Products Inc
NCRC Energy Solutions
Nanergy Inc formerly ObjectSoft Corporation
Nanoptek
National Hydrogen Association
New Energy Solutions Inc
New Mexico Hydrogen Technology Partners HyTep
Nuvera Fuel Cells
Ocenergy
Oscar Automotive Ltd
Ovonic Battery Company Inc
Ovonic Hydrogen Systems LLC formerly Texaco Ovonic Hydrogen Systems LLC
Oxford Catalysts Group plc
PLANET Gbr
Palmetto Fuel Cell Technologies LLC PFCT
Pfhotonika
Phoenix Canada Oil Company
Plug Power, Inc.
Power Energy Inc
Power and Energy also called Power Energy
PowerAvenue GmbH
Protium Energy Technologies
Proton Energy Systems Inc
Proton Power Systems Plc
Protonex Technology Corporation
Protonex Technology Corporation (Colorado)
PublicGen
Pure Energy Centre
Quantum Fuel Systems Technologies Worldwide Inc Quantum Technologies
RAM Capital Management Group

24) TEAM

Lisa M. McCowen

Founding Member
Senior Organizer

Benjie A. Balser

Chief Executive Officer, Intellectual Property Attorney, Electrical Engineer

Expert in intellectual property protection and patents
Obtained nine (9) patents thus far for Ion Power Group

David Sayers

Chief Financial Officer

Ten years of executive banking experience, two Master's degrees including Master of Accountancy - COO and CDO experience

Dr. A.J.G. Baumgaertner PhD

Atmospheric Physicist and Senior Scientist with the German Aerospace Center

Dr. Tathagata Acharya PhD

Mechanical Engineering
Expert in computational and rarefied gas dynamics - aerodynamics, MS and a BE

Dr. Hatcher Tynes PhD

Atmospheric Physicist
External Technical Resource Consultant

Dr. Sebastian Uppapalli, PhD

Mechanical Engineering
Computational Flow Characteristics

Dr. Gautam Thor PhD

Scientific Research - Diagnostics
IP Development

Clint McCowen

Ion Harvesting Consulting Specialist

International Patent Awardee - USA, China, Russia, Japan and Canada
Authority on the use of carbon nanomaterials for atmospheric ion harvesting

Steve Bolt

Electronics Engineering

Julee Meltzer

Technical and grant writer.

Bradford A. Scott

Founding Member
Financial Adviser

Nathan David Lyons

Financial Consultant

Lt. Colonel (rt) William I. McCowen

Management Consultant

Lt. Colonel (rt) Homer Harkins

Academic Affairs Director Special Operations University
Consultant – leadership and education

Derek Brett
Attorney
Legal Counsel

Major Roland Schmitt

Royal Netherlands Air Force
International political consultant

Keith A. Brahms

United States Air Force graduate
International and military adviser

Randy Allen

Property Management

Helen McCowen

Administration

25) GOALS

Ion Power Group business goals include, but are not limited to:

a) **Construct the world's first Ion Harvesting Farm** (a small farm for testing and measurements)

b) **Document Average Power Output** - conduct long term power measurements necessary to document the average power output.

c) **Document Power Output Vs Altitude** - conduct altitude vs power output measurements to plot the power output curve vs altitude of the Ion Collector.

d) **Demonstrate Scalability** – demonstrate that Ion Harvesting Technology is electrically scalable

e) **Development of a Super Ion Collector –** combination of Graphene and Graphite hybrid ion collector design.

f) **Complete multiple in-process technologies** – including high voltage to low voltage conversion technologies already in progress.

g) **Demonstrations -** Demonstrate consumer appliances powered by Ion Harvesting Technology

h) **File foreign patent applications** on Graphene based on US Patent 9,331,603 B2 through a pending PCT application, plus follow-up on many other patents pending throughout the EU.

i) **Continue filing government grant applications**

26) SUMMARY

Text here

Sincerely,

Benjamin A. Balser
Chief Executive Officer
Intellectual Property Attorney
Electrical Engineer

Ion Power Group LLC

IonPowerGroup.com

Email: Business@IonPowerGroup.com

27) Disclaimer

Ion Power Group LLC is a 'for profit' research and development collaboration organized as a Delaware Limited Liability Company. Although Ion Power Group has conducted years of research in order to accumulate its body-of-knowledge and international patents, Ion Power Group should be considered a start-up in terms of sales. Ion Harvesting Technology is one of the technologies under development by Ion Power Group, the patent pending Shock Wave Engine is another technology under development that harnesses low-head water sources to generate electricity. Ion Harvesting Technology is a research work-in-progress at the Proof-of-Concept stage and is not yet a mature technology - additional funding is required to continue research and development. No market, feasibility, cost, or economic studies have been conducted, as of this time, to determine the market penetration level and market acceptance of Ion Harvesting Technology for Earth or Aerospace (Mars) markets. All research to date by Ion Power Group reflects the use of Graphite in the ion harvesting process. Graphite is readily available at low cost; however, Graphene is not. Large companies are working on methods to mass produce Graphene; however, because it is not readily available, Graphene has not yet been tested by Ion Power Group. Because Graphene is a more electrically conductive variation of Graphite, Ion Power Group has obtained a patent on the use of Graphene for ion harvesting based on the educated belief that Graphene may provide another advance in ion harvesting efficiency. With adequate additional funding, Ion Power Group believes that Ion Harvesting Technology can become a profitable business venture by becoming a useful tool for Earth-bound markets and aerospace applications.