

Docket Number: 09-ALT-1

**DOCKET**

**09-ALT-1**

DATE APR 02 2010

RECD. APR 05 2010

**Docket Number: 09-ALT-1**  
**2010-2011 Investment Plan Committee**  
**April 2, 2010**

Please join me in the goal of creating a hydrogen highway which supplies hydrogen produced from renewable energy. Please include the "Clean Energy Water & Air Project" shown below in your development and investment plan. I am seeking support to license, construct and operate a utility-scale clean hydrogen production and underground storage facility in California.

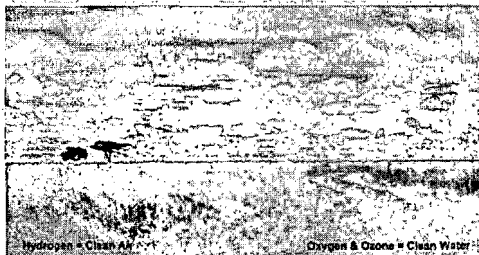
Please publish the ideas below in your development and investment plans. I have been in contact with your staff and they have been very supportive and helpful. I can provide additional information if necessary.

I have attached below:

- 1.) Flyer (Request for Support)
- 2.) Overview of projects
- 3.) Economic Analysis
- 4.) Invention 1: fresh water
- 5.) Invention 2: brine

# Request for Support

## Clean Energy Water and Air Project



Hydrogen = Clean Air      Oxygen & Ozone = Clean Water

**Clean Energy Water and Air Project**  
**Our Road to a Clean Energy Future.**



Hydrogen = Clean Air      Oxygen & Ozone = Clean Water

**Clean Energy Water and Air Project**  
**Do it for the children.**

**The Clean Energy Dream is possible with your support:**  
This project converts electricity produced from renewable and emission free sources; creates hydrogen gas which is a completely clean replacement for petroleum products, and produces products that can be used for large scale water treatment.

**How is this possible?**

- 1.) California Utilities produce large amounts of excess electricity at night. Wind energy is produced predominantly at night and nuclear facilities can't economically be powered down at night.
- 2.) Hydrogen gas can fuel vehicles and machines and replace petroleum products along the California Hydrogen Highway. Hydrogen gas is mixed with oxygen to create electricity and water.
- 3.) Large scale electrolysis and biological production are the two most efficient methods of clean hydrogen production.

**We need your support:**

- 1.) Change regulations so that California Utilities must provide excess electricity at a reduced cost to clean hydrogen production facilities.
- 2.) Create large tax credits both for companies producing hydrogen through electrolysis and for companies (refineries) who purchase large amounts of hydrogen produced from electrolysis. Refineries currently use large amounts of hydrogen (usually produced by burning natural gas) to remove sulfur from crude oil.
- 3.) Increase taxes on environmentally harmful hydrogen production, including natural gas reformation and other hydrogen production methods using hydrocarbons.
- 4.) Provide direct grants or loans to build hydrogen production facilities.

**Process (patents pending):** Two processes are possible: one uses fresh water or effluent as input, and the other uses brine as input. We propose to build a facility which receives electricity & water (brine or fresh water), which creates products for water treatment (chlorine, oxygen, ozone), and also creates hydrogen gas which will be compressed and stored underground, then distributed to either a refinery or sold to hydrogen fueling stations along the California Hydrogen Highway.

**Polls:** Pew Research (Nationwide polls, 2010)  
\*78% favor "Increasing federal funding for research on wind, solar and hydrogen technology."  
\*52% favor forcing companies to pay for their emissions even if it means higher energy prices.

**We request from you:** Please email your letter of support for our project to [mbbrown30@gmail.com](mailto:mbbrown30@gmail.com). Please contact Michael at 415-699-0261 if you are interested in this project. Our website is being developed.

**Site Location:** We are currently evaluating several hydrogen production and storage site locations: Contra Costa (near Martinez), Benecia, and near Los Angeles.

## 2.) Overview of projects:

California produces large amounts of electricity at night when this electricity can't be used because there isn't sufficient demand. This excess electricity must be stored or used, or it is wasted. The California public overwhelmingly supports renewable energy and clean technology products. The California legislature has mandated that both public and private entities purchase or produce 20% "renewable energy" (excluding large hydroelectric generation) by 2010. This goal is currently being increased to 33%. The majority of this "renewable energy" will come from new wind electric generation. Wind power is predominantly produced at night when electricity demand is at its lowest. Additionally, nuclear generation facilities can't easily and safely be shut down at night and thus may continue producing electricity even when electricity is not needed, at night. Therefore, this excess electricity must be stored so it can be redeployed onto the grid during peak demand when electricity is needed.

Electric utilities currently save this excess electricity in massive energy storage projects such as pumped storage. Pumped storage projects store excess electricity by pumping water up a hill during the night. Pumped storage projects then create electricity by allowing the water to roll back down the hill during the day time. Another method of saving large amounts of energy is by compressing air underground during the night and uncompressing this air during the day to turn a turbine and generate electricity. This process is called compressed air storage. The need for storage is likely to increase as California's dependence on wind power or other unreliable and intermittent sources of electric generation also increases.

There are two alternative methods of making use of this excess electricity. The first method utilizes smart grid technologies. Smart grid makes it possible for electric customers to power electric cars at night. The second is to use the electricity to produce clean hydrogen gas for use in mobile technologies. This hydrogen would be clean because it would be produced predominantly from renewable and emissions free energy sources such as wind power and nuclear power.

This project proposes to use excess electricity to produce clean hydrogen and other products. This hydrogen would be produced by electrolyzing water, either fresh water, effluent, or brine. Additionally, hydrogen could be produced from biological production at water treatment facilities. However, biological production is very new and experimental.

Other products are created in this electrolysis process order to make this clean hydrogen production as economic as possible. The products created would vary based on the type of water input to the system.

If fresh water is input into the system, the project would produce pure oxygen gas which can be piped to a water treatment facility. Oxygen can be used for burning hazardous materials. Oxygen gas can also be further oxidized to form ozone gas. This ozone gas can be used to disinfect water. Ozone is, in many ways, more environmentally friendly than using chlorine. Chlorination is currently the most common method of water disinfection in the United States.

If brine (ocean water) is input into the system, sodium hydroxide and chlorine would be produced. The sodium hydroxide can be sold or used in many different processes. Chlorine gas could be piped to a water treatment facility and used to disinfect water.

If the dream of clean hydrogen gas production as a replacement for petroleum products is to become a reality, the following regulatory changes must take place.

**Full rate recovery must offered to a California water or electric utility that builds the Clean Energy Water and Air Project.** California private and public Utilities hold monopolies on electricity delivery and water delivery. New capital investments are usually financed through either municipal bonds or private investment. Payments on these bonds and private investments are made by charging higher electricity and water rates to customers. Utilities are more likely to invest in this project if they believe they can recover the cost of its production through increased water or electricity rates in the future. This project is likely to be economic in the future. However, utilities must be properly incentivized for the risk they take if they are to invest in an important new technology project such as this. Your support in securing future rate increases to fund this project is crucial to the success of this project.

**This project requires tax credits be given to businesses who use hydrogen produced by clean methods such as electrolysis or biological formation. This project requires that additional taxes be levied on businesses that use hydrogen produced from hydrocarbons such as natural gas.** Hydrogen has many uses. Most importantly, hydrogen will be needed in large quantities at refineries as the demand for low-sulfur fuels increases and as the "sweet" quality of the world's crude oil and petroleum production decreases. Sweet crude is less abundant now than it has been in the past. Refineries will increasingly need to refine large amounts of tar sand oil or heavy crude oil in the near future (which will contain larger amounts of sulfur). Ironically, most hydrogen is created by steam reformation of natural gas which has, at most, 80% efficiency. This reformation process also releases substantial amounts of greenhouse gases into the air (CO<sub>2</sub>). Incentivizing refineries to purchase clean hydrogen would create an immediate and significant market for clean hydrogen production projects.

**This project requires direct grants and support such as funds from the Federal Stimulus Bill.** The Economic Recovery act designates hundreds of millions of dollars to be spent on "smart grid" or upgrades to electrical delivery and supply. Other storage projects have been given substantial amounts of grant money (including storage projects). If we move quickly we may be able to secure tens millions of dollars in grant money from the Stimulus Bill for this project.

### **3.) Economic Analysis:**

The economics of this project are dependent on future regulatory developments. The economics of hydrogen production combined with compressed storage range from a Net Present Value of -\$247,200,000 to \$5,243,000,000. The study period is 30 years. The payback period varies from one year to never. The assumption is that 50,000 kg of hydrogen and 400,000 kg of oxygen would be produced per day. The production facility is assumed to be 300 Megawatts in capacity. Plant construction is expected to last 2 years. The cost of water is negligible. The efficiency of producing hydrogen from electricity (80% to 50%); efficiency of compressed hydrogen storage (80% to 55%). The economics are most affected by: 1.) the future value and regulatory treatment of hydrogen produced by electrolysis or biological processes 2.) the regulatory treatment and price of electricity to be purchased 3.) The future regulatory treatment for storage of renewable electricity 4.) the price and value of other products created either for water treatment (Chlorine, ozone, oxygen) or for sale (sodium hydroxide). I can provide a detailed economic analysis if that that is necessary.

#### **4.) Invention 1 (fresh water):**

##### FIELD OF INVENTION

The present invention relates to an energy transport and storage system combined with a system of production of products for water treatment.

##### BACKGROUND OF INVENTION

This invention contemplates a design where the water interconnection is fresh water or effluent. The invention will use fresh water, electricity, and possibly an alternate hydrogen source as inputs to the invention. This invention will use these inputs to: produce and store hydrogen gas underground, produce oxygen gas which will be used both for water treatment as a combustion agent for solid matter including toxic materials and to be further oxidized to create ozone gas which can be used as a disinfectant at a water treatment facility, and produce electricity which can be reused by the electrolyser or sent to an electric grid.

The idea of electrolyzing water to produce hydrogen is not unique. However, this specific method of combining hydrogen gas storage and use with oxygen gas and ozone gas for use in water treatment is unique and beneficial to humanity.

First, this invention seeks to economically produce and store hydrogen gas. Hydrogen gas will be needed in large quantities at refineries as the demand for low-sulfur fuels increases and as the "sweet" quality of the world's crude oil and petroleum production decreases. Sweet crude is less abundant now than it has been in the past. Refineries will likely need to refine large amounts of tar sand oil or heavy crude in the near future (which will contain larger amounts of sulfur). Most hydrogen is created by reforming natural gas or other petroleum products with at most 80% efficiency. This reformation process also releases a substantial amount of greenhouse gas, including carbon dioxide, into the air. Due to regulatory constraints, refineries may need to purchase hydrogen gas in large quantities from alternative sources. In the long-term, hydrogen gas may be created in large quantities for many reasons. These reasons include: 1.) using hydrogen gas as a supplement or replacement for natural gas and other non-renewable petroleum products as a source of energy for mobile machines and devices 2.) chemical processing including fertilizers, and 3.) clean water creation.

There are many different methods of creating hydrogen gas. Currently, the most economic method is natural gas reformation. This method uses natural gas, a non-renewable resource, and creates substantial amounts of greenhouse gases. There are other experimental processes, such as biological production, which could economically yield large amounts of hydrogen. This invention contemplates creating hydrogen primarily through electrolysis. However, this invention anticipates allowing for the compressed storage and distribution of hydrogen from other sources. This invention anticipates allowing compressed storage from the sources of natural gas reformation and biological production in conjunction with water treatment, but is not limited to these sources.

Second, water treatment is an important and growing need in the United States and abroad. This invention would produce oxygen gas which would be transported to a water treatment facility. At this water treatment facility the oxygen gas could be used to increase the efficiency of burning solid waste produced from a water treatment process. The pure oxygen gas could also be used in the process of safely disposing of toxic solid and liquid waste produced by water treatment.

Additionally, ozone gas is a powerful disinfectant that can be used in large scale water treatment plants but is not effective in controlling biological contaminants in distribution pipes. However, for water treatment facilities which release water into the ocean, rivers or over short distances ozonation is ideal for a water treatment facility. Since the primary waste product of ozone is atmospheric oxygen, this method is less polluting than chlorinated water which could damage wildlife and alter the content of fresh water streams. Ozonation is the process of disinfecting water with ozone. Ozonation consists of dispersing ozone through water, thereby disinfecting the water. A competing disinfection process, chlorination, is unsuitable for some types of water treatment because it stays in water and is more polluting than ozonation. Chlorination is better for treating water that is to be redistributed.

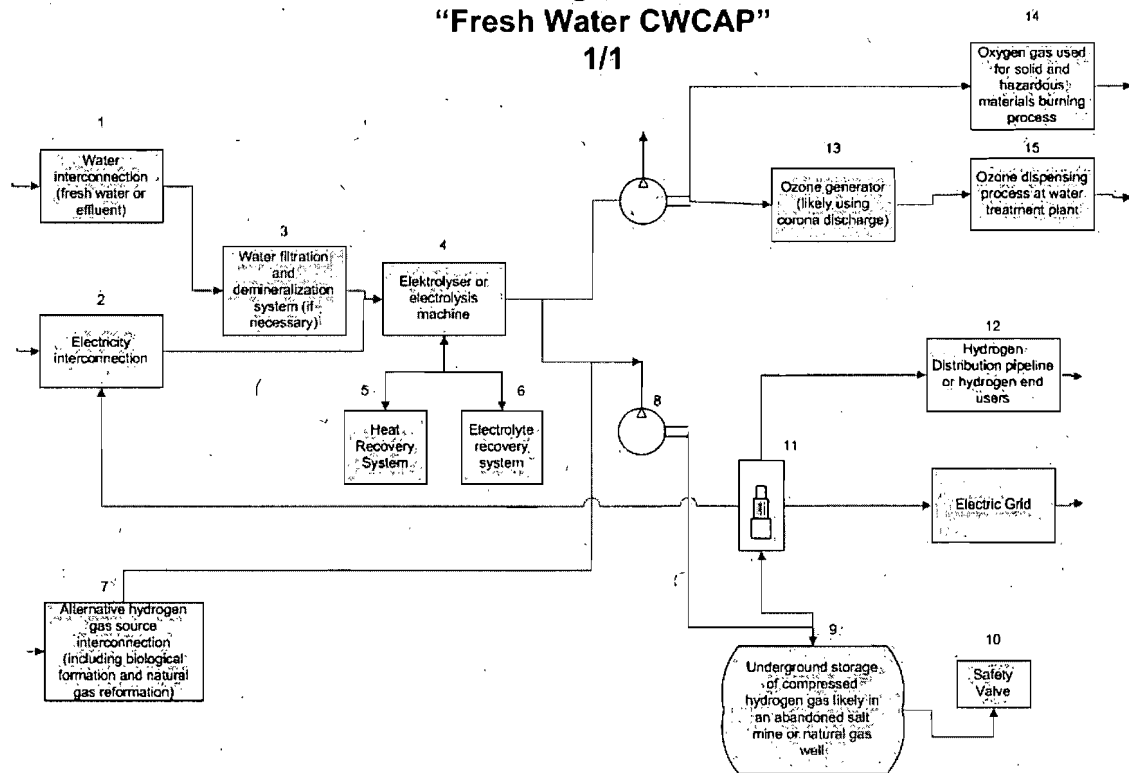
Since electrolysis creates pure oxygen gas, this oxygen gas could be shipped to a water treatment facility and further oxidized to create ozone. Ozone is not suitable for transport and would have to be created on-site at a water treatment facility. Ozone is more easily and cheaply created with pure oxygen than atmospheric oxygen. This invention would supply pure oxygen gas to the water treatment facility which would be converted to ozone gas onsite.

Third, this invention could also be used to create electricity and either reuse it or send the electricity onto an electric grid. The need for electric production and storage is likely to increase as the need for smart grid technologies increases and the world's dependence on nuclear power, which is necessarily generated at night because nuclear generation plants are inefficient to shut down at night, increases. This need for electric production and storage is also likely to increase as reliance on wind power or other unreliable and intermittent sources of electric generation increases. This invention will store and compress hydrogen underground. This invention will electrolyze water and compress the hydrogen underground primarily during the night when excess wind or nuclear generated electricity is being produced. It will then decompress the hydrogen (generating electricity by turning a turbine when the hydrogen gas is decompressed) and then pump out the hydrogen, thus creating electricity during the day when the price for electricity is high because the need for electricity is great.

#### SUMMARY OF INVENTION

This invention contemplates using electrolysis of either fresh water or effluent water (water previously used in agricultural, industrial, or residential uses) and electricity to produce oxygen gas, hydrogen gas, and electricity. The invention will produce oxygen gas to be used in water treatment. The oxygen gas will be sent to water treatment facility and use for the safe combustion of material and liquid waste. The oxygen gas will also be used to create ozone gas which will be used for the disinfection of water. This invention contemplates storing compressed hydrogen, created by electrolysis and other methods of hydrogen gas creation underground, and generating electricity while decompressing hydrogen gas.

Figure 1  
"Fresh Water CWCAP"  
1/1





## 5.) Invention 2 (brine):

### FIELD OF INVENTION

The present invention relates to an energy transport and storage system combined with a system of production of products for water treatment..

### BACKGROUND OF INVENTION

This invention contemplates a design where the water interconnection is brine. The invention will use brine (seawater, salty estuary water or ocean water), electricity, and possibly an alternate hydrogen source as inputs to the invention depending on the availability of an alternative hydrogen gas source. This invention will use these inputs to: produce and store hydrogen gas underground, produce chlorine gas which will be used for either water treatment or other industrial processes, and produce sodium hydroxide which could be used for industrial processes.

The idea of using electrolysis or other processes to produce chlorine and sodium hydroxide is not unique. The idea of producing hydrogen gas as an energy source is not unique. However, this specific method of combining hydrogen gas storage and use with chlorine gas and sodium hydroxide is unique and beneficial to humanity.

First, this invention seeks to economically produce and store hydrogen gas. Hydrogen gas will be needed in large quantities at refineries as the demand for low-sulfur fuels increases and as the "sweet" quality of the world's crude oil and petroleum production decreases. Sweet crude is less abundant now than it has been in the past. Refineries will likely need to refine large amounts of tar sand oil or heavy crude in the near future (which will contain larger amounts of sulfur). Most hydrogen is created by reforming natural gas or other petroleum products with at most 80% efficiency. This reformation process also releases a substantial amount of greenhouse gas, including carbon dioxide, into the air. Due to regulatory constraints, refineries may need to purchase hydrogen gas in large quantities from alternative sources. In the long-term, hydrogen gas may be created in large quantities for many reasons. These reasons include: 1.) using hydrogen gas as a supplement or replacement for natural gas and other non-renewable petroleum products as a source of energy for mobile machines and devices 2.) chemical processing including fertilizers, and 3.) clean water creation.

There are many different methods of creating hydrogen gas. Currently, the most economic method is natural gas reformation. This method uses natural gas, a non-renewable resource, and creates substantial amounts of greenhouse gases. There are other experimental processes, such as biological production, which could economically yield large amounts of hydrogen. This invention contemplates creating hydrogen primarily through electrolysis. However, this invention anticipates allowing for the compressed storage and distribution of hydrogen from other sources. This invention anticipates allowing compressed storage from the sources of natural gas reformation and biological production in conjunction with water treatment, but is not limited to these sources.

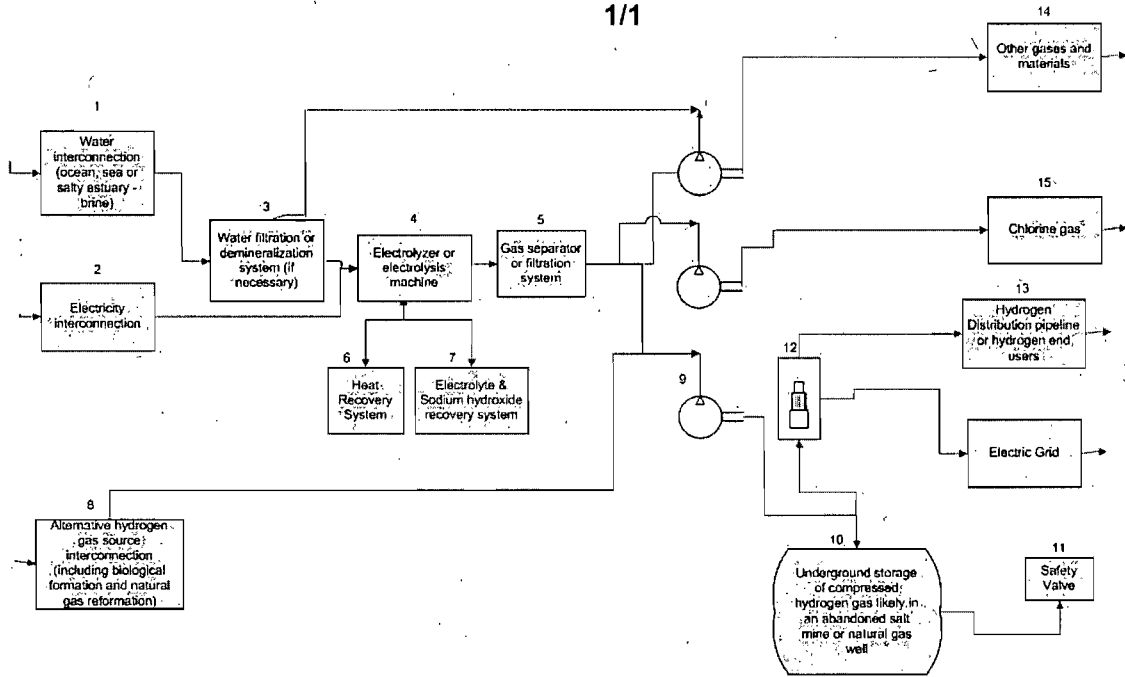
Second, water treatment is an important and growing need in the United States and abroad. In many locations, fresh water is either not available or prohibitively expensive to obtain. This invention will use brine water which is readily abundant on earth near a coastline. It will then produce chlorine gas which can be used to disinfect water and continue the disinfection of water through a water distribution system. This is because chlorine gas is a powerful disinfectant that can be used in large scale water treatment plants and is effective in controlling biological contaminants in distribution pipes. This invention would ideally supply chlorine gas to a water treatment facility. Alternatively, chlorine gas could be used for production of other products including but not limited to plastics and biological compounds.

Third, this invention could also be used to create electricity and either reuse it or send the electricity onto an electric grid. The need for electric production and storage is likely to increase as the need for smart grid technologies increases and the world's dependence on nuclear power, which is necessarily generated at night because nuclear generation plants are inefficient to shut down at night, increases. This need for electric production and storage is also likely to increase as reliance on wind power or other unreliable and intermittent sources of electric generation increases. This invention will store and compress hydrogen underground. This invention will electrolyze water and compress the hydrogen underground primarily during the night when excess wind or nuclear generated electricity is being produced. It will then decompress the hydrogen (generating electricity by turning a turbine when the hydrogen gas is decompressed) and then pump out the hydrogen, thus creating electricity during the day when the price for electricity is high because the need for electricity is great.

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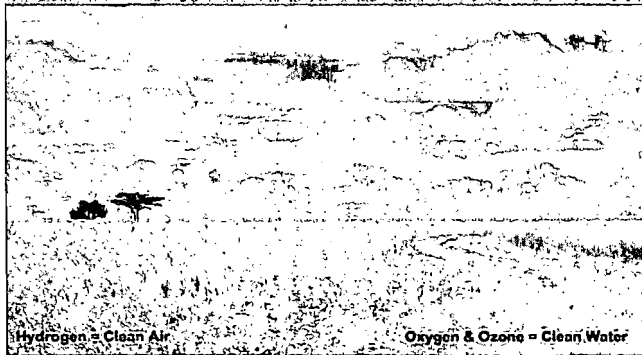
This invention anticipates the use of electrolysis of brine (seawater, salty estuary water, or ocean water) to produce electricity, hydrogen gas, chlorine gas, and sodium hydroxide. Other chemicals and gases will be filtered or processed. This invention contemplates storing compressed hydrogen, created by electrolysis and other methods of hydrogen gas creation underground, and generating electricity while decompressing hydrogen gas.

Figure 1  
"Brine CWCAP"  
1/1



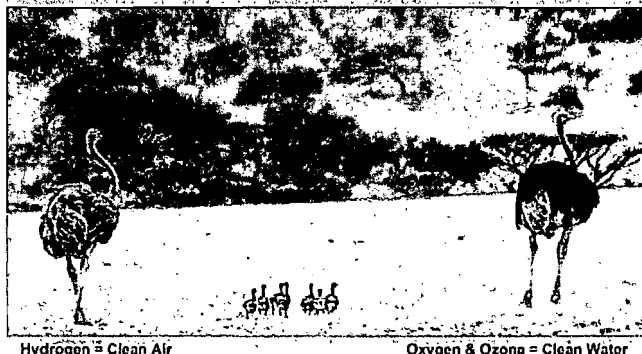
# Request for Support

## Clean Energy Water and Air Project



### Clean Energy Water and Air Project

Our Road to a Clean Energy Future.



### Clean Energy Water and Air Project

Do it for the children.

**Process (patents pending):** Two processes are possible: one uses fresh water or effluent as input, and the other uses brine as input. We propose to build a facility which receives electricity & water (brine or fresh water), which creates products for water treatment (chlorine, oxygen, ozone); and also creates hydrogen gas which will be compressed and stored underground, then distributed to either a refinery or sold to hydrogen fueling stations along the California Hydrogen Highway.

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