HOW-TO CONVERT YOUR GAS VEHICLE TO ELECTRIC©



by www.agua-luna.com

STOP GLOBAL WARMING
USE ALTERNATIVE ENERGY

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PREFACE

What is alternative energy anyway?

Alternative Energy or Alternative Fuels, are any materials or substances that can be used as a fuel, other than conventional fuels. Conventional fuels include: fossil fuels (petroleum (oil), coal, propane, & natural gas). Some well known alternative fuels include biodiesel, ethanol, butanol, chemically stored electricity (batteries & fuel cells), hydrogen, methane, natural gas, vegetable oil, biomass, & peanut oil.

In the year 2000, there were about eight million vehicles around the world that ran on alternative fuels, indicating an increasing popularity of alternative fuels. There is growing social interest, & a perceived economic & political need for the development of alternative fuel sources.



Since burning fossil fuels are known to increase greenhouse gas concentrations in the atmosphere, they are a likely contributor to global warming. Another concern is the peak oil theory, which predicts a rising cost caused by severe shortages during an era of growing energy consumption. According to the 'peak oil' theory, the demand for oil will exceed supply & this gap will continue to grow, which could cause a growing energy crisis starting by 2010. Lastly, the majority of the known petroleum reserves are located in the middle east. There is a concern that worldwide fuel shortages could intensify the unrest that exists in the region, leading to further conflict & war.



Biofuel

Plants use photosynthesis to grow & produce biomass, or biomatter, biomass can be used directly as fuel. Agriculturally produced biomass fuels, such as biodiesel, ethanol & bagasse (often a by-product of sugar cane) can be burned in internal combustion engines or boilers.

Biodiesel can be used in modern diesel vehicles with little or no modification to the engine & can be made from waste, vegetable, animal oil & fats (lipids). Vegetable oils can be used in modified diesel engines. In fact the Diesel engine was originally designed to run on vegetable oil rather than fossil fuel. A major benefit of biodiesel is lower emissions. The use of biodiesel reduces emission of carbon monoxide & other hydrocarbons by 20 to 40%.

In some areas corn, cornstalks, sugarbeets, sugar cane, & switchgrasses are grown specifically to produce ethanol (also known as grain alcohol) a liquid which can be used in internal combustion engines & fuel cells. Ethanol is being phased into the current energy infrastructure. E85 is a fuel composed of 85% ethanol & 15% gasoline that is sold to consumers.

Solid biomass

Direct use is usually in the form of combustible solids, either wood, the biogenic portion of municipal solid waste or combustible field crops. Field crops may be grown specifically for combustion or may be used for other purposes, & the processed plant waste then used for combustion. Most sorts of biomatter, including dried manure, can actually be burnt to heat water

& to drive turbines. Sugar cane residue, wheat chaff, corn cobs & other plant matter can be, & is, burnt quite successfully.

Biogas can easily be produced from current waste, such as: paper, sugar production, sewage, animal waste & so forth. These various wastes have to be slurried together & allowed to naturally ferment, producing methane gas. When a biogas plant has extracted all the methane it can, the remains are sometimes better suitable as fertilizer than the original biomass.

Other Fuels



Methanol (methanol economy) from any source can be used in internal combustion engines with minor modifications. It usually is made from natural gas, sometimes from coal, & could be made from any carbon source including CO2. Flexible fuel vehicles may run with a high percentage of ethanol (ethanol economy) (up to 85% Ethanol plus 15% gasoline for cold-starting vapor pressure) with no modifications.
Hydrogen

Interest in vehicles powered by alternative energy sources has been gaining traction in large part due to high gas prices & an increased awareness of global warming, which according to a recent Intergovernmental Panel on Climate Change (IPCC) report is 90% likely caused by humans.

Diesel type biofuels: Hempseed oil fuel or other straight vegetable oils, Biodiesel
Others with internal combustion, Ethanol, E85, Hydrogen internal-combustion, Ammonia, Natural gas, compressed or liquified, Autogas (LPG, LP gas, propane), Synfuel, synthetic fuels, Plug-in hybrid electric vehicle
External combustion, Organic waste fuel, Wood gas on-board gasification, Steam engine cars (like the Stanley Steamer)
No combustion, Electric vehicle, Solar cell-powered or -charged electric cars, Hydrogen fuel cell, MAGLEV with induction drive (a variety of electric mass transit), Air car working on compressed air
Some less conventional alternative fueled cars:, Nuclear powered, Solar Radiation, Sail

Ok, what is renewable energy then?

Renewable energy flows involve natural phenomena such as sunlight, wind, tides & geothermal heat. Each of these sources has unique characteristics which influence how & where they are used.

Wind power

Wind power is the fastest growing of the renewable energy technologies. Over the past decade, global installed maximum capacity increased from 2,500 MW in 1992 to just over 40,000 MW at the end of 2003, at an annual growth rate of near 30%. Globally, the long-term technical potential of wind energy is believed to be five times current production global energy consumption or 40 times current electricity demand. Wind power is renewable & produces no greenhouse gases during operation, such as carbon dioxide & methane.



Offshore wind turbines near Copenhagen

Water power

Energy in water (in the form of motive energy or temperature differences) can be harnessed & used. Since water is about a thousand times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy.

There are many forms of water energy:

Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams.
Micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a Remote Area Power Supply (RAPS). There are many of these installations around the world, including several delivering around 50 kW in the Solomon Islands.
Wave power uses the energy in waves. The waves will usually make large pontoons go up & down in the water, leaving an area with reduced wave height in the "shadow". Wave power has now reached commercialization.
Tidal power captures energy from the tides in a vertical direction. Tides come in, raise water levels in a basin, & tides roll out. Around low tide, the water in the basin is discharged through a turbine.
Tidal stream power captures energy from the flow of tides, usually using underwater plant resembling a small wind turbine. Tidal stream power demonstration projects exist, but large scale development requires additional capital.
Ocean thermal energy conversion (OTEC) uses the temperature difference between the warmer surface of the ocean & the colder lower recesses. To this end, it employs a cyclic heat engine. OTEC has not been field-tested on a large scale.
Deep lake water cooling, although not technically an energy generation method, can save a lot of energy in summer. It uses submerged pipes as a heat sink for climate control systems. Lake-bottom water is a year-round local constant of about 4 ℃.
Blue energy is the reverse of desalination. This form of energy is in research.

Solar energy use

A photovoltaic (PV) module that is composed of multiple PV cells. Two or more interconnected PV modules create an array.

In this context, "solar energy" refers to energy that is collected from sunlight. Solar energy can be applied in many ways, including to:

Generate electricity using photovoltaic solar cells.
Generate electricity using concentrated solar power.
Generate electricity by heating trapped air which rotates turbines in a Solar updraft tower.

Heat buildings, directly, through passive solar design.
Heat foodstuffs, through solar ovens.
Heat water or air for domestic hot water & space heating needs using solar-thermal panels.
Heat & cool air through use of solar chimneys.

Geothermal energy



Krafla Geothermal Station in Iceland

Geothermal energy is energy obtained by tapping the heat of the earth itself, usually from kilometers deep into the Earth's crust. It is expensive to build a power station but operating costs are low resulting in low energy costs for suitable sites.

Potential

While currently renewable energy sources only supply a modest fraction of current energy use (ca. 14% of primary energy use), there is much potential that could be exploited in the future.

The Renewable Energy Resource Base (Exajoules a year)

	Current use (2001)	Technical potential	Theoretical potential
Hydropower	9	50	147
Biomass energy	50	>276	2,900
Solar energy	0.1	>1,575	3,900,000
Wind energy	0.12	640	6,000
Geothermal energy	0.6	5,000	140,000,000
Ocean energy	not estimated	not estimated	7,400
Total	60	>7,600	>144,000,000

Current use is in primary energy equivalent.
For comparison, the current global primary energy use (2001) is 402 Exajoules a year.
Source: World Energy Assessment 2001.

References

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Small-scale Biogas Use in Costa Rica

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BACKGROUND

The concept of providing for one's self isn't new. Humans have always been self-sufficient, only in today's hectic day-to-day society do we find ourselves relying too much on others. In yester-year, a family had to kill themselves bringing the bare necessities to the home. Today the technology has changed as well as the materials, making it easier & more efficient to live comfortably independent.

Still, the idea of converting your gas guzzling automobile to 100% electric may sound impossible, and for less then the price of ANY type of vehicle, not to mention electric or hybrid cars in today's economy, just absurd. Well, accomplishing this isn't as far-fetched as society wants you to believe, nor as easy as I'd have you believe. There will be new ideas to adjust to, physical work required, (unless you prefer paying labor costs) and plenty of patience needed. Changing your mind set will be the biggest challenge. I will discus Alternate Energy Methods, Alternate Material Concepts, avoiding Main Stream Construction Techniques for several key reasons:

- Save the environment using recycled and natural materials.
- Monitor funds by keeping construction simple and controlled.
- Expand your knowledge & challenge yourself.
- Bring the family closer, acquiring personal satisfaction by accomplishing a project together that was before only dreamed of.
- Don't follow the Rat Race. Live for yourself.

I am a 28-year-old retired structural engineer from *Boeing Aerospace*, with an extensive background in fluid and structural dynamics. That said, I built my own Electric Vehicle (EV) for one reason, **Cost**. You'll find that by thinking outside the box, without taking any shortcuts, you can convert your own EV in as little as a few weeks for a 10th of the cost of any Dealer bought EV/Hybrid.

HISTORY OF ELECTRIC VEHICLES

The History of Electric Vehicles

The Early Years - Electric Cars (1890 - 1930)



1902 Wood's Electric Phaeton

Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland invented the first crude electric carriage. A small-scale electric car was designed by Professor Stratingh of Groningen, Holland, and built by his assistant Christopher Becker in 1835. Practical and more successful electric road vehicles were invented by both American Thomas Davenport and Scotsmen Robert Davidson around 1842. Both inventors were the first to use non-rechargeable electric cells. Frenchmen Gaston Plante invented a better storage battery in 1865 and his fellow countrymen Camille Faure improved the storage battery in 1881. This improved-capacity storage battery paved the way for electric vehicles to flourish.

France and Great Britain were the first nations to support the widespread development of electric vehicles in the late 1800s. In 1899, a Belgian built electric racing car called "La Jamais Contente" set a world record for land speed - 68 mph - designed by Camille Jénatzy.

It was not until 1895 that Americans began to devote attention to electric vehicles after an electric tricycle was built by A. L. Ryker and William Morrison built a six-passenger wagon both in 1891. Many innovations followed and interest in motor vehicles increased greatly in the late 1890s and early 1900s. In 1897, the first commercial application was established as a fleet of New York City taxis built by the Electric Carriage and Wagon Company of Philadelphia.



New York City Electric Taxis

The early electric vehicles, such as the 1902 Wood's Phaeton (top image), were little more than electrified horseless carriages and surreys. The Phaeton had a range of 18 miles, a top speed of 14 mph and

cost $2,000. Later in 1916, Woods invented a hybrid car that had both an internal combustion engine and an electric motor.

By the turn of the century, America was prosperous and cars, now available in steam, electric, or gasoline versions, were becoming more popular. The years 1899 and 1900 were the high point of electric cars in America, as they outsold all other types of cars. Electric vehicles had many advantages over their competitors in the early 1900s. They did not have the vibration, smell, and noise associated with gasoline cars. Changing gears on gasoline cars was the most difficult part of driving, while electric vehicles did not require gear changes. While steam-powered cars also had no gear shifting, they suffered from long start-up times of up to 45 minutes on cold mornings. The steam cars had less range before needing water than an electric's range on a single charge. The only good roads of the period were in town, causing most travel to be local commuting, a perfect situation for electric vehicles, since their range was limited. The electric vehicle was the preferred choice of many because it did not require the manual effort to start, as with the hand crank on gasoline vehicles, and there was no wrestling with a gear shifter.



1918 Detroit

While basic electric cars cost under $1,000, most early electric vehicles were ornate, massive carriages designed for the upper class. They had fancy interiors, with expensive materials, and averaged $3,000 by 1910. Electric vehicles enjoyed success into the 1920s with production peaking in 1912.

The decline of the electric vehicle was brought about by several major developments:

- By the 1920s, America had a better system of roads that now connected cities, bringing with it the need for longer-range vehicles.
- The discovery of Texas crude oil reduced the price of gasoline so that it was affordable to the average consumer.
- The invention of the electric starter by Charles Kettering in 1912 eliminated the need for the hand crank.
- The initiation of mass production of internal combustion engine vehicles by Henry Ford made these vehicles widely available and affordable in the $500 to $1,000 price range. By contrast, the price of the less efficiently produced electric vehicles continued to rise. In 1912, an electric roadster sold for $1,750, while a gasoline car sold for $650.

The History of Electric Vehicles

The Middle Years of Electric Cars (1930 - 1990)



1975 Electric Postal Vehicle



1971 Battronic Truck

Electric vehicles had all but disappeared by 1935. The years following until the 1960s were dead years for electric vehicle development and for use as personal transportation.

The 1960s and 1970s saw a need for alternative fueled vehicles to reduce the problems of exhaust emissions from internal combustion engines and to reduce the dependency on imported foreign crude oil. Many attempts to produce practical electric vehicles occurred during the years from 1960 to the present.

In the early 1960s, the Boyertown Auto Body Works jointly formed the Battronic Truck Company with Smith Delivery Vehicles, Ltd., of England and the Exide Division of the Electric Battery Company. The first Battronic electric truck was delivered to the Potomac Edison Company in 1964. This truck was capable of speeds of 25 mph, a range of 62 miles and a payload of 2,500 pounds.

Battronic worked with General Electric from 1973-1983 to produce 175 utility vans for use in the utility industry and to demonstrate the capabilities of battery-powered vehicles. Battronic developed and produced about 20 passenger buses in the mid 70s.



Sebring-Vanguard CitiCar

Two companies were leaders in electric car production during this time. Sebring-Vanguard produced over 2,000 "CitiCars." These cars had a top speed of 44 mph, a normal cruise speed of 38 mph and a range of 50 to 60 miles.

The other company was Elcar Corporation, which produced the "Elcar". The Elcar had a top speed of 45 mph, a range of 60 miles and cost between $4,000 and $4,500.

In 1975, the United States Postal Service (see top image) purchased 350 electric delivery jeeps from the American Motor Company to be used in a test program. These jeeps had a top speed of 50 mph and a range of 40 miles at a speed of 40 mph. Heating and defrosting were accomplished with a gas heater and the recharge time was 10 hours.



Elcar

The History of Electric Vehicles

Recent Years (1990 to 1998)



US Electricar S-10 Electric Pick Up Truck

Several legislative and regulatory actions in the United States and worldwide have renewed electric vehicle development efforts. Primary among these is the U.S. 1990 Clean Air Act Amendment, the U.S. 1992 Energy Policy Act, and regulations issued by the California Air Resources Board (CARB). In addition to more stringent air emissions requirements and regulations requiring reductions in gasoline use, several states have issued Zero Emission Vehicle requirements.

The "Big Three" automobile manufacturers, and the U.S. Department of Energy, as well as a number of vehicle conversion companies are actively involved in electric vehicle development through the Partnership for a New Generation of Vehicles (PNGV). Electric conversions of familiar gasoline powered vehicles, as well as electric vehicles designed from the ground up, are now available that reach super highway speeds with ranges of 50 to 150 miles between recharging.

Some examples of these vehicles are the Chevrolet S-10 pickup truck (top image), converted by U.S. Electricar and no longer available. It was powered by dual alternating current motors and lead acid batteries. It had a range of about 60 miles and could be recharged in less than 7 hours.

The Geo Metro, converted by Solectria Corp., is an electric-powered 4-passenger sedan powered by an alternating current motor and lead-acid batteries. It has a range of 50 miles, and it can be recharged in less than 8 hours. During the 1994 American Tour de Sol from New York City to Philadelphia, a 1994 Solectria Geo Metro cruised over 200 miles on a single charge using Ovonic nickel metal hydride batteries.



Ford Ecostar

The "Big Three" automobile manufacturers also developed electric vehicles. An early 1990s vehicle was the Ford Ecostar utility van with an alternating current motor and sodium sulfur batteries. The top speed was 70 mph and it had a range of 80 to 100 miles. While about 100 Ecostars were produced, it was considered an R&D vehicle and never offered commercially.

Ford offered an electric version of its Ford Ranger pickup. It had a range of about 65 miles with its lead acid batteries, had a top speed of 75 mph, it accelerated from 0 to 50 mph in 12 seconds, and it had a payload of 700 pounds.



Ford Ranger

General Motors has designed and developed an electric car from the ground up instead of modifying an existing vehicle. This vehicle, called the EV1, was a 2-passenger sports car powered by a liquid-cooled alternating current motor and lead-acid batteries. The EV1 had a top speed of 80 mph, had a range of 80 miles, and could accelerate from 0 to 50 mph in less than 7 seconds.



GM EV1

In addition to the EV1, General Motors offered an electric vehicle Chevrolet S-10 pickup. This vehicle had a range of 45 miles, it accelerated from 5 to 50 mph in 10 seconds, and it had a payload of 950 pounds.

Other electric vehicles that were available during 1998 included the Toyota RAV4 sport utility, the Honda EV Plus sedan, and the Chrysler EPIC minivan. These three vehicles were all equipped with advanced nickel metal hydride battery packs. Nissan placed limited numbers of their Altra EV station wagons in California fleets during 1998. The Altra was equipped with a lithium-ion battery pack. In addition, both Ford and General Motors during 1998, made the Ranger, the EV1, and the



Toyota RAV4

S-10 pickup available with nickel metal hydride battery packs.

While the vehicles in 1998 satisfied the driving requirements of many fleet operators and two car families, the cost of $30,000 to $40,000 (1998) made them expensive. However, this cost was considerably lower when tax credits and incentives were included.

Large-volume production and improvements in the production process are expected to reduce prices to the range of current gasoline-powered vehicles.

An excellent site on the history of electrical vehicles is "the history of electric vehicles" site, the first online archive created to encourage electric vehicle enthusiasts to help preserve the recent history of electric vehicles.

Planning Your Conversion



The first step in the conversion process is determining what kind of car to convert. You also have to determine if an electric car will fit your needs. Below is a list of items to consider before embarking on the project. All the assumptions are based on using deep-cycle or sealed lead-acid batteries which are available today.

Is an EV appropriate for your needs?

The average conversion EV has a realistic range of 30 to 70 miles in everyday driving conditions depending on the type of batteries you have and the weight of the vehicle. If your commute is more then 35 miles one way in very hilly terrain an EV may not be a good idea. However, if your commute is on average terrain and is about 20 miles each way an EV is perfect. If you are a two car family and one car is usually used for short trips you may want to consider an EV.

Do you have easy access to charge your car?

Town homes, apartments and parking garages may impose a challenge and will probably require permission from the management or homeowner's association.

Do you have the facilities to build your conversion?

If you don't have a driveway, carport, or garage all is not lost. Ask a friend, family member, or rent garage space. The project should take anywhere from 2 months to a year.

Do you have the proper tools to build an EV?

With conversion kits available today most people with basic hand and power tools can do the work themselves. Some tasks can be contracted out such as welding. The only special tools you will need are a torque wrench, cable crimpers, and an engine crane; all of which can be rented.

What is your budget for the conversion?

For a complete kit consider spending $4000 - $6000. Batteries can cost another $700 to $1200. Kits are highly recommended because they include all the parts necessary for the conversion as well as instructions. It is highly recommended

that the first time EVer buy the book "***Convert It***" if it isn't available with the kit. This book has detailed step-by-step instructions on converting a car from scratch.

Choosing a car

Now that you have a basic idea of what you will need to do a conversion, the next step is choosing a body style and chassis. You may already have a car picked out for this purpose.

Do you want your EV to be a family commuter, utility vehicle, a high performance watt rod?, or a combination of uses?

- For a family commuter with a range of 40 miles or more consider a light compact sedan that has enough room to accommodate 16 to 20 6-volt batteries. Escorts, Hondas, late model Novas, GEOs, Saturns, Rabbits, Neons, etc. are popular choices. 6-volt batteries are preferred over 12-volt batteries in this application because they have more energy density which is necessary for range. To add pep but sacrificing some range you may consider 8-volt batteries from Trojan or US Battery.
- Pickup trucks are great for utility purposes and are popular for a high school rally project. They have the extra payload capacity to carry the batteries and you can fit them under the bed. 20 6-volt batteries are common configurations. For extra range add 4 more 6-volt batteries for a total of 144 volts.
- High performance EVs are a blast to drive and fun to race at NEDRA events. You want as light a car as possible with the structural integrity to handle the weight of the batteries. Typical configurations are 2+2s or two-seaters such as Toyota MR2s, Honda del Sols, Porshe 911s and 914s, and Mazda RX-7s. 144 volt systems or more using 12-volt deep-cycle batteries are very popular today. These include the Optima Yellow Tops and the Genesis Hawker batteries. You can expect a range of anywhere from 20 to 40 miles. You can increase your range and amp hour capacity by running two or more parallel strings of batteries.
- Be creative and mix and match your own configuration.

Hints on choosing the right chassis

Manual 4 or 5 Speed Transmission

Use a manual transmission instead of an automatic. Automatics are avoided because they are not as efficient. Driving an EV with a gear shift is easier then with a gas car because EVs don't idle so there isn't a problem with stalling.

Electric motors are also 98% efficient so you will not need to shift as much. Many city EVers just leave the car in second gear.

Power Brakes

Power brakes are recommended because of the extra weight of the batteries. Vacuum can be restored with an electric vacuum pump available through kit suppliers.

Power Steering

Power steering can be use but for a simple conversion it's not necessary because an extra motor would be needed to drive the power steering pump. If your vehicle has power steering just cap off the hoses. If power steering is necessary there are ways to rig up a motor to drive the pump.

Air Conditioning

Most conversion don't use AC systems because they add space and place a greater load on the batteries. However, you can still retain the AC by adding a 1 horsepower permanent magnet DC motor to drive the compressor.

Choose a car without rust

Even if a car has light surface rust this could be an indication of something worse under the car. EVs require a sound undercarriage to carry the extra weight of the batteries.

Weight

Typically an EV will add 200 to 500 pounds to the weight of the car. Check the weight rating of your car to make sure the weight of your conversion will be within reason.

For the purpose of this conversion we'll be using a 1986 Ford Escort. The car will be used as a commuter vehicle and family car. It will have a 96 volt system using 16 US Battery brand 6-volt batteries. This conversion was done in the early 90's when 96-volts was a popular conversion at the time.

Costs

Now that we've decided on our body style and voltage system it's time to discuss the budget for the project. There are several options here. Kits are the easiest way to build an EV. They include all the parts you need except for the batteries.

There are several kit suppliers in the U.S. The kit for this conversion was purchased from KTA Services in California. Highlighted parts are included in the conversion kit.

For those on a shoestring budget, used parts can be found within the EV community or from surplus catalogs. Parts can also be ordered as you need them from the suppliers as well. Every so often used Advanced DC motors and controllers can be found for a good price.

Advanced DC 8" motor	$1320.00
Adaptor plate and hub	650.00
Motor mount	137.50
Curtis-PMC1221B motor controller	750.00
Throttle controller	60.00
Main contactor	130.00
Main circuit breaker	110.00
DC/DC Converter	420.00
Voltmeter	48.00
Ammeter	48.00
Onboard battery charger	550.00
Charger interlock relay	15.00
50 ft 2/0 welding cable	180.00
Cable lugs	144.00
Shrink tubing	19.00
120 volt battery box fan	20.00
Wiring diagrams	20.00
Vacuum brake system	205.00
Heating system	395.00
Electric wire and connectors	170.00
16 6-volt batteries, US Battery @ $42.00 each	672.00
4 Goodyear Invicta low rolling resistance tires @ $60.00 each	240.00
New wheels	250.00
New clutch	63.00
Air shocks	65.00
"Convert It" Manual	25.00

Hardware	300.00
Battery box plywood	30.00
Tools and supplies	200.00
Paint and supplies	120.00
Angle iron	40.00
Welding services	350.00
Flywheel resurfacing	55.00
Total	**$7926.00**

Components

Here is a list of the main components that will be installed in the car:

Advanced DC Motor



The motor is an 8" Advanced DC series-wound motor. It weighs 107 pounds and is rated at 68 peak horsepower. These motors are available in several sizes.

Adaptor plate



The adaptor plate mates the motor to the transmission. It is constructed of 1/2 inch aluminum and is pre-drilled with bolt hole patterns for both the motor and transmission. An aluminum spacer is also used for proper spacing between the shafts of the transmission and motor. Adaptor plates are available for many cars.

DC Motor Controller



The controller regulates current going to the motor. It is a solid-state device that uses a pulse width modulator (PWM) that sends short bursts of current to the motor at a rate of 15 kHz. Controllers are available from both Curtis and DCP.

Potbox (Potentiometer)



The potbox is a 5K ohm throttle between the controller and the accelerator, similar to the way a sewing machine pedal works. The potbox's lever arm is attached to the existing accelerator cable.

Main Contactor



An electric relay that serves the same purpose as the ignition switch in a gas car. When the key is turned to the start position, the contactor closes the circuit to allow current to flow to the controller.

Circuit Breaker



A safety device that shuts down power for servicing or during an emergency. The circuit breaker is installed under the hood and can be switched both off and on from the drivers seat with an extension or cable.

Main Fuse



The main fuse protect the system from high voltage spikes. A fuse should be installed at each battery box or group of batteries.

Shunt



A shunt is placed in series within the wiring as a means to connect meters. Shunts are available in different sizes for both high and low power configurations.

Charger interlock

A relay that keeps the circuit open so nobody will inadvertently drive off with the charge cord plugged into the car.



DC/DC Converter

The DC/DC converter is similar in function to a gas car's alternator. It charges the 12 volt accessory battery by chopping voltage from the main battery pack down to 13.5 volts.

Batteries

The most common batteries used in conversions today are deep-cycle lead-acid batteries. Although Nickel Metal Hydride (NiMH) batteries are being used by the auto manufacturers for their EVs they are not available to the average EVer building their own EV.

The deep-cycle lead acids are divided into two groups: flooded batteries, also known at wet cells and sealed batteries also known as valve-regulated lead-acid (VRLA) batteries.

Flooded batteries are available in 6 and 8-volt versions from Trojan battery and US Battery. Flooded batteries are inexpensive, can take some abuse, and have a high energy density which makes them a good choice for range. They can last anywhere from three to five years. On the down side they are heavy, up to 70 pounds each, and have high internal resistance which doesn't appeal to the racing set. For distance and cost they are a good bet.

The most popular 12-volt sealed batteries used in EVs today are the Optima Yellow Tops and Genisis Hawker batteries from GNB. Sealed batteries are lighter then wet cells, have low internal resistance and can be installed in various positions. On the downside they are expensive, have a shorter lifespan and limited range. To increase range the batteries can be run in parallel strings which increases the amp/hour capacity of the pack.

Tools and Supplies

Most do-it yourselfers already have the tools required to convert an EV. Equipment such as engine hoists can be rented and welding can be contracted out.

It is a good idea to keep a notebook with you as you work on your conversion. There will be times when you need to write down measurements, create drawings and list hardware and supplies for different aspects of the project. Keeping these notes all in one place will make referencing information easier. You also may need to refer to them years after you have completed your project.

Tools

- Jack stands
- Floor jack
- Wheel chocks
- Engine hoist
- Saw horses
- Workbench or Workmate
- C-clamps
- Drop light
- Soldering iron
- Combination wire stripper and crimping tool
- Cable shears for 2/0 welding cable
- Lug crimpers for 2/0 welding cable
- Heat gun for heat shrink tubing
- Hammer
- Punches
- Chisels
- Hack saw
- Screwdrivers
- Socket wrenches
- Torque wrench
- Wrenches
- Pliers
- Aviation snips
- Drill and/or drill press
- Circular saw
- Saber saw
- Grinder
- Measuring tape
- Square
- Level
- Volt meter

Supplies

- 1" x 1" x 3/16" angle iron, 12' length for battery rack
- 1" x 1" x 3/16" angle iron, 5' length for battery rack
- 1 1/2" x 1 1/2" x 3/16" angle iron, 20' length for battery rack
- 3/4" x 3/4" x 1/8" angle iron, 20' length for battery hold down

- 1" x 1" x 1/8" metal, 10' length for various brackets
- 4' x 8' x 3/4" plywood for battery box
- 4' x 8' x 1/2" polyurethane foam insulation for battery box
- 1 1/2" x 20' PVC pipe for conduit
- 5" x 10' vent hose for battery box ventilation
- 1/4" Fomecore for models and templates
- Elmers wood glue
- 4 cans Black Rustoleum spray paint for engine compartment and brackets
- 2 quart Rustoleum primer for battery box
- 2 quarts White Rustoleum Waterproof paint for battery box
- Noalux: compound applied to battery lugs to prevent corrosion
- Stainless steel bolts, nuts, washers and lockwashers for brackets and hardware
- Grade 8 automotive bolts, nuts, washers and lockwashers for motor mounts and battery racks

Safety

Like any project involving automobiles and tools there are inherent risks. However EVs have hazards that you should be aware of. Being aware of these possible hazards will prevent damage to the vehicle and serious injury to yourself. Below are a few basic guidelines to follow.

1. Always shut off the power when servicing the car.
2. Dissipate the capacitors from the controller before servicing the controller or propulsion system. Even though the controller is off the capacitors may still be live. A light bulb works well as a dissipation device.
3. When servicing the drive train always keep the drive wheels off the ground with proper jack stands.
4. Keep loose hair, jewelry or clothing away from spinning motor shafts.
5. Always wear proper eye protection when working with power tools and handling batteries. Deep-cycle batteries contain caustic acid which may splash or spill when they are moved or handled.
6. Wear protective clothing when carrying or moving batteries. Acid could spill and burn a hole through any clothing it contacts.
7. Wear steel toed boots when carrying or moving batteries. Batteries can weigh up to 80 pounds and can cause serious injury if they fall.
8. Wear heavy gloves when moving or carrying batteries. Use protective rubber or latex gloves when checking or watering batteries.
9. Always provide proper ventilation when charging batteries. A small spark can cause a fire if hydrogen gas accumulates in an enclosed area.
10. Never inhale the fumes when watering the batteries.
11. Tape the ends of wrenches when tightening battery terminals. A loose wrench can come in contact with battery terminals and cause a short.
12. Never ground the propulsion batteries.
13. Never work on the car when you are tired or in a hurry.

Getting Started

This is where we get our hands dirty - removing all the greasy gas parts. This includes the engine, radiator, gas tank, fuel lines, exhaust system, and emission wires and hoses. The transmission, clutch, and flywheel are retained for use in the conversion. Many parts that are removed can be sold. It's best to purchase a Haynes manual, car specific, for this project.



Yuk!! View of engine before removal
Important wires are located and labeled.

Before starting it is important to take down measurements of the car's original ride height so when the conversion is done you will know if the suspension will need additional work. Measure the ride height at the top of each fenderwell.

Label all wires leading to the engine before removing it. Ignition wires will need to be located and labeled because the existing ignition switch will be used to turn the electric car on. The accelerator cable will also be retained. Measurements also need to be taken from the transmission to ensure proper alignment when the electric motor is installed.



All gas components removed. It just needs a little clean-up and painting.

With all the old gas stuff removed it's time to get down to business and install the electric components. But first, the engine compartment will be degreased and painted.

This is the point where the actual conversion begins. The empty engine compartment provides a better perspective of how the components and batteries will be layed out.

Installing the Motor



Before putting the motor assembly together take the flywheel to the machine shop and have the flywheel balanced. This may be a good time to replace the pressure plate and clutch disk and start with new ones. Also inspect the throwout bearing on the transmission shaft.

The motor is mounted to the transmission with an aluminum adaptor plate and spacer ring. The adaptor plate is made of 1/2 inch thick adonized

aluminum. Adaptor plates are available for a whole range of cars. The spacer ring ensures correct clearance between the motor shaft and the transmission shaft. The hub, which is attached to the motor shaft, is used to mate the flywheel to the electric motor. And the clutch assembly bolts to the flywheel as it did on the gas engine.



Motor, adaptor plate and flywheel clutch assembly

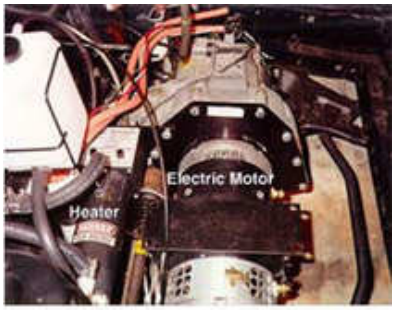
The first step of the motor assembly is attaching the hub to the motor. The hub in the kit is machined with a key way, two threaded holes for the set screws and a matching bolt pattern for the flywheel. Once the hub is on the shaft drill into the shaft through the set screws holes so the screws will seat properly. Blow out any metal shavings and screw the set screws in place. Two set screws are used for each hole, one on top of the other.

Position the motor so the terminals are easily accessible once the motor is mounted in the car. Next, position the spacer plate and adaptor plate to the face of the motor and bolt them into place. Bolt the flywheel to hub. Then bolt the clutch assembly to the flywheel. Make sure all the bolts are tightened to the correct specifications.

Once the motor assembly is complete, it is lowered into the engine bay and bolted to the transmission. It may take a few tries to align the shafts of both the motor and the transmission so an engine lift and an extra set of hands is real helpful. After the unit is bolted into place, with the drive wheels off the ground, put the car in gear and rotate the tire to make sure the motor shaft is also rotating. After this test hook up the motor to a 12-volt battery and briefly run through the gears to make sure everything is working and well balanced.



Lowering the completed motor assembly



Motor assembly bolted to transmission

At this time the car's new heating system is also installed. The new heater pumps hot Prestone solution through the existing heater core. The unit uses the existing heater controls and operates when the heater lever is moved to the hot position on the dash. The tank above the heater supplies Prestone to the heater. The heating element is powered by the propulsion batteries and the unit's pump is powered by the 12 volt system.

There are other options for heaters as well. A popular heater being used today is a resistive heater that resides where the heater core is inside the heater plenum in the dash area. This heater requires no plumbing like the other heater described above. In some cars such as the Ford Escort the heater core can easily be removed from the heater plenum behind the glove box. The ceramic element of the heater is powered by the main battery pack. This unit also can use the same heater controls on the dash.



Motor Support

Getting back to the motor we need to securely bolt the motor to the frame of the car. One end of the motor is already anchored to the frame with the transmission so we need to secure the other end. The kit comes with a motor support that wraps around the motor and has a base to provide an area to mount a bracket to the car. You have several options here. Attaching a brace from the upper motor mount attachment points on the car to the motor support is a common option. For rear wheel drive cars the motor support can be attached to a brace that attaches to both frame rails. In rear wheel drive cars it may be also necessary to add a torque bar from the frame of the car to the motor to prevent the motor from twisting in the motor support when the motor is started.

For this conversion a rack system was designed to span the width of the engine compartment to support not only the motor but the controller, three batteries, and the battery charger as well. The rack is made of 3/16 inch thick angle iron. The rack rests on top of frame rails integrated into the unibody construction of the car. A smaller rack is located where the radiator used to be. This rack will support three batteries. It helps to build fomecore models of the racks for positioning purposes. You can also give the finished model to the welder. To accomplish this fist measure your compartment, frame to frame. Then design your rack to best accommodate the space you have. Below is a photo of the finished rack.



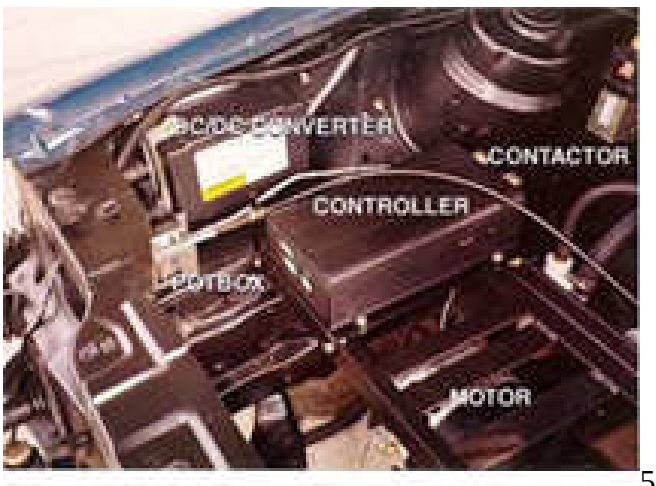
Battery rack models



Front rack which will support three batteries, the motor and controller

Installing the Components

EVs require very few parts so installing the components is relatively simple. Below is a photo showing the major components installed in the car. As you can tell they don't take up as much room as the engine. The rest of the space will be filled with batteries. Not shown in the photo is the



Electric components installed

compact battery charger which is mounted at the opposite side of the new motor compartment.

Ideally, the components should be placed close together to keep wire lengths short. The controller requires sufficient cooling to work properly so it should be placed in the airstream or mounted on a heatsink with a thermal joint compound for heat conduction. The potbox should be mounted on a sturdy surface and the accelerator cable should be routed in such a way so as to prevent kinks or pinching. Since there is a slight spark when the contactor closes it should be placed below the top level of the batteries. Each component should be kept away from water splash. Some EV converters mount all their components on a board that is hinged to allow easy access to batteries and the motor.



Underside showing conduit, battery box vent and air bags installed.

PVC pipe is mounted under the car as a conduit for the wiring that runs to the rear battery pack. The wiring harness that runs inside the conduit includes heavy cables that connect the battery packs, a charging wire for the positive lead of the top most battery, wires for the battery box fan, and extra wires for future expansion.

Air bags are installed in the coil springs to support the weight of the rear batteries. The vent in the rear spare tire well is ventilation for the battery box. The spare tire will be stored on top of the battery box.

Installing the Battery Box



Rear battery box

Since 10 of the batteries will be located in the rear section of the passenger compartment the batteries will need to be stored in a protective box. This is to prevent fumes from entering the passenger compartment when the batteries are charging and to protect occupants of the car in an accident. The box also keeps the batteries warm in cold weather. Because of the limited space in the front of the car, battery boxes were not installed.

Mounted on the side is an explosion proof

brushless fan that ventilates the box when the batteries are charging. The fan is wired in series with the fan in the battery charger so when the charger is on the battery box fan is on. A marine grade ventilation bilge hose is attached to the fan and routed to the vent on the underside of the car.

The box is constructed of marine grade plywood and painted with water repellant paint. Metal banding is secured around the box so the weight of the batteries will not break the box apart in an accident.

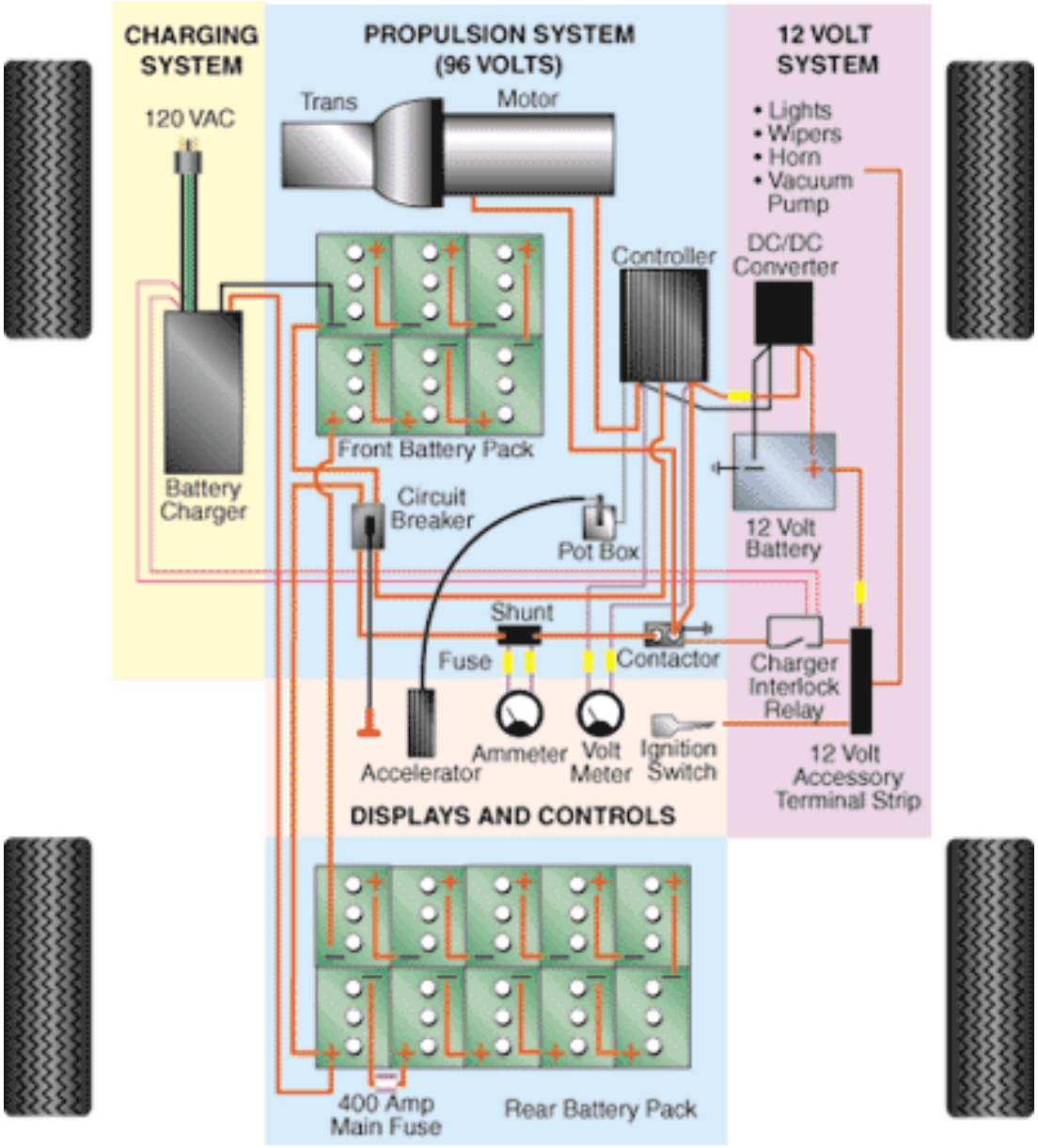


Rear battery box installed

The box is securely mounted with bolts to the frame of the car. For ease of installation the box in this conversion fits in the trunk. However, with careful planning, some cutting, and a little welding, the battery box can be sunk into the floor of the trunk to regain storage space. Before the batteries are installed, a layer of baking soda is spread on the floor of the box and the air bags in the coil springs are filled with air.

Wiring

As shown in the wiring diagram, there are four basic systems in an electric car: the propulsion system, 12 volt system, charging system and the driver's displays and controls. The propulsion system uses high voltage to power the electric motor, in this case 96 volts. The 12 volt system powers the accessories such as the radio and lights. The onboard charging system uses 120 VAC household current rectified to DC power to charge the batteries.



The driver's display and controls are pretty much the same as in a gas car. Although not shown in the illustration, the clutch pedal and mechanism are the same and the power brake system is the same except an electric vacuum pump supplies vacuum for the power brakes. The accelerator linkage is now linked to the potbox. Instead of a fuel gauge there is a voltmeter and there is an ammeter that measures the propulsion system amperage.

The propulsion system's battery pack is split between the front and rear of the car. Since high current, up to 300 amps, will be used in this conversion heavy duty 2/0 welding cable capped with heavy duty lugs is used for connections. In addition, a 400 amp fuse is placed in the circuit. To prevent corrosion a thin layer of Noalux is applied on each battery terminal.

On the 12 volt side, 16 gauge wiring is used throughout the vehicle, except the wiring for the 12 volt battery which is heavier. The existing ignition wire, 12 volt accessories, and components including the vacuum pump, and contactor are wired to a terminal strip. When the ignition key is turned to start the car, the contactor closes the circuit in the propulsion system. Although the circuit is closed, current will not flow to the motor until the driver accelerates.



Low and high voltage wiring of the components

Also wired into the car is a charger interlock which is a safety relay that opens the contactor while the car is charging. This prevents the car from being driven off while the car is still plugged into the charger.

The charger is an onboard transformerless unit with built in GFI (ground fault interruption). Input wiring includes 10 gauge household wire that is wired from the charger to a 110 VAC outlet under the front bumper of the car. Output wiring includes a positive lead from the charger to the top of the battery pack and a negative lead from the charger to the bottom of the battery pack. The charger has a built in ammeter so amperage can be adjusted according to the available current at the charging location. This means the car can be charged anywhere where there is available electricity.

Testing the Car

We've finally got the car together, or almost together, and it's time for a road test. Before heading out, the battery charger is tested and the batteries are charged. The 12 volt system, propulsion wiring, fuses, and battery terminal connections are inspected one last time and the air shocks are filled.

Now for the time we've all been waiting for. Turn the key to the start position. Instead of the usual "er-er-er-vrooom" you'll hear the contactor click then silence. Put the car in gear, release the brake, press the accelerator and off you go.

The first thing you'll notice is how quiet the car is. This will make it easy to spot any unusual noises or vibrations. The car should brake and accelerate smoothly. The vacuum pump should occasionally turn on to provide the proper level of

vacuum for the brakes. If all checks out take a few laps around the neighborhood and enjoy your efforts. Don't be surprised if your car's range is shorter on the first run then expected. The batteries usually need about 40 charges before they meet optimum range.



The new EV is ready for its first road test

ABOUT THE AUTHOR

AguaLuna is an Off-Grid, Family Owned, 100% Alternative Energy / Fuel Run Ranch. We share / teach methods & projects that are designed / compiled & currently running (here on the ranch) with others, in the hope that everyone can accomplish some form of Self-Sustainability / Green Alternative Energy upgrade to their home or vehicle.

The planet IS being Destroyed & Global Warming is no longer questioned. Simply flip through your TV or pick up a newspaper, the subject makes headlines daily...

Global Warming
Melting ice sheets & glaciers
Floods & droughts
Great hurricanes & cyclones

Seasonal extremes
Seasonal phenomena's
Species extinction
New & resurgent diseases

These catastrophes are Natures Natural WAKE UP call & we all need to Answer It !

Advancements in technology & information make going green A LOT easier today. For example, Using Alternative Energy's like Ethanol (corn oil), Biodiesel (fry grease), Hydrogen (water), Solar Power, Wind Power, Water Power, etc., instead of polluting & harmful fossil fuels, is an extremely simple, cheap & HUGE step.

What's better then a cheaper, safer & healthier alternative to Global Warming ? The earth provides for us unlimited FREE Energy, why not use it ?

My husband & I have lived 100% Off the Grid & Bill & Debt Free on our ranch in West Texas for the last 8 years. My husband (a retired Engineer from Boeing Aerospace) has written, compiled & built every project we offer in our Alternative Energy Guides collection, which are all available for viewing / testing in our On-Site Workshop. This is why we not only believe 100% in our Alternative Energy Guide Collection, but are capable to offer FREE unlimited online consultation at no extra cost, with every guide purchased, like no one else can over the Internet. We are standing by to walk you step-by-step trough ANY problems you may experience in building your own Alternative Energy items.

CLICK http://s37.photobucket.com/albums/e88/arcious/Hacienda_Agua_Luna/ to meet us & visit the ranch, where we live completely self sufficient. Let us share our knowledge & experience with you & your family.

And don't forget to check out other Alternative Energy Guides
http://www.agua-luna.com/guides.html
We've formatted them in an easy to read, step-by-step way to provide EVERYONE, ANYONE, EVERYWHERE an abundant amount of information, while having in mind all skill levels & have designed the booklets to suit each individuals needs from the beginner to the expert. Titles include...

How to build a Wind Generator
Building a Windmill
How to find Free Solar Panels
Building a Solar Panel

How to build a Solar Stove
How to Build an Arc Welder
How to Live off the Grid
Build a Solar Water Heater

DIY Biodiesel
Build a $10k 5,000sqf home
DIY Automatic Animal Feeder
Super Cooler Plans

How to Convert your car to EV
How to Run your car on Ethenal
Build an Alchohol Still
Build a Solar Panel

... & Much more, specifically written to better assist your Living off the Grid / Alternative Energy Experience.

> **Note:** *For the best savings we Highly Recommend our Feature 40+ Package. It contains over 40 Alternative Energy / Live off the Grid Booklets for the price of just 5. The 40+ Package will kick start you into your NEW Alternative Energy Life Style & will guide you to help us STOP GLOBAL WARMING.*

Because our life style here at agua-luna.com Ranch is 100% Lived Off the Grid, we are familiar with the Day-to-Day aspects of Self Sustainability & how simple it is to actually make the conversion. No one else can offer that.

If you're interested in making your first GREEN steps with our help, we offer a number of affordable options. First take a tour through the site, then check out our instructive Alternative Energy Guides, & if going green sounds good to you, sign up to join us here on the ranch & take part in our On Site Workshop or Online Workshops, gain experience in our Internship Program during one of many Sustainability Projects, catch an Alternative Energy Seminar in your area or simple stay in one of our cozy 100% Off-Grid Cabins, experiencing nature's stress free landscape & what Living Self sufficient / away from society's rat race has to offer.

Because agua-luna.com is a non-profit, 100% Alternative Energy Green Off the Grid run Ranch. All purchases & donations go strictly to costs incurred & future expenses in providing the newest Eco minded projects & information to a larger array of people, in the hopes of helping as many as possible in making some form of Green conversion.

About the Agua-Luna On-Site Self Sufficiency Workshop…

The following procedures are recommended for both first-time enrollees and those who have already experienced a seminar or have previously taken a course/s with agua-luna.com:

AguaLuna Ranch in Far West Texas is an Off-Grid Eco orientated and Green run Ranch, dedicated to creating learning communities for on-going professional sustainable development. Members of the agua-luna.com On-Site Workshop, who are driven by all things environmentally friendly, work to teach others Green and Alternative ways through hands on courses. We invite you to sign up for our Summer Workshop and make the conversion now.

AguaLuna Workshop Information

The Workshop will consist of a series of lab and on-site based tutorial lectures and projects covering alternative energy and / or self sustainability, including past, present, and future applications and techniques, particularly in its application in making the Environmentally Greener conversion.

The workshop will be held on-site at the AguaLuna Ranch. See dates, fee's and course topics at www.agua-luna.com

The Workshop is intended for first-timer enrollees or repeat offenders who are motivated to make an environmental difference in their own lives and in the lives of those around. Travel and accommodations information is available upon request agua-luna@lycos.com Local / primitive camping accommodations, on the Ranch, may be provided at no charge, upon request, to participants for the duration of the workshop.

Participants earn their Green Certificate certifying their knowledge of the latest in "green" building practices, technologies and techniques.

The topics will address economic, ethical, environmental and social aspects of some form of self sustainability and / or alternative energy. Specific topic based projects will be taught and carried out by attendees in a hands-on safe environment. Each of the workshops will feature a 1 week (4 hr/day) eco based component, entirely devoted to some form of Alternative Energy Concepts and is meant as an introductory course to the world of Green living.



Next Step: Download and Fill out the work-shop sign up form by clicking http://www.agua-luna.com/workshop_form.pdf or send an email to the address below requesting the form. Feel free to include any information you feel pertinent.
Send completed applications to:
agua-luna@lycos.com
or
AguaLuna
Hc 65 276 G
Alpine Tx
79830

AguaLuna Workshops

Alternative Energy Concepts Workshop
$480 per week (fee covers all project materials and lab costs)
This workshop course is directed towards the average person who wants to gain a basic knowledge of Alternative Energy. Participants will learn Passed, Current and Future Energy and fuel resources, alternative fuel and energy options, alternative fuel and energy conversion, and more. Participants and Instructors will prepare and perform theoretical, lab and on-site presentations, examples and projects, leading the learning experience.

Home Small Scale Hydrogen Generation Workshop
$480 per week (fee covers all project materials and lab costs)
This workshop course focuses on the basics of Small Scale Hydrogen Generation and how it can be applied safely in the average Home, vehicle and daily use. The basic technical knowledge and skills in this workshop will be useful in helping family and consumers better understand and incorporate Hydrogen as a safe fuel, limiting if not extinguishing their need for fossil fuels. Hands on electrical and chemical Hydrogen generation will be featured. Participants and Instructors will prepare and perform theoretical, lab and on-site presentations, examples and projects, leading the learning experience.

Self Sufficient House Construction Workshop
$480 per week (fee covers all project materials and lab costs)
This course is designed for any interested in specific techniques and construction methods, utilizing natural or eco friendly materials. The focus will be on material properties in their relationship to different locations, climates and accessibility, but other topics relevant to both environment and human health / need will be covered. Specific topics include different methods in working with and building homes out of Adobe, Cob, Pole, Rock, Papercrete, Recycled materials, Rammed earth, Hay bale Cordwood, Underground and their ecologically-friendly impact on the terrain. Participants will work in the lab as well as hands on through activities and case studies to improve their knowledge and skill in building sustainable / eco friendly, green homes.

How To DIY Wind Generator I Workshop
$480 per week (fee covers all project materials and lab costs)
This course is a workshop focused on the basics of Wind Generations and how it can be applied to the home. The basic technical knowledge and skills in this workshop will be useful in helping the consumer better understand Wind technology as a useful form of electricity and how it will affect their need for alternative energy. Laboratory investigations, instruction and projects will give participants experience with energy extraction and transformation, conversion, practicality, incorporation, maintenance, and more. The course focuses on history, theory, environmental need for, and home applications of the wind turbines as a viable source of needed electricity, with several small hands-on projects carried out. This course is a pre-request to help understand “Practical Wind Generator use and construction” which will be covered in the “How To DIY Wind Generator II Workshop”

How To DIY Wind Generator II Workshop
$480 per week (fee covers all project materials and lab costs)
This advanced workshop is only open to those who have attended one of the previous “How To DIY Wind Generator I Workshops”. Attendees will learn how to prepare, construct and install advanced Practical Wind Generators for home or business use. Activities will include parts description and location, generator construction, How to Build your own blades, pole raising, wiring, battery banks, inverters, and more. Participants will prepare and perform preparation lab activities in class, carrying out the remainder of the project in an on-site construction environment.

What to bring:
The weather in Texas is very volatile so bring lots of layers of clothes you don’t mind destroying at work, sturdy closed-toed work shoes, sunscreen and a hat with a wide brim to protect you from the intense sun.

- Leather work gloves
- Heavy duty rubber cement gloves
- Safety Glasses
- Ear plugs
- Dust masks
- Hammer
- Utility knife

- Retractable tape measure
- Tool belt

How To Build your own Solar Panels I Workshop

How To Build your own Solar Panels II Workshop

Can't make the On-Site Workshop? Self Sufficiency Workshops are now available online. See below for details, dates and pricing or contact us at agua-luna@lycos.com.

AguaLuna Self Sufficiency Online Workshop / Course

AguaLuna's popular Self-Sufficiency Workshop courses have been updated and will now be offered starting this year online. The courses are designed for first-timer enrollees or repeat offenders who are motivated to make an environmental difference in their own lives and in the lives of those around.

The courses, taught entirely on the Internet, gives participants the knowledge, background, resources, and confidence they need to carry out alternative energy / self sufficient upgrades to their life, home and vehicles. A minimum of 15 hours online, plus an additional 15 hours of reading, writing, research, projects and taking exams is required for each course.

Participants earn their Green Certificate certifying their knowledge of the latest in "green" building practices, technologies and techniques.

All course work can be done on a home computer. Course participants will be introduced to ethical theory before moving on to evaluating self-sufficiency and alternative energy issues. The course incorporates activities on specific topics about environmental solutions, carbon foot prints, self sufficient building, and alternative energy. Course participants are welcome to use these activities in their own teaching or outreach work as long as that work is not for profit. There will be extensive online discussion with other enrollees.

Dan Martin, a retired Boeing Engineer who majored in Theoretical and Structural physics now living 100% Off-the-Grid, The Author of 10 How to DIY Self Help / Self Sufficiency / Alternative Energy Guides will be this instructor. For more information about this years course content, please contact him directly attn: Dan Martin at agua-luna@lycos.com or visit www.agua-luna.com.

Simply Download and Fill out the work-shop sign up form by clicking HERE or send an email to the address below requesting the form. Feel free to include any information you feel pertinent.
Send completed applications to:
agua-luna@lycos.com
or
AguaLuna
Hc 65 276 G
Alpine Tx
79830

For more details about the agua-luna.com workshops, please contact us agua-luna@lycos.com or call 206-333-0321, leave a message with your phone number and email.

Again, I thank you for your interest in our programs. I hope you will be able to join us this summer.

AGUALUNA INTERNSHIP INFO

The agua-luna.com Internship program is open to anyone with an interest in sustainability / alternative energy and a willingness to work hard. People of all ages and backgrounds are encouraged to sign up.

Six applicants will be chosen for each session (schedule at www.agua-luna.com). Accepted interns will have the opportunity to learn alternative eco friendly building concepts and techniques while working full time alongside the agua-luna Mentor Team for approximately 1 month to 2 months.



Internships are unpaid positions. Interns are responsible for providing their own accommodations, food, transportation, supplies, etc. or primitive camping and meals are available at no charge on-site.



There is no application deadline.

What to expect:
Each session will start with a brief orientation meeting at the Agua-Luna Visitors Center. This will include a small tour of the Agua-Luna Ranch, projects and potential work sites, showing a few finished projects as well as the job site where you will show up for work at 9 am the next day.

Expect to be challenged physically and mentally, to work hard and play hard. Some have found it difficult to be away from their homes and jobs for a month. Please come prepared to support yourself for the entirety of your stay. Also, please keep in mind you will be working on a construction site.

During the session interns may attend any scheduled on-site workshops and seminars. Upon completion of the session interns receive a Certificate of Clean Green Building, and the new found skills of environmental construction.

Note: All applicants will receive a response.



What to bring:
It is very difficult to attend an internship without a vehicle as the Taos area is so spread out. Interns have gotten by with carpooling with other interns and/or hitchhiking, but it can be a challenge.



The weather in Texas is very volatile so bring lots of layers of clothes you don't mind destroying at work, sturdy closed-toed work shoes, sunscreen and a hat with a wide brim to protect you from the intense sun. If you are camping you'll want a tent, a tarp, a campstove (open fires are ok), a sleeping bag, a five gallon water jug, a good flashlight, etc.

Tools: Having a few simple tools will make your internship more comfortable and add a wider variety of work. Here is a list of some helpful tools you can choose to bring (all tools are supplied).

- Leather work gloves
- Heavy duty rubber cement gloves
- Safety Glasses
- Ear plugs
- Dust masks
- Hammer
- Utility knife
- Retractable tape measure
- Tool belt
- Any other hand tools may be useful, i.e. a speed square, combo square, bevel square, chalk line, torpedo level, pliers, chisel as well as small power tools (drill, circular saw)

Participants earn their Green Certificate certifying their knowledge of the latest in "green" building practices, technologies and techniques.

Next Step: Download and Fill out the internship application by clicking http://www.agua-luna.com/internship_form.pdf or send an email to the address below requesting the form. Feel free to include any information you feel pertinent.
Send completed applications to:

agua-luna@lycos.com
or
AguaLuna
Hc 65 276 G
Alpine Tx
79830