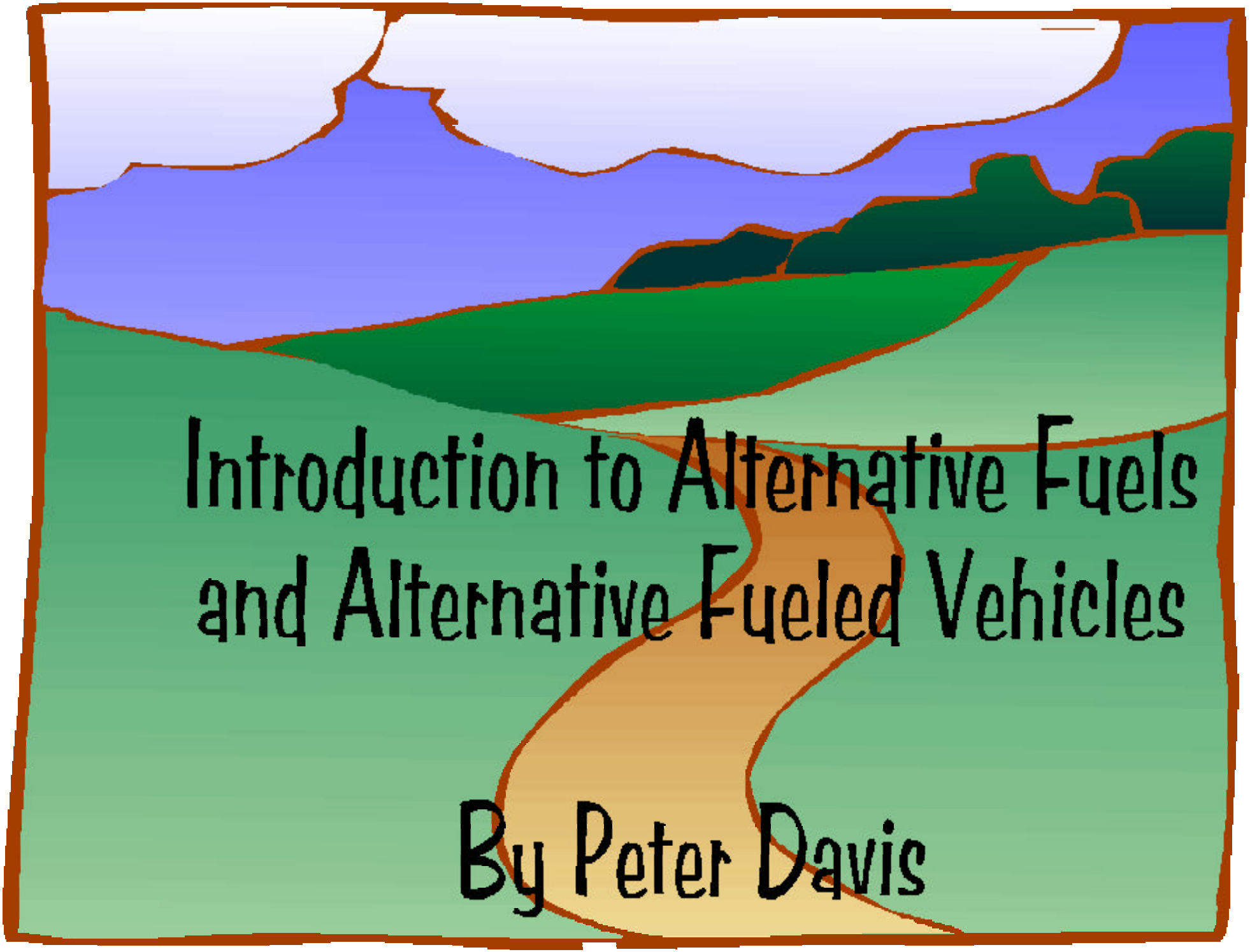

Introduction to Alternative Fuels
and Alternative Fueled Vehicles
By Peter Davis

Introduction To Alternative Fuels and Alternative Fueled Vehicles

By Peter Davis

Miramar College, San Diego

February 1999

Today you are going to start...

Start the journey toward the understanding of Alternative Fuels and Alternative Fuel Vehicles. (AFV)

Alternative Fuels are energy sources for transportation that are kinder to our environment.

Fuels that produce less harmful emissions.
Fuels that are renewable.
Fuels that we can produce here in the USA.

Here are the names of some of the alternative fuels that people around the world are using TODAY:

HYDROGEN: This is the lightest fuel. We can make this fuel from bio-mass products!

METHANOL: We make it from natural gas but it can made from FARM PRODUCT biomass. It is a light alcohol.

NATURAL GAS: Here's a gas produced from the remains of Dinosaurs and Vegetation that died millions of years ago. Combining HYDROCARBONS and METHANE makes NATURAL GAS.

LIQUID PETROLEUM GAS, LPG: This fuel is derived from natural gas and refinery processes.

ETHANOL: Made by fermenting crop starches and sugars; corn is used primarily.

ELECTRICITY: We can make electricity many ways and store the electrical energy in BATTERIES.

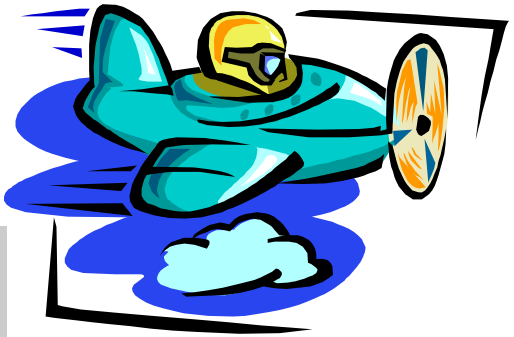
BIO-DIESEL: An organic fuel made primarily from corps like soy, peanut, sunflower canola and rendered tallow

An AFV is an Alternative FUELED Vehicle, like

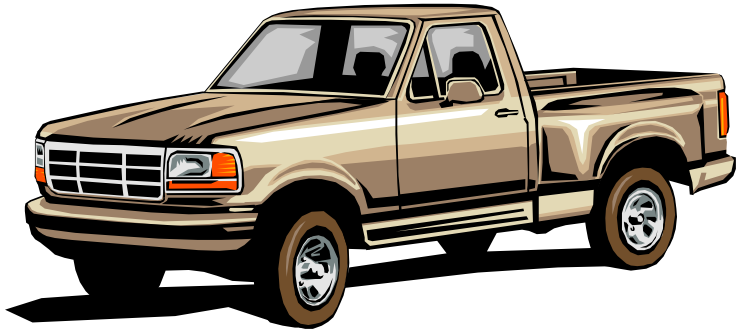
A Car

or a Boat

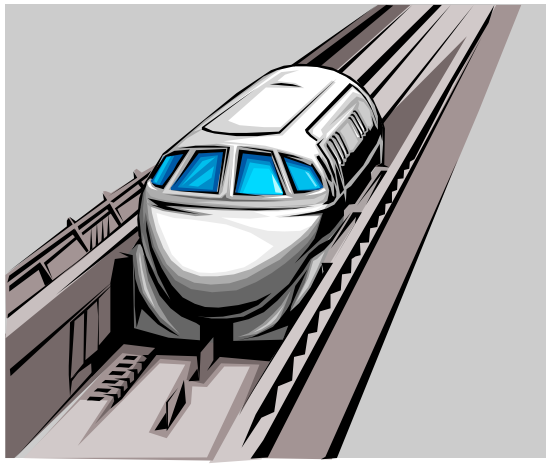
or an Airplane



or a Truck



or a Train



or probably any vehicle that ONCE

used <u>only</u> FOSSIL made FUEL

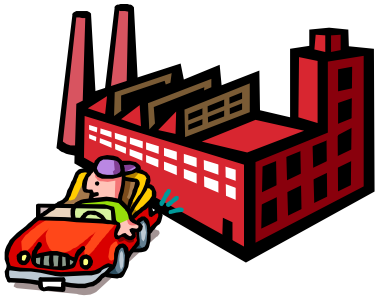
to make the engines run!!

Well, the hardest thing ever to do is …"START"

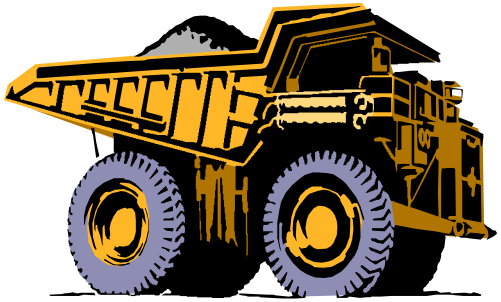
So if you START now and know why it is so important to make a change ...it makes the changing easier. Especially when you know all about the reason for changing. If you look at it this way...it is really simple!

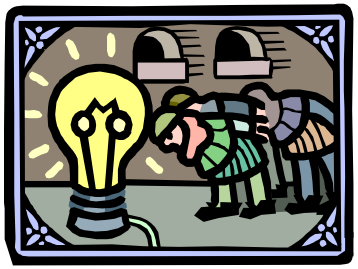
In the United States we all need to attack the air pollution problem. There are many government agencies, many air resource boards, many schools and many regional clean city programs working together to solve our air pollution problems. Mostly it will take people like YOU and ME to make a difference and make the commitment for clean air by using alternative fuels.

We have begun to work with automakers



heavy equipment makers





energy providers

scientists and inventors

farmers

fuel technicians

chemists

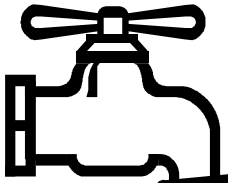
oceanographers

and many more people who are interested in achieving cleaner air for all of us tomorrow and tomorrow will be here sooner than we think!

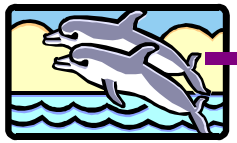
On the next few pages you will learn about today's production of energy and the technologies that create and store it. Remember that there are many ways that we try to create ENERGY. You and your friends will develop many NEW and CREATIVE ways to make energy in the future! Today there are some fairly simple ways for us to create and transport energy!

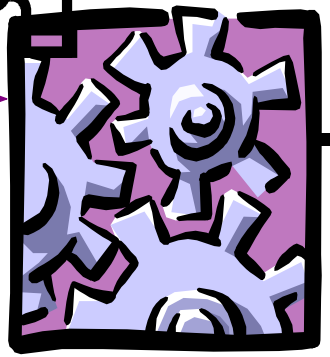
We can farm and grow a crop (BIOMASS)

We can tap the energy of water (HYDROELECTRIC)

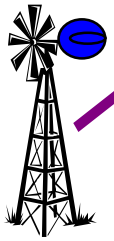


We can harvest energy from the oceans (BIOMASS)





We can force the hot steam from the earth (GEOTHERMAL)



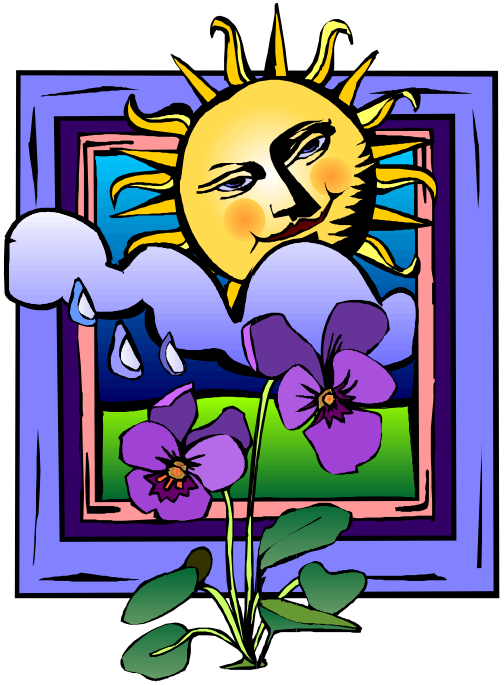
We can harness the winds (ELECTRIC WIND GENERATORS)

We can collect the sun's energy (PHOTOVOLTAIC)

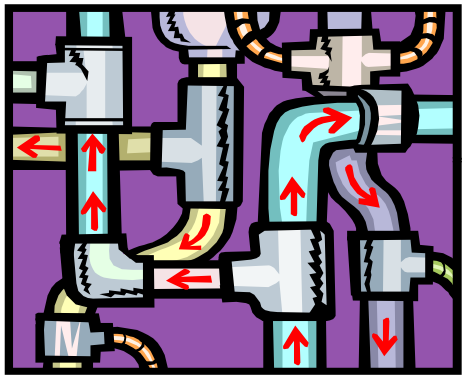
This is just a very SHORT list of alternative ways to create energy. Some of this new energy will be a LIQUID FUEL, some of it will be a GASEOUS FUEL and some of it will be an ELECTRIC ENERGY FUEL. We need to create inventive ways to store the fuel for tomorrow. Some fuels will be easily transported from place to place. Other fuels will be transmitted over the country on small cables. Just imagine all the ways to move the energy after it has been created. Do you have any ideas about how to transport energy?

California makes electricity many different ways.

Some electricity is made by SOLAR CELLS, a very clean form of energy production.

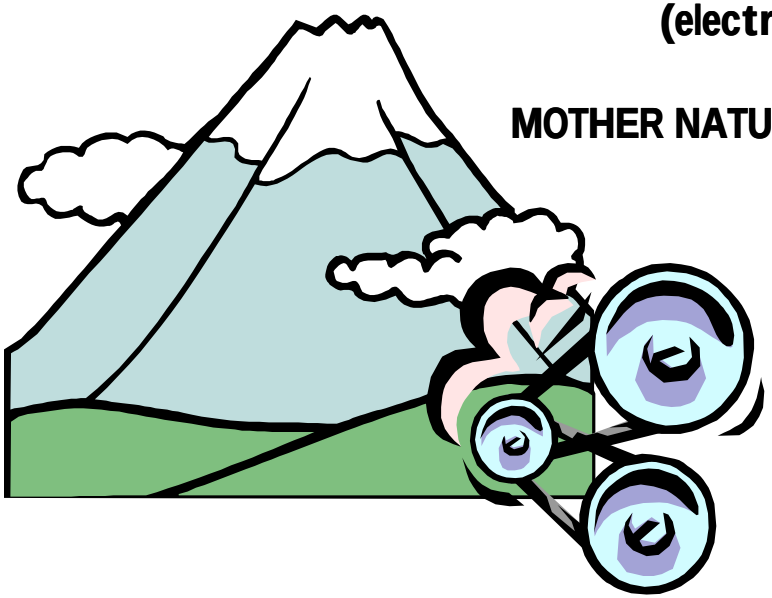


Another way to make electricity is to use water, a HYDROELECTRIC source of energy, created by forcing water to help us!

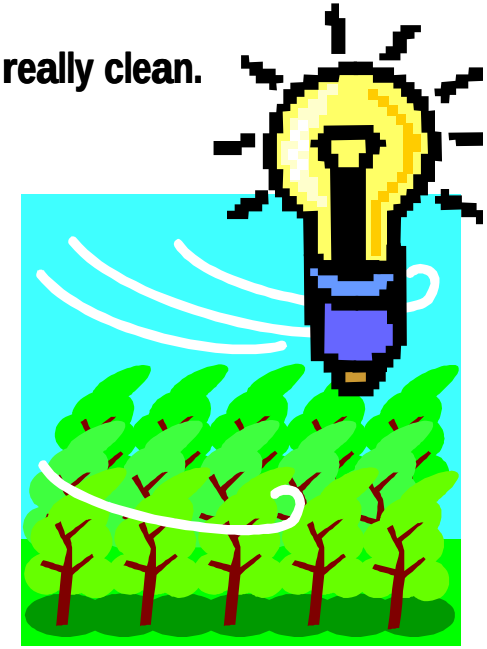


One other way to create electricity is to go to places that are geothermally active…
where the water gets super hot and turns into steam.

That hot steam powers the
(electric making) turbines that make electricity.
This source of power is really clean.
MOTHER NATURE gets to help us.



Some people have thought of many other ways to create electricity, some use the wind and some use natural gas to turn the electric making turbines.



When we use the Alternative fuel and we put it in our car and drive, it burns “cleaner” In fact, an electric car that uses a battery or a fuel cell is much “cleaner” because it does NOT burn a fuel!

Did you know that electric vehicles have been around for a long time? They have been cruising around since the 1830’s. Guess what? There were more ELECTRIC VEHICLES on the road at the end of the last century than are on the roads today!

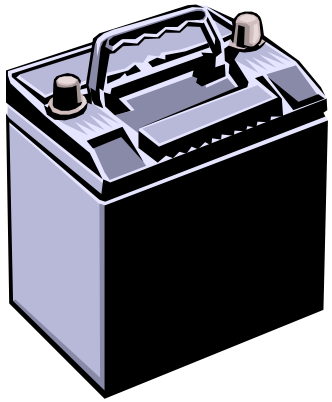
They’re ...BACK!

The “Electric Car” and the people who love them are not new. Electric car clubs have been here for years and years. The electric car enthusiast is a person just like YOU and me. They thought about the “environment” and decided that FOSSIL FUEL transportation is really harmful to our WORLD. They also thought that electricity might be a cheaper option than gasoline. They could save the environment and save money. Now there’s a good deal for everyone.

Today the electric vehicle is called the “EV” for short. You probably have seen electric vehicles and never known that they were “EV’s”. For instance, in California some cities use electrically powered streetcars.

Other cities in California use electricity to power the electric motors in the buses. Some cities even use electricity to power their light rail train system, a form of mass transit, by using overhead electrical wires or ground rail track.

As EV's continue to make a major come back in the United States the vehicles are improving in many ways.
The mileage has been increased...some over 150 miles per charge.



Batteries are made in every shape and size. Most batteries are made from metals. Some batteries are made from lead, some from Nickel or other metals like Lithium or Zinc. Battery technology is improving the storage and power performance of new kinds of batteries. These improvements in battery storage and power performance make the EV a much more desirable vehicle.

EV’s don’t have a tail pipe to release pollution into the atmosphere.
But, the way the electricity is made could cause pollution!
Some energy companies make electricity by burning COAL...
Power created by fossil fuel like coal creates some form of air pollution.

So, did you know it takes more ALTERNATIVE FUEL

to travel the same distance as FOSSIL FUEL?

You do now!!

Here is something really neat!

Alternative fuels are chemically less confusing and less complex than gas!

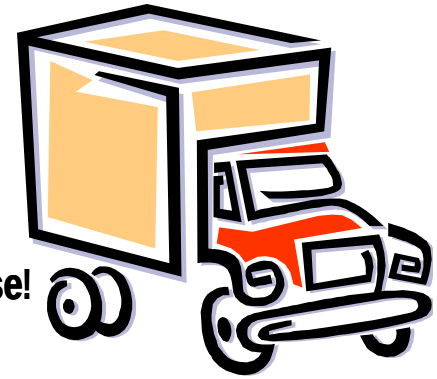
So when you drive and burn alternative fuel ...the fuel produces fewer and less harmful emissions. That is much better for our environment. It means less pollution! It means CLEANER AIR!

People are trying very hard to find the right fuel for the right job!

Some people think it should be ETHANOL, an alcohol liquid fuel made from corn or some other type of grain. Sometimes ETHANOL can be made from other agricultural, farm or timber waste. ETHANOL can be mixed with gas to make a fuel called GASOHOL. This fuel product is found mostly in the Midwest of America. Another combination fuel is E-85, it is a combination of 85% ethanol and 15% gas. It seems that ETHANOL is a renewable source of energy. One of the best things is that most of the biomass waste that California creates can be transformed into this valuable Alternative Fuel!

Some other people have said that they believe that METHANOL is their choice of alternative fuels. METHANOL is usually made from natural gas, but it can be made from coal or a biomass product. It is a clean burning liquid fuel. Methanol can be combined to produce M-85. M-85 is 85% METHANOL and 15% unleaded regular gasoline.

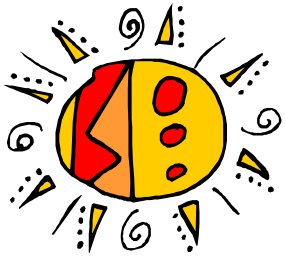
Still other people say that vehicles should be powered by NATURAL GAS. Today natural gas is available in several forms: Compressed natural gas, (CNG) and Liquefied natural gas, (LNG) . CNG is used today in passenger vehicles, trucks, school and transit buses. The gas is stored in a very strong cylinder and regulated to the engine as the driver demands more fuel. LNG is used for really long or heavy duty applications like locomotives or long-haul semi trucks. In California CNG is relatively available to you and me. There are two types of fueling station a "slow fill" station and a "quick fill". In fact you could have a "slow fill" station at your house!



PROPANE is yet another alternative fuel best known as LIQUEFIED PETROLEUM GAS, (LPG). Imagine, this fuel turns to a liquid, when you force it into a storage cylinder container, under pressure. When you use it, you let it escape from the storage container, then the liquid changes back to a gas before you can burn it! This gaseous fuel when produced in California is made during the refining of other petroleum products and from natural gas production. PROPANE today is used widely in rural areas where natural gas is not available. These rural areas use PROPANE to heat their homes and cook their meals. You probably have a PROPANE barbecue at home. Propane is the most widely used vehicle alternative fuel in the world.

It seems that many concerned folks,like YOU and me are trying to plan for the future.
Some people don't realize that the future is here today!

The FUEL CELL, BIO DIESEL and SOLAR-POWER fueling options ARE already powering vehicles of Yours and mine.

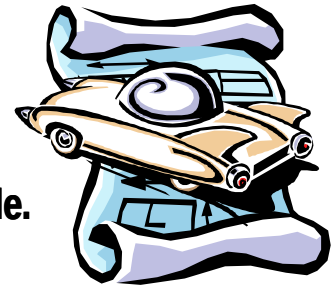


We do this stuff today! We created solar powered vehicles that take the sun's energy and transform it into electrical energy.
We store that energy in a battery and use the energy when we drive our electric vehicle .

In Hawaii, there is a man who goes to the fast food stores, buys all the left over oil that was used to make your French fries . He takes that used oil and transforms it into a fuel product that we call BIO-DIESEL. It makes diesel trucks and cars run on French fry oil! WOW! The diesel car smells like French fries. Other companies make BIO-DIESEL from corn, cottonseeds, peanut, sunflower, canola and rendered tallow (animal fat)

The FUEL CELL is like a battery. It makes electrical energy. You store that energy or just use the energy to power an electric motor to drive a vehicle. There are many different kinds of fuels for the FUEL CELL. Some people use HYDROGEN, other people think that METHANAL is a good fuel for the FUEL CELL. Today many scientists are working with methanol, phosphoric acid or molten carbonate salts in FUEL CELL research

The FUEL CELL is here today!! Not in a hundred or twenty or three years...it is NOW!!



Builders are busy developing all sorts of energy efficient AFV's for us to consider owning. You will see many HYBRIDS driving around your neighborhood. HYBRIDS today are vehicles that are ELECTRIC MOTOR driven with some other form of energy source to move the vehicle.

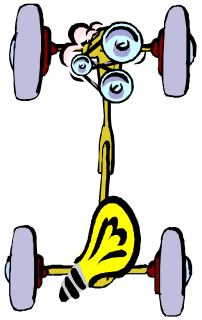
Imagine, a PARALLEL HYBRID vehicle, it has an electric motor to propel your car and a gas engine that has two functions. The gas engine generates electricity for the battery in the VEHICLE for the electric motor to use as well as helping propel the vehicle. That's how a PARALLEL HYBRID vehicle moves. There are many kinds of HYBRID VEHICLES like the *flywheel* or the *solar assist* or the *petro-electric* HYBRID VECHICLES. Pretty simple.

Two ways to make your vehicle move and probably controlled by a computer!!

What do you think about that? Have you seen one in your city? READY? Do you remember what you read?

What is one kind of liquid fuel that can run an AFV _____

Do You know the name of a gaseous fuel that an AFV could use ?_____



AFV's that use a blended fuel mixture can use _____ or _____ Fuels.

What do we store electrical energy in? _____

Name one type of fuel for a FUEL CELL _____ .

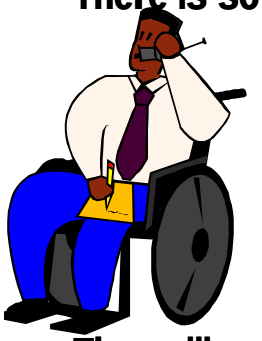
What Vehicle uses both an electric motor and a gas engine to drive? _____

You have learned many new terms, heard different ideas, thought about future travel and considered your important part in the changing future of our world.

Look at all that is possible today. Now you will have to decide to change your fuel needs and utilize all your educational options. DO this so your world will have cleaner air. You will still be FREE to drive across OUR nation in a vehicle, powered by a source of fuel that is friendly to our environment and decreases our dependence on petroleum.

There is so much to learn.

You and I have only begun to "SEE" this new future.



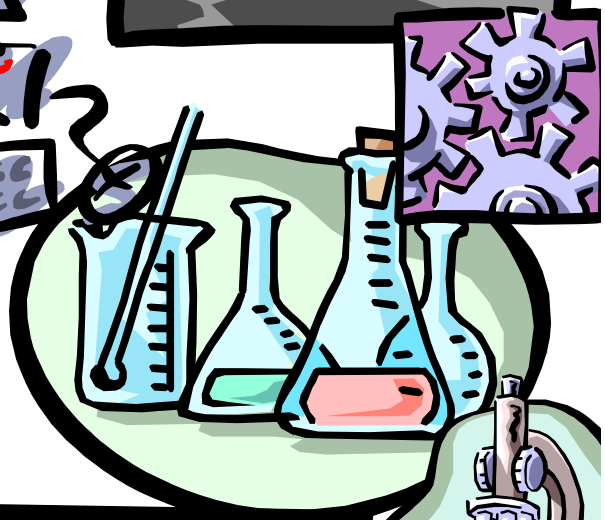
Today, somebody, somewhere, is working on a new technology to invent or rediscover something to do with energy. They will use computers. They will ask energy questions of their friends and colleagues, they will write "ENERGY PAPERS" . They will question why we do what we do. They will suggest new ways to look at OUR energy solutions. They will invent an ultra–battery system, called an ULTRA-CAPACITOR. They will try to make fly-wheels spin forever. They will use a magnet to lift a train and propel the MAG LIFT train down the monorail track. These people, maybe even your friends, will stretch their minds around this problem of energy, and somehow, improve the making and delivery of energy to YOU and ME.

Others, maybe YOU, will design vehicles that are lighter and stronger than vehicles we drive today. Still, some people, like YOUR little brother or sister, will help us operate our vehicles with faster and faster computers.
Vehicles that will some day "THINK' about the traffic and YOU.

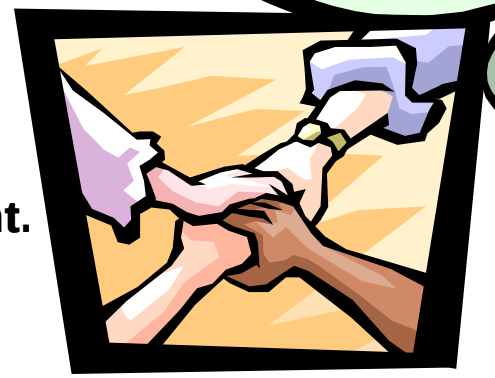
Still more and more people, will work on individual parts that make up these new high tech vehicles. Maybe Your Mom or DAD, will design new roads that will allow the driver to sit back in the vehicle, look out the window and enjoy the scenery as their vehicle travels down a "intelligent transportation system" That's right, a smart car!!

Driving itself, passing others as it travels down the road, stopping, starting, avoiding others, slowing ...
a safer intelligent vehicle!

A smart vehicle's COMPUTER will display the condition of the road and major elements of the vehicle on a monitor for you to read as it zooms down the road. Imagine that!



Some people, like YOU, will train to become technicians of this new technology. People, like YOU and me, will watch this technology change. You and I can continue to learn about the newest vehicle designs and on board computers.



We will follow the creation of new energy sources and storage systems and so many other things which we can not think of today.
Remember, YOU will be designing our future.
All of us can make the future better and help save our environment.

So you need to know what is going to happen to transportation and YOU…

How are you going to go to school?

Or to the market?

Or to the movies?

Or to the Mall?

Or to the BIG GAME?

Or go to your best friends house?

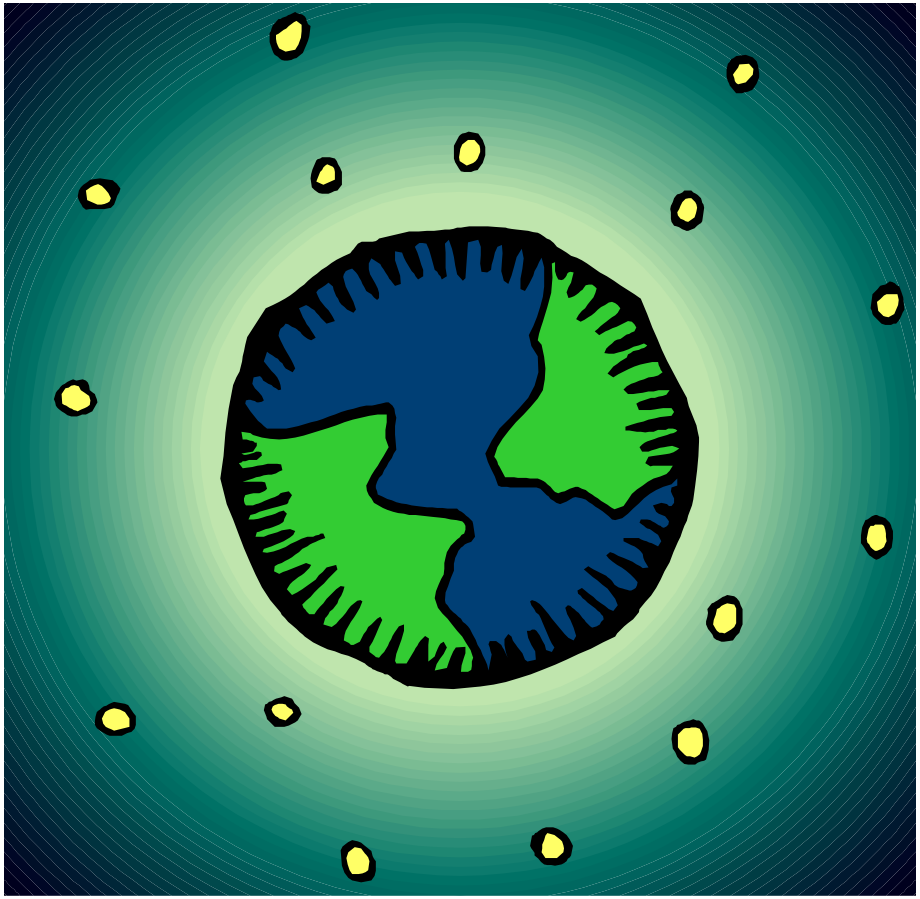
Or go Home?

The World is in need of change…
A change from Fossil FUEL driven vehicles
to ALTERNATIVE FUELED VEHICLES!!

The earth is a very wonderful place to live…

The earth is surrounded by many protective layers of atmospheres that protect us from harmful radiation.

We, You and I, must protect the Water, the Land and the Air we breath.



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We must protect the atmosphere that protects each one of us!

It's the only WORLD we have!

Help make it better.

The author has researched alternative fuel and AFV vehicle material on Web sites, books, magazines articles, manufactory literature, newspapers , pamphlets and used them as references when preparing this book.

Clean Cities Web Site
www.ccities.doe.gov

San Diego Clean Cities
www.sdrafvc.org

Alter Fuels Data Cntr
www.afdc.doe.gov

Miramar College
www.miramar.sdccd.cc.ca.us

AFV Resources
www3.cerritos.edu/atc/resources.htm

BOOKS OR ARTICLES

Alternative Fuel Vehicles for a cleaner environment,
pamphlet United States Postal Service

Alternative Fuels and Vehicles Information Resources
pamphlet U.S. Department of Energy's Office of Transportation Technology

Taking an Alternative Route, Fueling the Future
pamphlet U.S. Department of Energy
Argonne National Laboratory's Energy Systems Division

Alternative Cars in the 21st Century,
A New Personal transportation Paradigm
Robert Q. Riley
Society of Automotive Engineers, Inc.
400 Commonwealth Drive Warrendale, PA 15096 USA

ABC's of AFV's a guide to alternative fuel vehicles
January 1995, California Energy Commission
Bob Aldrich, Principal Author
Claudia Chandler, Assistant Director
Media & Public communications Office
Second Edition Printing February 10, 1995

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October 1997

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Clean Cities
U.S. Department of Energy

NGV Tech Update, Sept 1997
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Gird, Winter 1997/1998 Vol. 20, Number 4
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Chicago, Illinois

Automobile Magazine, June 1998, Volume 13, Number 3
Regional Clean Cities

Propane Vehicle Magazine, Volume 3 Number 5
October 1998

AND MANY MORE!

Glossary

Alternative Fuel Vehicle (AFV) - A Vehicle that does not rely on FOSSIL FUELS as a source of fuel energy.

Bio-diesel – A fuel produced for diesel engines. An organic fuel made primarily from corps like soy, peanut, sunflower canola and rendered tallow

Compressed Natural Gas, (CNG) – A fuel that is compressed to about 3000 lbs. per square inch and held in a cylinder under high pressure, released it expands for use as a fuel.

Dual fuel vehicle – An Alternative fueled vehicle that can operate on two different fuels, in separate fueling systems, such as CNG and GASOLINE.

EV– A vehicle that is powered by electricity, source of power may be a fuel cell, a battery or a solar panel.

Fuel Cell – A device that has no moving parts, it coverts fuels into electricity.

Geothermal Energy - Created by the molten material and water in the earth coming together and producing superheated steam.

Hybrid Vehicle – a vehicle that uses electrical propulsion and some kind of combustion engine system to propel the vehicle down the road.

Intelligent Transportation System (ITS) - A system that allows a "smart car" to take interact with the electronic "road" technology and operate safer.

Liquefied Natural Gas (LNG) —Natural gas condensed to a liquid, stored in cylinders at very cold temperatures

M85– A blend of 85 percent methanol and 15% unleaded gasoline.

Natural Gas Vehicle – A vehicle that uses only liquefied or compressed natural gas.

Ozone layer – A protective atmospheric layer shielding us some forms harmful radiation.

Petroleum — A fuel that produces air pollution

Propane — A fuel made during the processing of natural gas liquids and the refining of crude oil (Liquefied Petroleum Gas)

Regenerative Braking — The braking process converts kinetic energy into heat into an electrical charge to the storage battery.

Utilities companies — Companies that produce different types of energy for us

For More information about Alternative Fuels and the next generation of AFV Vehicles

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Mr. Jim Huges Instructor, ATT Chair	Rio Hondo College 3600 Workman Mill Road Whittier CA 90601	562-692-0921 Ext. 3710
Mr. Cal Macy Program Director	Long Beach City College 1305 E. Pacific Coast Hwy Long Beach CA 90806	562-938-3067
Mr. Gene La Zor Electronics Depart Chair, Coordinator ATT	Cerritos Community College 11110 Alondra Blvd. Norwalk CA 90650	562-860-2451 Ext. 2919
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Thank You One and all!

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MARY WEAVER, PINE VALLEY ELEMENTARY SCHOOL AND HER CLASS
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MICHAEL DALEY, COORDINATOR ATTI
LANA THOMPSON, MIRAMAR COLLEGE
LOIS BRUHN, SAN DIEGO COMMUNITY COLLEGE DISTRICT
STEVE BIMSON, SAN DIEGO REGIONAL TRANSPORTATION CENTER
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SAN DIEGO REGIONAL ALTERNATIVE FUEL VEHICLE COALITION MEMBERSHIP
JOHN SHACKLETT, MORSE HIGH SCHOOL
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LARRY, TERRI, JACK, SARAH AND STEPHANIE NELSON, HAWAII
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PETER ELIAS, MIRAMAR COLLEGE, CHILD DEVELOPMENT
RICHARD L. BECHTOLD, QSS GROUP, INC.

The United States Department of Energy coordinates the "Clean Cities " program for the state of California.

The Clean Cities program presently supports twelve (12) Alternative Fuel Vehicle Coalitions in California alone.

The Coalition mission is to promote the use of Alternative Fuel and Alternative Fueled Vehicles through outreach programs, education and incentives.

Each Coalition is operated by concerned volunteer citizens; they would welcome (and I would encourage) your involvement.

For information about the Clean City Coalition nearest you, contact:
the U.S. Department of Energy, 1301 Clay Street, 4th floor north, Oakland, California 94612

510-637-1950 or visit their Web site at www.ccities.doe.gov

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