



*Automobiles
and Energy*

NAME _____
CLUB _____
BIRTHDATE _____
YEARS IN PROJECT _____
YEARS IN 4-H _____



4-H AUTOMOTIVE PROGRAM

AUTOMOBILES AND ENERGY

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Special appreciation is given to Art Lewis and the School of Industrial Engineering and Management of the University of Wisconsin, Extension Division 4-H Programs.



I — Preface

The content of the 4-H Automobiles and Energy members' manual has been designed to stimulate thinking about the world energy situation: how petroleum energy is used in the United States; how each of us can reduce the amount of petroleum products we use without reducing our quality of life; and how teenage America can take the lead in energy-conservation programs now and in the future.

The specific objectives formulated for this unit are:

1. To focus attention on crude oil resources as they are believed to exist today.
2. To suggest management measures which will result in immediate savings of energy.
3. To enlist teen-age America in helping with the crusade to extend finite crude oil resources.

Suggestions to help adult volunteer leaders work with teenage youth on this unit can be found in the back of the manual. It is envisioned that volunteer leaders will utilize: tours and trips to automobile dealers, garages, and service stations; and available films and slide-tapes which are related to consumption of fuel. Discussion of current magazine and newspaper articles on energy use could be a valuable supplement to this very important unit.

Teens need to be prepared to accept the fact that there will be many conflicting reports on energy use. There may be exaggerated claims on both sides of the question. Some people may claim that oil resources will be depleted with 25-30 years; others may say 50-60 years; still others may project further into the future based on an optimistic hope that there will be new discoveries of oil. Perhaps each of us want to be optimistic even though we know that all resources on Planet Earth are finite.

We welcome 4-H members and leaders into this Automotive Unit because we feel that the search for answers will be enlightening to all who seriously pursue the subject of energy consumption.

II — SITUATION

Most of our energy resources presently come from fossil fuels, which are a special kind of decaying organic material. These fossil fuels were formed within the earth over 400,000,000 years ago. Natural gas,

petroleum products, and coal are the main kinds of fossil fuels.

Man is consuming these fossil fuels at a rapid rate. If consumption rates continue unchanged, natural gas and oil will be depleted within the next 50 - 60 years. There is enough coal estimated to last 500 - 600 years at present use level. But if coal alone is substituted for oil and gas, it may only be several decades before its supply is at a critical level.

It will take several million years to form new fossil fuels. Therefore, substitute energy sources must be developed to relieve the burden placed on existing fossil fuels by increased consumption. This research will take time. Conserving energy will give us that time.

What will be the status of our fossil fuel supplies in the year 2000? That's just a few years away — within most of our lifetimes. However, some drastic changes will occur even sooner. Experts tell us when 80 percent of a valued product has been used up, prices soar and it becomes a very precious commodity.

Even though many people are not aware of it, our oil imports are increasing steadily. It was reported in 1976 that the United States actually imported as much oil as it produced.

The United States has one-sixth of the world's population, but consumes one-third of the world's energy resources. This presents an ethical problem; do we have a right to consume energy at this rate?

There are also political and economic questions. When we import half or more of the oil needed, what happens if the foreign governments refuse to sell to us? Would we resort to rationing the domestic production? Or, would we let the price go extremely high so that price would determine the amount consumed? Since so many products are manufactured from petroleum, how do you establish the priority as to which manufacturing concerns receive a supply of the base material? What are the alternatives?

The Alaskan oil fields are expected to produce for 10-15 years, but the total amount available is only a small percentage of the total oil annual consumption in the United States. Therefore, the Alaskan oil fields will not solve our problems.

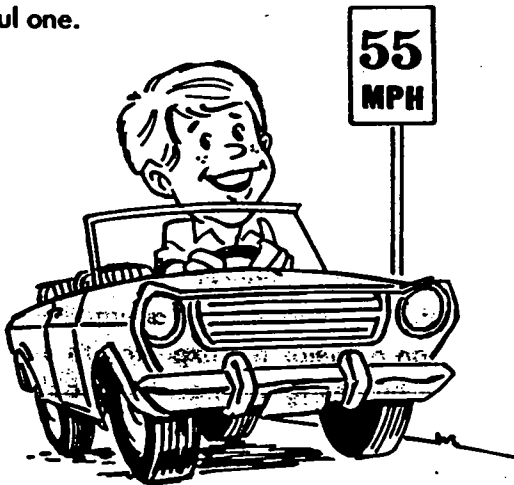
The situation in the United States is serious. The cost of our oil imports is so huge that we cannot sell enough manufactured goods or agricultural products to pay for oil imports. As a result, we have what is known as a trade deficit and this contributes to the

problem of inflation in the United States.

A high percentage of the energy consumed is wasted. Voluntary conservation measures would help to solve our short-term energy problems. But, we will make little progress toward energy conservation until more of the public really believes that an energy crisis exists. The one great advantage of voluntary energy conservation is that it is far more acceptable to us. We do not like to be told what we have to do. We much prefer to be given the facts and then determine what is best for each of us in the given situation. The fact is that the energy crisis now exists and will get steadily worse until significant conservation efforts are undertaken by all citizens of the United States.

III — DRIVING FOR ECONOMY

Now, let's consider your car. Since it represents approximately 40% to 45% of your yearly energy bill, any savings can prove to be substantial. And as gasoline prices continue to rise, the more each small savings measure will mean. The single most important element in determining your car's fuel economy is how you drive and maintain your car. Driving habits are extremely important. In fact, a recent study by the Environmental Protection Agency states that driving habits and travel characteristics can have more effect on fuel economy than any vehicle design feature. It is estimated that careful drivers can get 30% more mileage than the average driver and 50% more than a wasteful one.



Here are some tips to help you drive more economically . . .

1. Slow Down. Driving at 55 mph will give you about 20% better mileage than driving at 70 mph. Dropping down to 50 will increase your mileage

25%, and 40 mph will increase your mileage by approximately 50%. The best mileage for cars often occurs between 30 and 40 mph.

2. Accelerate smoothly but don't creep away from stops. However, avoid "jack rabbit" starts since they require almost twice as much gas as normal ones.
3. If possible, avoid stop and go traffic. City driving uses 30% to 50% more gas than highway driving. Drive at a smooth, steady pace, anticipating road and traffic conditions. Minimize braking by maintaining a reasonable distance and coasting to stops instead of slamming on the brakes.
4. Climb hills gently. Hold the accelerator steady until more power is needed, then increase gradually. Avoid pressing the accelerator to the floor. Winding and hilly roads require more gas than level straight ones.
5. Don't allow your car to idle for more than a minute. It requires less gas to stop and restart it than to let it idle. This applies to warm-ups also. The improved viscosity of modern oils eliminates the need for long warm-ups. Instead, drive slowly for the first one-quarter mile.
6. Remove all excess weight from your car. Each 50 pounds costs you one percent more in gasoline costs.



7. Avoid bad roads if possible; they increase friction and reduce mileage. In fact, driving on patched or broken asphalt roads reduces fuel economy by 14% as compared to driving on smooth roads; similarly, driving on gravel roads reduces mileage by 36% as shown in Table 1.

Table 1. MPG vs. Road Surface

If your car gets 14 MPG on good smooth roads, it will get

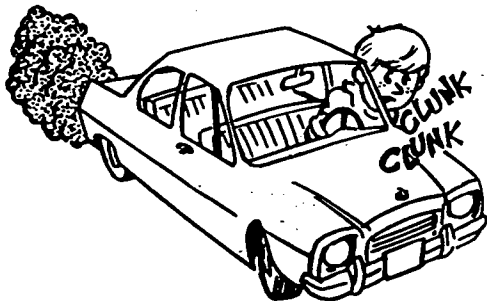
MPG	On	Percent Less
12	Broken Asphalt	14%
11	Dirt	21%
9	Gravel	36%
6½	Sand	55%

8. Be sure to remove snow tires after the bad weather is over. They not only increase friction, but they also wear out more quickly in warm weather.
9. Check your mileage each time you fill up. This helps you learn which driving habits will produce the best mileage.

IV — MAINTAINING GOOD CAR HEALTH

Another important factor in fuel economy is **good maintenance**. Gasoline consumption increases and power decreases when your car is malfunctioning. By correcting the following, considerable amounts of gasoline can be saved.

1. Regular tune-ups can save up to 10% of your gasoline bill. Spark plugs, timing, points, carburetor adjustment, and emission controls should all be checked. A misfiring plug can increase consumption by as much as 12%, and a malfunctioning carburetor can use up to 20% to 25% more gas. The car should be in good mechanical condition so it can benefit from a tune-up, i.e., no burned valves or worn rings.



2. Keep the air filter clean. An air-starved engine will get fewer miles per gallon.
3. Don't allow tires to become under-inflated because this will increase resistance, which requires more power and gasoline to overcome. Check tire pressure frequently, at least once per month and maintain it at the recommended pressure.
4. Proper wheel alignment will increase mileage.



5. If your car is an automatic, regularly check the level of the transmission fluid.

¹Some people suggest carrying 3 to 4 lbs. over the recommended air pressure for your tires. This might give slightly better mileage, but it also increases tire wear. In no case should you exceed the maximum recommended air pressure stamped on the tire.

V — CAR CHARACTERISTICS AND ECONOMY

A third factor in determining mileage is the **physical characteristics** of the car itself. In general, the best mileage (mpg) is obtained from cars that are lighter in weight, have small engines, manual transmission, low axle ratios, and low frontal area (width x height). Here are some items you should consider when shopping for your next car or truck.

1. Vehicle weight greatly increases fuel consumption. A 5,000 pound car uses twice as much fuel as a 2,000 pound car.

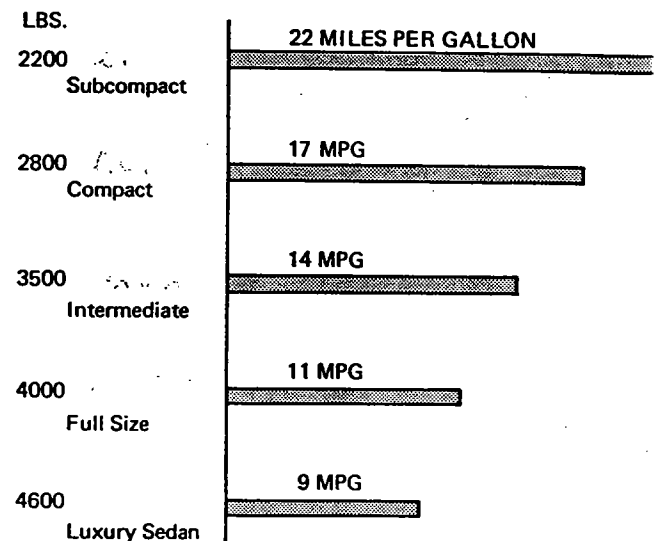


Table 2: Comparison of Vehicle Weight to MPG

(Source: Springer, George S., and Gene E. Smith, *The Energy Saving Guidebook*, Technomic Pub. Co., Westport, Connecticut, 1974.)

2. Options such as air-conditioning, automatic transmission, and power steering are noted gas users.
 - a. Air-conditioning reduces fuel economy by an average of 10% (20% in stop-and-go traffic). Use it sparingly, especially in traffic.
 - b. A manual transmission is more important on a small car where it can increase car performance by 1.2 mpg as opposed to only 0.2 mpg on a regular size car.
 - c. Power steering can increase fuel consumption by 1% to 6%. Power brakes and electric windows, seats, and antennas do not decrease fuel economy substantially, but they do add a bit to vehicle weight, which increases gasoline consumption.



3. Radial tires help reduce resistance and therefore help increase mileage ratings by an average of 5% to 6% (some claim as much as 10%). These tires also have a longer life. These two factors will offset the additional cost if you plan to keep your car for any length of time.
4. Currently, diesel engines get 40% to 70% better fuel economy than conventional engines. Rotary engines are 20% to 35% less efficient.
5. Emissions controls are not the "guzzlers" some people believe. While they do increase the fuel use of 3500 + lbs. cars by 13% to 18%, cars weighing less than 3500 lbs. actually get 1% to 2% better mileage, according to recent studies by the EPA.
6. EPA mileage ratings, which are now provided for all new cars, are the results of statistical, not actual tests, and are considered by many to be too high. They are, however, a good relative basis for comparisons between new car models.

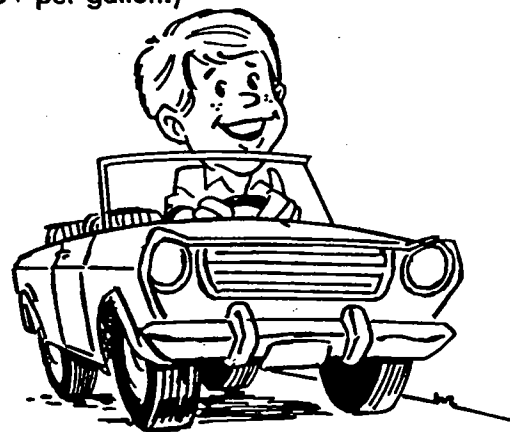
VI — OTHER FUEL-SAVING TIPS

The following is a list of several other miscellaneous tips to keep in mind when trying to save gasoline.

1. Wind and grade have the same effect on fuel economy as does speed. Driving 50 mph into a 20 mph wind has approximately the same effect as driving 70 mph in still air. Similarly, 50 mph on a 4 percent grade is the equivalent of 70 mph on a level grade.
2. Be wary of additives and gadgets which claim to increase mileage.
3. Consider buying a vacuum gauge (\$8 to \$16). It measures how efficiently an engine is running and when fuel consumption increases. It can help you

monitor your driving techniques to learn which ones produce the best mileage, and it can also help detect engine problems.

4. Never attempt to save gas by shutting off your engine and coasting down hills.
5. Pulling a trailer adds considerably to wind resistance and weight. It takes more power to overcome this extra load; consequently, even slower speeds are necessary to provide adequate mileage.
6. Motorcycles get from 43 to 100 mpg, depending on the cc rating. Of course, they don't protect you from the elements, and they are less safe statistically than automobiles.
7. Use gasoline of the correct octane rating for your car. The "correct" one is the lowest possible octane level which will keep your car from "knocking." (When buying gas remember that by using "Self-Serve" pumps you can save yourself up to 5¢ per gallon!)



VII — TRIP PLANNING TO SAVE FUEL

One effective method of saving gas is to park your car and not go anywhere. While this would save 100 percent of your gasoline costs, it may not be very practical. What you can do, however, is essentially the same thing, i.e., minimize mileage via efficient trip planning. Some ways of doing this are:

1. Eliminate all unnecessary trips and combine others so that as much as possible can be accomplished in one outing. Cold engines are very inefficient, so it is important to fuel economy to get the engine warm and keep it that way. In an average car, ten 40-mile trips will use the same amount of fuel as 100 one-mile trips. If singular short trips cannot be avoided, walk or ride a bicycle to avoid using the car. Trips of less than five miles account for 15%

of the total miles driven in the United States and 30% of the fuel used. An alternative for these trips is public transportation.



2. If you have several errands to run, plan your route so as to minimize mileage and time. Avoid backtracking if possible.



3. Call in as many orders as you can to avoid making short trips. Many places will deliver. Bank or pay bills by mail.
4. Plan your vacation route carefully. Try to avoid bad roads and large cities during rush hour traffic (i.e., 5-6 p.m., 7-8 a.m.). Consider traveling by train or bus instead of by car or plane. Also consider vacationing closer to home; many people never consider visiting a nearby tourist attraction that outsiders travel many miles to see. Take only what is essential and avoid having to use a luggage rack, which can reduce performance by 1 to 2 mpg. If it cannot be avoided, drive more slowly.



5. Cold weather affects gas mileage. It takes 10% less gas to operate a car at 80° F. than 30° F. (2% less for each 10° F. decrease). It would profit you then to make long trips in the summer months.

6. Short trips are greatly affected by cold weather. In 10° F. weather, the average car gets only 4 mpg for the first mile, while in the summer it would get 6 mpg for that initial mile. This is another good reason to curtail short trips, especially in winter.
7. Join a carpool. Just pooling up with one other person could save you almost half of your current work-commuting gasoline bill.
8. Use mass transit if available. A full bus uses 50 percent less energy per passenger mile than a car with four passengers.

VIII — SUGGESTIONS ON LEADING THIS PROJECT

It is suggested that this project be a combination of discussion and action-oriented sessions to meet the needs and interests of the group. It is expected that the members of the group will do some of the teaching from the third meeting to the end of the project. This provides an important developmental experience for them. They can use resource materials procured from the sources listed in this manual or located elsewhere.

If one member of the group keeps records on the family car, perhaps he or she might share the record-keeping system with the others. Or, before a visit to a garage, they may want to develop a list of questions to ask a mechanic on how to increase m.p.g. If a field trip is planned to observe people's driving habits, perhaps they will plan how to report observations via radio, T.V. and newspaper or school newspaper to get an energy-saving message to the public. It is strongly encouraged that the group think of ways they can be assertive in telling the energy crisis message. These are only a few of the ways they can teach each other and the public at large about possible solutions.

For the first meeting or two, the project leader should review and discuss the content of this project manual and do the "Let's Discuss" section found on page 8. Also, at the first or second meeting, develop a plan for five or six additional meetings by selecting from the Unit Activities, or designing activities which will enhance members' understanding of efficient operation of the automobile. The plan for these meetings should be recorded on page 15 of this manual.

Assign responsibilities for locating unit aids for future meetings to members of the project group. This

is an important experience for them and will aid them in the future by developing confidence in their ability to locate resources. Assign responsibility for contact-

ing dealers or garages for meetings to members, or ask one of the members to accompany you when these contacts are made.

IX — LET'S DISCUSS

Read through and check whether you agree or disagree. Then discuss the questions as a group.

	YES	NO
1. My family could get along without an auto	_____	_____
2. My family could reduce car travel by 50% with no loss in the quality of our life	_____	_____
3. My family can use a car with smaller body and engine the next time we buy	_____	_____
4. My family, 4-H Club, church, or other groups we are members of now utilize car-pooling to the maximum extent	_____	_____
5. Our family car is tuned and serviced regularly to obtain the maximum miles per gallon ..	_____	_____
6. Every driver in our family has pledged to drive no faster than 55 M.P.H.	_____	_____
7. Young Americans can have great impact on reducing total automotive fuel consumed if they launch an all-out media campaign on energy waste	_____	_____
8. Our family uses (plans to use) radial tires and checks inflation periodically to maximize M.P.G.	_____	_____
9. Our family plans to have a council meeting to discuss methods we will use to reduce fuel consumption	_____	_____
10. Our family plans and limits the number of trips it makes to the same location daily or weekly	_____	_____

X — LET'S DO . . . UNIT ACTIVITIES

1. **Maintenance** Visit a garage or maintenance center and have a qualified mechanic discuss how to maintain cars for maximum efficiency.
2. **Tire Center** Visit a tire dealer to learn the relationship between tire maintenance and wheel alignment for most efficient and least expensive operation of car. (Those members who do not know how to change a wheel safely should learn how at this meeting).
3. **4-H Automotive Unit** Study the "Car Costs and Record-Keeping" unit on pages 31-35 of 4-H Automotive Unit I — "The Car and the Highway." Adopt or adapt this record-keeping system for all cars in each family for at least a six-month period. Meet again to share with each other the results of record-keeping.
4. **Media Meeting** Use one meeting to prepare material for radio, T.V. and newspapers relative to saving energy. This can be a series of articles or broadcasts, or both.
5. **Public Service Announcements** Use one meeting for recording public service announcements and other material prepared for radio. Submit articles to newspapers.
6. **Simulation Games** Ask your extension agents to loan you group simulation games related to

