FUEL ECONOMY
IS SPEED ALL THAT IMPORTANT?

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BY: Bob Gummersall, Chief Technical Advisor Bob_Gummersall@rversonline.org
And Dick Lucas New Rversonline Writer dick_lucas@agilent.com

May 24, 2004 – We are reintroducing the article because of the recent significant increases in fuel cost. Diesel is currently $2.40 and Gas at $2.30 and the price trend is still higher. The basic research in the article is based on sound scientific procedures and we should take seriously the idea that slowing down will have a major affect on fuel economy.

We have decided to publish this article as a first in a series. Other articles will come when we get further data from our readers and have completed additional research. If you have data that can help us, please email it to one of the addresses shown above.

FUEL COSTS have increased about 40% during 2000 and it looks like it might keep going up. I believe that diesel and gas fuel cost about $1.00 per gallon at the beginning of 1999, $1.30 beginning of 2000 and about $1.90 at the beginning of 2001. There are many reasons for this significant increase but we will not try to describe them here. We will try to find ways to help Rvers to limit the affect this increase causes on living our lifestyle.

BACKGROUND INFORMATION - MORE TECHNICAL INFORMATION THAN YOU REALLY WANT BUT you really need it. The energy that moves your vehicle comes from burning fuel. This energy is used to overcome wind drag, friction, rolling resistance and hills. All you have to do is look at any racing machine to see that wind resistance is a major energy burner. The degree of streamlining and the size of the frontal area of any given coach is given thus can't be changed. How that shape is driven determines the amount of energy required.

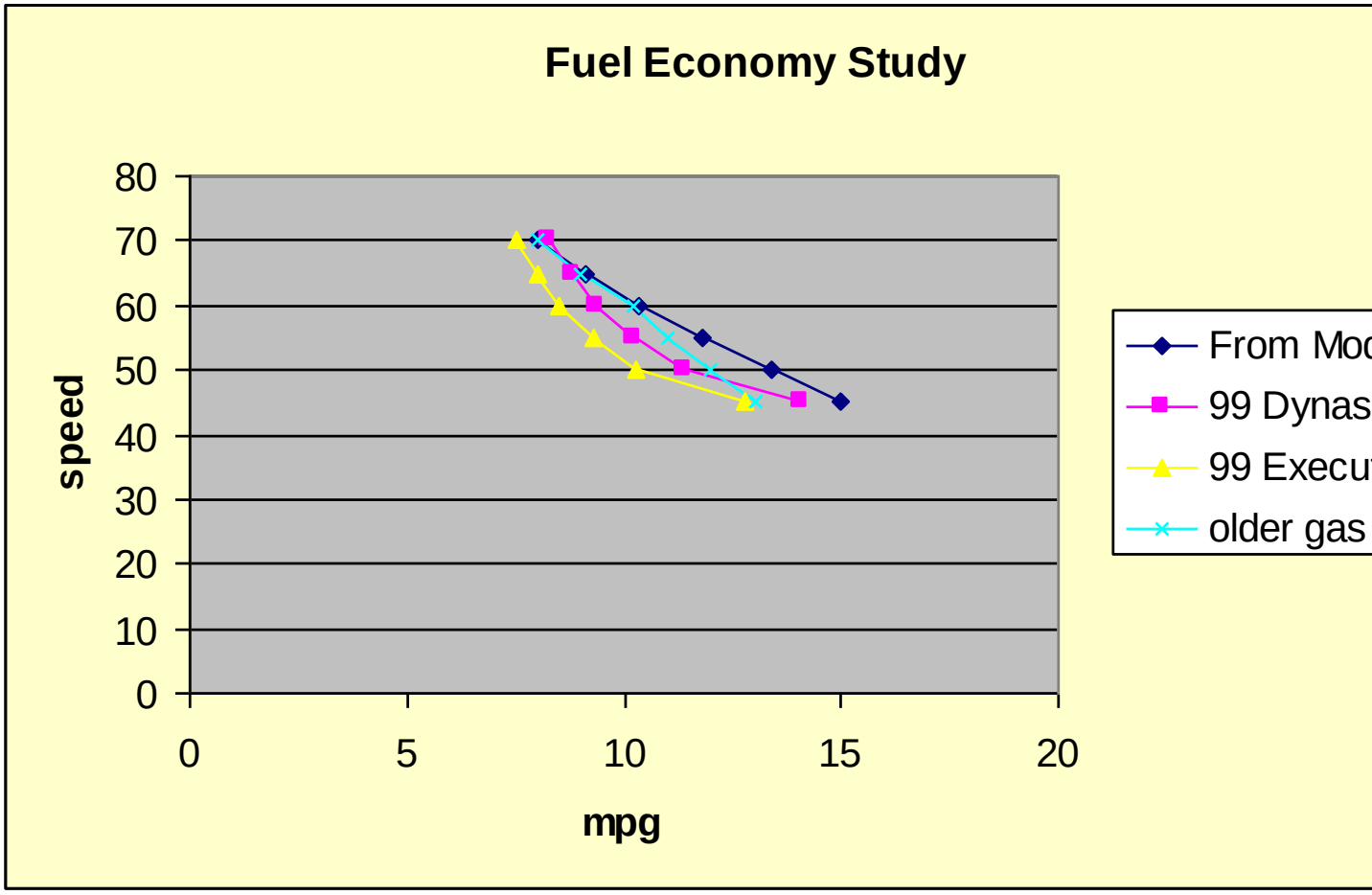
Friction losses are like the energy lost to heat in your automatic transmission. Automatic transmissions have a torque converter that churns the fluid transferring power between the engine and the shifting mechanisms. This causes the fluid to heat up and special radiators are provided to cool it, thus loosing energy. Most modern transmissions have "lock-up" torque converters that minimize the loss of energy. Each rotating component in your rig generates friction thus looses energy through heat.

Rolling resistance is composed of all the components on the coach that have to rotate in relationship with the ground. If you look at your tires, they have a flat spot where they contact the ground. There is a bulge at the bottom of the tire where it is distorted by the contact with the ground. As that tire rotates, that bulge moves as the tire sidewalls are flexed causing the tire to warm up. Again, that heat is the manifestation of the losses caused by rolling.

Potential energy is what moves a weight from one height to another. Just walk up a flight of stair to experience expending potential energy. The more weight, the more energy it takes. If you climb over a mountain pass, you have invested a tremendous amount of energy simply moving your vehicle up the hill. In an ideal world, that energy is recoverable, because you can coast down the other side, but in reality, you end up wasting that energy by either using the engine or the brakes to slow you down. When traveling in hilly country your mileage will be significant and negatively affected. Exactly how much will depend on how fast you go up the hill.

The effectiveness of using all this energy is determined by many factors. Diesels are inherently more efficient than gas engines, but if you have a gas engine there is nothing you can do, except to learn how to drive your vehicle, no matter what it is or what type of engine you have, economically. This what we will spend the rest of this article describing.

VEHICLE SPEED is the dominant factor in determining fuel economy. This chart shows a typical relationship for a typical diesel pusher Class A Motorhome. The line in **blue** is from a sophisticated computer model that takes into consideration drag, frontal area, weight, tire pressure, brake fuel flow (gallons/hour*horsepower) and driveline horsepower loss. The lines in **yellow, light blue** and **pink** are actual data recorded on a flat road with no head/tail wind at 50 degrees F in two different coaches.



Data used in Computer Model:

Drag	=	0.9
Frontal Area	=	102
Vehicle Weight	=	29000
Tire Pressure	=	90
Brake g/hr-hp	=	0.022
Drive line HP loss	=	20

You will notice from the chart that by reducing speed by 10 miles per hour (mph) from 65 mph to 55 mph, there is a 40% increase in fuel economy from 8.5 miles per gallon (mpg) to 12.5 mpg. This possible increase in fuel economy just by itself could make up for the recent increase in fuel cost. The data on this chart has been calculated from a computer model that any of you can try for you own rig. It is offered for your use on the Internet at http://www.bgsoflex.com/auto.html. This model was designed for passenger vehicles and gets squirrelly for the weights, tire pressures and rolling horse power of motorhomes. We used it just as a guide. We have done field trials to verify this data with good success as shown from the plot. The above data was taken from Bob's Dynasty and several other coaches using scientific measurements of speed, fuel flow, ambient temperatures, etc. A Cummins RR4 Vehicle Monitoring System was used as the base gathering tool after having done a lot of work to verify its accuracy.

So the big question is "Will we drive 55 from now on?" Probably not because driving in traffic at the speed limit, or a little over, with the truck traffic is the safest possible speed to drive. Driving 55 on most Interstate Highways would cause most of the truck traffic to want to pass. If they could not pass they would be very frustrated. When there is little or no traffic, slowing down and enjoying the scenery, will significantly increase fuel economy and decrease drive stress and fatigue. We will try during the first months of 2001, to slow down so as to increase fuel economy.

TIRE PRESSURE has a significant effect on fuel economy. Tire pressure also effects tire life, handling, safety and comfort. We recommend selecting a tire pressure that is at least the recommended pressure from the tire manufacturers for your RV. This pressure is found on a chart of weight vs. pressure for any given size tire. These charts are available from every tire manufacturer. If this pressure is not the maximum rated pressure, then increase it 5 lbs at a time checking the handling and comfort with test drives. You will get the best fuel economy with the highest pressure since the rolling resistance will be the least it can be. For example if your coach weight demands at least 85 psi and the maximum pressure possible is 110 psi, then try 90, 95, 100, 105 and 110. Settle on the highest in that range that gives acceptable handling and comfort. The chances are that the ride comfort will not be best at 110, but your mileage will be.

The Michelin tire people at www.michelintruck.com indicate that tire pressure is best set by the deformation of the tire. Deformation is related to the weight on the wheel, tire size and pressure. Michelin furnishes this data in the form of inflation tables. At too low a pressure, you will generate excessive heat and the tire life will suffer. At too high a pressure, you can damage by hitting road objects. The high pressure causes the force of hitting a road object to be concentrated and can damage the tire cords. In addition, higher than optimum tire pressures will reduce the contact patch, affecting road holding properties. Michelin recommends that each coach be weighed at all four corners and the pressures be set accordingly. If at all possible, you should contact the manufacturer of your tires and obtain a set of inflation tables.

ROAD CONDITIONS can affect fuel economy. Driving in mountains generally equals very poor fuel economy because of the effects of potential energy as described above. It takes a lot of fuel to get up the hill and a lot of that potential energy is wasted coasting down the other side. As an example a typical diesel coach burns 16 gallons per hour at 50 mph under full power climbing a grade. That translates to 3 miles per gallon while climbing and over 100 mpg coasting down the other side. Field data shows that it does not make any difference what speed you climb the hill. Almost no fuel is burned going down hill and the

vehicle has to be slowed with an exhaust brake or the service brakes thus wasting energy. Therefore, if the unit gets 9 mpg on flat roads, then the net mileage for the 10 miles up and 10 miles down a hill gets 6.6 mpg. Of course, the longer the climb the worse the mileage overall will be.

WEATHER CONDITIONS can have a significant effect also. Driving in headwinds or tail winds has a significant effect on fuel economy. The major winds in the United States flow west to east and if you are driving either east or west you will achieve either a lower or higher mpg. Drivers could increase fuel economy by reducing speed into head winds. The effect of wind tends to average out for the average RV. Ambient temperatures have a small effect on fuel economy because cold air is significantly denser than hot air. Most of today's engines are computer controlled and maintain the proper fuel to oxygen ratio to give full combustion and lowest pollution. So we conclude that ambient temperature has little or no effect on fuel economy.

VEHICLE MAINTENANCE especially related to air and fuel filters and tire pressure can significantly affect the performance of any RV. We recommend that all drivers pay close attention to the drivability of their rig, because a decrease in performance is a telltale sign of required maintenance. Maintenance schedules should be religiously followed to insure proper performance and economy. Tire pressure should be checked at least once per week.

CONCLUSION – The conclusion is **yes speed is the major controlling factor** in fuel economy. The information presented here indicates that there is significant opportunity to reduce the affect of higher fuel costs on the experience of our RV lifestyle by **slowing down!** We encourage you all to consider slowing down, maintaining tire pressure and doing regular maintenance on you rig.

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