

A-21 Fuel Page

Gunnerman Fuel

Source: <http://www.rbbi.com>

Gunnerman A-21 water based fuel references, short reviews of articles, and full text articles are below. One recent note - the 2nd "Products for a Better World" article says the nickel catalyst is no longer needed.

"Engines That Run on Water"

Business Week August 8, 1994

In 1994 a half water, half gasoline fuel starting getting some press. One of the first articles was in the August 8, 1994 issue of Business Week on page 47. The article was titled, "Engines That Run on Water." It described the 66 year old, Rudolph W. Gunnerman and his 7 years of development work on this project. He claims the mixture gets 40% better mileage from the gasoline it contains and emits significant less pollution because the engine runs cooler. In early July Caterpillar formed a joint venture with A-55 LP, Gunnerman's tiny 9 person company in Reno Nevada. The key ingredient is .5% of a secret emulsifier that enables fuel and water to mix - and stay mixed. Also a small piece of nickel must be attached to the top of the cylinder heads. The process has powered a city bus for 5 months in Reno and the Air Force put 6 vehicles through a 14 week test.

"Partners to Develop Water-based Fuels

R&D Magazine October 1994

An R&D Magazine October 1994 page 12 article, "Partners to Develop Water-based Fuels", discusses the partnership with Cat and says a Corvette is about to be tested with the fuel.

AP Feb 14, 1996

A February 14, 1996 Associated Press Report updates the project and also gives the side of some of the skeptics.

"Fuel Passes Tests, May Be Breakthrough"

Tulsa World February 10, 1996

Two related news clips in the February 10, 1996 Tulsa World also talk about the current status of the project. "Fuel Passes Tests, May Be Breakthrough" and "Water, Naptha Blended." The reports claim a 60 reduction in EPA monitored emissions. It says that last

November, Nevada certified it as a clean alternative fuel. It says it is really a mixture of Naptha (an earlier stage of petroleum refining) and water with a milky appearance. It also has a vapor pressure about 1/5 that of gasoline. It gives the name of the partnered firm between Gunnerman and Caterpillar as Advanced Fuels. The new fuel is being called A-21.

Diesel Progress

February 1996

The February 1996 issue of Diesel Progress (page 6) described successful testing in a 1991 Ford Tarus.

Products for a Better World

This online magazine has two great articles about the fuel.

["Alternative Fuel"](#)

["A-21 Fuel - Half Water or Half Vapor"](#)

"Fuel of the Future"

Seattle Times August 6, 1996

The Seattle Times - Today's Top Stories National News

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Aug 6, 1996

Science: Fuel of the future?

Water-naphtha mix hailed as cheap, low-emission breakthrough, but scientists doubt its efficiency

[Background and Related Stories](#)

*by Diedra Henderson
Seattle Times staff reporter*

On the phone, German-born inventor Rudolf Gunnerman is cordial, witty and savvy. He is the meister of the sound bite, eminently quotable and not the least bit shy about his accomplishment: He's the person, he says without reservation, who found a solution while others pointed to problems.

Inventors like Gunnerman believe that one of the world's most common compounds - good old tap water - can be blended with fuel to power your car, truck or lawn mower. If they're right, you could pay much less at the gas pump. But scientists caution to not believe the hype, which overstates a few, limited benefits of the new fuel.

Gunnerman claims to have devised a means to blend water with naphtha in order to power engines in a cleaner, cheaper, more efficient way.

"New ideas and better ideas are not necessarily found by universities or by large companies. New ideas and better ideas are found by people who look for them," says Gunnerman, 68.

And others are making claims similar to the Reno inventor. A pair of men working out of a garage in the shadow of Seattle-Tacoma International Airport say they mix water with fuel from the gas pump to give race-car drivers "impressive horsepower gains."

Elsewhere, passions flare. Gunnerman's contentions have drawn the ire of scientists who say adding water to fuel is hardly a new invention. The engine types Gunnerman chooses for his demonstrations, they add, are quite forgiving of his fuel mix. More importantly, mixing water with fuel decreases - not increases - fuel efficiency, they say.

David Kittelson, University of Minnesota director of the Center for Diesel Research sighs mightily when called. Kittelson, a professor of mechanical engineering, calls Gunnerman's claims "absolute nonsense. They're violating the second law of thermodynamics."

Water does not burn. Dissociating it into its hydrogen and oxygen parts to attain a burn takes as much - or more - energy than you'd receive.

"It sort of opens up a Pandora's box - that's why I sighed when we first started talking," Kittelson added. "People in universities have an awful lot to do. We're going through periods where we're having dramatic changes in funding structures . . . because of that it's very difficult to do what we're supposed to do and that is sort of seek out the truth. Getting into this water-fuel issue involves a lot of time . . . a lot of time . . . and not much payback."

Michael Seal, director of the Vehicle Research Institute at Bellingham's Western Washington University, agrees. Seal conducts engine research and built an award-winning hybrid vehicle that runs electrically and on natural gas.

Adding 10 gallons of water to 10 gallons of fuel might give only nine gallons of power, Seal said. "I could be wrong - but I'd like to know how I'm wrong. It's pretty well-known that water doesn't burn and there's no way of getting energy from it," Seal said. "Basically, you lose in some way. The best you could hope to do is break even."

"In a way, they are right. In another way they are totally wrong," Gunnerman countered. "They're incorrect in the point they think every fuel burns alike," he said. "I have achieved a better combustion pattern than you get with straight gas or

straight diesel."

Infusion of credibility

"Caterpillar" is the single word that brings a degree of credibility to Gunnerman's claims.

The Peoria, Ill.-based heavy- equipment manufacturer entered a joint venture with Gunnerman in July 1994. Together, under the name Advanced Fuels, they've conducted experimental uses of the A-21 fuel - made up of 70 percent naphtha, a crude-oil byproduct, and 30 percent water.

And now, Paccar Inc. is throwing its trucking weight in Gunnerman's corner.

The Bellevue-based manufacturer of Kenworth and Peterbilt trucks recently sent a truck to Peoria for testing with the A-21 fuel. Paccar changed out the engine to add a Caterpillar engine and modified the cylinders and fuel injectors to handle more fluid volume.

They also did a series of baseline tests of noise, cooling, drivability and fuel economy, said Jim Reichman, Paccar's technology-development manager.

Back at Paccar's Mount Vernon technical center, Reichman is enthused. "We're pretty pleased with it," he said. "We've actually had it out and driven it and are in the process of doing some tests on it."

Paccar's goal is to get the truck in a customer's hands to get continuing feedback on its performance.

Caterpillar would not allow photographs to be taken of the beige vehicle, saying the exterior looks no different than any other Peterbilt and the interior changes and specific test results are proprietary information.

Secrecy is not uncommon on the A-21 project or on a local endeavor financed by a South King County pair, Tim Shadduck, 42, and Rick Course, 49. For a demonstration, they fetched a gallon of regular unleaded gas from the station down the street and water from the garden hose, run through a charcoal filter.

"I've got a more exotic filtration. But for demos, this will work fine. We'll do it real backyard style here so there's no question," Shadduck said.

Shadduck uses a clear, viscous emulsifier to suspend water within the fuel. Injecting the "magic bullet" into a container turns the water-fuel mixture milky white. Like Gunnerman, Shadduck reveals little about the biodegradable substance.

He said Gunnerman's fuel "kind of brought down the walls of disbelief," but skeptics abound. "I keep waiting for that big brick wall to come up in front of me and say, 'You can't do this.' "

Shadduck eases a brown 1975 Nova, "Injection Research" etched on its side, onto the roadway. He uses a laptop computer to regulate fuel intake and punches the gas pedal to nudge the speedometer arm from 60 mph to 80 mph within seconds.

The pair are targeting race-car drivers, who now pay \$5 a gallon for racing fuel.

Gunnerman is expanding his reach to governments that run municipal bus systems, agencies increasingly mindful of more stringent emissions standards in the coming years. For that reason, some are willing to investigate a fuel - and even pay a bit more for higher fuel usage - to meet new guidelines.

A cooler burn

Engineers have known for years that adding water to fuel brings benefits. Water was used in World War II for fueling aircraft. And in the 1970s, General Motors used a water-injection system for its Corvair model, keeping the water in a separate tank, said Dave Schwartz, spokesman for the Society of Automotive Engineers.

Water cools the fuel's flame in the combustion chamber, Schwartz said. A cooler burn reduces the chances of engine-damaging explosions, known as detonations - a fact that hasn't escaped Formula One racers.

And the cooler burn produces less pollutants - especially Oxides of Nitrogen. Known as NOx, Oxides of Nitrogen are produced from elements in the air, in response to heat.

"NOx is a big issue," the University of Minnesota's Kittelson said. "I think the motivation Caterpillar has is the concern about NOx emission. They're trying to get any possible technology for NOx control under their wing so they have options available to them. . . . Faced with very stringent emissions standards that might materialize in the next century, you want to have all the technology."

Plans for expansion

The Regional Transportation Commission in Reno has been running one of its Citifare buses on the A-21 fuel. This fall, they will decide whether to switch more coaches to the mixture, said Michael Steele, Citifare manager.

Dick Cooper, Gunnerman's spokesman, said the company is hoping to extend use of its fuel to West Coast bus fleets including markets in California, Oregon and Seattle. They're estimating fuel costs of 60 to 65 cents per gallon for the naphtha blend, not including local, state and federal taxes.

The Reno coach, equipped with the Detroit Diesel 277-horsepower engine, posted reduced emissions while using the A-21 fuel. Oxides of nitrogen and unburned hydrocarbons, two emissions that are precursors to smog, were below results with diesel fuel. And particulates, a carcinogen, were also reduced. Fuel use increased.

"We did lose some performance; our miles per gallon dropped," Steele said. "The cost could be comparable, or increased, but it's an emission benefit."

But Seal was less giddy. Dramatic improvements are not difficult because federal regulations for diesel engines are lax.

"It's a very easy test to pass, which is why you see diesel trucks belching black smoke on the highway and they're legal," he said. The A-21 test results are "not

that exciting."

Using natural gas gives even lower emissions, with negligible readings of unburned hydrocarbons, Seal said.

But burning natural gas brings a new set of distribution headaches.

Paccar has looked at alternate fuels since 1991. Compressed natural gas is slow to fill up and the tanks are heavy. Liquefied natural gas is very cold, about minus 260 degrees, and you've got to go to Canada or Portland to get it.

A-21 "certainly represents a non-diesel energy system that is a lot simpler," Reichman said.

Background

[West Virginia University's Alternative Fuels Research Program Web site](#)

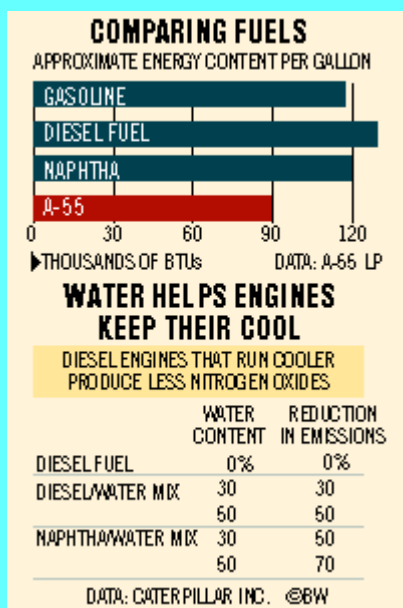
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NEW Would Cars Run Better With Water?

Business Week 5 May 1997 Page 126F

WOULD CARS RUN BETTER WITH WATER?

Don't laugh. A fuel mixing H₂O and naphtha might just work



After two years of hush-hush work with Caterpillar Inc., a small Reno (Nev.) company called A-55 LP is marketing an unusual new fuel for cars, trucks, buses, and diesel generators. It promises to reduce pollution and might also improve mileage. That's mainly because it's diluted with 30% to 55% water. No joke: water. The rest is primarily naphtha, a derivative of crude oil that's typically cheaper than gasoline or diesel fuel, because it needs less refining.

The fuel, called A-55, is the brainchild of Rudolf W. Gunnerman, a Reno inventor who could easily be mistaken for the mad scientist in the movie Back to the Future. He has spent 10 years and \$25 million on the fuel, financing its development mainly with royalties from his other patents. Gunnerman's detractors--and there are many--believe his fuel smacks of Tinseltown make-believe. Oil companies aren't

impressed. "It's a curiosity, not a technical breakthrough," says Amoco Corp.

TESTING. Despite the skepticism, Gunnerman's single-minded salesmanship has sparked wide interest among environmental agencies and regulators. Thomas M. Houlihan, head of the White House's new Interagency Environmental Technology Office (IETO), got the

Energy Dept. and the Environmental Protection Agency involved. Sierra Pacific Power Co. in Reno generated electricity for more than a year with A-55. State and local agencies in California and Nevada continue to test it in a variety of vehicles.

In Australia, Beston-Pacific Corp. of Adelaide recently plunked down \$5 million to license A-55. Alexander John Paor, a senior executive with a big Australian law firm, became so enthusiastic he resigned to help Beston-Pacific commercialize A-55. Gunnerman has deals cooking in Britain, Hong Kong, Japan, Korea, Mexico, and the Philippines.

Caterpillar teamed up with Gunnerman in 1994, after a Reno city bus had racked up 11,500 miles--with 20% better mileage than it got on diesel fuel. The claim that A-55 can boost mileage is a sticking point for skeptics. Gunnerman asserts the increase stems from a catalytic reaction that breaks down the water into combustible hydrogen and oxygen. David B. Kittelson, director of the Diesel Research Center at the University of Minnesota, says this requires at least as much energy as is released when the hydrogen burns, "so you don't win."

Researchers have tried adding water to fuel for decades, Kittelson adds. But nobody could make oil and water mix. Gunnerman found a proprietary emulsifier that keeps A-55 mingled for at least a year, he says. To burn A-55, gasoline engines need only minor modifications, mainly in timing controls--a tune-up that runs a couple hundred bucks. Diesel engines require more tinkering.

"SELL THE SYRUP." Last October, Gunnerman decided it was time to take A-55 to market, so he backed out of the venture with Caterpillar. New Mexico may be the next proving ground. Last month, its legislature followed Nevada's 1995 lead in designating A-55 as an alternative fuel. By federal definition, this term excludes anything based on petroleum. Thus, without state action, fleet owners can't substitute A-55 to comply with an EPA mandate to use more alternative fuels. This is a stumbling block in the U.S., which explains why Gunnerman spends so much time overseas.

Gunnerman's scheme calls for setting up local joint-venture companies to make the fuel--and import his proprietary emulsifier. "It's a Coca-Cola situation," says IETO's Houlihan. "Sell the syrup, do the bottling locally." If EPA, Energy, and others agree there's fizz in A-55, it just might work.

By Otis Port in New York, with bureau reports
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Newsgroup Discussions

There have also been some lively discussions in the "rec.autos.tech" newsgroup about the A-21 fuel. If you search the newsgroups using Deja News, try Gunnerman as a search word. There is a link to Deja News near the bottom of the [Other Useful Links Page](#).

Here is a copy of two part July 1996 newsgroup posting regarding the fuel which also contains a news clip.

Article 1 of 2

Subject: Naphtha Fuels: Real or What?
Date: 1996/07/30
Newsgroups: alt.energy.renewable
Article Segment 1 of 2

Not exactly "renewable", but of some interest to alternative-fuels types:
Rudolph W. Gunnerman lives here in town (Reno, Nevada).
I met him about 5 years ago at a conference on air quality. Since then I have followed the issue in the local press, thru contacts at local air quality agencies, and friends in Nevada Division of Mines.

Best I can figure is he is using the water to generate steam, another working fluid. Engine and exhaust temperatures are low. Fuel economy improves about 20-25%. The trick is the emulsifier. He's used his techniques with gasoline, diesel, and naphtha. He has been in partnership with Caterpillar since 1994. Blending plants in Reno and the Sacramento Valley, 35,000 gallons/day, are in progress. He is targeting large users:

fleets and such.

I have not financial relationship with the company.

Here is a recent article:

SACRAMENTO, Calif. (Mar 16, 1996 12:27 p.m. EST) -- A new petroleum-based fuel that promises to cut vehicle smog by nearly half has won federal approval to be become the first "primary fuel" on the market since the invention of gasoline and diesel more than a century ago.

The Reno inventor of the creamy white fluid says it can be used in existing cars with minor modifications costing less than \$500, and may sell for less than half the price of conventional fuel.

"It's cheaper and cleaner," said Rudolf Gunnerman, who has invested seven years and \$7 million of his personal fortune to develop the "A-21" formula, or "advanced fuel for the 21st century."

The fuel, up to 55 percent water, also has been shown to be much more fire-resistant than gasoline and diesel.

Sacramento area air pollution officials have taken a strong interest in the fuel because of its potential for reducing oxides of nitrogen emissions from vehicles, the chief culprit in the region's summer smog problem.

"It's not a commercial technology yet, but we have high hopes that it will succeed and get on the market," said Ranson Roser, an engineer with the Sacramento Air Quality Management District.

The U.S. Department of Energy on Friday declared the "A-21" formula a "primary fuel," clearing the biggest regulatory hurdle for its use in government fleets and eventually private vehicles.

The action means the fuel can now be sold just like gasoline and diesel without further federal review, energy department officials said.

"We're extremely excited," said Peter Gunnerman, director of Advanced Fuels, a partnership with the Peoria, Ill.-based truck manufacturer Caterpillar Inc.

Representatives of the oil industry and environmentalists remain skeptical.

"A number of options have come and gone in the past two decades, said Jason Mark, a transportation analyst with the Union of Concerned Scientists

in Berkeley. "We've learned that there's no such thing as a silver bullet."

Peter Gunnerman, the inventor's son, said the fuel must satisfactorily complete several more rounds of customer-acceptance tests and pass California's environmentally stringent fuel certifications.

Under federal rules, engines modified to use the fuel are legal as long as they don't increase emissions.

Those modifications will cost consumers no more than \$500, Peter Gunnerman said. Diesel bus and truck modification would cost about \$1,000. Modified vehicles could still run on gasoline or diesel, he said.

The company first wants to market the fuel as an alternative to diesel for the heavy-duty trucks and construction equipment in smoggy areas.

Fleet operators at the state and large companies are highly motivated to find a fuel like A-21, says Kurt Ettinger of the Department of Energy's Alternative Fuels Hotline.

"It's probably close to half again cleaner than regular gasoline, at least," says Ed Glick, a planner in charge of the mobile sources section of the Nevada Division of Environmental Protection, which has studied A-21. "It'll meet the 2005 standards -- the gasoline that we're all using now wouldn't."

Article 2 of 2

Subject: Naphtha Fuels: Real or What?

From: (email address removed)

Date: 1996/07/30

Article Segment 2 of 2

While large trucks would be more expensive to modify to use A-21, that cost is not nearly so expensive as the modifications that will be required when new regulations on diesel fleets go into effect in 1998. Moreover, the fuel is produced at oil refineries and can be transported in existing pipelines and trucks, giving it what is referred to in the oil industry as "transparency." Now the developers must market the technology to the oil giants. Right now, the company's blending facility outside Reno is making 35,000 gallons of A-21 daily, with the capacity to produce three times that much. A second blending station opened recently in Woodland. Don Patterson, a truck engine account manager with Tenco, the Caterpillar dealership for 10 counties surrounding Sacramento, has used A-21 to fuel a three-axle, 300 horsepower tractor truck, and he's impressed. "It felt exactly like diesel, good acceleration, no smoke," he says. "You could not tell you were driving an alternative fuel truck. The other alternative fuels, compressed natural gas, liquid natural gas, you do get a horsepower and torque loss. Not with this. I've been a journeyman mechanic for 25 years, and I've never seen anything like it." At the Gunnerman's modest operation in downtown Reno, a sample of the fuel is mixed in a bucket and then run through both a V-8 automobile engine and a 350 horsepower diesel engine, with a marked reduction in smoke from the tailpipes, but no apparent reduction in power. With blowtorch in hand, Gunnerman demonstrates another one of A-21's remarkable properties: because of its low volatility, a tray full of the fuel fails to ignite under the flame. Thus, the fuel will not explode in automobile crashes. A-21 has also been successfully used in boilers, specifically by the city of Reno, which receives 250 kilowatts of electricity a day from an A-21-fueled generator stationed on the Gunnerman's property.



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