



# MI-Hemp Report 1

## Hemp for the Automotive Industry

Written, Designed and Researched and by Paul Pearson, MI-Hemp Communications Director. Contributors include Everett Swift, Executive Director, and special thanks go to the Detroit Public Library, the Wayne State University Kresgee/Purdy Library, the Barton Ford Educational Library, R. Wroblewski, and C. Penn.

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Environmental Engineering, compared glass fiber (GFR) and natural fiber (NFR) reinforced products on several fronts. The report, with the simple title "Are natural fiber composites environmentally superior to glass fiber reinforced composites?" reviewed prior studies and performed specialized tests to develop detailed understandings of multiple aspects, including strength and even the life cycle environmental impact from one auto side panel.

The report's unsurprising conclusions:

We propose that NFR composites are likely to be environmentally superior to GFR composites in most applications also for the following reasons: (1) natural fiber production results in lower environmental impacts compared to glass fiber production; (2) NFR composites have higher fiber content for equivalent performance, which reduces the amount of more polluting base polymers; (3) lower weight of NFR composites improves fuel efficiency and reduces emissions during the use phase of the component, especially in auto applications; and (4) end of life incineration of natural fibers results in energy and carbon credits.

One reservation that remained was the use of fertilizers for natural composites, which may have "results in higher nitrate and phosphate emissions, which can contribute to increased eutrophication in local water-bodies."

After reading the report, Paul Pearson, MI-Hemp's Communication Director asks, "Shouldn't we of course seek alternatives which utilize smaller amounts of fertilizer?"

Pearson pointed out that hemp fiber filter technology can clean post-production water, allowing agriculture, industrial production, and auto parts and end-product vehicle manufacturing to all coexist within our new green/renewable paradigm.

### Select Web Resources

- <http://www.internationalhempassociation.org/pdf/J237.pdf>
- <http://www.youtube.com/watch?v=wEKEdHBY&feature=related>
- <http://www.greenbang.com/?s=hemp>
- <http://www.topgear.com/us/blog/more/driven-hard-lotus-elise-eco/>
- <http://www.ford.com/doc/2003-04sustainability-report.pdf>
- <http://www.flexformtech.com/pdf/2005/Composites%20Technology%20April%202005.pdf>
- <https://www.msu.edu/~satish/CompositesA-final%20published.pdf>
- <http://www.michigan.gov/gov/0,1607,7-168-215654--,00.html>

### Select Print Resources

- Small, E. and D. Marcus. 2002. Hemp: A new crop with new uses for North America. p. 284-326. In: J. Janick and A. Whipkey (eds.), *Trends in new crops and new uses*.
- Karus, M., M. Kaup, and D. Lohmeyer. 2000. Study on markets and prices for natural fibres (Germany and EU). 3rd Int. Symp., Bioresource Hemp, Proc. Bioresource Hemp 2000 and other fibre crops
- Osburn, L. *Energy Farming in America*. Frazier Park, CA. 1989
- Conrad, C. *Hemp: Lifeline to the Future*. Los Angeles. 1993
- Popular Mechanics*. December, 1941

Photo Credits: Purdue University, Henry Ford Museum & Greenfield Village/Benson Ford Research Center, Michigan.Gov, Lotus, Journal of Industrial Hemp

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### -Hempoline

Recently, a product called Hempoline, a mixture of hemp oil and ethanol, was used in an episode of the television series Coolfuel Roadtrip.

Clearly, the methods of utilizing hemp agricultural products for automotive fuel are varied. The introduction of this crop will work perfectly with our free market economy to provide less polluting alternatives to the environmentally damaging use of petrochemicals.

### -Michigan Already using Bio-Fuel

The Michigan Department of Natural Resources, Parks and Recreation, began using biodiesel blends in 2005. Their press release on the Michigan.gov Website, "Biodiesel Fuel Used in Parks and Recreation Equipment," mentions "More than 25 facilities are using biodiesel blends to fuel their diesel mowers, tractors, bulldozers, backhoes and other diesel-powered heavy equipment."



Most Major Manufacturers Using Hemp

In addition to Ford and General Motors mentioned in this paper, Chrysler, BMW, Mercedes-Benz and Honda are each making use of hemp for a variety of reasons.

"It makes sense," says Everett Swift, Executive Director for the Michigan Industrial Hemp Education and Marketing Project, MI-Hemp. "Lightweight parts mean less poisoning petrochemicals per mile driven."

Swift began the group in 2008 to gather the concerns of agriculturalists, environmental activists and hemp product manufacturers and distributors. "Education is our goal. Especially about how ridiculous it is to import auto part hemp from Canada or China when we can grow it right here and keep money in this state."

He adds "Michigan is missing out on a valuable resource."

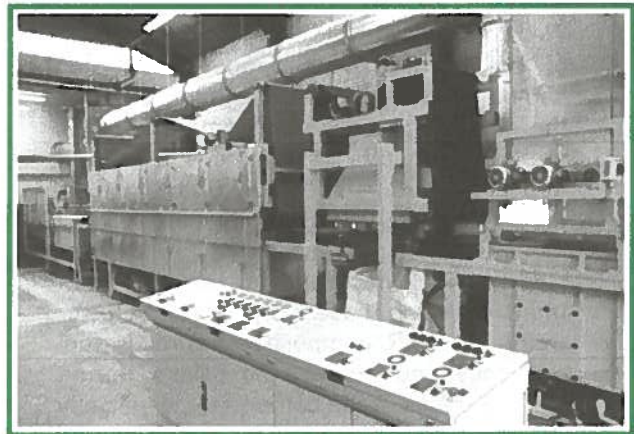
This is backed up by reams of evidence. According to a report released in 2000 by Nova-Institute GmbH (German), the 1999 automotive hemp production

in the European Union was *at least* 1,770 metric tons, and certainly higher. The report, in examining trends and conditions over the previous decade noted "increasing prices brought about a growing demand for hemp fibres in the automotive industry."(p. 34) Since then, of course, the market has expanded even further.

Consider Mercedes-Benz, a leader in using hemp for press-molded parts. Most of their C-class vehicles in the last several years have utilized roughly 30 biocomposite parts, mostly including hemp.

The Energy Efficiency and Renewable Energy bureau of the U.S. Department of Energy has a recent cooperative research partnership with R&D from General Motors, Vehicle Design R&A from Ford, and the Oak Ridge National Laboratory. The relationship's report subject was "Lightweighting Materials focuses on the development and validation of advanced materials and manufacturing technologies to reduce automobile weight without compromising other attributes." It studied hemp, flax and kenaf.

All samples for hemp came from Stemergy, a hemp-growing company in Ontario.



Over 1.5 Million Cars in U.S. Made with Hemp Composites

Natural Fiber Composite (NFC) use is on the upswing, according to FlexForm Technologies, LLC, of Elkhart, Indiana. Their products are used in the interiors of several lines of vehicles, which also can include plant biomass from sisal, jute, kenaf, and sometimes thermoplastic polymers. They estimate their products alone are used in well over a million North American vehicles.

A recent issue of Composites Technology noted, "Automobile Manufacturers are taking more advantage of the benefits associated with NFC's while seeking alternatives to neat polymers, which are becoming more expensive."

In 2004, Michigan State University released an interesting study. This joint project between the Composite Materials and Structure Center, Department of Agricultural Economics, and the Department of

## Hemp Instead of Polluting Petrochemicals in Your Gas Tank?

Rudolf Diesel's 1890 invention of the efficient engine bearing his name sought to empower farmers by giving them an alternative to high-priced petroleum-derived fuel sources. In that vein he designed an engine to run on the oil of hemp and peanuts.

The performance of biodiesel is virtually the same as petro-diesel. Like ethanol, biodiesel is a renewable fuel and can be produced domestically. This keeps U.S. dollars from flowing out of the country, and preferably the state, and reduces dependence on foreign oil.

Interestingly, former U.S. President George Bush, Sr., briefly discussed biofuels. As reported by the conservative WorldNetDaily.com Website:

Bush had a smart plan to wean America off of oil, at least partially ... On June 12, 1989, the self-proclaimed "environmental president," unveiled a plan to cut down on air pollution caused by petrol fuels.

"Too many Americans continue to breathe dirty air," said the elder Bush, "and political paralysis has plagued further progress against air pollution. We've seen enough of this stalemate. It's time to clear the air."

How? Why switching to methanol, of course -- what Bush tagged, "home-grown energy for America." Gives you kind of a warm, patriotic feeling, doesn't it? Turning our own trees to fuel (methanol being alcohol made from wood) makes more sense than relying on fickle foreign cartels like OPEC and even more fickle domestic cartels like the U.S. Department of Energy.

Unfortunately, like so many other things in the Bush presidency, what started out good, spoiled in the end. Along with bombing Iraq, Bush also bombed his energy policy. Despite all his gallant (and probably disingenuous) efforts, alternative non-petrol fuels remained on the drawing board, far from the gas tanks of Americans.

Pity.

[January 08, 2001]

### -Seed oil fuel

In April of 2001, a classic Mercedes-Benz rolled into the lobby of a Washington, DC, hotel for its debut as the Hemp Car. This time, the car was a normal, non-hemp car, with hemp in the fuel tank instead of in the panels and cushions.

Spokesperson Kellie Sigler explained the fuel comes from hemp seed oil, and that "... it's much less polluting, it's renewable, the net carbon added to the atmosphere is balanced out by the life cycle of the

plant." She added, "There's no sulfur," holding hemp in high esteem, pointing to one of its major benefits to the environment.

No conversion was needed to burn the fuel.

The white station wagon made a 13,000 mile (21,000 km) circuit around the U.S. and Canada, visiting 50 cities in 90 days, using 600 gallons of hemp seed oil for fuel.

### -Bioconversion

Of course when grown for biomass, hemp conversion can produce fuels such as methane, methanol and regular gasoline. This way, we move closer to the goal of energy independence while curbing the use of palm oil and even corn, used to make biodiesel and E85 ethanol, leaving food to be grown for food.

Chris Conrad, author of *Hemp: Lifeline to the Future*, asks the ethical question "Should we take food from this hungry world to make fuel when we can turn garbage and energy crops into fuel?"

"If all the diesel engines today were converted to use hemp biodiesel, you could wipe out world hunger while providing a natural balance to global warming" says Paul Stanford of the Hemp and Cannabis Foundation, also working to restore industrial hemp as an agricultural commodity.

Some engines would need a conversion to use the new fuel, and vehicles could come from showrooms in the future able to use these new sources.

### -Methanol

The vast majority of U.S. vehicles use gasoline, and hemp can be used with several different processes to replace petrochemicals. Pyrolysis, the heating of biomass, especially in a related process called gasification, has a low cost-per-energy ratio. Variations of this process can be used to produce several types of petrochemical replacement.

One of these is methanol. In 2005, Nobel Prize winner George A. Olah proposed an entire economy based on methanol. His essay, "Beyond Oil and Gas: The Methanol Economy," appeared in a German chemical trade publication, and was turned into a book in 2006 with the same name (written with 2 co-authors).

Biomass engineer Lynn Osburn, in her book *Energy Farming in America*, argued that pyrolysis is the most efficient method of biomass conversion, capable of replacing non-renewable fossil fuels.

Methanol, however, has its drawbacks, such as a high freezing temperature and its toxicity if spilled or absorbed by the human body. Further research can possibly lessen these drawbacks, or other final output products may be used instead, such as hemp biomass for ethanol and other gasoline variants.

"Imagine the potential now that better technology and cogeneration power are available,"

## Japanese Manufacturers Jump on the Hemp Bandwagon

The Honda Civic Hybrid series of cars released in 2007 a limited edition vehicle with hemp. The musical group Fall Out Boy designed a "tricked-out" version of the car with black with silver paint designs and some extra accouterments. Inside was hempified upholstery, including the headliner and carpeting with standard-issue vinyl.

## Ford Leads the Way

For several years, the Ford Motor Company has been the largest American manufacturer for Green Revolution vehicles. With several hybrids and even hybrid SUVs, their commitments have been inventive and even include natural bio-composites. Their 2008/9 Sustainability Report highlights their dedication towards such concerns as lowering carbon emissions in manufacturing and reassessing all areas of the production process.

The Report notes:

We are also developing fiber composites a substitute for the glass fibers traditionally used in plastic automotive components to make them stronger. For example, we are assessing the possibility of substituting up to 30 percent of the glass-fiber reinforcement in injection molded plastics with sisal and hemp natural fibers. These parts have competitive mechanical and thermal properties and good surface appearance, and can be cost competitive. These natural-fiber reinforced parts also reduce vehicle weight significantly and reduce life-cycle CO2 emissions, compared to glass-fiber-reinforced parts.

Their 2003/4 Corporate Citizenship Report states "We are experimenting with hemp, flax, purified cellulose and native prairie grasses. In addition, we are testing ways to replace the nonrenewable resin with renewable materials to make a vehicle ... completely biodegradeable (compostable) once its useful life is over."

This is the second wave of sustainability in the history of the company. In the 1930s and 1940s, Henry Ford grew hemp on his estate in Dearborn, MI, and began the effort to make body panels from biomass, especially the strongest linear fibers. Although the overall strength of the panels were not as strong as steel, they were lighter and would last longer, as most blows to the panels would bounce out, similar to the flex panels of later vehicles made by GM's Saturn division.

The photograph below was taken in 1936 in Dearborn, MI, showing hemp grown for Henry Ford's Soy Bean Institute, which manufactured early composites. A "Soy Bean Car" was produced, which included hemp in the panels.

Commenting on his innovations, a Purdue University analysis released in 2002 commented "Henry Ford recognized the utility of hemp in early times. In advance of today's automobile manufacturers, he constructed a car with certain components made of resin stiffened with hemp fiber."

The published report (ASHS Press, Alexandria, VA) continues:

There is also considerable potential for other industries using hemp in the manner that the automobile industry has demonstrated is feasible. Of course, all other types of transportation vehicles from bicycles to airplanes might make use of such technology. Natural fibers have considerable advantages for use in conveyance (Karus et al. 2000): low density and weight reduction, favorable mechanical, acoustical, and processing properties (including low wear on tools), no splintering in accidents, occupational health benefits (compared to glass fibers), no off-gassing of toxic compounds, and price advantages. Additional types of composites using hemp in combination with other natural fibers, post-industrial plastics or other types of resins, are being used to produce non-woven matting for padding, sound insulation, and other applications.

Henry Ford is quoted as having asked why we should use up forests and mines, when "we can get the equivalent of forest and mineral products in the annual growth of the hemp fields?"



spiritual drug.

"Hemp is hope and not dope," says MI-Hemp's Executive Director, Everett Swift. His group advocates the reintroduction of variations of the plant which provided textiles for American soldiers during the Revolutionary War, rope and oakum (a wood binder) for most of the naval vessels throughout history (until recently), and the paper for the first drafts of the Declaration of Independence. One of the major industrial crops in history, with a long lineage from ancient Taiwan and China, nearly 30,000 uses have been found for hemp.

"Hemp has untapped economic potential," adds Swift.

This paper explores the possible uses of hemp in Michigan's huge automotive industry, and how it can be beneficial to jobs and the environment.

Granholm finished her broadcast with the words "Through our continued partnerships with the federal government and the private sector, we are witnessing the dawn of a new Green Economy in Michigan."

MI-Hemp hopes this is the case, and within this small report, will attempt to illustrate why.

## Hemp and Automotive Production in England

In a recent episode of the English TV show Top Gear, host Adam Henson explained misunderstood aspects of the hemp plant. "Because of its association with the drug, it was banned in England until 1993. But you can't get drugs from hemp, and so now it's back in our fields, and being grown as a crop."

Lee Preston of Lotus Engineering, which makes high-performance cars, discussed their Eco Elise, explaining to Top Gear why they are integrating hemp in this test vehicle. "What we want to do here is actually reduce the carbon footprint of the car. We used hemp instead of fiberglass, because basically it's grown locally to us and it's a strong material."

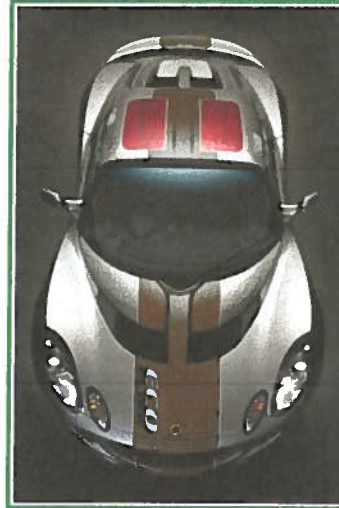
Preston also introduced the car to GreenBang.com at an auto show in London. "The seats are actually made out of hemp." This includes the composite form of the seat itself, and even the mats. "The seats are lighter than standard ... the performance is enhanced."

He continued, "The hemp we use is locally sourced ... from within 20 miles of the factory in Norfolk," adding the company providing the source material is growing well over 3000 acres of hemp.

The outer panels of the car are also made out of composite-formed hemp, which is "very strong." The Eco Elise doesn't disappoint Lotus purists, having a bold, wide stripe from the front to the back. The difference here is clear – no paint, showing the hemp panel's bio-form. "You could see that the panels, the front, the access panels, the hard top, the spoiler, are

actually made of hemp, and we've exposed those as well."

Although the car is currently only a concept, Preston commented on lessons learned, stating "the hemp [has been] successful," having passed the quality test. Lotus is "taking bits of technology off this car, and actually putting it into production."



Back in Norfolk, Top Gear's host, while wearing boots, pants and a shirt made with hemp, spoke with farmer Dan Squire. "We've got great confidence in the crop as a change crop," Squire commented. Getting down to pure economics, Henson asked "How does it stack up with profitability in comparison to conventional arable crops?"

"It's a lot better margin than peas and beans, very comparable with really good rape\* crops, and will even stand on its own feet with cereals."

(\*Relatives of the mustard and cabbage family, including canola.)

When asked how easy hemp is to grow, Squire confirmed what MI-Hemp describes as some of the truly highest benefits of utilizing hemp: "You sew it in early May, late April ... [use] good fertilizer, probably half of what is required of wheat or rape, and no chemicals from that day onward until it's harvested."

The *Journal of Industrial Hemp* (vol. 7, no. 1 of 2002) detailed the reintroduction of hemp as a resource for European industry. In the article "Natural Fibres in the European Automotive Industry," authors Michael Karus and Markus Kaup found that in Germany and Austria, hemp use in the auto industry rose an incredible 90% between the years 1996 and 2000, making it the second largest bio-crop, behind flax, but way ahead of jute, sisal, kenaf, and even coconut fibre. Other EU countries used over 3,500 metric tons of hemp in automobiles in 2000.

The article also listed 16 manufacturers using similar methods for such things as door inserts in Audi coupes, seat backs and parcel trays in Volkswagens, and headliner panels, door inserts, column covers, instrument panels, and rear shelf panels in Opels. European Daimler-Chrysler used natural fibres in the door inserts, windshields and dashboards, business tables, and column covers in their A-, C-, E- and S-Klasse (Class) vehicle lines.

This important report is online at the first link in the [Resources](#) section on page 6 of this report.



# MI-Hemp Report 1

## Hemp for the Automotive Industry



### Michigan is Poised for the Future

The Michigan Industrial Hemp Education and Marketing Project is dedicated to expanding industrial hemp as an agricultural resource for Michigan farmers, providing a natural, renewable and CO2-neutral environmental option to move our state into the new Green Economy. For more information, visit [MichiganHemp.org](http://MichiganHemp.org).

A radio broadcast in 2009 given by Michigan Governor Jennifer Granholm highlighted the state's commitment to 'go green.' She stated

Michigan is going to lead a green industrial revolution in our nation.

We'll be a beacon that guides this country along the path to energy independence.

Our state has the manufacturing infrastructure, the skilled workforce, the universities and the natural resources to do it. Michigan will design and manufacture fuel-efficient cars, advanced batteries for electric cars, wind turbines, solar panels and more.

Recently, renewable and Green Energy production projects have produced more than 11,000 new jobs in the state. Small, residential-sized wind turbines in Manistee; the expansion of an existing wind turbine manufacturing facility in Grand Rapids; a new solar panel factory in Battle Creek; and new and expanded Green Economy operations in Detroit, Novi, Saginaw and other Michigan cities have benefited from the new focus.

In addition, the Michigan Energy Corps was formed, putting unemployed citizens back to work with special Green Economy programs like weatherizing homes, schools, and public buildings, and installing renewable energy technologies.

Clearly, Michigan can offer a unique synthesis of Green Economy expansion as the center of the U.S. and indeed the world automotive industry. With the Green Economy goals of finding newer and greener manufacturing materials, lessening the weight of motor vehicles, and finding greener sources of energy, we have to ask ourselves if underdeveloped and un-utilized sources can fill new needs. Providing Green Economy jobs, and benefiting existing industries – with the goal of keeping more Michigan money in Michigan with localized systems – would be key to making the state synonymous with the phrase "Green Economy."

The Michigan Industrial Hemp Education and Marketing Project (MI-Hemp) was created in 2008 with these and many other environmental, yet profitable, goals in mind.

Hemp is the industrial form of Cannabis, the same plant that can also, through completely different lines of seeds, pollinations and growing techniques, make an illegal recreational, medical and >>>

Formed in 2008, MI-Hemp is a grassroots non-profit based in Hillman, MI.