Negative: Ethanol Rail Safety

By Katherine Baker

Trains carrying fuels like oil and ethanol across the heartland of our nation are a well-known hazard. New standards for safer rail cars are coming, but Congress left a loophole that postpones standards for tanker cars carrying ethanol until 2025. The standard for safer tanker cars for oil is a standard called DOT-117, which defines the safety features and safeguards built into a tanker car design. Currently, most ethanol is carried in DOT-111 cars, which are considered more dangerous. AFF plan moves up the DOT-117 standard for ethanol rail transportation to a more immediate timeline, not waiting until 2025.

This NEG brief argues that the rail cars aren't the real problem and that the Status Quo is already accelerating the movement toward DOT-117 anyway. Forcing it to go faster won't work and will only disrupt markets and impose unnecessary costs on consumers. And focusing on the rail cars distracts us from solving the root cause: the derailments themselves, which need lots of study and perhaps new regulations to solve.

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OPENING QUOTES

“Nothing short of ban on mega oil trains can solve this”

NATASHA GEILING, 2016. (Climate reporter for ThinkProgress.) “New Oil Train Rules Would Force Railroad Companies To Plan For The Worst” JUL 14, 2016 <https://thinkprogress.org/new-oil-train-rules-would-force-railroad-companies-to-plan-for-the-worst-785be6f14474/> (brackets added)

[Staff attorney for environmental advocacy group Columbia Riverkeeper, Lauren] Goldberg was quick to note, however, that the rules could still fall short of protecting communities. The Mosier derailment, which eventually sent some 42,000 gallons of oil into the Columbia River, was caused by a sheared track screw that had been cleared by a Union Pacific safety inspection just weeks before the incident — these new rules would do little to prevent that kind of accident from occurring. “Piling another band aid on the problem doesn’t address the root cause: Volatile oil is unsafe on railroads passing through communities and along critical water resources, like the Columbia River,” Goldberg said. “Nothing short of a ban on mega oil trains can solve this.”

MINOR REPAIR

Minor Repair: Track safety

NEW YORK TIMES 2015. (journalist Jad Mouawad) “New Oil Train Rules Are Hit From All Sides” MAY 1, 2015 <https://www.nytimes.com/2015/05/02/business/energy-environment/us-sets-new-rules-for-oil-shipments-by-rail.html>

Placing blame on the railroads, Jack Gerard, the chief executive of the American Petroleum Institute, said regulators should focus instead on preventing derailments and enhancing track inspection and maintenance.

INHERENCY

1. Railway company incentives solve

BNSF paying shippers to switch early

Jennifer McKevitt, January 2017. (has covered manufacturing issues for a variety of sources, such as Crain's Cleveland Business, the News-Herland and a variety of private clients. She attended Northwestern University and the University of Iowa's Writer's Workshop.) “BNSF ethanol transport discount seeks to promote safe transport” Jan. 26, 2017. <https://www.supplychaindive.com/news/bnsf-railway-discount-dot-117-111-safety-ethanol-shipping/434873/>

Beginning in April, BNSF Railway will offer $300 per car discounts to ethanol shippers, provided they agree to use the new DOT 117s rather than the DOT 111s, Reuters reported Wednesday. The DOT 111s, which are prone to punctures, have been involved in 16 accidents since 2006, resulting in numerous fires and 48 deaths.

Railway companies offer discounts to switch to DOT-117

Reuters news service, 2017. (journalists Jarrett Renshaw and Christ Prentice) “New, safer U.S. rail cars gather dust even as ethanol trains grow longer” MARCH 15, 2017. <http://www.reuters.com/article/us-usa-ethanol-rail-analysis/new-safer-u-s-rail-cars-gather-dust-even-as-ethanol-trains-grow-longer-idUSKBN16M2SA>

BNSF Railway Co has started offering discounts to ethanol shippers this April if they agree to use DOT 117s. Generally, shippers have stuck with older cars because most railcar owners would hit shippers with financial penalties if they break long-term leases. “While we are having some success in getting ethanol customers to upgrade to DOT 117s when their leases expire, we are not seeing a lot of demand from customers to make this switch,” said Christopher LaHurd, a spokesman with GATX Corp, a leading U.S. leaser of rail cars.

2. Accelerated replacement in Status Quo

Worst cars removed by 2018, newer cars must be replaced by 2020

Jad Mouawad, 2015. (New York Times reporter) “New Oil Train Rules Are Hit From All Sides” MAY 1, 2015. <https://www.nytimes.com/2015/05/02/business/energy-environment/us-sets-new-rules-for-oil-shipments-by-rail.html>

The regulations introduce a new tank car standard for oil and ethanol with better protections, and mandate the use of electronically controlled brakes. Facing growing pressure from members of Congress as well as local and state officials, the Department of Transportation has taken repeated steps in the last two years to tackle the safety of oil trains and reassure the public. Last month, for example, it set lower speed limits for oil trains going through urban areas. Under the new rules, the oldest, least safe tank cars would be replaced within three years with new cars that have thicker shells, higher safety shields and better fire protection. A later generation of tank cars, built since 2011 with more safety features, will have to be retrofitted or replaced by 2020.

DOT-111 are coming off by 2018, while CPC-1232 cars will be gone by 2020

Jad Mouawad, 2015. (New York Times reporter) “New Oil Train Rules Are Hit From All Sides” MAY 1, 2015. <https://www.nytimes.com/2015/05/02/business/energy-environment/us-sets-new-rules-for-oil-shipments-by-rail.html>

By 2018, the rule would phase out older tank cars, DOT-111s, long known to be ill suited for transporting flammable material. A newer generation of cars, known as CPC-1232, would have to be retired or refitted to meet the new standard, DOT-117, by 2020.

HARMS / SIGNIFICANCE

1. Equipment failures steadily declining

Trespassing causes over 90% of fatalities, equipment-related failures are steadily declining

Jennifer McKevitt, 2017. (has covered manufacturing issues for a variety of sources, such as Crain's Cleveland Business, the News-Herland and a variety of private clients. She attended Northwestern University and the University of Iowa's Writer's Workshop.) “BNSF ethanol transport discount seeks to promote safe transport” Jan. 26, 2017. <https://www.supplychaindive.com/news/bnsf-railway-discount-dot-117-111-safety-ethanol-shipping/434873/>

While the numbers of accidents mentioned above may seem high, in fact, more than 90% of train-related fatalities occurred as a result of trespassing. Only 14% of accidents recorded in 2015 were equipment based, while fatalities based on equipment failures have steadily declined since 2005.

2. Overloaded car problem – explains why ethanol is safer than oil

Weight of trains contributes to derailment of oil trains

Justin Mikulka, 2016. (freelance writer, audio and video producer;. has a degree in Civil and Environmental Engineering from Cornell Univ.) “Overloaded: New Rules Allowed for Heavier Bakken Oil Trains’ September 19, 2016. <https://www.desmogblog.com/2016/09/19/overloaded-new-rules-allowed-heavier-bakken-oil-trains>

As oil train derailments continued to happen, more people began to express concerns about the weight of these trains as a possible contributing factor in derailments. Doug Finnson, president of the Teamsters Rail Conference of Canada, expressed concerns about the size and weight of the oil trains to CBC News after an oil train derailment in Canada in 2015, saying, “These trains are likely too long, too heavy, and going too fast for the track conditions in place.”

Increase in weight of trains coincided with “bomb train” problem for oil

Justin Mikulka, 2016. (freelance writer, audio and video producer;. has a degree in Civil and Environmental Engineering from Cornell Univ.) “Overloaded: New Rules Allowed for Heavier Bakken Oil Trains’ September 19, 2016. <https://www.desmogblog.com/2016/09/19/overloaded-new-rules-allowed-heavier-bakken-oil-trains>

This change was also explained in two slides from a presentation titled, “The Tank Car Story: A Builder’s Perspective,” that was presented to the Northeast Association of Rail Shippers. The first slide shows that prior to 2010, the tank cars were operating with weight limits of 263,000 pounds for a loaded car. The next slide shows that starting in late 2011, oil trains began operating with tank cars with limits of 286,000 pounds for a loaded car. When, in late 2011, industry started shipping Bakken oil in the new 286,000-pound cars via long unit trains, a new era of rail tank car transportation began. And a mere two years later, as oil-by-rail started to reach signficant volumes, the risks of these bomb trains became more and more clear, with derailments and fires occurring in places including Lac-Mégantic, Quebec; Aliceville, Alabama; and Casselton, North Dakota (and those were just in 2013).

Overload danger doesn't happen with ethanol. Ethanol is lighter, so it's less dangerous

Justin Mikulka, 2016. (Justin Mikulka is a freelance writer, audio and video producer living in Trumansburg, NY. Justin has a degree in Civil and Environmental Engineering from Cornell University.) “Overloaded: New Rules Allowed for Heavier Bakken Oil Trains’ September 19, 2016. <https://www.desmogblog.com/2016/09/19/overloaded-new-rules-allowed-heavier-bakken-oil-trains>

Because crude oil can be quite heavy, we can infer that these rail tank cars are not fully loaded with liquid before reaching the 286,000 pound limit, which would leave empty space in the tank cars. But how much empty space is the industry really leaving in these oil rail cars? Would the oil industry ever put profits above safety? Ethanol is a manufactured product that weighs 6.59 pounds per gallon. Crude oil is a raw material and can vary greatly across an area like the Bakken formation, which underlies parts of North Dakota and Montana in the United States, and Saskatchewan and Manitoba in Canada. A ConocoPhilips specifications sheet on Bakken crude gave a range of 5.83-8.58 pounds per gallon for Bakken crude oil. Clearly, Bakken oil has the potential to be much heavier than ethanol, creating an opportunity for overloading tank cars with crude oil that isn’t an option with ethanol. At the NTSB round table, Greg Saxton, engineer for tank car company Greenbrier, explained that with ethanol being so light, it is possible to fill up the car before reaching the weight limit, saying, “In some cases you won’t be able to fully load that car to 286,000.”

3. Ethanol not as dangerous

Yes, you have to be careful with it, but it's nowhere near as dangerous as petroleum, because it breaks down harmlessly when spilled

U.S. Energy Information Administration, 2017. (The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.) “Ethanol and the Environment” Last updated: February 9, 2017 <https://www.eia.gov/energyexplained/index.cfm?page=biofuel_ethanol_environment>

Unlike gasoline, pure ethanol is nontoxic and biodegradable, and it quickly breaks down into harmless substances if spilled. Chemical denaturants in fuel ethanol make up about 2% of fuel ethanol by volume, and many of the denaturants are toxic. Similar to gasoline, ethanol is a highly flammable liquid and must be transported carefully.

SOLVENCY

1. Short timeline

Not enough time to get all the cars replaced or retrofitted. It will take 500 years to retrofit the entire fleet!

Justin Mikulka, 2016. (freelance writer, audio and video producer; has a degree in Civil and Environmental Engineering from Cornell University.) “Rail Safety Report Card: Only 225 Of Over 100,000 Unsafe Tank Cars Were Retrofitted in First Year” May 9, 2016. <https://www.desmogblog.com/2016/05/09/report-card-only-225-out-over-100-000-unsafe-tank-cars-retrofit-first-year>

A year ago, when Federal regulators announced new rules for “high hazard” trains moving crude oil and ethanol, the oil industry protested that the rules were too strict. The main point of contention made by the American Petroleum Institute (API) was that the requirement to retrofit the unsafe DOT-111 and DOT-1232 tank cars within ten years did not allow enough time to get the job done. Meanwhile, according to information recently provided to DeSmog by the Association of American Railroads, only 225 of the tank cars have been retrofitted in the past year. So, the API may have been onto something because at that rate it will take roughly 500 years to retrofit the entire fleet of DOT-111s and CPC-1232s based on government and industry estimates of fleet size of approximately 110,000.

2. DOT-117 still vulnerable

DOT-117 will puncture on slow impact

Tarika Powell and Eric de Place, 2015. (Tarika Powell, senior research associate, researches and analyzes energy policy and infrastructure. Eric de Place, policy director, spearheads Sightline Institute’s work on energy policy. He is known as a leading expert on coal and oil export plans in the Pacific Northwest, and he is considered an authority on a range of issues connected to fossil fuel transport.) “TESORO’S NEW OIL TRAIN CARS: TOO FEW AND STILL TOO DANGEROUS” December 15, 2015. <http://www.sightline.org/2015/12/15/tesoros-new-oil-train-cars-too-few-and-still-too-dangerous/>

The known facts about DOT-120s suggest these cars are superior to the rest of Tesoro’s fleet, but there is still cause for concern. For example, the outer steel shell of Tesoro’s new tank cars would be 9/16 of an inch, exactly the same thickness as the DOT-117, which federal regulators have shown will puncture with a side impact as slow as 12 mph.

DOT-117 has inadequate thermal protection. They can still explode just like DOT-111

CHICAGO TRIBUNE 2015 (Richard Wronski, journalist) " New rules for oil tank cars don't offer enough fire protection, experts say" 14 May 2015 <http://www.chicagotribune.com/news/ct-tank-cars-rules-met-20150514-story.html> (Brackets added)

The DOT-117 cars are 85 percent less likely to release their contents than the DOT-111s, [Univ. of Illinois railroad engineering Professor Christopher] Barkan said. But tank cars need to be have additional thermal protection as well as being stronger, said Barkan, who added it was hard to understand why the Transportation Department decided to retain the old standard, which was developed for liquefied petroleum gas, not crude oil. "In 2015, we would like to have a tank car that doesn't fail after 100 minutes or, better still, never fails at all," Barkan said. It was especially troubling, Barkan said, in light of the series of fiery oil train explosions in recent years, including one in Lac-Megantic, Quebec, that killed 47 people in 2013. The latest explosive derailment occurred May 6 in Heimdal, N.D. Six cars were engulfed in flames and burned for more than 24 hours. Nearby residents were evacuated. "You have this odd situation where the regulated community wants a safer standard than the Department of Transportation is requiring," Barkan said. "They are supposed to be the guardians of safety."

DISADVANTAGES

1. Masking DA: Focus on rail cars distracts us from solving the real issues

Ethanol is safer than oil. Focus on tank cars distracts us from derailment prevention. Impact: problem never gets solved or gets worse

Erin Voegele 2015. (journalist) " NTSB makes rail car safety recommendations to PHMSA" ETHANOL PRODUCER MAGAZINE 7 Apr 2015 <http://ethanolproducer.com/articles/12108/ntsb-makes-rail-car-safety-recommendations-to-phmsa>

“It is clear from the NTSB’s report, and its focus on the last four crude oil incidents between February and March of this year, that there is something unique about Bakken crude that is causing it to be highly explosive,” [president of the Renewable Fuels Association, Bob] Dinneen said. “The U.S. ethanol industry is deeply committed to rail safety. Indeed, we are proud of our enviable safety record. Because of the obvious differences between highly volatile crude oil and ethanol, we don’t think all Class 3 flammable liquids should be treated the same. The NTSB should focus on the commodity being transported that is posing the most risk to our communities, and raising the most concern from the public.” “We also believe that any effort to address rail safety must look at the root causes of the derailment, especially rail operations and track integrity,” Dinneen continued. “We can make appropriate improvements to the tank car, but ultimately the focus should be on preventing these incidents in the first place. If the effort only looks at the tank car, we will have done nothing to avoid more tragedies in the future and that would be a callous insult to the 47 lives lost in Quebec.”

Preventing Derailment is the key, and lots of work needs to be done to figure it out

The National Academies of Sciences, Engineering, and Medicine, 2017. (The National Academies of Sciences, Engineering, and Medicine are distinctively qualified to provide nonpartisan, objective guidance for decision makers on pressing issues. As we have done since our founding in 1863, we marshal the energy and intellect of the nation’s critical thinkers to respond to policy challenges with science, engineering, and medicine at their core.) “Concerns Remain About Safety of Rail to Transport Energy Liquids and Gases; Pipeline and Maritime Transportation Have More Comprehensive Safety System in Place, Says New Report” Oct. 11, 2017 <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=24923>

The committee determined that incomplete understanding of the dynamics of tank-car unit train derailments and a lack of clear guidelines and resources for state and local emergency responders continues to present safety risks. As the tank cars that are compliant with new design specifications are being phased in, tank cars built to older specifications that are less crashworthy and less resistant to thermal failures may continue to be used for flammable liquids traffic for several years. Preventing the derailment of these cars is imperative, the committee said. Post-incident investigations of severe flammable liquids train derailments indicate track wear and defects are common causal factors. Questions remain about the technical basis for track inspection standards, which set an allowable failure rate, and whether these allowable rates and repair priorities should be adjusted for routes that continue to be used by tank-car unit trains.

Big Links to DISADS 2 and 3

Link: $5.4 million more expensive

Jarrett Renshaw, Chris Prentice, 2017. (Reuters Reporters) “New, safer U.S. rail cars gather dust even as ethanol trains grow longer” MARCH 15, 2017. <http://www.reuters.com/article/us-usa-ethanol-rail-analysis/new-safer-u-s-rail-cars-gather-dust-even-as-ethanol-trains-grow-longer-idUSKBN16M2SA>

Based on current lease rates, a shipper using 1,000 of the older cars instead of the new models would save $5.4 million annually.

Link: Costs billions to replace all older cars

Jarrett Renshaw, Chris Prentice, 2017. (Reuters Reporters) “New, safer U.S. rail cars gather dust even as ethanol trains grow longer” MARCH 15, 2017. <http://www.reuters.com/article/us-usa-ethanol-rail-analysis/new-safer-u-s-rail-cars-gather-dust-even-as-ethanol-trains-grow-longer-idUSKBN16M2SA>

It would cost about billions to replace all of the older cars with 117 model cars, Davis said in a phone interview. “Owners paid $100,000 for these (current) cars, and you’re going to melt them down like a tin can to make a new one,” Davis said. “That’s a lot of stranded capital.”

Brink: Cost lead to shortages

Jad Mouawad, 2015. (New York Times reporter) “New Oil Train Rules Are Hit From All Sides” MAY 1, 2015. <https://www.nytimes.com/2015/05/02/business/energy-environment/us-sets-new-rules-for-oil-shipments-by-rail.html>

Oil companies, though, said the mandate to build new tank cars to replace older models starting in 2018 would stretch the industry’s manufacturing ability and lead to shortages.

Brink: replacement schedule leads to shortages

David Thomas, 2015. (reporter who has covered government and society since graduating from Ottawa’s Carleton University with degrees in political science and journalism. He has written for National Geographic, Maclean’s, The Globe and Mail, The Gazette, and The Canadian Press news agency) “DOT-117 tank car rule debuts with controversy” May 01, 2015. <http://www.railwayage.com/index.php/regulatory/dot-117-tank-car-rule-debuts-with-some-controversy.html>

Speaking for shippers and fleet owners, the American Petroleum Institute said the ECP requirement will further stress an already impossible timeline for total fleet renewal. It warned that oil shortages will result as existing tank cars are withdrawn before builders can replace them: “We support upgrades to the tank car fleet and want them completed as quickly as realistically possible. The railcar manufacturing industry’s own calculations show it does not have the shop capacity to meet the retrofit timeline announced today, which will lead to shortages that impact consumers and the broader economy.”

2. High Costs for Consumers

Link: Cost a lot.

Brink: Rail preferred mode of transportation for ethanol

Curtis Tate, 2017. (Staff Writer – Transportation. Writes for NorthJersey.com, a local news source) “Ethanol has replaced oil trains as hidden safety risk in N.J.” Oct. 13, 2017 <http://www.northjersey.com/story/news/transportation/2017/10/13/ethanol-has-replaced-oil-trains-hidden-safety-risk-nj/758520001>

In July the agency forecast that this year could set a record for the corn-based renewable fuel, which is blended into domestic gasoline stocks to help reduce carbon emissions. Because production is so dispersed, and the distances to refineries so great, rail has become the preferred mode of transportation for ethanol.

Link: Shortages. Cross apply the Thomas 2015 evidence above, tank car replacement = shortages

Impact: higher costs.

One shortage that is forecasted is expected to raise the price as high as $85 a barrel

Luke Graham, 2017. (journalist for CNBC; has previously worked for The Sunday Times, Metro and several local newspapers.) “Oil shortages could push prices all the way to $80, commodities expert says” 27 Sept 2017 <https://www.cnbc.com/2017/09/27/oil-shortages-could-push-prices-all-the-way-to-80-commodities-expert-says.html>

"The fundamentals are changing and the market is rebalancing," Jodie Gunzberg, head of commodity and real asset indices at S&P Dow Jones Indices, told CNBC Wednesday. This support is coming from several sources, including OPEC whose members are complying with production cuts and China where there is demand growth, according to Gunzberg. "I think Hurricane Harvey really gave (oil) a boost, it was a catalyst for some of the disruptions in the refineries," she added. "We are seeing real rebalancing in the oil market." "When we look at the index data, we can see the price could move even as high as $80 to $85 (a barrel). Not immediately, but with their structural backwardation and shortages in the market, you just can't replenish it overnight," she said.

Impact: higher prices. Ethanol stabilizes prices

Ethanol producer Magazine, 2016. (Ethanol Producer Magazine is the ethanol industry’s premier trade journal.) “Higher ethanol blends can alleviate gas shortages, price spikes” September 19, 2016. <http://ethanolproducer.com/articles/13724/higher-ethanol-blends-can-alleviate-gas-shortages-price-spikes>

A Sept. 9 leak in the Colonial pipeline, which supplies gasoline to many states in the southeast and east coast has resulted not only in gasoline shortages, but also price spikes at the pump. As workers act to fix the leak and remediate the environmental consequences of a 336,000-gallon gasoline spill, Emily Skor, CEO of Growth Energy issued the following statement: "We are relieved to know that no one was hurt in this incident. It is, however, a sobering reminder of the important role biofuels, like ethanol play in our nation's fuel mix—and why they must be increased. While ethanol is already in 97 percent of the nation's fuel supply, the widespread adoption of increased blends, such as E15 across the nation, can help blunt the severity of these supply shortages and price shocks.

Impact: Costs. Ethanol reduces gas price by over 50 cents per gallon

Ethanol producer Magazine, 2016. (Ethanol Producer Magazine is the ethanol industry’s premier trade journal.) “Higher ethanol blends can alleviate gas shortages, price spikes” September 19, 2016. <http://ethanolproducer.com/articles/13724/higher-ethanol-blends-can-alleviate-gas-shortages-price-spikes>

"Studies show that ethanol is cleaner burning, biodegradable and helps reduce gasoline prices by $.50 to $1.50 a gallon. Furthermore, they are higher in octane and are better for engines and the environment, helping reduce the use of toxic additives that lead to groundwater contamination, smog, asthma and cancer.

3. Environment

Link: Cost a lot.

Brink: Shortages

Impact: Human health and environment harmed.

Ethanol producer Magazine, 2016. (Ethanol Producer Magazine is the ethanol industry’s premier trade journal.) “Higher ethanol blends can alleviate gas shortages, price spikes” September 19, 2016. <http://ethanolproducer.com/articles/13724/higher-ethanol-blends-can-alleviate-gas-shortages-price-spikes>

"Studies show that ethanol is cleaner burning, biodegradable and helps reduce gasoline prices by $.50 to $1.50 a gallon. Furthermore, they are higher in octane and are better for engines and the environment, helping reduce the use of toxic additives that lead to groundwater contamination, smog, asthma and cancer.

“Increased carbon emission” Response: Crops to make ethanol offset CO2 production

U.S. Energy Information Administration, 2017. (The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.) “Ethanol and the Environment” Last updated: February 9, 2017 <https://www.eia.gov/energyexplained/index.cfm?page=biofuel_ethanol_environment>

Producing and burning ethanol results in emissions of carbon dioxide (CO2), a greenhouse gas. However, ethanol is considered atmospheric carbon-neutral because corn and sugarcane, the two major feedstocks for fuel ethanol production, absorb CO2 as they grow and may offset the CO2 produced when ethanol is made and burned. Some ethanol producers burn coal and natural gas for heat sources in the fermentation process to make fuel ethanol, while some burn corn stocks or sugar cane stocks.

“Increased carbon emission” Response: Government supporting cleaner was to produce it

U.S. Energy Information Administration, 2017. (The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.) “Ethanol and the Environment” Last updated: February 9, 2017 <https://www.eia.gov/energyexplained/index.cfm?page=biofuel_ethanol_environment>

The U.S. government is supporting efforts to produce ethanol with methods that use less energy than conventional fermentation and that use cellulosic biomass, which requires less cultivation, fertilizer, and pesticides than corn or sugar cane. Cellulosic ethanol feedstock includes native prairie grasses, fast growing trees, sawdust, and even waste paper.

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