September 1, 2010.

This is an abstract of my latest book, *T108 Tank Cars*. I hope you'll find it interesting. I made the file small enough to be readily attached to an email message and you are free to send it out to anyone you like or even post it on the internet.

I wanted to do this book because I thought it would be a good illustration of a modern relationship between politics and business. When the current incarnation of fuel ethanol was new, I found it intriguing. Even today it may have its place when the feedstock is locally grown and the product is locally distributed. As ethanol production grew sharply during the last decade, I began to have concerns. As I did background research for this book, my concerns deepened. What I found in the end was shocking in its magnitude. The amount of economic resources that political policy diverted into a questionable direction is staggering. It became clear that politics had directly caused a feverish economic boom followed by a dramatic bust. Industry is most efficient when work is steady, so this is not desirable. I don't mean to pick on ethanol specifically, and I fear this is typical of what is happening in other areas as well.

The rest of the book is about the tank cars themselves. It will be available soon for those who want all the little details.

Eric

T108 Tank Cars:

Chemicals, Ethanol, and the Green Economy

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Introduction and summary

Overview

The ethanol train only arrived recently on the American railroad scene. Government subsidies and mandates promoted fuel ethanol to the point where dedicated trains carrying millions of gallons each are needed to deliver ethanol to fuel blenders who add it to gasoline.

Reasons given for promoting ethanol are global warming, sustainability, and job creation. Arguments given against ethanol are energy inefficiency, pollution, and use of public money for corporate welfare. Ethanol has become a major political issue with a strong lobbying presence in government. Biodiesel production depends on the same business model as ethanol.

This book shows the effect of ethanol and other commodities on the T108 tank car type. The T108 is defined as a general service tank car with a capacity between 27,500 and 31,499 gallons. When built as a 100-ton capacity car without insulation, it is ideal for ethanol. Insulated T108s carry vegetable oils and tallow used to produce biodiesel. The recent biofuels movement elevated the once uncommon T108 into the most popular item in the catalog for several years until the bubble burst near the end of 2008. Approximately 33,000 tank cars were built for ethanol between 2004 and 2008. These represent an investment of about three billion dollars.

Biofuels need ongoing subsides and mandates to remain viable on a national scale, and current lobbying in Washington is shifting in favor of subsidizing biofuels pipelines because continuation of existing subsidies has become politically more difficult.

Any reduction of subsidies could cause a significant reduction in ethanol production. Construction of pipelines would also drastically reduce the need for ethanol tank cars. Either way, the recent investment in ethanol cars would become largely useless. If this happens, the cars may be shortened for other uses as was done with surplus grain cars during the 1980s.

Ironically, many of the early cars built by Union Tank were "changeable" and could be readily shortened by replacing the center tank section. Few if any were actually "changed" and now that this may become desirable, these cars will be retired because of their age instead.

Types of T108 tank cars

The T108 was introduced in 1965, about 18 months after "Plate C" clearance standard went into effect allowing significantly larger freight cars in general use. The earliest T108s were non-insulated 100-ton cars used for a wide range of chemicals produced by both petrochemical and other chemical companies. These include:

- pentanes, hexanes, heptanes, octanes
- ethyl acetate, propyl acetate, butyl acetate, vinyl acetate
- methanol, ethanol, propanol, butanol
- amines, propylene oxide, tetrahydrofuran, acrylonitrile, etc.

Some petrochemical companies found a use for a 125-ton non-insulated cars as early as 1967. These are uncommon. Once an increase in gross rail load from 263,000 to 286,000 pounds for 100-ton cars was allowed in the 1990s, 100-ton T108s became suitable for the heavier commodities the 125-ton cars would have handled such as gasoline and lubricating oil.

Petrochemical companies also found a use for a 125-ton insulated car in about 1967. They were primarily intended for asphalt, a residue left after petroleum distillation in refineries. Though more numerous than the 125-ton non-insulated cars, they are still uncommon.

Since 1995, numerous orders of 100-ton insulated T108s have also been built. Many are used for vegetable oils. Others appear to be used by petroleum companies for paraffin wax. Neither of these commodities require placards, so a particular car's contents are hard to confirm. Nearly all of these are rated at 286,000 pounds gross rail load.

Ethanol production

The amount of raw ethanol added during the production of certain alcoholic beverages is sufficient to be shipped in tank cars. This and other industrial uses predate the modern renaissance of fuel ethanol. Although ethanol destined for human consumption is usually taxed and ethanol used for fuel is subsidized, all ethanol is essentially the same. However, both fuel and non-fuel ethanol may be subsequently denatured (made undrinkable) by the addition of methanol or gasoline to prevent illegal consumption.

Ethanol can also be made from petrochemical feedstocks such as ethylene, but current United States production comes mostly from biological fermentation of corn followed by distillation. The common name of ethanol is grain alcohol.

Methanol is usually produced from natural gas in the United States, but could also be produced from coal. It traditionally was produced from wood, hence its common name, wood alcohol. Much more methanol is typically produced in the United States than non-fuel ethanol. Although methanol can also be used as a fuel, the idea was abandoned despite several trials.

Ethanol pros and cons

- U. S. gasoline consumption in 2008: 138 billion gallons
- U. S. ethanol production in 2009: 11 billion gallons
- U. S. ethanol capacity as of June, 2010: 13 billion gallons per year

The value of ethanol is complicated. As a fuel oxygenate additive, it makes sense and appears to be economically and environmentally competitive with other oxygenates such as the now banned MTBE. At present, ethanol plant capacity is just about large enough to blend 10% ethanol into all gasoline as a fuel oxygenate.

The value of ethanol as a fuel in competition with gasoline is dubious at best. Although ethanol is presently produced domestically from renewable sources, it is not and rarely has ever been economically competitive with gasoline. Continuing and increasing government subsidies and mandates are required to support its use as a fuel.

Ethanol has about 90% energy as gasoline for the same volume. If one gallon of gasoline takes you 20 miles in your car, a gallon of ethanol will only take you 18.

Fuel ethanol has several other problems. One unit of energy is required to produce 1.34 units of ethanol energy and usually comes from natural gas, a fossil fuel. It would be more efficient to use natural gas directly in vehicles or for home heating. Ethanol production also requires a significant amount of water. One of the more modern plants estimates a net loss of 1.2 gallons of water per gallon of ethanol produced. Note that neither of these figures includes any fuel, water, or fertilizer consumed in growing the feedstock, typically corn.

In April 2007, the Environmental Protection Agency relaxed emission standards for ethanol plants. From what I have seen, ethanol plants can produce visible air pollution

On the plus side, ethanol plants that use grains as a feedstock produce a useful by-product called distillers grain which is used as a livestock feed. Other biomass ethanol plants lack this economic advantage.

Gasoline production uses one unit of energy to produce about 0.805 units of gasoline energy according to one source and numbers like this are often used to show that ethanol production is more energy efficient than gasoline production. However, in these comparisons the number associated with gasoline includes feedstock production while that used for ethanol does not.

A March, 2008 report from the Energy Information Administration calculates refinery efficiencies of well over 80% for gasoline which translates to less than 1 unit of energy consumed per 4 units of gasoline energy produced. This is logical because all that is vaporized during distillation at an oil refinery becomes product while most of what is vaporized at an ethanol plant is only water. So, the efficiency of an oil refinery is greatly superior to the efficiency of an ethanol plant, and the charge that the current ethanol production process requires burning more fossil fuel energy than the amount of renewable energy produced appears to be correct once the energy required for corn production is included.

In addition, petroleum distillation produces a variety of liquids besides gasoline which are then used as feedstocks for a host of other products. Even the residue left over after evaporation is useful as asphalt. An ethanol plant produces only ethanol and distillers grain, and the latter is produced only if the feedstock is grain.

For biodiesel, one unit of energy is used to produce 3.20 units energy. While this sounds very positive for the potential of biodiesel, this statistic doesn't tell the whole story because it also ignores feedstock production.

While it makes good sense to use recycled oils and animal fats discarded from meat processing plants to make motor fuel, the advantages decrease significantly as production expands beyond what can be supported by the existing feedstocks. By the way, there was probably never a time when used oil wasn't recycled industrially. It's only on the consumer side that recycling is a recent idea.

Ethanol subsidies

The Federal ethanol subsidy started in 1978 and was initially applied as a complete or partial waiver of the excise tax placed on gasoline. The effect was to make ethanol more competitive in price with gasoline and promote its use. Of course, every change in the subsidy was preceded by extensive lobbying on behalf of ethanol producers such as ADM and created a boom or a bust in the ethanol industry.

Legislation started changing the underlying nature of the subsidy in 2004. Since then, increasing complexity of legislation makes it very difficult to give the subsidy a specific numerical value. In addition, Federal money passes through states and is applied in the form of ethanol plant construction subsidies, often in the range of 10 to 15%. Subsidies for biofuels pipelines are currently being discussed.

- Energy Tax Act of 1978— The 4 cent excise tax on gasoline was waived for E-10 blended gasoline (10% ethanol). Resulting ethanol subsidy: 40 cents per gallon.
- Energy Security Act (1980)— Insured construction loans to small ethanol producers.
- Surface Transportation Assistance Act (1982)— The gasoline excise tax increased to 9 cents, of which 5 cents was waived on blended gasoline. Resulting ethanol subsidy: 50 cents per gallon.
- Tax Reform Act (1984)— The gasoline excise tax exemption was increased to 6 cents. Resulting ethanol subsidy: 60 cents per gallon.
- Omnibus Budget Reconciliation Act (1990)— The ethanol subsidy was reduced subsidy to 54 cents and extended to 2000.
- Clean Air Amendments of 1990— Two new gasoline standards required the use of fuel oxygenates to reduce fuel emissions in areas with bad air pollution. Ethanol and MTBE are both fuel oxygenates.
- 1998: The ethanol subsidy was reduced to 51 cents and extended through 2005.
- California changed from MTBE to ethanol as a fuel oxygenate during 2003, and many other states followed suit by 2006. The change was primarily due to well water contamination by MTBE. MTBE is also know as methyl tertiary-butyl ether and is made from methanol and iso-butylene.
- American Jobs Creation Act of 2004: The subsidy was shifted from an excise tax exemption to a blender tax credit and extended to 2010.
- 2006: Energy Policy Act, etc. — Although the blender tax credit still exists for now, the effect of mandates and additional incentives buried in subsequent legislation make calculation of a per gallon ethanol subsidy impossible. The effective ethanol subsidy is estimated by some to be between 1 and 2 dollars which seems plausible.

Biodiesel subsidies

American Jobs Creation Act Of 2004 included a blenders tax credit which went into effect in 2005. The subsidy was 1 dollar per gallon for biodiesel made from oil seeds and animal fats and 50 cents per gallon for diesel made from recycled oil. The subsidy was initially to last through 2006, but later extended through 2008. It subsequently expired, but lobbying for reinstatement continues.

Corporate welfare

Dwayne O. Andreas never completed college and pursued a career in agribusiness, ultimately becoming CEO of ADM in 1971. For the next 29 years, he agressively transformed ADM into an agribusiness giant and the largest ethanol producer. Old plants were constantly improved and new plants were constructed during his tenure.

Andreas gave heavily to both political parties even in the 1960s, and with this ongoing relationship, ADM's business naturally came to include ethanol subsidies which some refer to as corporate welfare. In fact, ADM is one of the companies most often cited in corporate welfare articles.

ADM was also involved in a price-fixing scandal during the 1990s which added to their problems. I remember it being quite a circus at the time when the Fed's informant turned out to be a unscrupulous criminal himself. Regardless, ADM pled guilty to lysine price-fixing charges and paid a large fine. Surprisingly, later studies show the price of lysine didn't increase during the time the price-fixing cartel was in effect. Any benefit ADM received out of the cartel seems to have been limited to an assurance of a fixed share of the lysine market which would have allowed them longer term production planning.

ADM was under a lot of pressure to "diversify" their board of directors during the late 1990s. Dwayne O. Andreas retired in 1999 and was replaced by his nephew, G. Allen Andreas who served until 2006. The present CEO of ADM is Patricia A. Woertz who has a university degree in accounting, post-graduate training as an executive, and was formerly a vice president at Chevron. Of course, she is a strong advocate of biofuels and especially biodiesel.

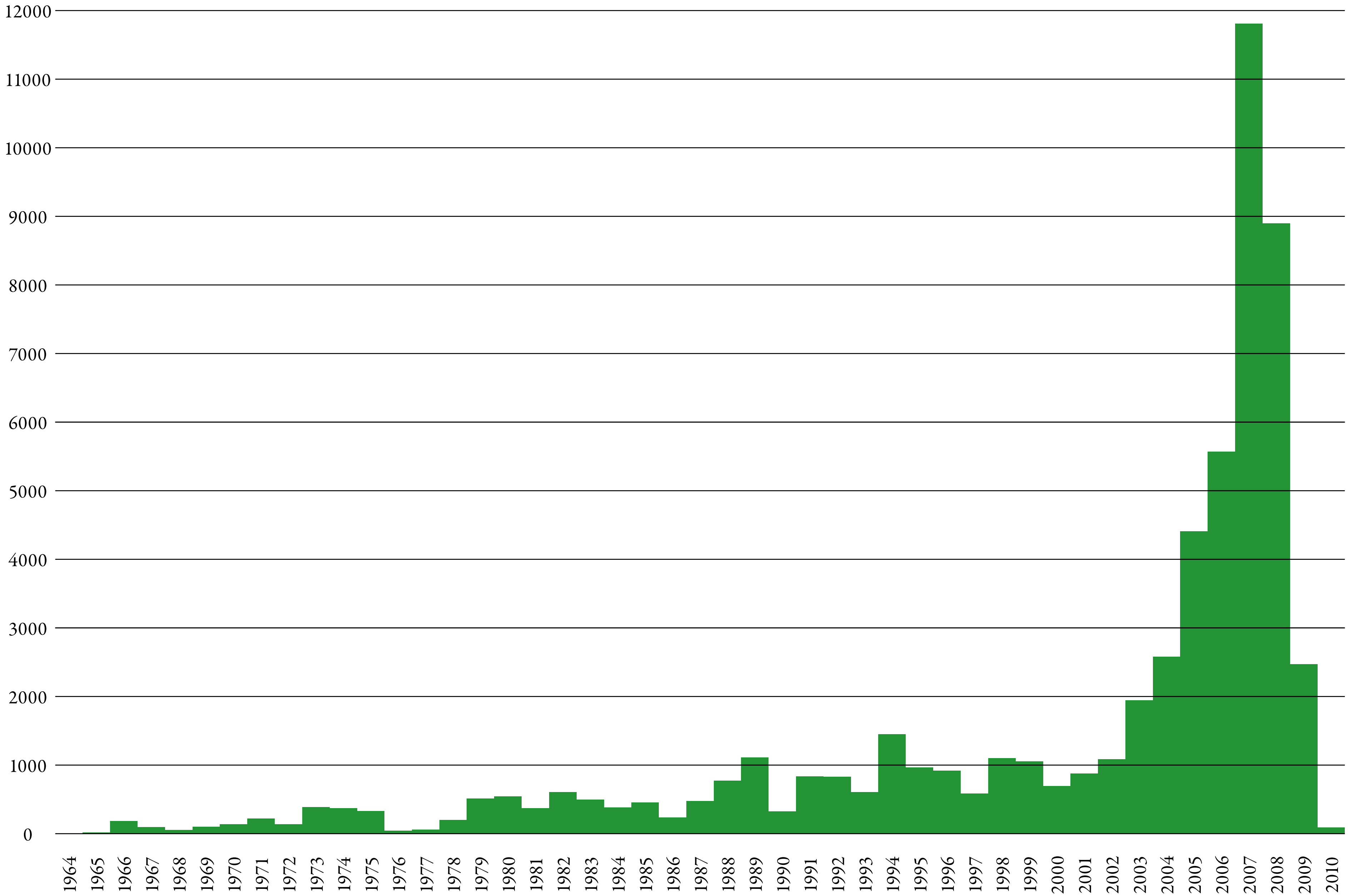
Growth of the North American T108 fleet

The annual production of T108 varieties is summarized on the next two pages. Those used for ethanol are included with the 100-ton non-insulated cars shown on the next page. Few ethanol cars were built before 1977. The introduction of ethanol subsidies in 1978 caused a modest increase in T108 production. State mandates caused a more significant increase starting in 2003, but this was nothing compared to the bubble that government promotion of green economics caused several years later. The vast majority of the cars built after 2002 were intended for ethanol. Production dropped precipitously after 2008 to a current level of about 1.5% of the peak. Perhaps 75 to 85% of the cars currently in service are used for fuel ethanol.

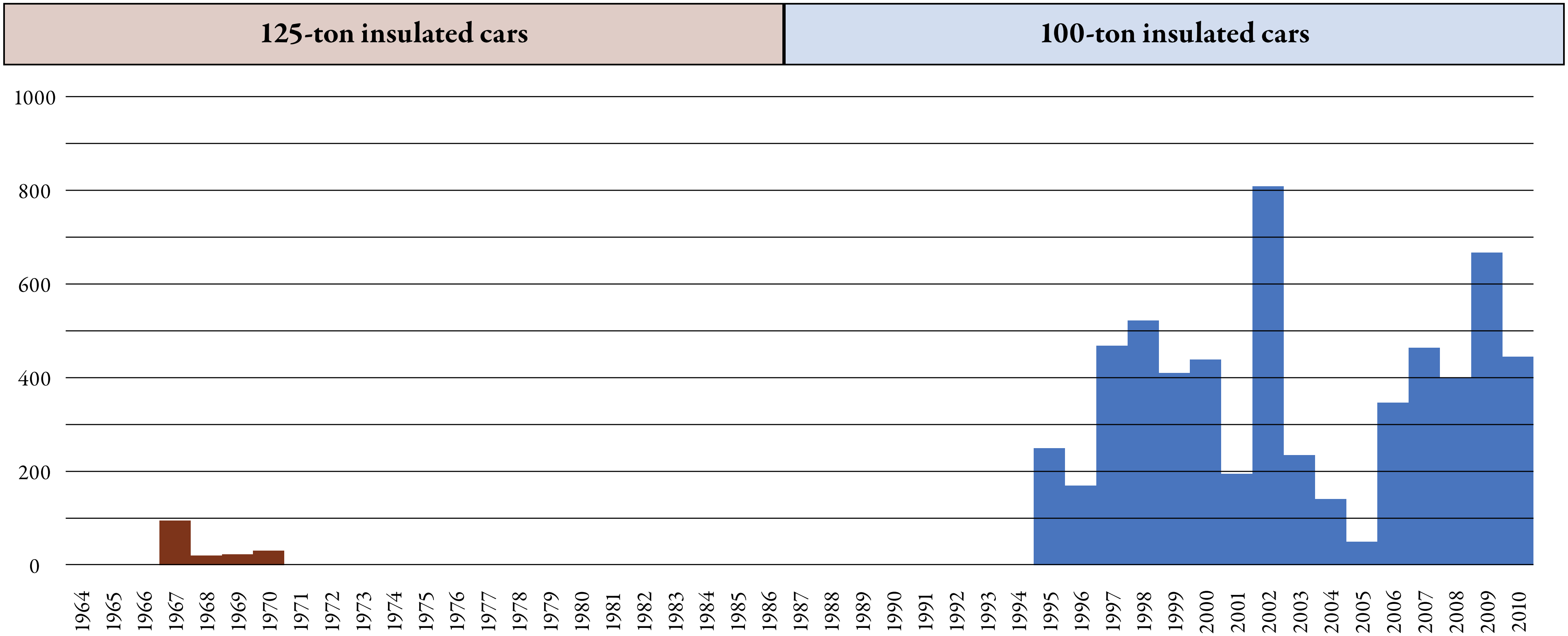
The following page shows the annual production of three other types of T108 cars. The two groups of 125-ton cars appeared fairly early, but were only produced in small numbers over short periods. There appears to have been a brief general interest in various types of 125-ton cars that lost its momentum by the mid 1970s.

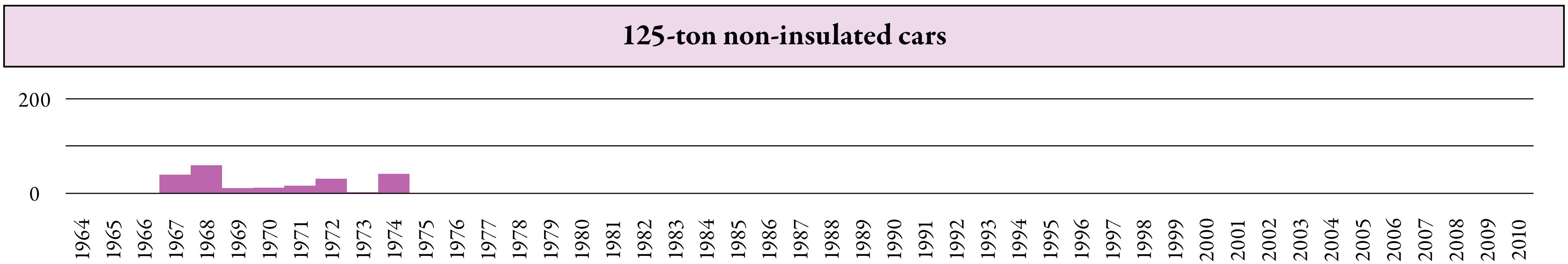
Insulated cars with 100-ton trucks did not appear until 1995 soon after an increase from 263,000 to 286,000 pounds gross rail load was allowed. For the most part, these represent a shift of existing business from smaller cars rather than new business. Some are used for biodiesel feedstocks.

100-ton non-insulated cars



These are mostly 263,000 pound gross rail load cars used for various petrochemicals and alcohols, and especially ethanol. The top twelve reporting marks in descending order are: UTLX, TILX, NATX, GATX, DBUX, PROX, ADMX, CTCX, SHPX, ACFX, ETCX, and CGTX. Total: over 57,000 cars.





The 100-ton insulated cars are mostly 286,000 pound gross rail load cars used for animal, vegetable or petroleum oils and waxes that would have been carried in 263,000 pound gross rail load T107 cars before 1995. The top six reporting marks in descending order are: ADMX, TILX, MBLX, AZXX, UTLX, and CRGX. Total: over 6,000 cars.

The 125-ton insulated cars are 315,000 pound gross rail load cars used for bitumen and asphalt. The top three reporting marks in descending order are: CONX, UTLX, and HPLX. Total: over 150 cars.

The 125-ton non-insulated cars are 315,000 pound gross rail load cars apparently used for petrochemicals. The top three reporting marks in descending order are: NATX, WMBX, and HPLX. Total: over 200 cars.