WHAT'S NEW FOR CARS:
IN TERMS OF LUBRICANTS AND FUELS

The past century has seen countless innovations made to cars and trucks to render them more reliable, powerful, comfortable, and economical. Despite all of these improvements to the design and manufacturing of automobiles, average fuel economy has been virtually stagnated. Cars like the antiquated Ford Model T were reportedly able to achieve up to 23 mpg (10.2 L/100km) [1] which is comparable to the estimated 24.6 (9.6 L/100km) combined mpg put forth by a 2020 Ford Edge [2]. Ostensibly, from those numbers, it is not a far stretch to come infer that automakers have not improved on the fuel efficiency of their cars in the past one hundred years; however, that is a fallacy.

Many innovations that would increase the fuel economy of cars such as advances in fuel and lubricant additives, engine efficiency and hybrid drivetrains have instead been offset by additions to the car elsewhere, such as via increased crash safety, amenities and engine performance. Since the early 1900s, when the Model T was in production, there has been significant improvements to fuel. Compression ratios in early gasoline cars were very low (4-5 bars) compared to modern vehicles, due in part to engine knock at higher compression levels of 11-13 bars. In order to reduce knock, fuel additives such as tetraethyl lead, alcohols, ethers and aromatics were developed to increase octane rating [3]. This has led to engines that are capable of much higher compression ratios which in turn leads to a higher engine efficiency. Examples of engines designed to take advantage of the higher knock rated gasoline include the Mazda Skyactiv-X engine which is able to achieve upwards of 16.3:1 compression leading to an estimated 60 mpg (3.92 L/100km). [4]

Lubricants have also improved in the past century leading to significant ameliorations in engine efficiency and reliability. Internal friction can lead to degraded performance which is why proper lubrication is necessary however early motor oils such as API SA and SB rated oils contained little (SB) to no (SA) anti-wear additives and very high kinematic viscosities. API SA and SB oils had only one SAE rating of 50 which is significantly higher than the 0W-20 and 0W-16 viscosities of modern SN and SN plus oils. This lower viscosity of modern oils allows for significantly better oil flow leading to better lubrication of crucial engine components. SN oils also contain detergents and a multitude of other functional additives that can lead to improved engine performance and economy due to less carbon and sludge buildup in the engine. The lower friction arises from reduced oil film thicknesses engendering the risk of wear, which was combatted by metallurgy, coatings and additives.

Forced induction, smaller-displacement "downsized" engines are becoming increasingly common in modern cars as opposed to the larger-displacement, naturally aspirated engines typically seen in older cars. The inline four-cylinder has become the most popular engine configuration overtaking V6 and V8 engine configurations. This is due in part to the introduction of reliable turbocharging, which can allow a smaller engine to achieve the torque and power numbers of a larger engine while allowing for the higher fuel efficiency ratings expected of a smaller engine. Advances to fuel injection have also made a noticeable increase to fuel economy as direct and port-injected cars tend to use less fuel at lower revs when compared to carbureted engines.

Many manufacturers around the world are incorporating hybrid technology into their powertrain design. Vehicles such as the Toyota Prius have long included hybrid drivetrains; however, as emissions and fuel economy standards, and CO_2 taxes, begin coming into effect car makers are looking towards mild hybrid setups, such as the one seen in the new Volkswagen Golf. These systems allow for a small battery and electric motor to propel the car when it is traveling downhill or on a highway. [5] In addition, these hybrid motors can provide stronger initial acceleration which can help offset the negative effects of smaller displacement engines, such as turbo lag, as electric motors are able to provide maximum torque instantaneously.

Ralph Nader's book "Unsafe at Any Speed", published in 1965, proved to be pivotal at causing drivers, automakers, and government officials to evaluate crash safety of automobiles. The following year the National Highway Traffic Safety Administration (NHTSA) was founded to reduce motorway related injuries and deaths. [6] Since then there has been a marked improvement to overall safety of cars on the road; however, there have also been sacrifices that have been made to protect the occupants of the vehicle. The Ford Mustang has increased in weight nearly 1,000 pounds (454kg) from 1965 to 2020 [7,8] with much of the weight going towards active and passive safety equipment such as airbags, chassis components, ABS, crashworthiness and crash mitigation systems, as well as stringent exhaust after-treatment devices. Although, these improvements have resulted in a reduction of more than half in vehicle mortality rating from 1966 to 2017 [9].

Another primary factor contributing to increased vehicular weight is supplemental amenities and comfort features. Henry Ford was infamously quoted as saying, in reference to the Model T, "Any customer can have a car painted any color he wants, so long as it is black." This is in stark contrast to modern vehicles which offer virtually endless options and features to accommodate to driver comfort and preference. With newer cars being equipped with features such as power seats, windows, and steering; noise insulation; air conditioning, and advanced suspensions with many more features available to be added as optional extras and especially on overmotorized cars. All these features contribute significantly to the weight of the car which, in turn, leads to a reduction in the overall fuel efficiency of the vehicle. [10]

As automakers grapple with increasing fuel economy standards, both in the United States, and abroad, it is likely we will start to see larger investments being put toward engine and automobile design. The new Safer Affordable Fuel-Efficiency (SAFE) act forces automakers to increase average corporate fuel efficiency to 33.2 mpg (7.08 L/100km). [11] This fuel economy increase will lead to many improvements regarding the design and construction of the cars we drive today and to the parts and fluid contained therein.

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