Global Light Vehicle sales were up just 0.2% in 2018 and the Volkswagen group was top for the third year. At best we remain at peak auto for 2019. Global plug-in electric sales growth was strong but still less than 2% of the total. Toyota Corolla is the bestselling model, sold in over 150 countries, but it's still only 1% of global car sales.

PASSENGER VEHICLES

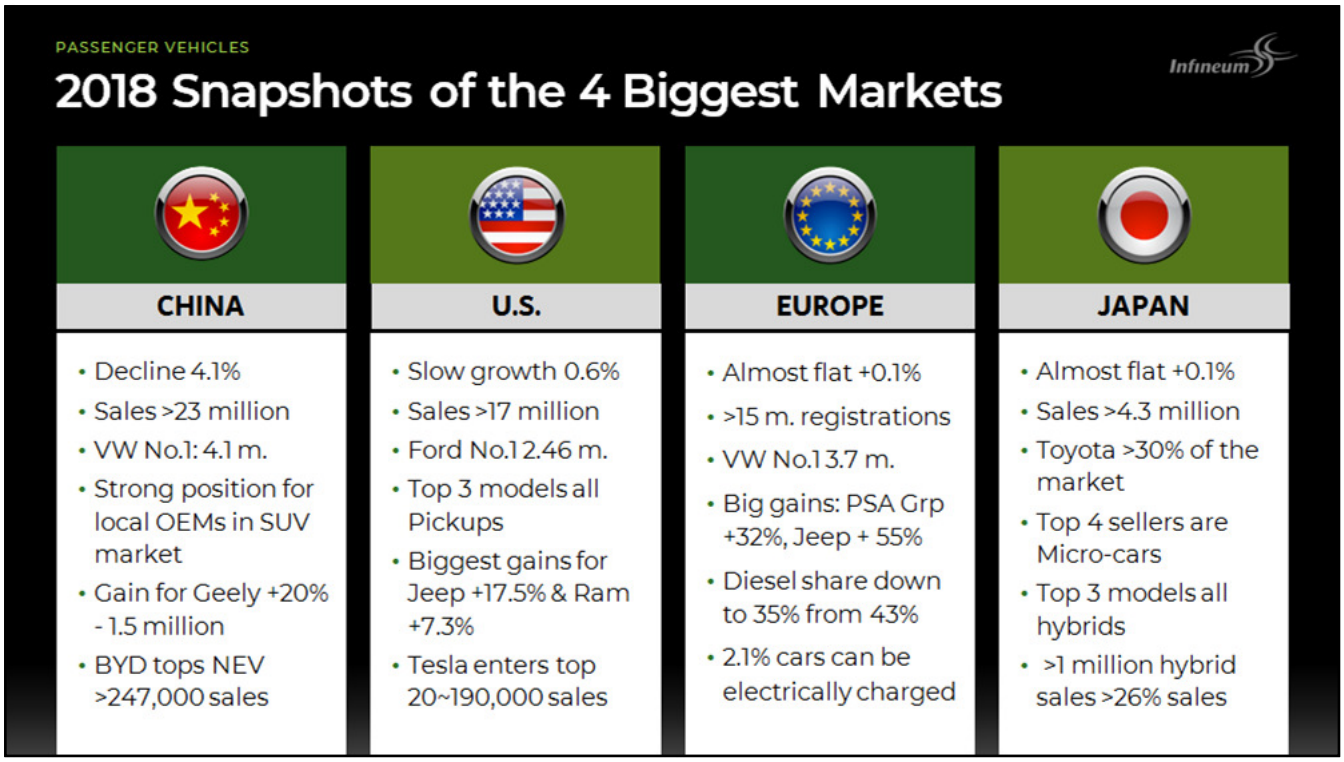
Top-Selling Vehicles Around the World in 2018

- **US:** F-150 – 909,330
- **Europe:** VW Golf – 502,752
- **Japan:**
  - Micro car: Honda N-Box – 241,870
  - Standard: Nissan Note – 136,324
- **China:**
  - Sedan: VW Lavida – 503,800
  - SUV: Haval H6 – 452,600

Ford F-150 retains the US top spot

Image: Ford Motor Company

Regionally sales reflect market preference. In the US and Europe, the Ford F-150 and The Golf win again. In Japan, the top three sellers were all micro cars led by the Honda N Box. In China, while the same models led as last year, sales of both were down from 2017.

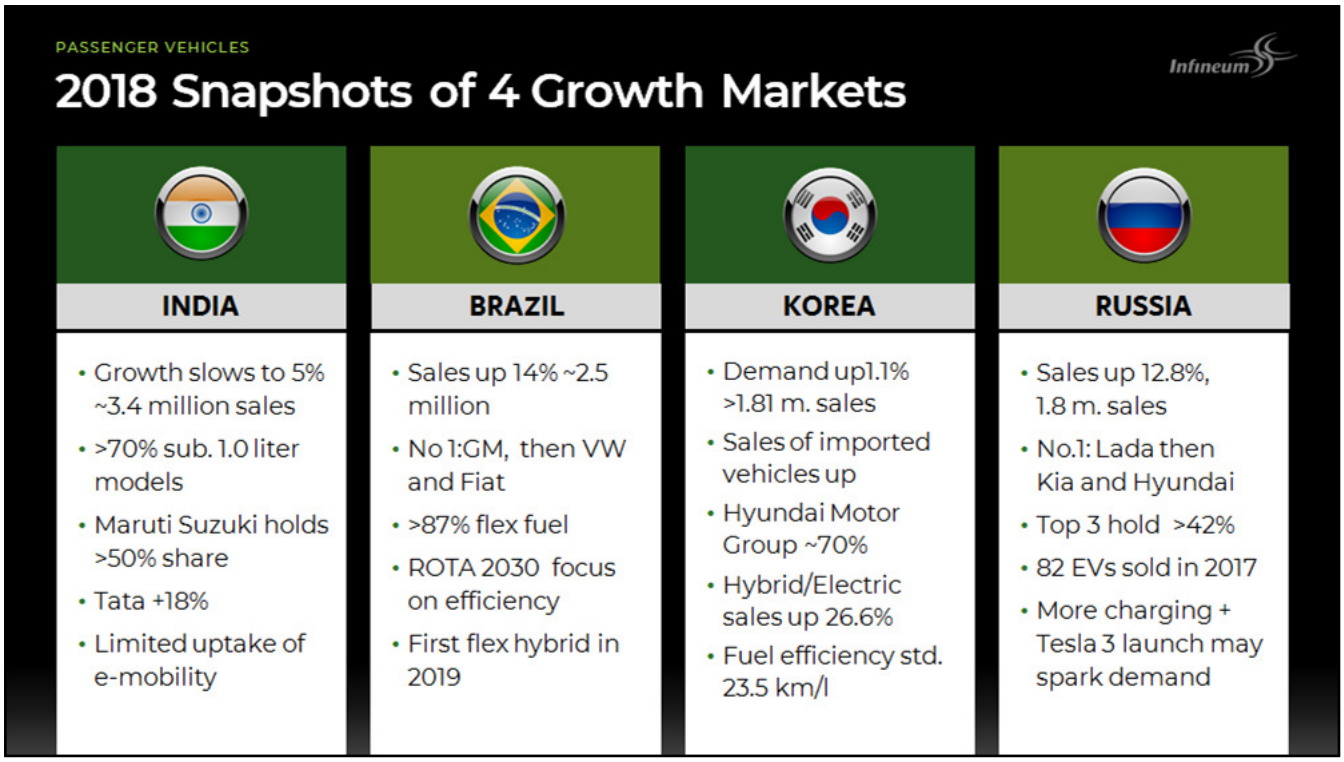


Looking at the four biggest markets in 2017…Total passenger car sales in China were down on 2017 but still more than 23 million. VW retained its no 1 position, and local OEMs enjoyed a strong position in the SUV market. Geely for one saw very strong growth despite pressure from global JVs. NEV sales flew past the million mark, with BYD claiming the top spot.

US sales remain stuck at just over 17 million. Ford remains number 1 but the real winners were Jeep and RAM. Tesla moved rapidly into the Top 20, by the end of the year the Model 3 was the highest monthly revenue vehicle… let's see if it stays there.

Europe saw a 5th consecutive year of slow growth. VW retains the number 1 slot, but big gains were had by PSA Group and Jeep. Diesel registrations dropped 8% and alternative powered vehicle sales were up almost 30%.

In Japan sales remained almost flat at 4.39 million., Toyota sold the most cars, but in a first for 50 years, Nissan claimed the top selling model spot with its compact Note hybrid, equipped with Nissan's e-POWER electric powertrain. Toyota's Aqua and Prius models followed closely behind, all 3 being hybrids. Sales of electric and hybrid vehicles were up 11% on 2017, and hybrids account for a quarter of total vehicle sales in Japan.

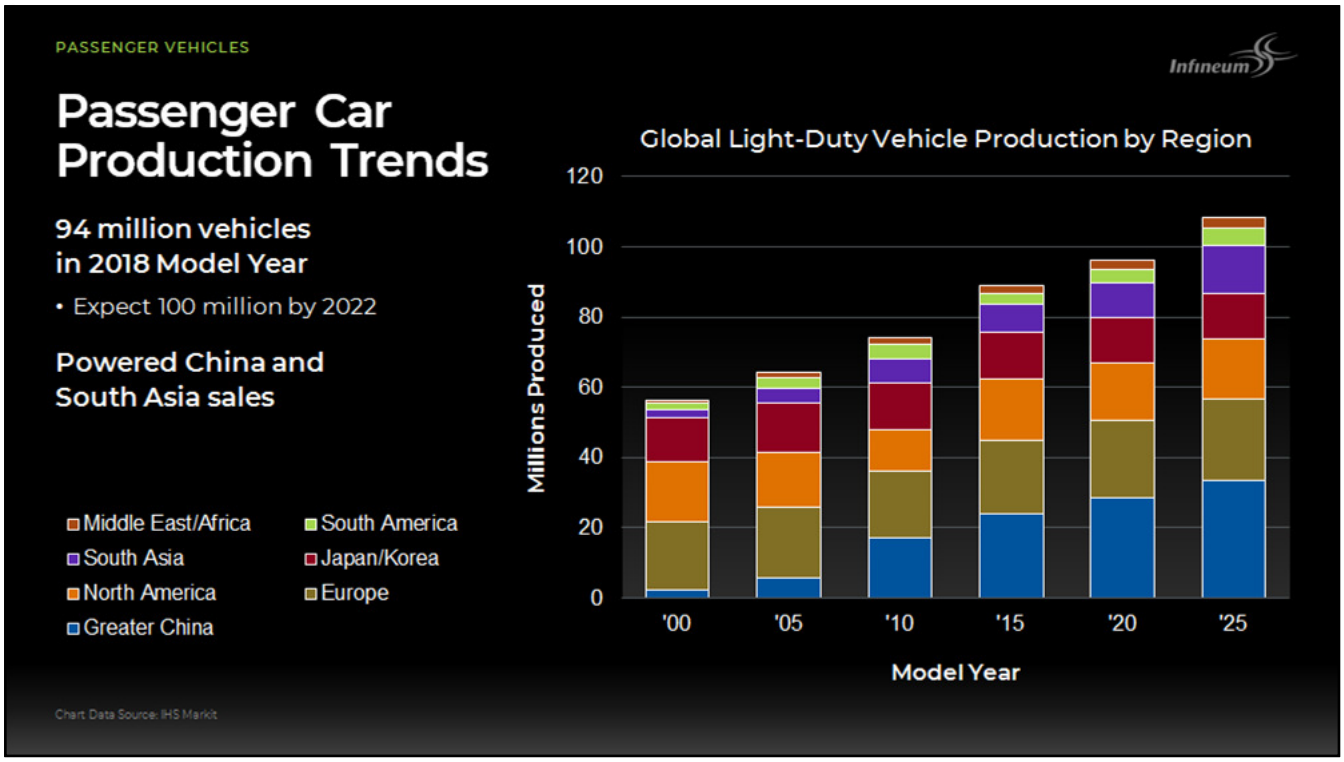


In India, Passenger car sales were up 5%. Small sub. 1 liter vehicles are the most popular, with Suzuki holding the number 1 slot, although Tata saw strong growth in 2018. Electrification is unlikely to be a big part of the drive for improved fuel economy in this region, owing to lack of infrastructure and driving profiles.

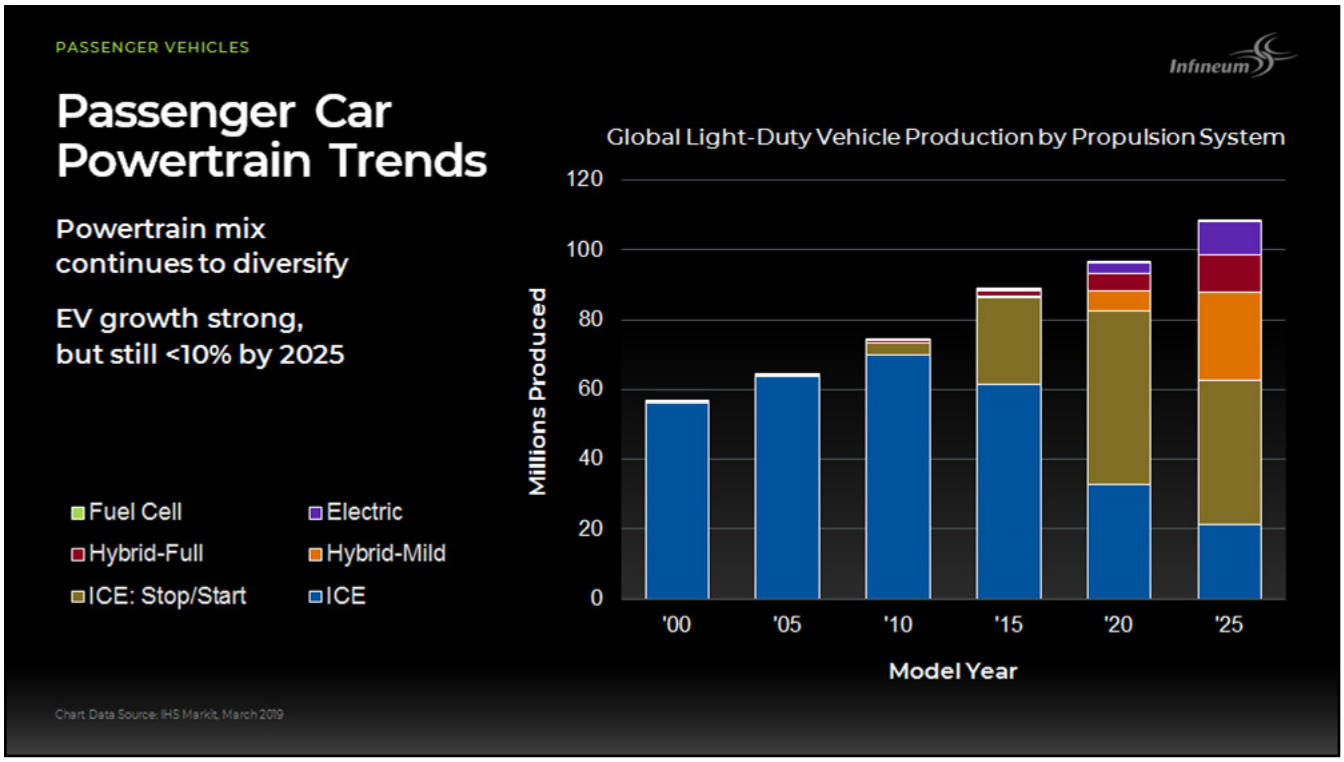
As the Brazilian economy continued to recover from its 2016 slump, car and light sales were up and 2019 looks like another year of growth. GM retained the #1 position, with the FCA brands of Jeep and Fiat combined in 2nd and VW in 3rd. A new incentives program will give tax reductions to OEMs advancing vehicle efficiency and will also include tax reductions for hybrid and electric vehicles. Toyota is expected to launch the first Brazilian hybrid flex engine in 2019, most probably in the Corolla.

In Korea light-vehicle sales were up with sales of imports up 11.6%. Hyundai and Kia remain 70% of the market. Green car sales were over 123,000, ~ 7% of sales. California emissions standards apply for gasoline and LPG vehicles and Euro 6 for medium diesel vehicles. New fuel economy standards phase in by 2020.

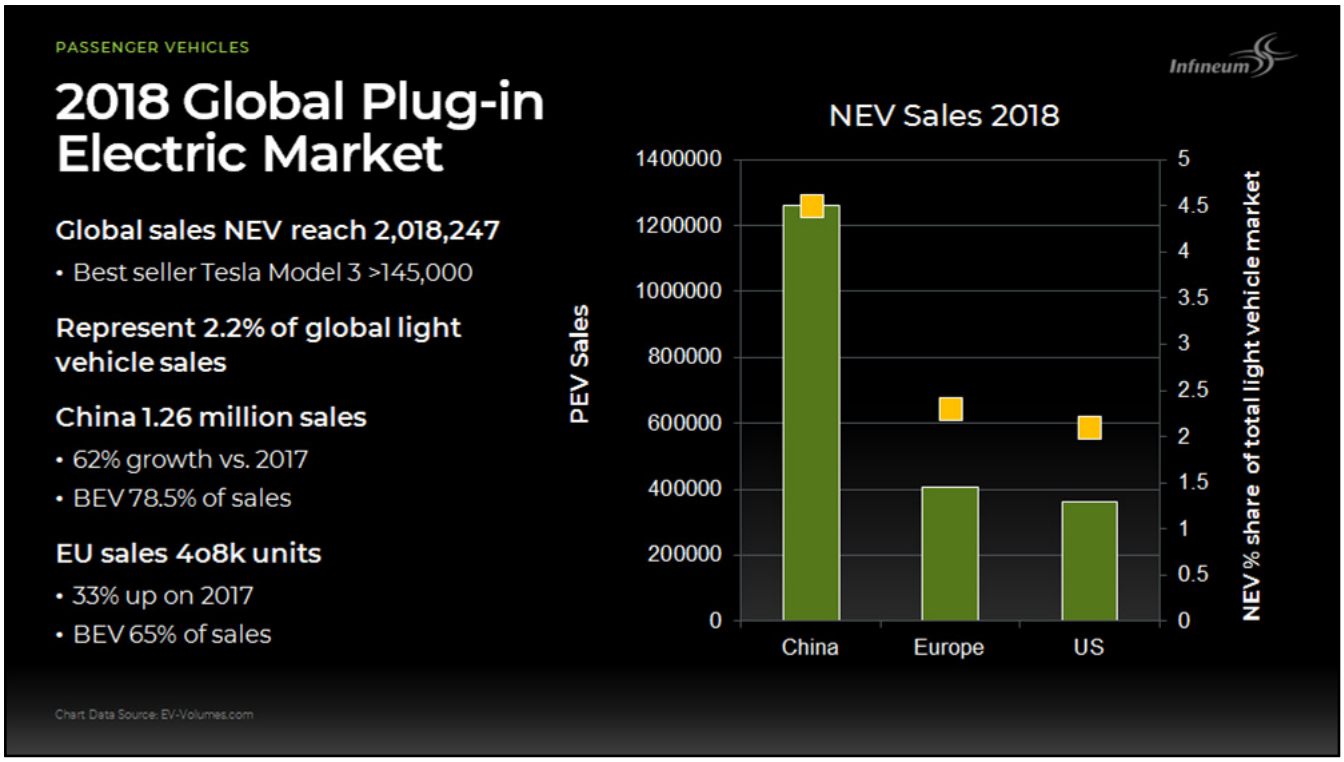
In Russia, demand was up in 2018 with Lada retaining the number one spot. Euro 5 applies to all light-duty vehicles and 10ppm sulfur fuels are mandated. The move to electric has not sparked yet in Russia, with only 53 charging stations in Moscow and only 82 EVs sold in 2017, pushing the country's total to 1,771. But plans from MOESK to triple the charging stations in 2019 and the introduction of the Tesla 3 Model could intensify demand.



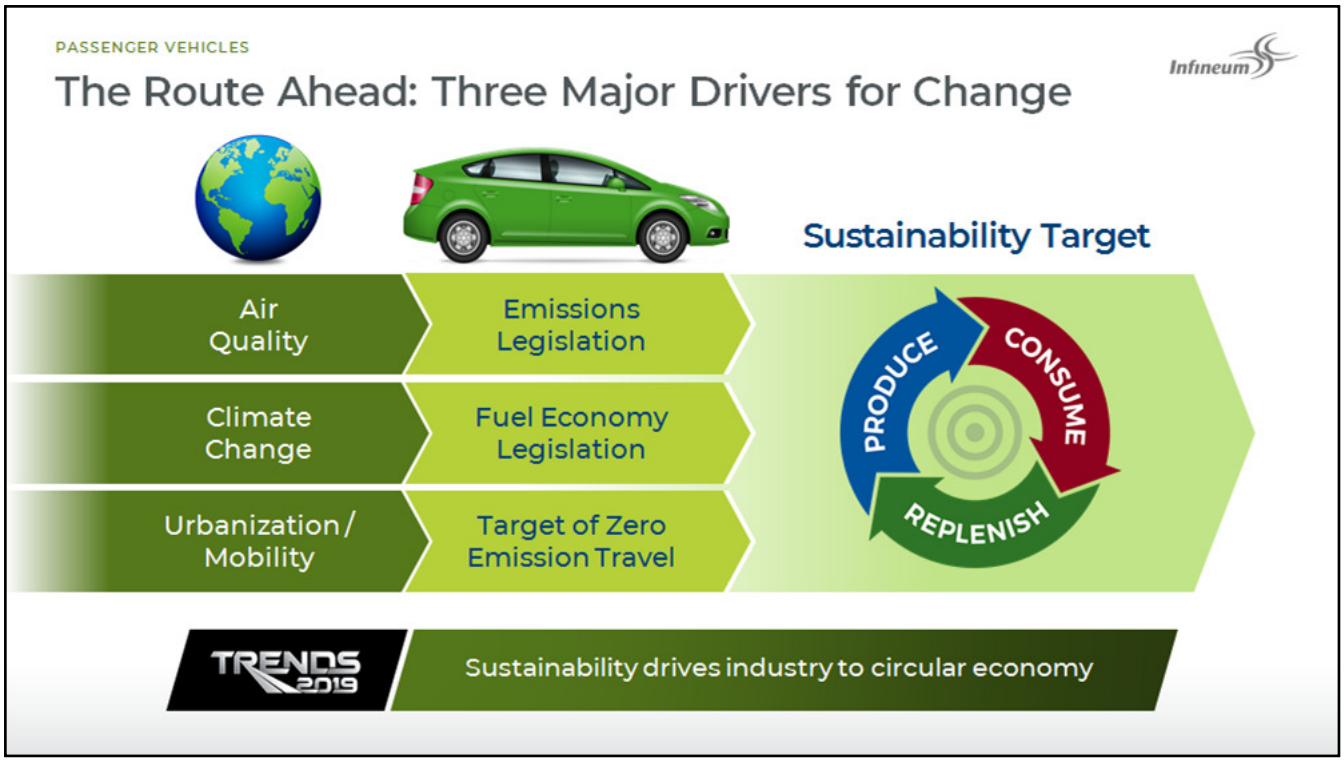
Looking forward, growth in Asia will continue to power total vehicle sales upwards, towards 100 million units annually.



Globally, the decline of ICE-only powertrains is steady, but stop-start and hybrids fill much of the void. By 2025, only about 6% rely solely on electricity.

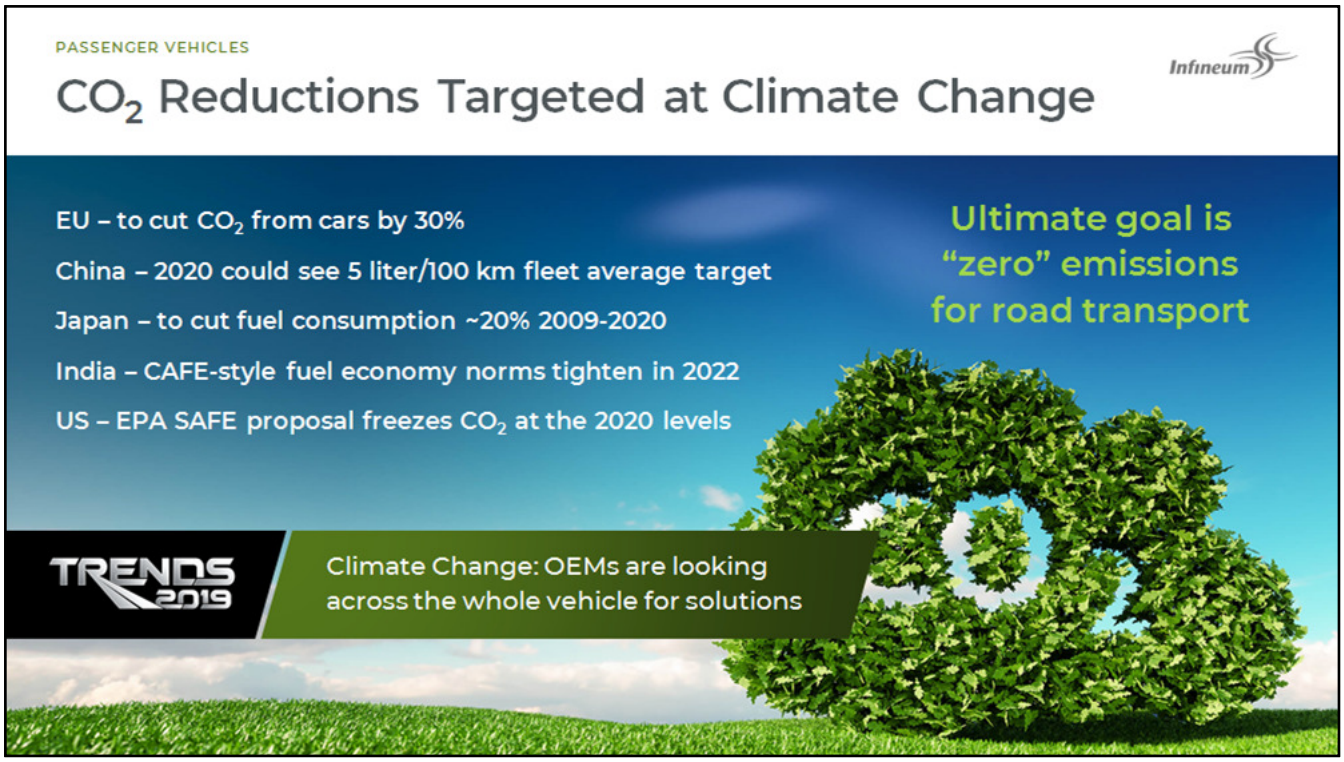


In 2018, NEV sales rose above 2 million, or about 2% of global light vehicle sales. But regionally, variations are huge, with demand driven in some regions by mandates and incentives but also constrained in others by high electricity costs and lack of a charging infrastructure. In China, NEV sales exceeded the million mark reaching 4.5% of car sales with battery electrics accounting for nearly 80% of NEV sales. In Europe, sales were up and battery electric vehicles are gaining popularity over plug-in hybrids, due to revised taxation schemes.



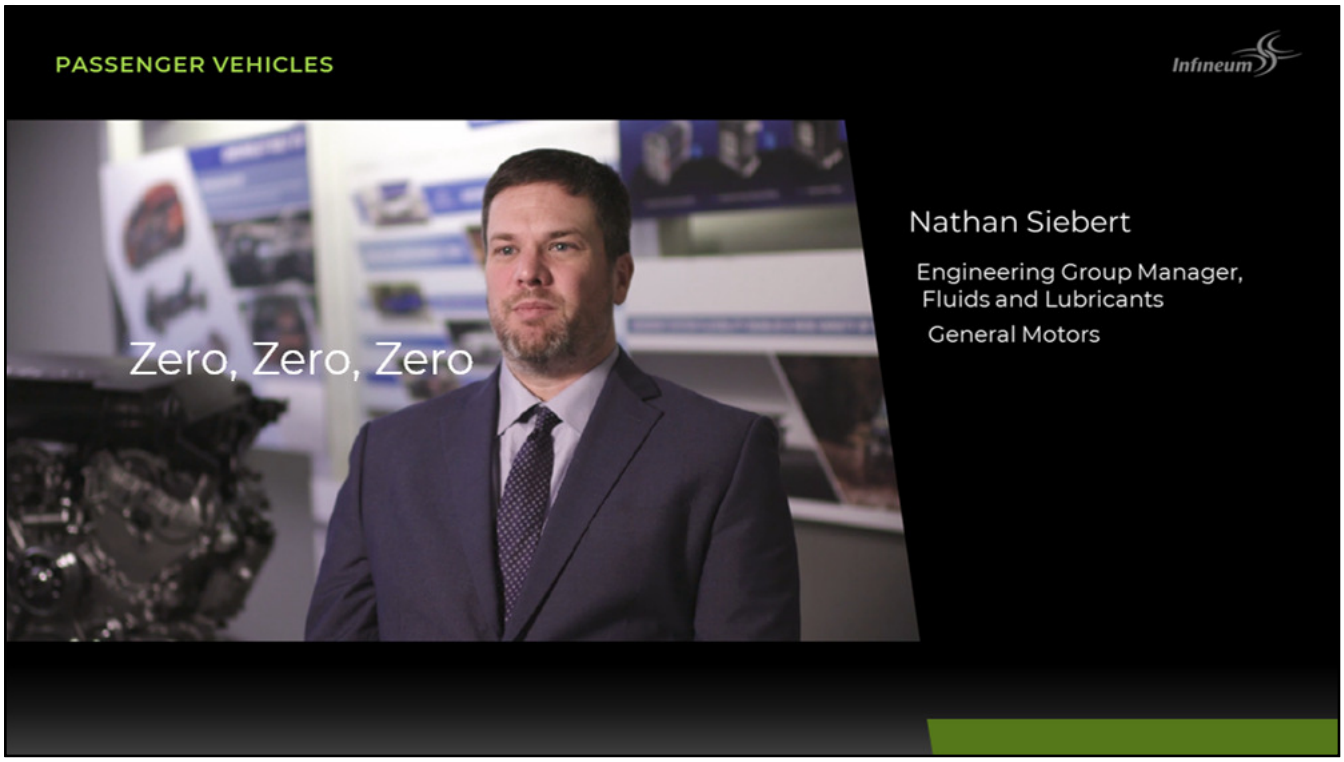
Three very well-established drivers are shaping the latest technology developments in the automotive sector. Air quality, particularly in major cities is driving the introduction of more stringent tailpipe emissions standards. Climate change is driving the need to cut emissions of greenhouse gases resulting in legislation to lower fuel consumption. And as more of the world's population is concentrated in cities vehicle ownership patterns change and we work towards zero emissions travel. Sustainability means exploring new ways to gain as much energy as possible from the vehicle and then at the end of its useful life, to enrich or return it, giving us the ability to continue a defined behavior indefinitely. A truly circular process.

Across the world tighter emissions limits are being mandated and we can see a move to US Tier 2/3 and Euro 6 type regulations in many regions.



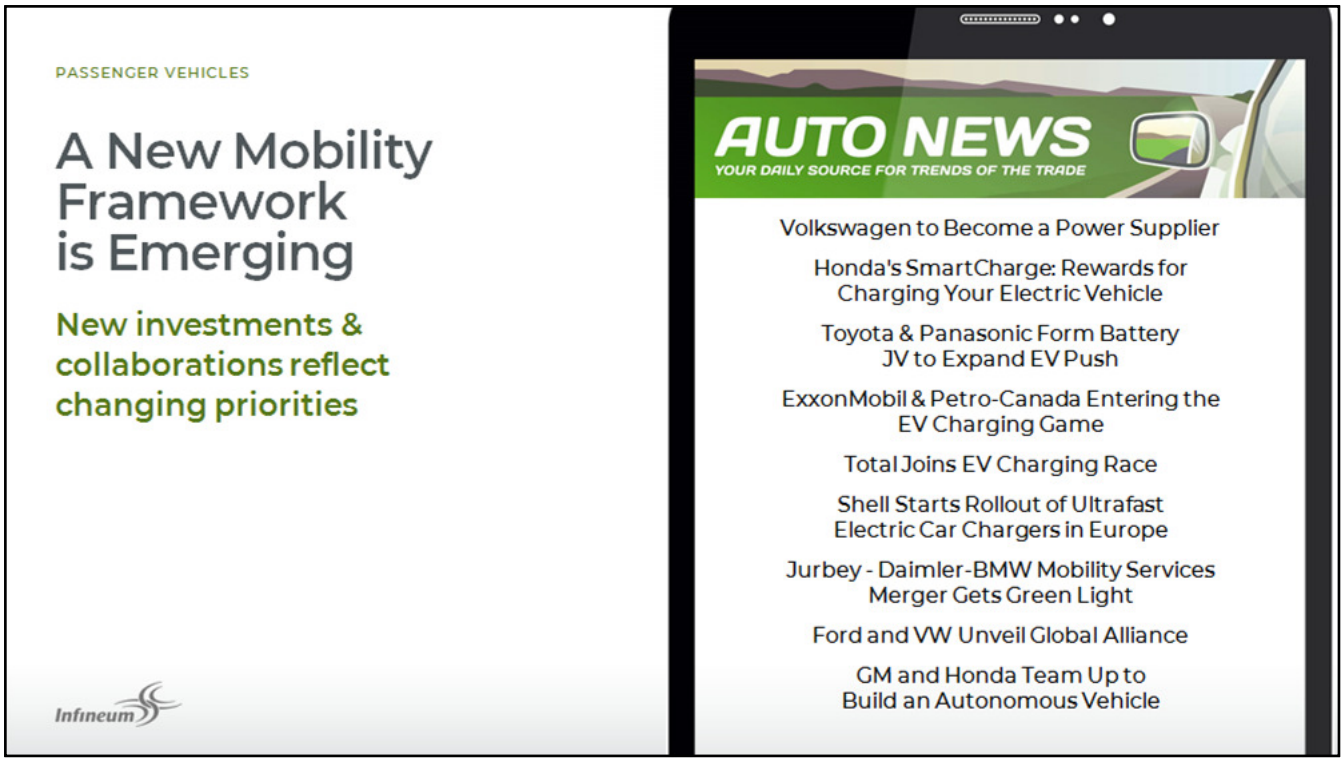
Globally, the trend is to try and control the rising temperature of the planet, by reducing GHG emissions. Although the new EPA "Safer Affordable Fuel Efficient" (SAFE) Vehicles proposal for MY 2021-2026, only freezes CO2 limits at 2020 levels, OEMs are still looking across the whole vehicle for solutions.

By 2030, forecasters suggest two thirds of the world's population will live in cities and these urban centers will evolve with imperative climate control and technical advances. While ambitious, striving towards "Zero Emission Travel" is emerging as the ultimate target.



Let's hear from Nathan Siebert of GM, about their CEO's vision of the future.

Nathan Siebert: "GM's chairperson, Mary Barra, has been quite clear on GM's future vision of Zero Crashes, Zero Emissions and Zero Congestion."



Innovation does not stop with the vehicle OEMs and Oil Cos are working hard to overcome some of the barriers to electrification, in particular, charging. OEM collaboration is also increasing, driven by the sheer cost and technological burden of developing electric vehicles and other advancements such as self–driving cars. These are just a few of the headlines.

PASSENGER VEHICLES

Improvements in ICE Technology Continue

Mazda: SKYACTIVE-X Spark Controlled Compression Ignition

- 30% more torque, 20-30% better FE than current gasoline engine
- Available in 2019 in the Mazda3

Toyota Dynamic Force Engine

- 40% thermal efficiency, higher torque, fuel efficient

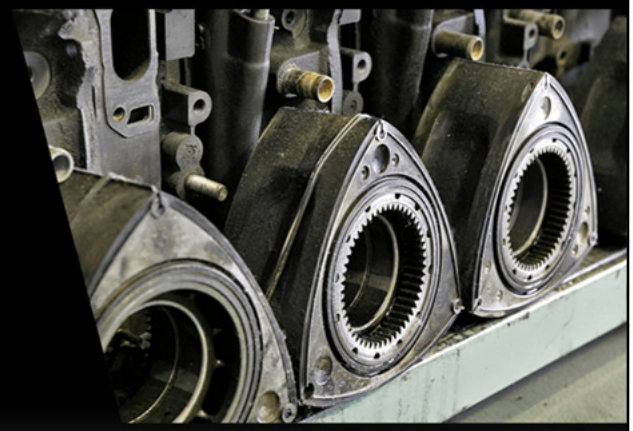
Daimler: New inline 6-cylinder petrol engine

- Launches in 2019 in S-Class

Nissan: Variable compression turbo

- Available in the 2019 Altima

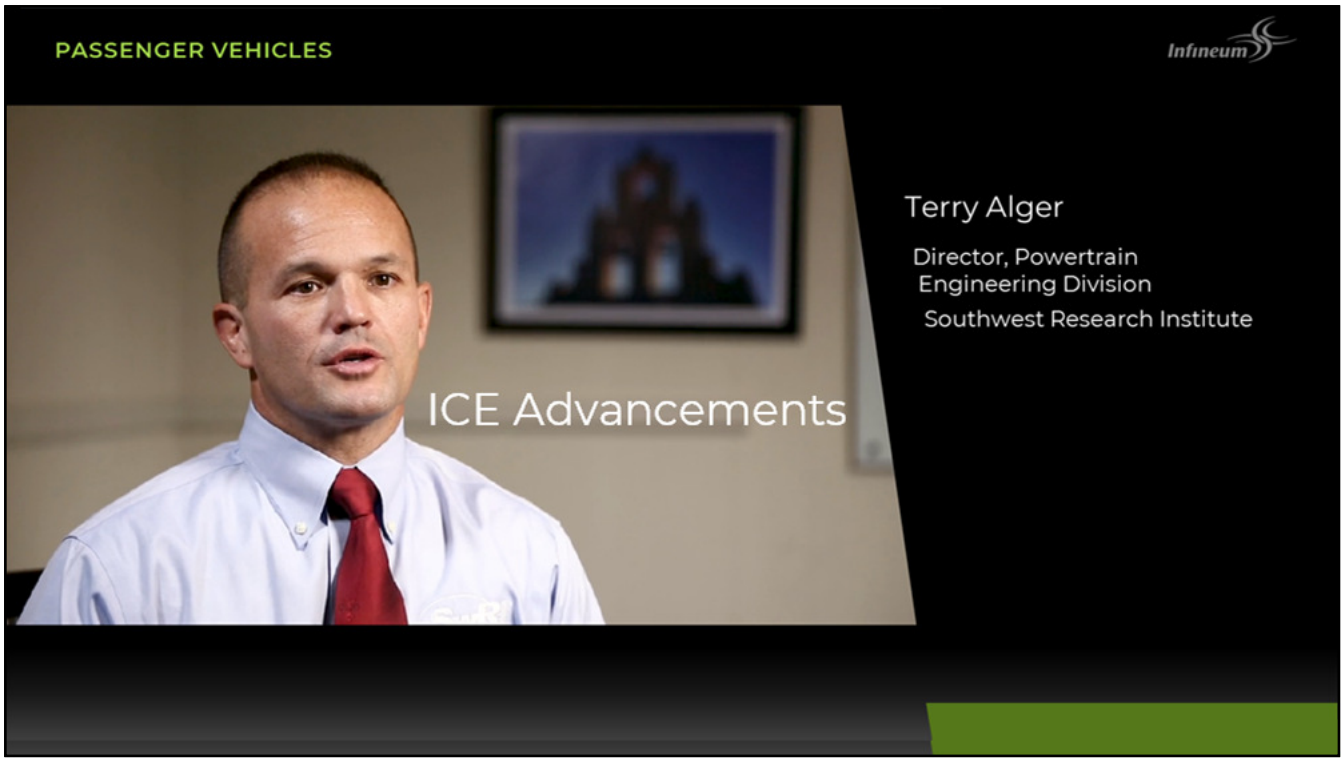
GM: 2019 Silverado can run on 2-cylinders



The focus for innovation is undoubtedly on EVs but there are still major advances in ICE designs. Mazda's gasoline Skyactive-X engine offers the best of diesel and gasoline engines, with more power, better real-world fuel economy and fast response, and it has been designed to work as a standalone power unit or in hybrid vehicles.

Toyota's new 2.0-liter Dynamic Force gasoline engine achieves higher torque and fuel efficiency through high-speed combustion technologies and a variable cooling system to achieve improved thermal efficiency. Daimler has introduced a new inline 6-cylinder engine with intelligent turbocharging and an Integrated Starter-Alternator, offering the same performance as an 8-cylinder, but much more fuel-efficient.

Nissan's, variable compression ratio, turbo 4-cylinder engine, which generates the performance of a V6, moves to mass market in the 2019 Altima. GM's new full-size pickups will be the first to offer a turbo-4, that can run on 2 cylinders and saves 380 pounds over the current models with the 4.3-liter V-6. The theme is the same, smaller displacement engines without sacrificing power or efficiency.



Terry Alger from the SwRI Powertrain and Engineering group takes us through just a few of the key recent advances.

Terry Alger: “The largest, most prevalent trend in passenger car engines right now is turbocharging. The days of extremely high brake mean effective pressure levels in these engines are probably over though, as companies are more focused on right-sizing the engine to match the specific power with the efficiency and performance requirements of the vehicle. Some companies have gone with Miller-cycle operation, either late intake valve or early intake valve closing events, usually combined with variable valve trains to recover some of the performance challenges that Miller-cycle offers. Other companies have gone with high-dilution levels of cooled EGR to try to mitigate knock and reduce the performance degradation that comes with knock. Other companies this year have come out with the first mass produced variable compression ratio engine. This engine started off in a premium segment vehicle, but it's making its way into the mass market vehicles in the sedan category.”

PASSENGER VEHICLES

ICE Innovations for Hybrids

INFINITI energy recovery system

- Instant electric torque & lag-free acceleration
- Scavenges & recycles heat and kinetic energy

Daimler hybrids and EQ Boost

- 48V system powers components & boosts engine improved efficiency and drivability
- Plug-in Hybrid with 50km electric only range

Mazda brings back the rotary engine

- Paired with battery as range extender

Infineum

Top Image Source: INFINITI Motor Company Ltd.

In the Hybrid world we are seeing a number of innovations. The prototype, Project Black S powertrain from INFINITI, uses the world's first dual hybrid Energy Recovery System, delivering instant electric torque and lag-free acceleration alongside a turbo-charged V6 ICE, by scavenging and recycling both heat and kinetic energy, under braking and acceleration. Daimler plans to electrify its entire fleet by 2022 beginning with hybrids and is introducing new technology under its EQ brand. EQ Boost, adds a 48 Volt electrical system that supplies power to the water pump and air-conditioning compressor, and can boost a conventional engine for short periods with an additional 22 hp, increasing the vehicle's efficiency and its driving dynamics. Mazda plans to launch its first hybrid in 2020 as part of its "Sustainable Zoom-Zoom 2030" program, it's taking a different approach to many, by pairing a battery with a range extender rotary engine.

PASSENGER VEHICLES

Hybrid Lubrication Challenges

Infineum

New Operating Conditions

Increased start/stop stress
Cooler operating conditions
Fuel/water contamination

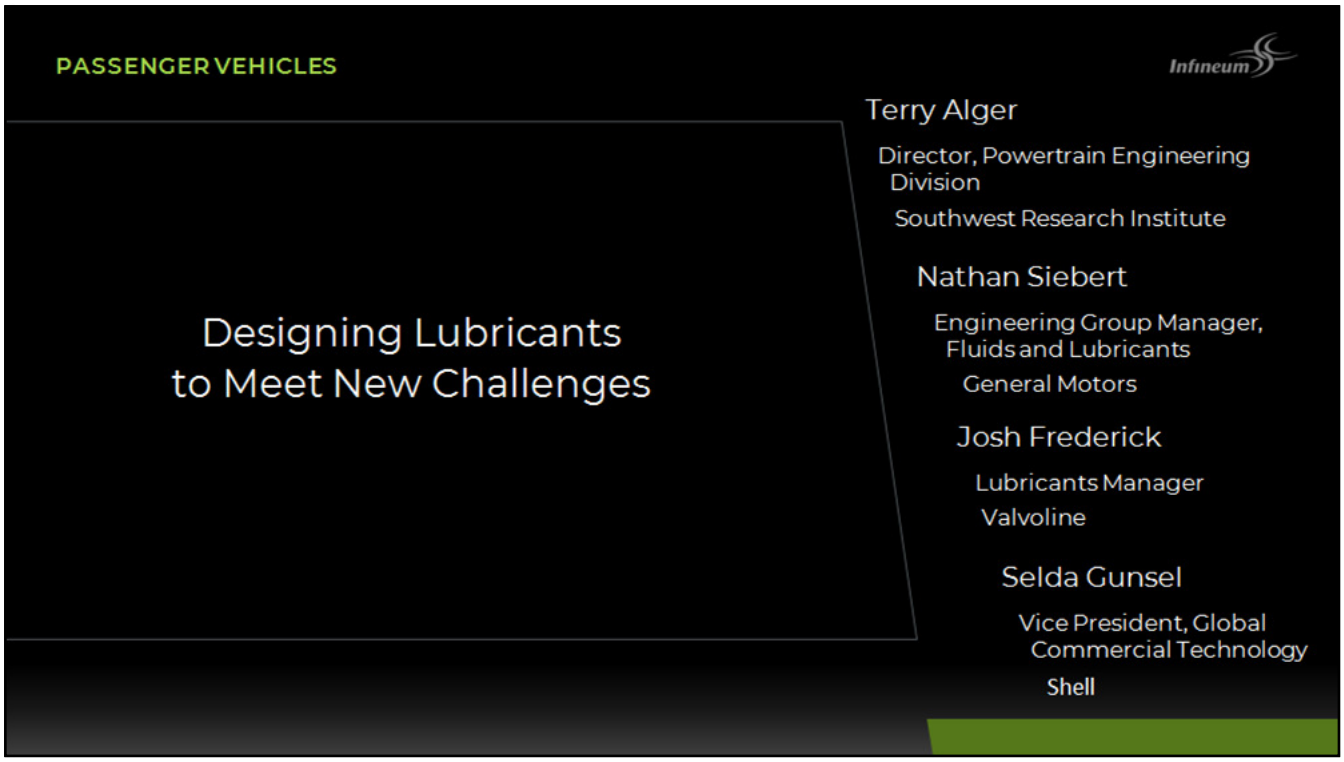
Lubricant Technical Challenges

Fast cold start response
Higher thermal loading
Cleanliness & wear protection

TRENDS 2019

Co-development of hardware with the lubricant is increasingly important

Hybridization introduces new operating conditions and brings new technical challenges for the lubricant. Increased start/stop activity puts more stress on the engine and cooler operation is observed. Water-in-oil contamination is a potential issue and increased fuel levels may introduce fuel dilution challenges for the lubricant. Co-development of the lubricant with the hardware is now more essential than ever.



Getting past the first reaction of reduced fluid volumes for EVs we now all realize the lubrication needs are very varied and challenging. We tried to capture this with a set of interviews including Terry Alger, Selda Gunsel from Shell, Josh Frederick from Valvoline and Nathan Siebert.

Terry Alger: "What we see is a trend towards the cheapest possible solution that gets you the regulatory impact that's desired. So, in this case we anticipate a large influx of mild hybrids, and 48 volt architecture being important to that, with a relatively small battery pack so that you can get the fuel economy benefits of having a hybrid without the tremendous cost associated with a full size battery pack and electric motors. "We anticipate that electric vehicles will have very unique fluid needs. The first is that if you have a plug-in hybrid you're going to see the engine operating much less frequently and for shorter periods of time than you would in a typical non-hybrid application. This means that the engine oil is going to be exposed to a lot more harsh operating conditions, often with much more condensed water in the oil, and also some partial products of combustion that it would not normally see. So we anticipate the oil's going to need to deal with those problems.

Nathan Siebert: "The industry has focused on electrification and hybridization. While this will have some effect on fuel retention and water dilution, I think the industry is missing GM's focus on autonomous vehicles and the effects that that will have on future lubricant needs."

Josh Frederick: "We certainly have the work cut out for us in the immediate term with engine oils that provide better fuel efficiency and better protection for modern engines. Looking further down the road as electrification gains more traction, certainly some of these EVs will not use engine oil. However, as a class, many of them will use driveline fluids and coolants that will be highly-engineered fluids. In other words, highly-engineered fluids are going to be a component of transportation for the ongoing future. "

Terry Alger: "In addition to the lubrication challenges, battery coolant is going to be an area where a lot of new work is going to need to happen. The batteries are challenged when they're exposed to operating conditions outside their nominal. At Southwest Research Institute we like to compare batteries to people: people are very happy at 75 degrees, and once you get away from 75 degrees, you have a big challenge. So, the new cooling concepts are going to be focused on keeping batteries inside a tightly controlled window."

Selda Gunsel: "The latest lubricant technology, such as low viscosity high performance synthetic lubricants, can improve fuel economy and reduce CO2 emissions of the vehicles on the road today without the need to buy a new car or change the entire vehicle fleet. We see opportunities to offer specialty e-fluids to address the specific performance needs of electric vehicles and we are working with car manufacturers around the world on new transmission fluids, coolants, greases and process oils designed specifically for electric vehicles."

PASSENGER VEHICLES

North American Viscosity Trends

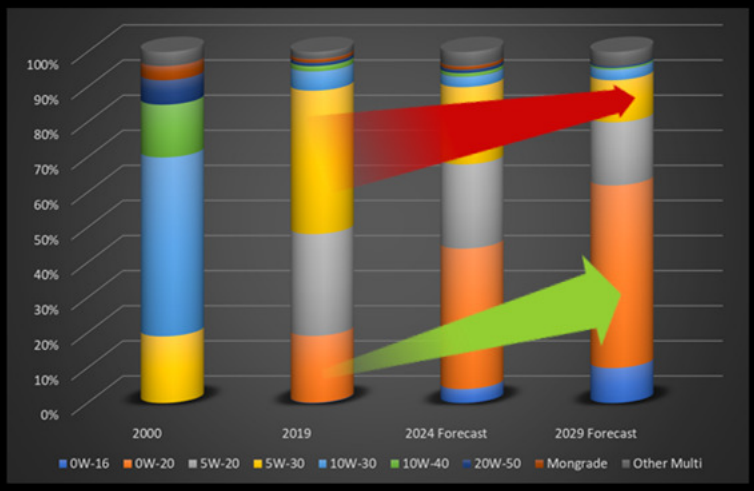
SAE 5W-30 dominant reign ending

Lower viscosities continue to grow

- For MY2018, SAE XW-20 recommended grade
- Significant growth for 0W-20

SAE 0W-16 is niche and growing slowly

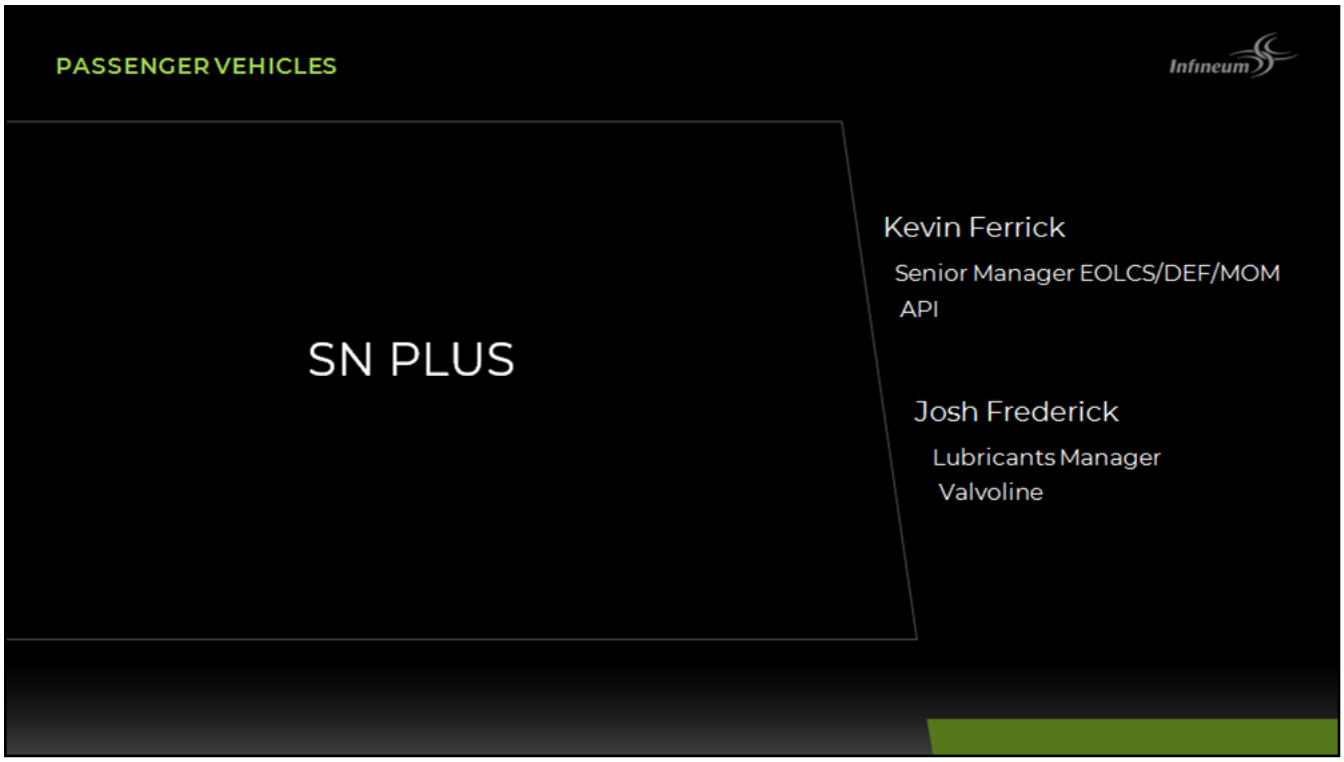
Move to 0W-XX increases Grp III use but creates more complexity



In viscosity trends, SAE 5W-30 remains the dominant grade in 2019 but it won't last much longer. For MY2018, the recommended viscosity is typically XW-20 across US OEMs.

Non-existent in 2000, SAE 0W-20s will be close to 20% by YE 2019 & XW-20 is nearly 50% of PCMO market. SAE 0W-16 is niche but as OEMs use it for new vehicle certifications and factory fill, demand will develop. Moves to 0W grades are increasing Grp III use. Additional base oil options now exist but this creates more qualification work and complexity.

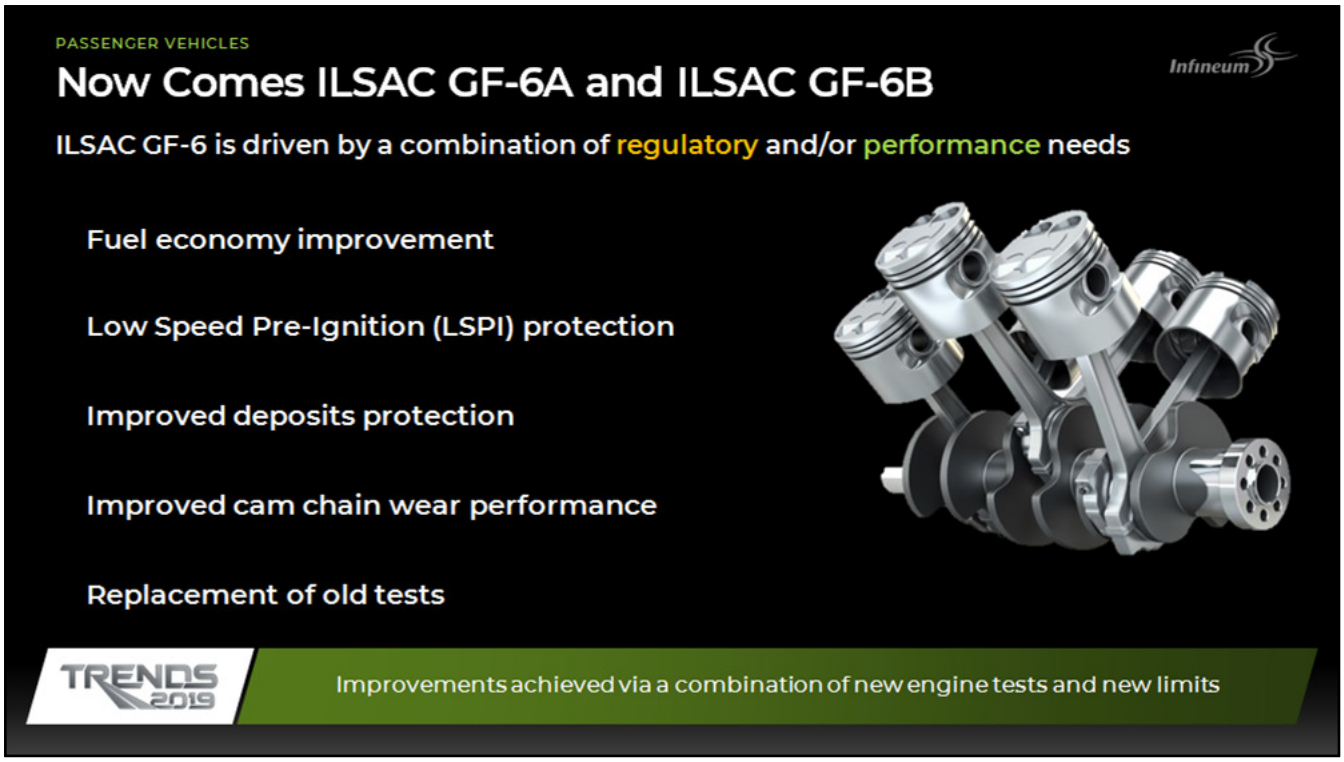
Last year we saw the introduction of API SN Plus and these products are now widely available. They have reduced levels of Calcium and employ higher levels of Magnesium, compared to the API SN products they replaced. The ASTM testing system and API SN PLUS certification program have worked well and delivered products to the marketplace that provide better LSPI protection.



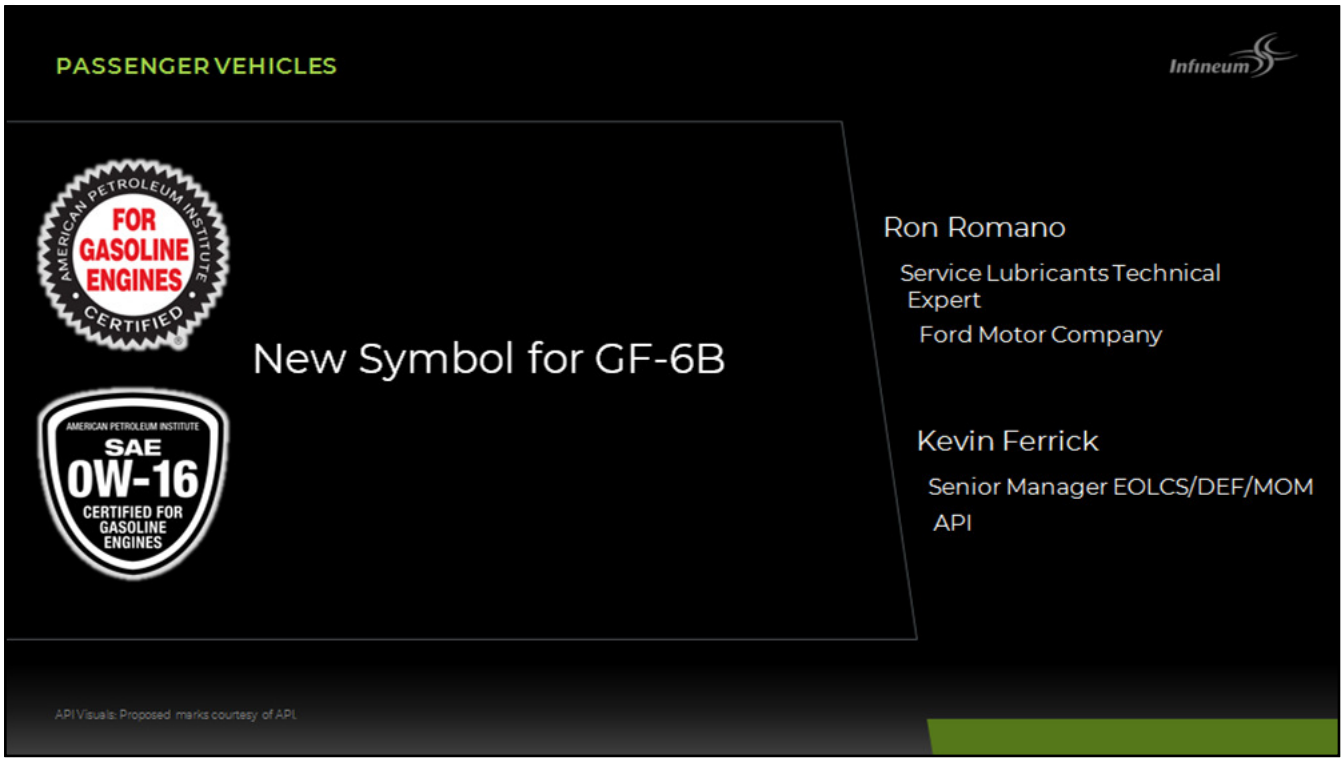
Let's hear from Kevin Ferrick from API and Josh Frederick about the roll out of SN PLUS.

Kevin Ferrick: "I think the SN PLUS introduction went well. API has licensed more than 2,500 oils that meet the requirements for the classification. This is a good step toward reducing the incidence of Lube related LSPI."

Josh Frederick: "We were greatly encouraged by the manner in which all parties worked together to deploy the SN PLUS supplement last May. We feel like this was a prudent move in order to protect engines in the field from catastrophic failure. At this point, we don't see any reason that the SN PLUS deployment will have any effect on the GF-6 timeline."



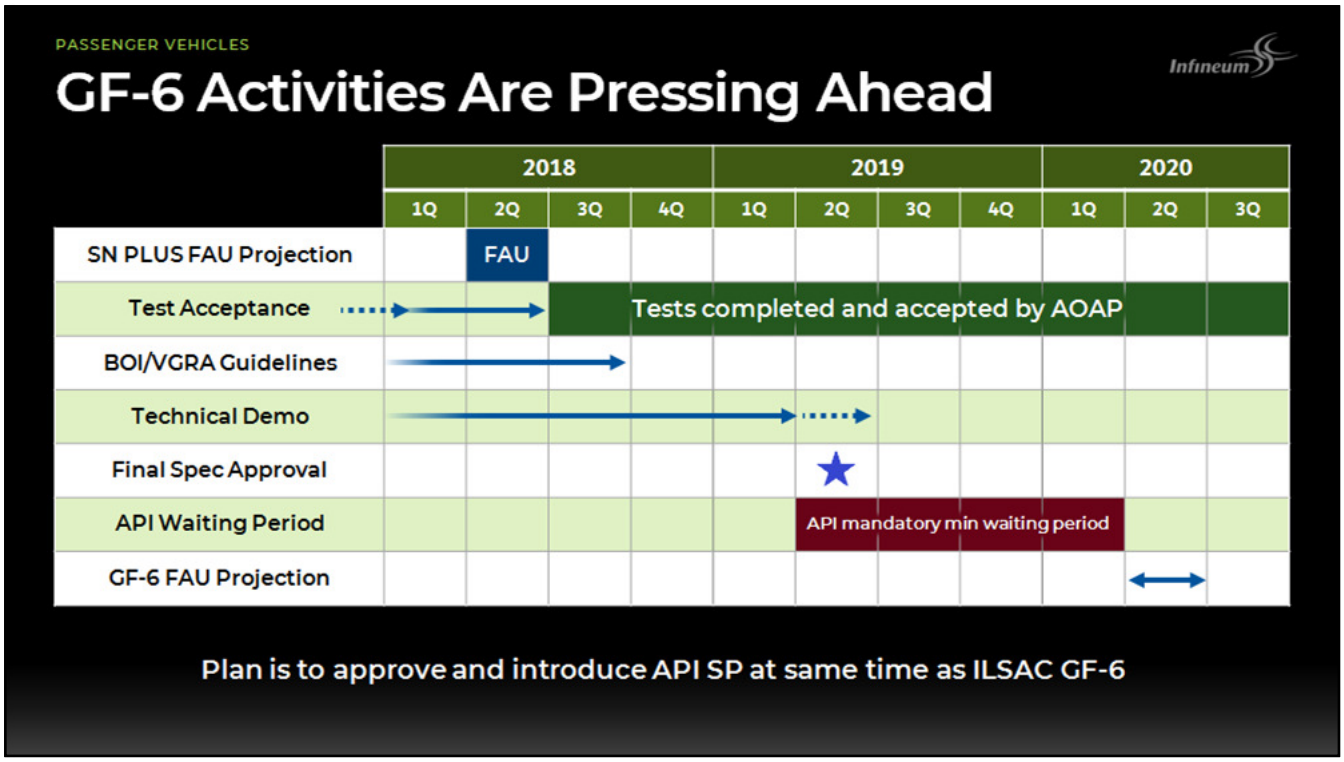
And here comes GF-6, with new and replacement tests to meet the new regulatory and performance needs. Fuel economy improvement is needed to help meet higher MPG CAFE targets and deliver ILSAC GF-6B for lower viscosity oils (0W-16). Low Speed Pre-Ignition (LSPI) protection is required for modern turbocharged engines. Improved deposits protection is driven by smaller hotter engines. Improved cam chain wear performance developed from a need that was not addressed in today's engine tests. Also, the challenges of continuing to supply several test with aging hardware drove the replacement of some old tests.



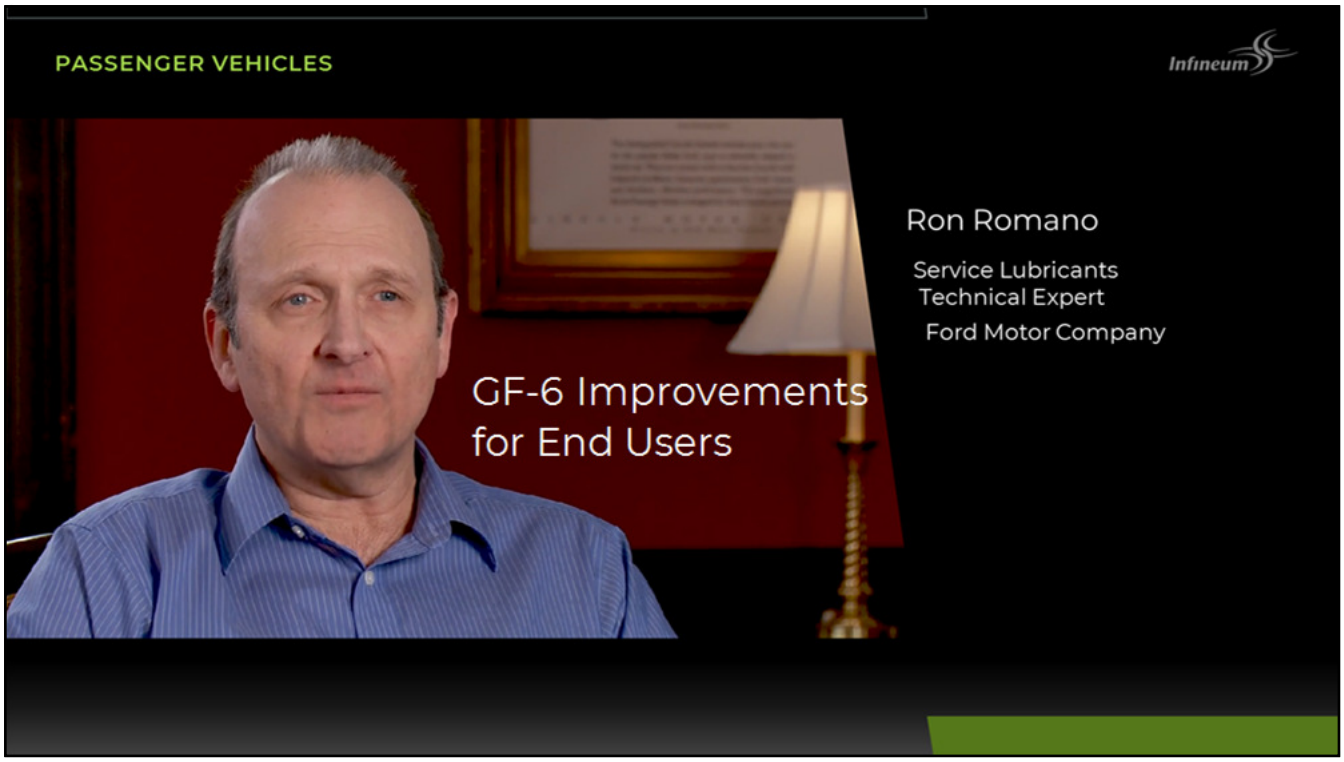
We will also have a new ILSAC viscosity grade and a new symbol to identify it to avoid misapplication. Let's hear from Ron Romano from Ford and Kevin Ferrick.

Ron Romano: "ILSAC has asked API to create 2 separate symbols for GF-6A and GF-6B, the second symbol to give the customer a little bit more to differentiate the 2 besides the viscosity grade. We're also going to rely on API and the OEMs to come out with some kind of educational material for the customer to be able to distinguish between these 2 categories."

Kevin Ferrick: "API considered a number of designs for the new GF-6B symbol and eventually chose one that we thought would stand out on package labels. We certainly wanted something that looked different from the API Starburst. I do think the new symbol will help prevent misapplication of 0W-16 oils. The viscosity grade itself should also help—most vehicle owners at least know the oil viscosity recommended for their car or truck. API promotes our oil standards through trade shows, social media, and the trade press. We even reach out to the motoring public through radio. However, we need a renewed campaign for GF-6A and GF-6B."



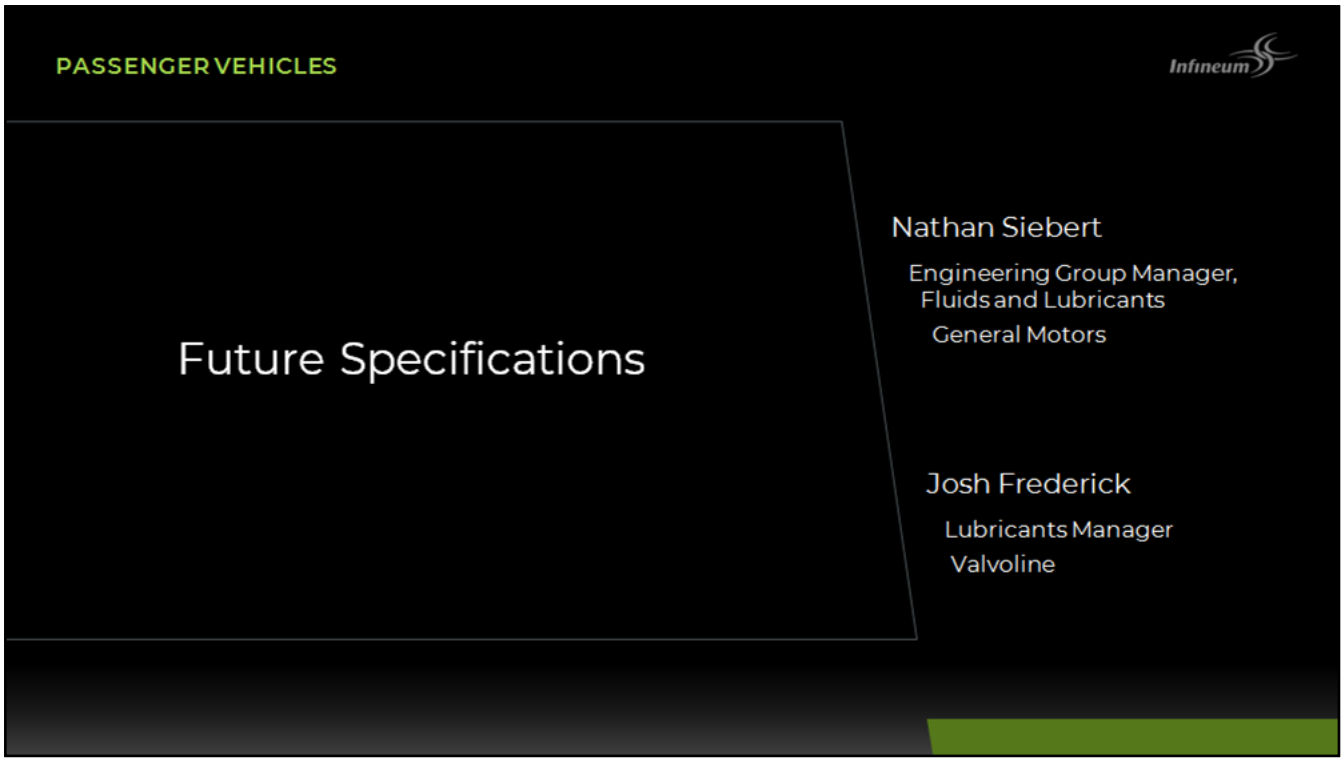
As we said GF-6 is nearly complete a first allowable use on May 1, 2020 seems likely.



Ron explains the benefits for end users of GF-6.

Ron Romano: “ILSAC's pretty confident that we'll get a performance improvement out of GF-6. We feel the way we've set the limits we will get some improvement in durability. We're asking for an improvement in fuel economy; that was kind of one of the main reasons for going forward with GF-6. We realize that there probably is a tradeoff between durability and fuel economy, there always has in the past, so there shouldn't be any reason it's not going to be here today. But, with some of the parameters that are part of GF-6, we haven't asked for any improvements in performance with tests like the Seq. V for sludge protection. We're keeping the same requirement basically as we've got in GF-5 because we feel that the performance is acceptable there. We do have some new tests, like the LSPI test, and the chain wear test which we know will dramatically change the formulations that are going to be made for GF-6 compared to GF-5, a little closer to the SN Plus-type formulations. And we do realize that there could be some tradeoffs in fuel economy and protection because of some of those tests.”

The lubricant specification landscape is becoming increasingly complex with multiple OEM specifications, huge variation in performance requirements and the use of engine tests from different regions. dexos Gen 3, the JASO ultra-light viscosity GLV spec and yes GF-7 will follow.

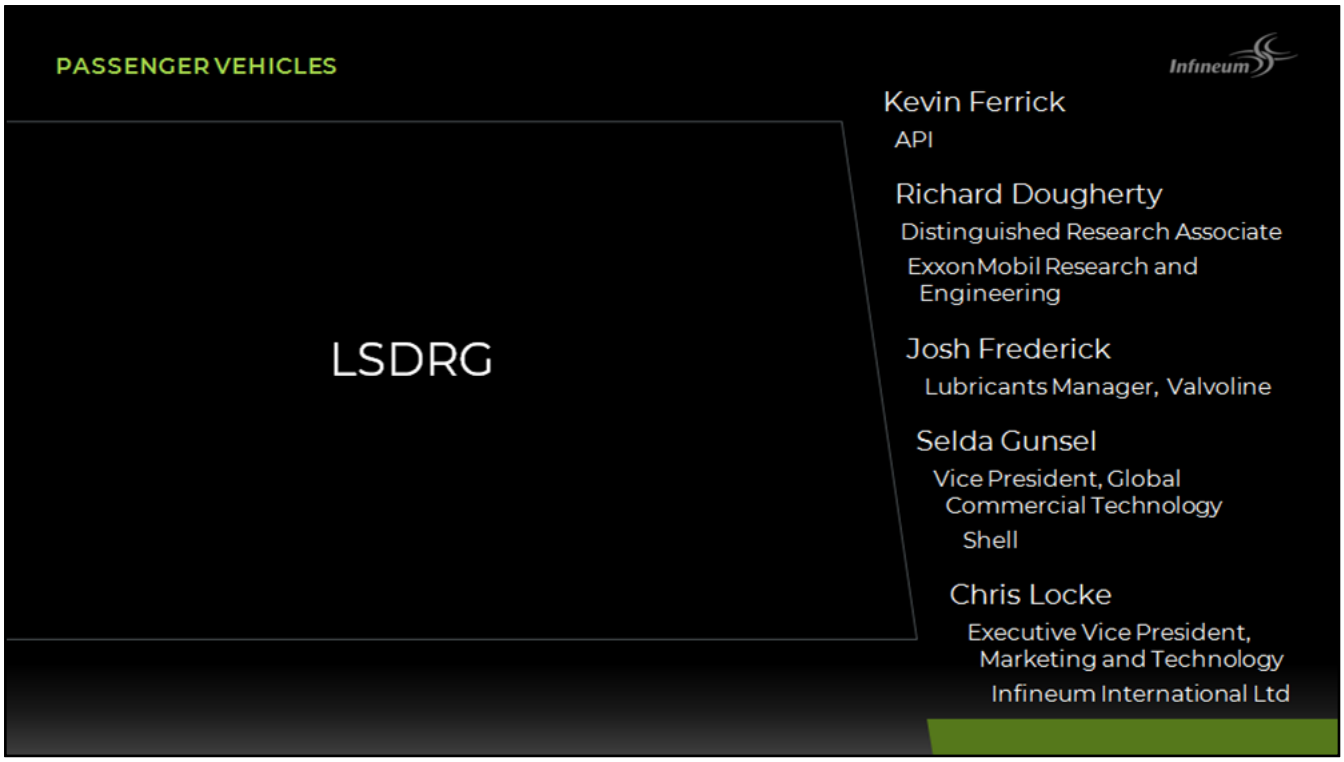


Nathan Siebert and Josh Frederick share some insights on the next generation of specs.

Nathan Siebert: "To continue our great history of innovation we will be launching a Dexos 1 Generation 3 later this year. A GF-7 specification will need to include better LSPI performance and lower ash levels to facilitate the introduction of gas particulate filters."

Josh Frederick: "If history is any indicator, there probably will be some category after GF-6 as we continue to look for more fuel efficiency, better protection for modern engines, potentially compatibility with gasoline particulate filters, and probably another need or two that we don't even foresee coming at this point."

The development of new tests for ILSAC GF-6 and the ACEA sequences has consumed a huge amount of industry resource and has contributed to the delay in their introduction. All stakeholders are keen for an improved oil category development process to reduce complexity, time, and funding. API is currently sponsoring the Lubricants Specification Development Review Group to investigate changes in these processes.



A new series of API specifications will no doubt follow, but all seem to agree that a new process to develop them is needed. Let's close with some thoughts on this from some key industry stakeholders.

Kevin Ferrick: "Most would agree that the current process is slow and at times cumbersome. The changes being considered by the group will lead to a more efficient and streamlined process."

Richard Dougherty: "An evergreen test development process will be needed to keep pace with changing engine designs. This process will also help ensure consumers with state-of-the-art vehicles have sufficient engine protection through capable, high-quality oils. Ultimately, we will need new funding models to make this a reality. The Lubricants Standards Development Review Group is hard at work evaluating new processes which could speed up and improve test development and maintenance."

Josh Frederick: "Certainly there are things we can do to improve the efficiency of the category development process. However, despite all of this good work, we still believe that at the end of the day test development and test funding are going to remain the greatest challenges in category development."

Selda Gunsel: "Oil Specifications will continue to evolve alongside hardware advancements to increase durability, fuel efficiency and reduce emissions. Future specification development will need to take into account the rapid changes in hardware engineering.

Chris Locke: "The API LSDRG group was formed as the first centralized activity to address the need for change in North America. Europe has taken a rather different approach, and is working via the CEC Management Board and the AAA committees to institute change in their processes but with similar objectives in mind. We still maintain that positive change can only come about when all the key stakeholders work together to instill change that is beneficial for all. Change is never easy, but it is vital in keeping our processes both aligned with, and supportive of, the needs of the future."

PASSENGER VEHICLES

Building Towards Sustainability

Most macro-forecasts point to an eventual decline in the total volume of the lubricant market, but opportunities still abound in a market that is becoming increasingly challenging from a technical standpoint, with changing consumer and societal needs. Looking ahead sustainability is targeted in all we do from this point forward.

Permissions