# GLOBAL FUEL TECHNOLOGY
# PT Pertamina (Persero)


*Gaikindo International Conference*

R. Choerniadi Tomo

24 July 2019

# Agenda for Today

1. **Depletion of Fossil Fuel for Automotive**
2. **Alternative Energy to Replace Fossil Fuel**
3. **Green Fuel as Local Endowment Renewable Energy**



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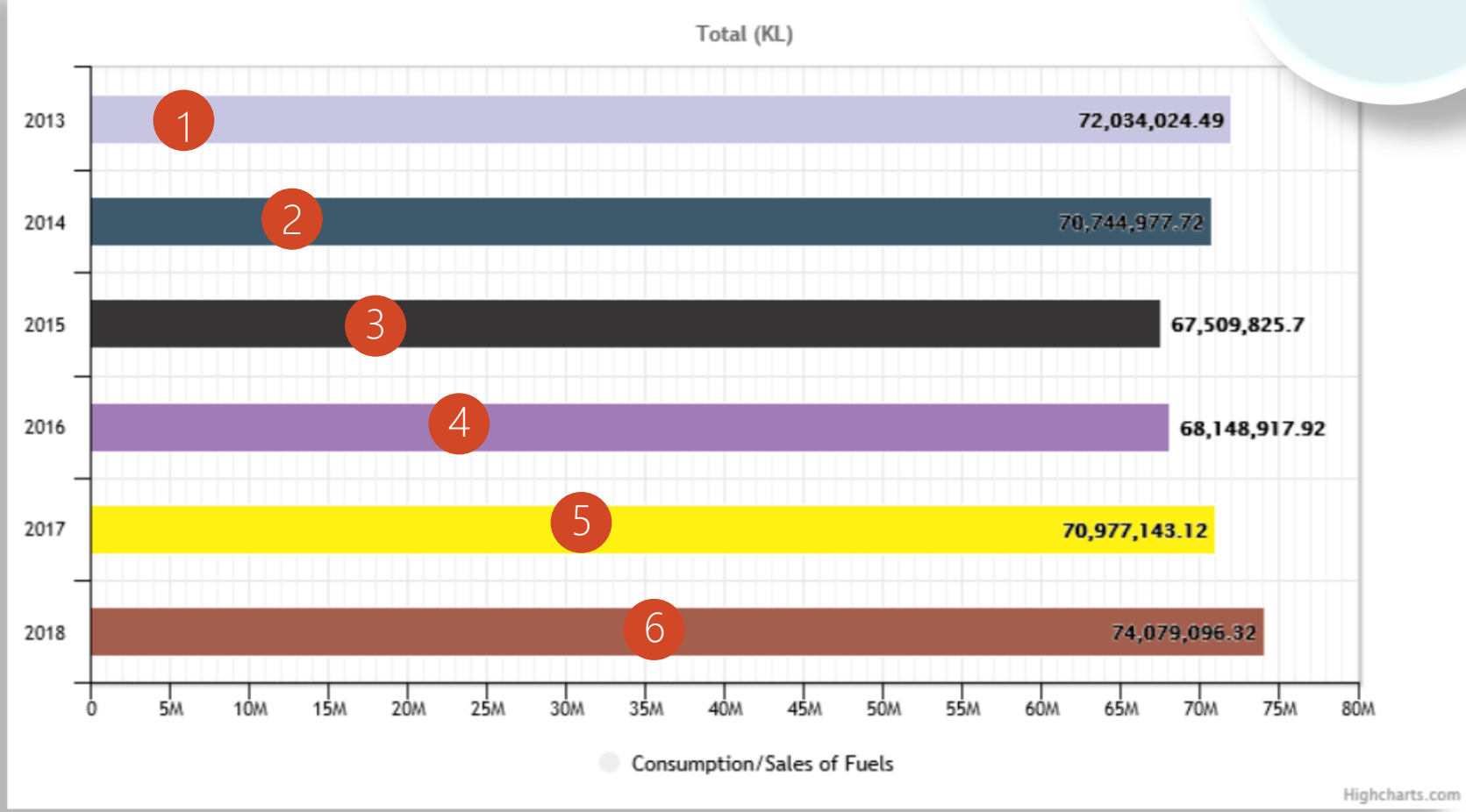
# **Depletion** of Fossil Fuel for Automotive?

# Indonesia Fuel Sales




Source: Ministry Of Energy And Mineral Resources
Directorate General Of Oil and Gas



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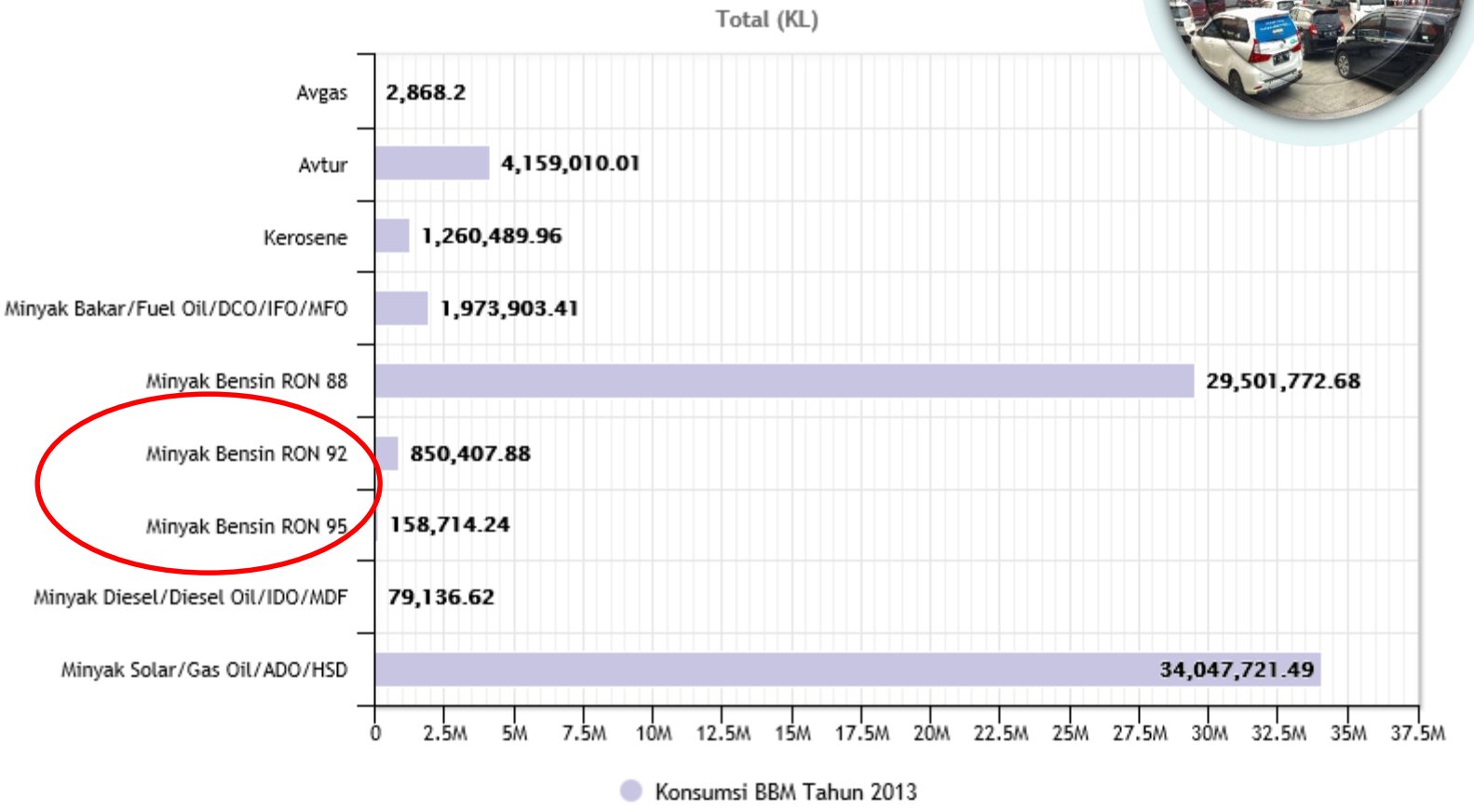
# 2013 Indonesia Fuel Sales




1. 2013 Less Clean Fuel Sales — 29.5 Million KL
2. 2013 Cleaner Fuel Sales — 1 Million KL

3.4%

Source: Ministry Of Energy And Mineral Resources, Directorate General Of Oil and Gas



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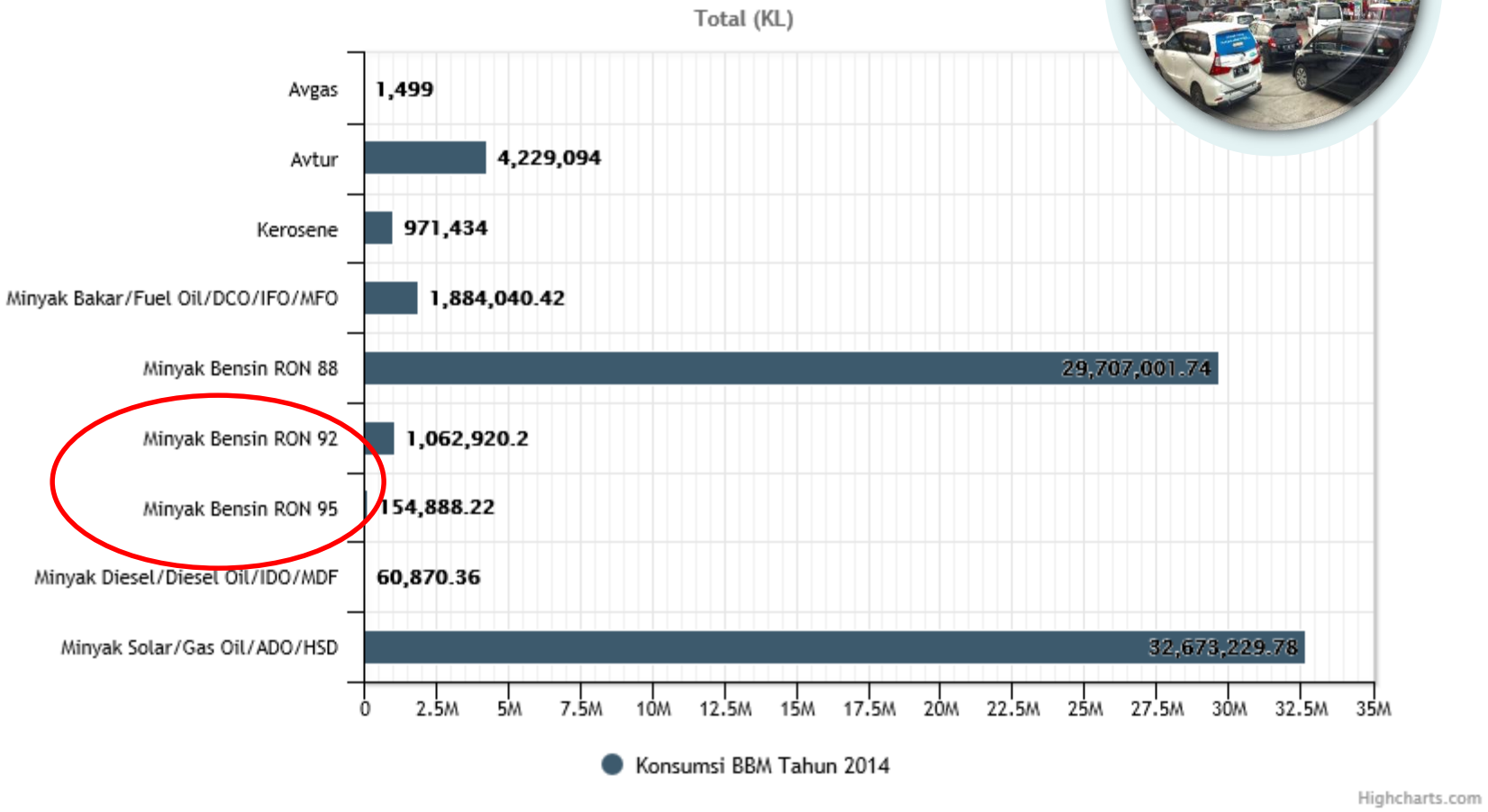
# 2014 Indonesia Fuel Sales




1. 2014 Less Clean Fuel Sales — 29.7 Million KL
2. 2014 Cleaner Fuel Sales — 1.2 Million KL

4.1%

Source: Ministry Of Energy And Mineral Resources, Directorate General Of Oil and Gas



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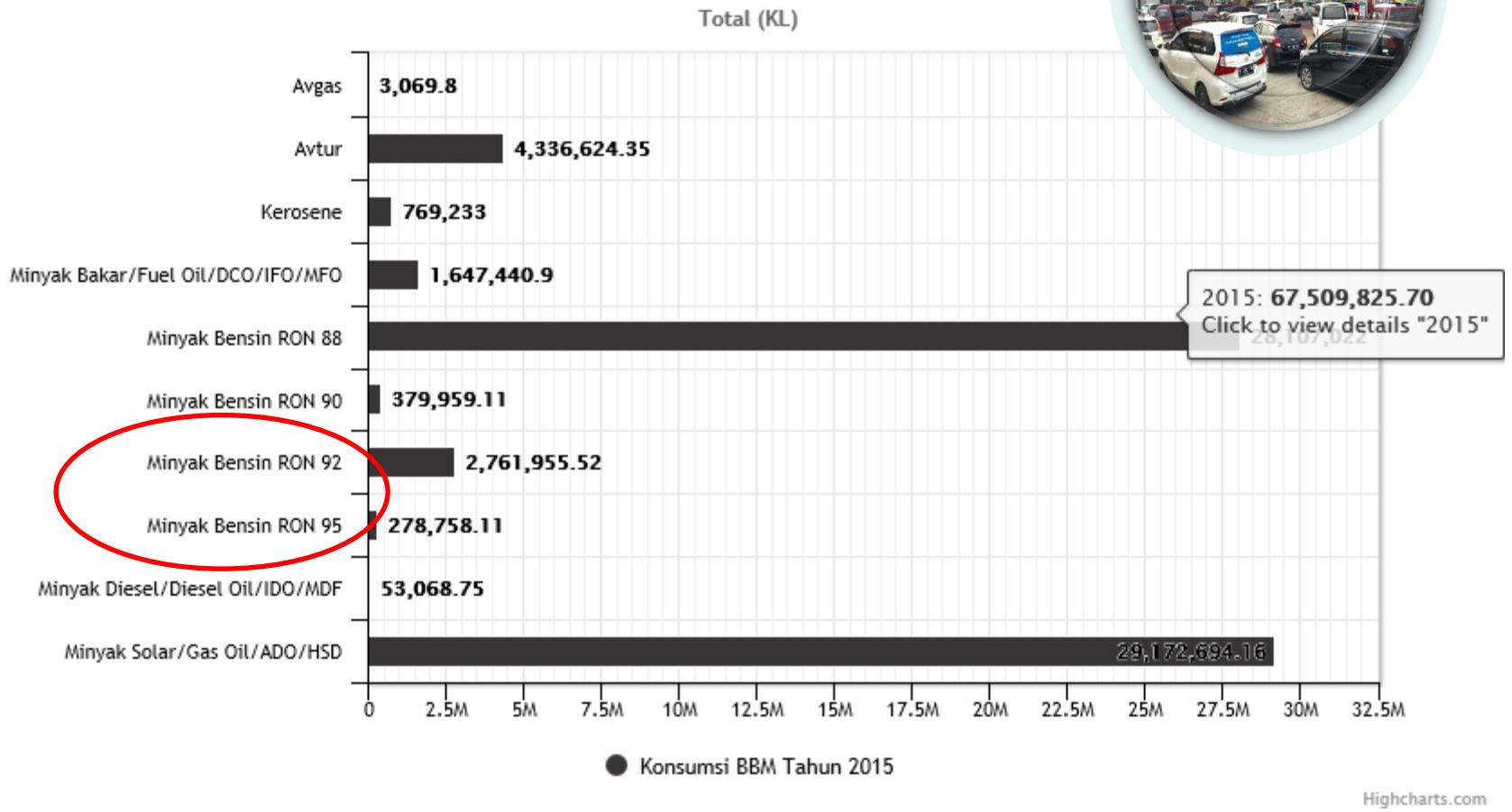
# 2015 Indonesia Fuel Sales




1. 2015 Less Clean Fuel Sales — 67.9 Million KL
2. 2015 Cleaner Fuel Sales — 3 Million KL

4.5%

Source: Ministry Of Energy And Mineral Resources, Directorate General Of Oil and Gas



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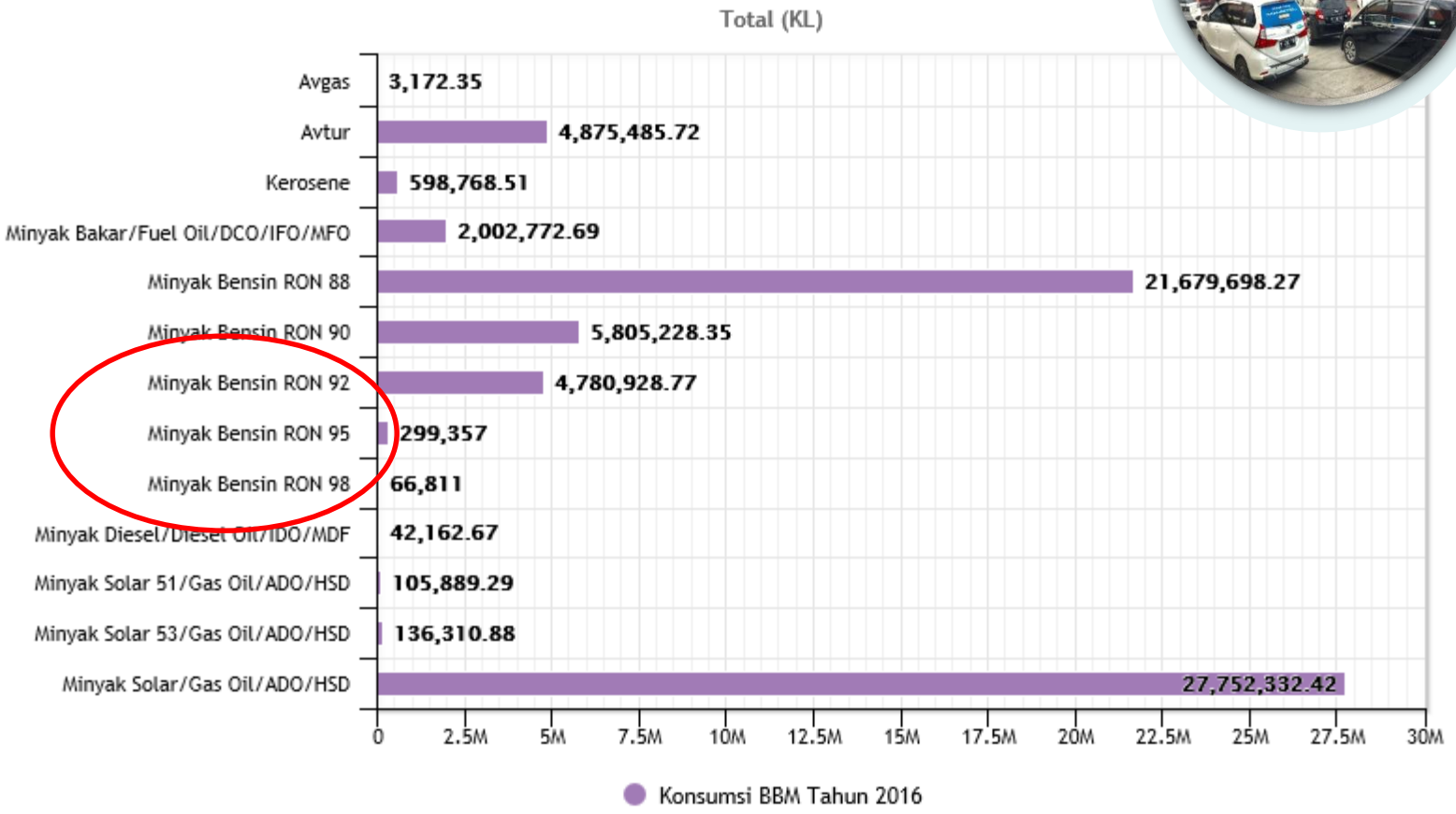
# 2016 Indonesia Fuel Sales




1. 2016 Less Clean Fuel Sales — 27.5 Million KL
2. 2016 Cleaner Fuel Sales — 5.1 Million KL

18.7%

Source: Ministry Of Energy And Mineral Resources, Directorate General Of Oil and Gas



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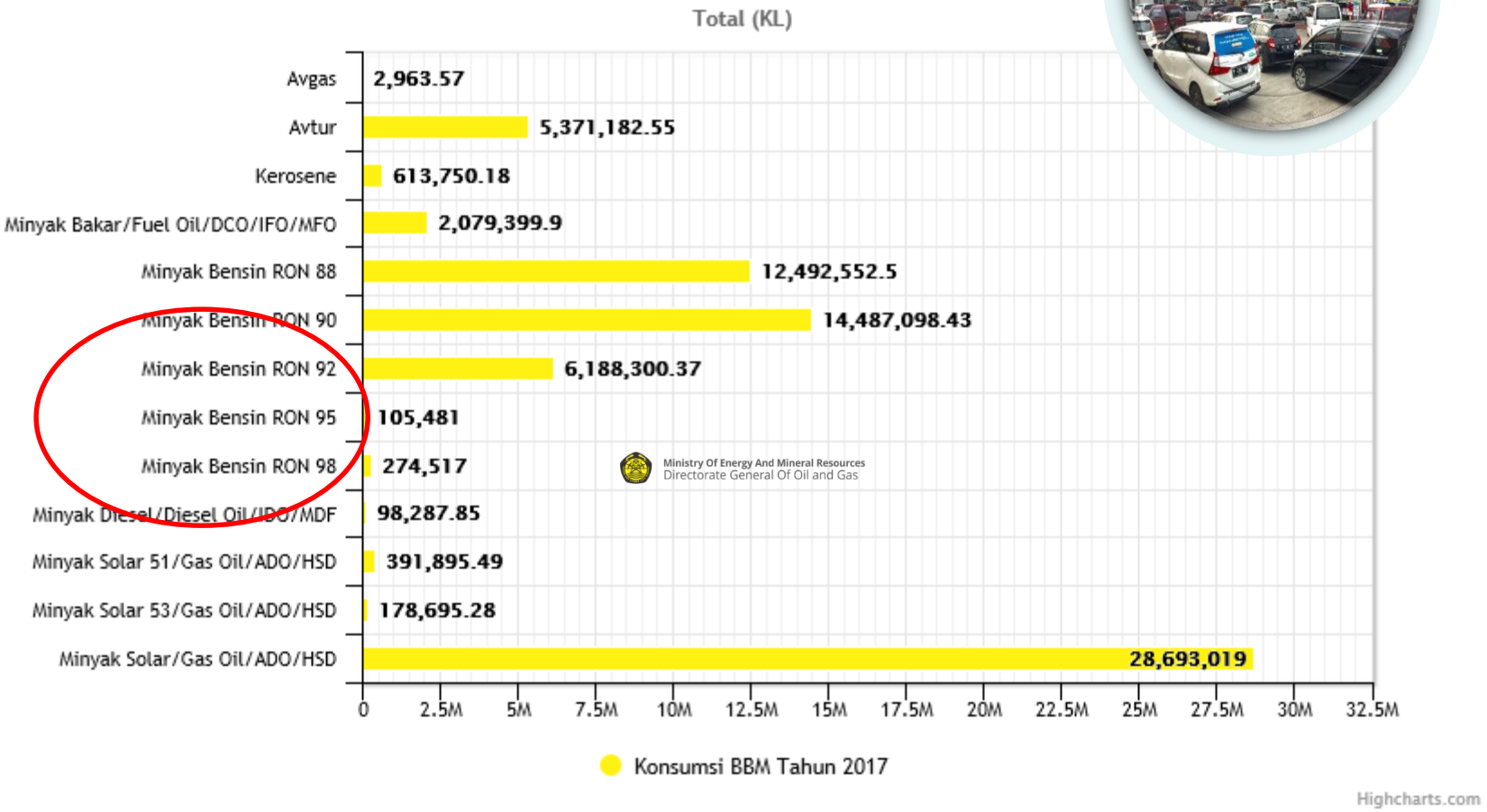
# 2017 Indonesia Fuel Sales




1. 2017 Less Clean Fuel Sales — 27 Million KL
2. 2017 Cleaner Fuel Sales — 6.5 Million KL

24.3%

Source: Ministry Of Energy And Mineral Resources Directorate General Of Oil and Gas



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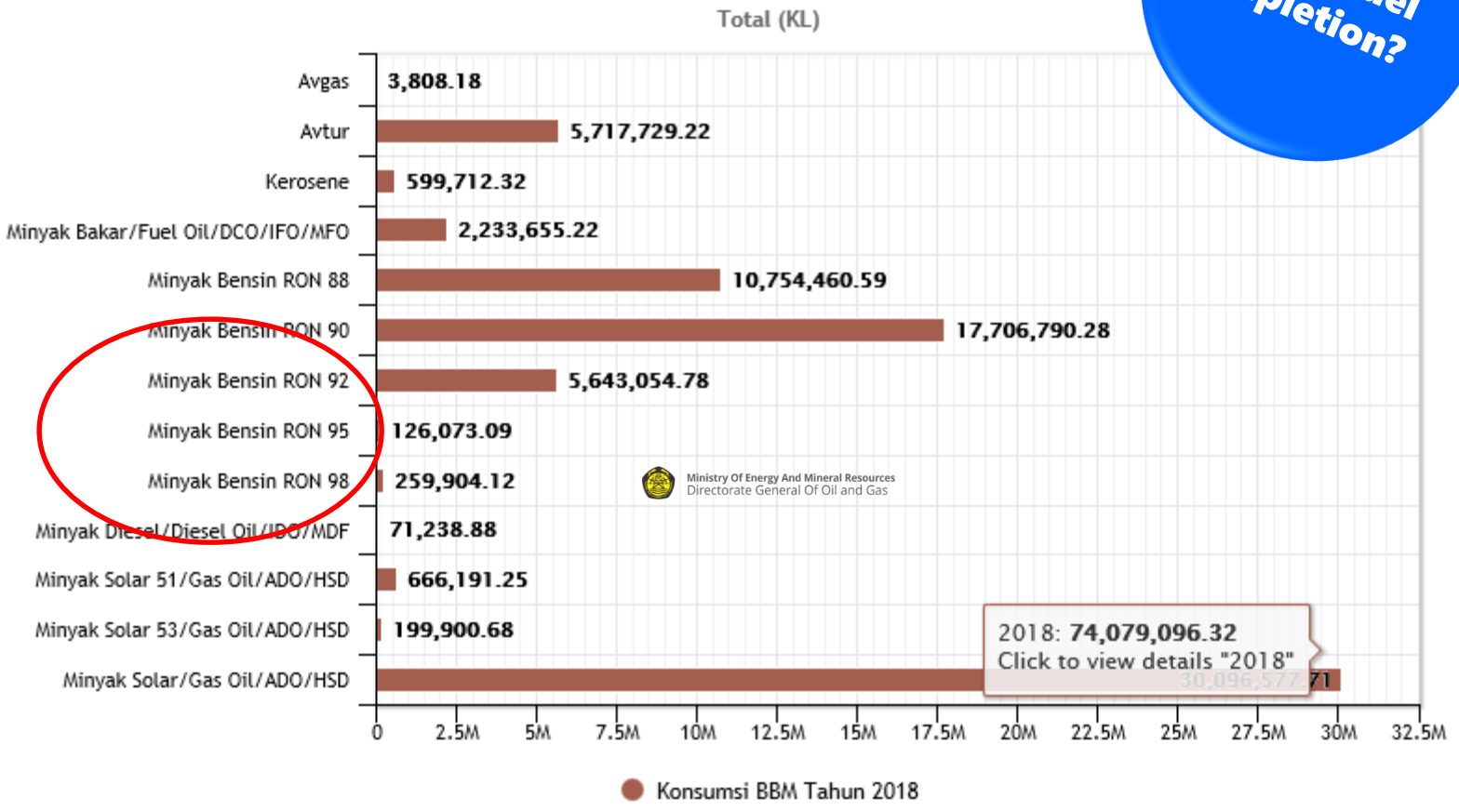
# 2018 Indonesia Fuel Sales

Automotive Fossil Fuel Depletion?




| | | |
|---|---|---|
| 1 | 2018 Less Clean Fuel Sales | 28.5 Million KL |
| 2 | 2018 Cleaner Fuel Sales | 6.5 Million KL |

21.2%

Source: Ministry Of Energy And Mineral Resources Directorate General Of Oil and Gas



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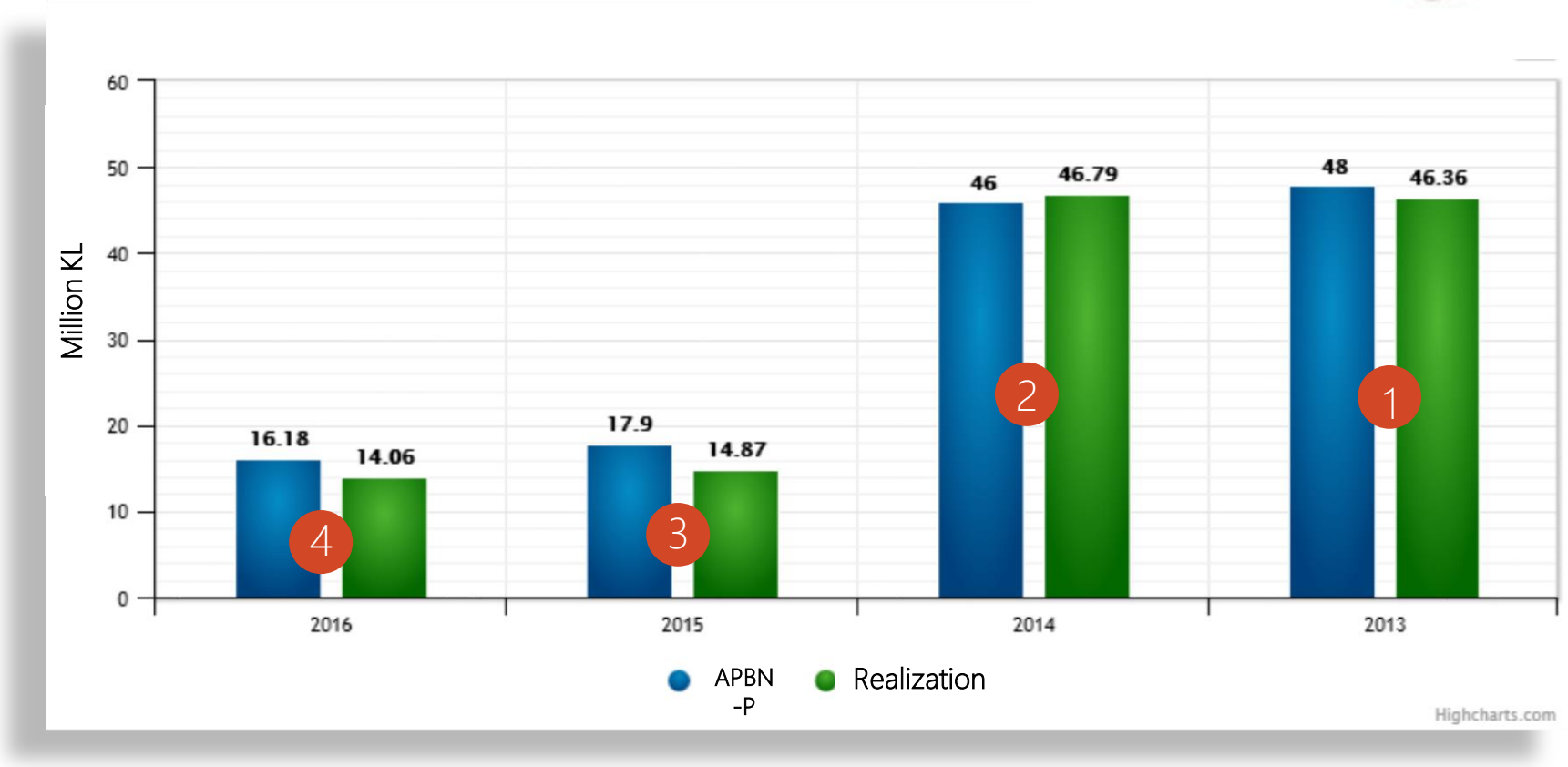
# Subsidized Fuel Sales




Source: Ministry Of Energy And Mineral Resources
Directorate General Of Oil and Gas



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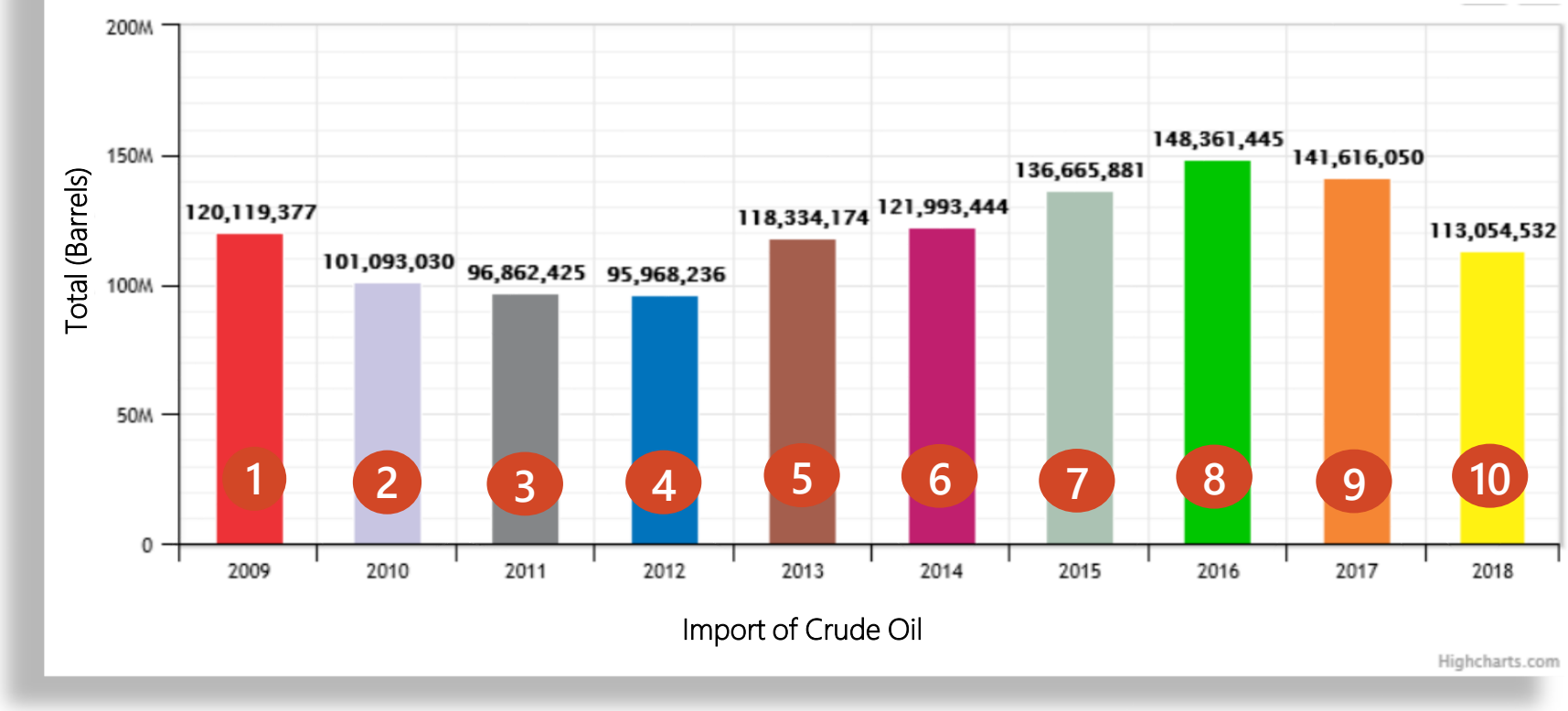
# Crude Oil Import



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# Fuels & Vehicles "EURO"
## Stages Parameters Evolution



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| Parameter | Stage→ | EURO-0 | EURO-1 | EURO-2 | EURO-3 | EURO-4 | EURO-5 | EURO-6 | *EURO-7* |
|---|---|---|---|---|---|---|---|---|---|
| | Year→ | < 1993 | 1993-1995 | 1996-1999 | 2000-2004 | 2005-2009 2018 | 2010-2013 | 2014-2018 | *>2020 ?* |
| **Fuels (Petrol) Environmental Quality** | | | | | | | | | |
| Sulfur | *ppm* | 2000 | 500 | 500 | 150 | 50 50 | 10 | 10 | *10* |
| Lead | *mg/l* | 150-840 | 13 | 13 | 5 | 5 N Alwd | 5 | 5 | *5* |
| Manganese | *mg/l* | 18 | 18 | 18 | 18 | 18 | 6 | 2 | *2* |
| Aromatics | *%v/v* | 42-53 | 42-53 | 42-53 | 42 | 35 40 | 35 | 35 | *??* |
| Benzene | *%v/v* | 5 | 5 | 5 | 1 | 1 5 | 1 | 1 | *1* |
| Olefins | *%v/v* | ---- | ---- | ---- | 18 | 18 | 18 | 18 | *18* |
| RVP (summer) | *kPa* | 80 | 80 | 70 | 60 | 60 | 60 | 60 | *60* |
| MTBE & ETBE | *%v/v* | 0-15 | 15 | 15 | 15 | 22 2.7 | 22 | 22 | *??* |
| RON | | 83-95 | 95 | 95 | 95 | 95 98 | 95 | 95 | *102* |
| **Vehicles (Petrol-fuelled) Exhaust Emissions** | | | | | | | | | |
| CO | *mg/km* | ---- | 2720 | 2200 | 2200 | 1000 1000 | 1000 | 1000 | *??* |
| HC-NOx | *mg/km* | ---- | 970 | 500 | 350 | 180 | 160 | *160* | *??* |
| NOx | *mg/km* | ---- | ---- | ---- | 150 | 80 80 | 60 | 60 | *??* |
| THC | *mg/km* | ---- | ---- | ---- | 200 | 100 100 | 100 | 100 | *??* |
| NMHC | *mg/km* | ---- | ---- | ---- | ---- | ---- | 68 | 68 | *??* |
| PM | *mg/km* | ---- | ---- | ---- | ---- | ---- | 5 | 5 | *??* |
| PN | *number* | ---- | ---- | ---- | ---- | ---- | ---- | $6*10^{11}$ | *??* |

**N** = Critical Parameter (part of the problem) **N** = Beneficial Parameter (part of the solution) **N** = Euro 4 Indonesia

# Indonesian Current Petrol Grades Quality



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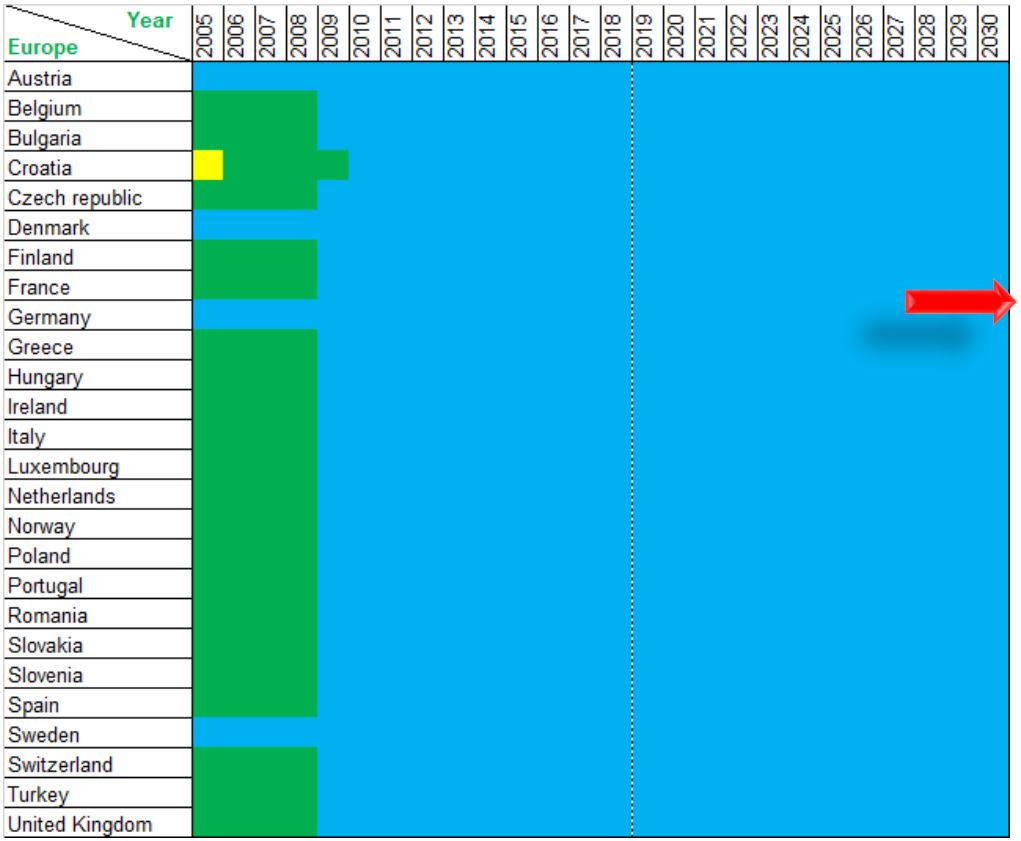
| Parameter | *Units* | PT | EURO-Stages' Equivalent | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PrE | | E0 | | E1 | E2 | | E3 | | E4 | | E5 | | E6 | | *E7* |
| Sulfur | *ppm* | Re/Pr | | | | | | 500 | | | | | | | | | | |
| | | Pp | | | | | | 50 | | | | | | | | | | |
| Lead | *mg/l* | All | | | | | | 13 | | | | | | | | | | |
| Manganese | *mg/l* | All | | | | | | | | | | | | | | | | 0 |
| Aromatics | *%v/v* | Re | | | ---- | | | | | | | | | | | | | |
| | | Pr | | | 50 | | | | | | | | | | | | | |
| | | Pp | | | | | | | | 40 | | | | | | | | |
| Benzene | *%v/v* | Re | ---- | | | | | | | | | | | | | | | |
| | | Pr/Pp | | | 5 | | | | | | | | | | | | | |
| Olefins | *%v/v* | All | | | ---- | | | | | | | | | | | | | |
| RVP (summer) | *kPa* | Re | | | | | | | 69 | | | | | | | | | |
| | | Pr/Pp | | | | | | | | 60 | | | | | | | | |
| MTBE & ETBE | *%v/v* | All | | | 15 | | | | | | | | | | | | | |
| RON | | Re | | | 88 | | | | | | | | | | | | | |
| | | Pr | | | 92 | | | | | | | | | | | | | |
| | | Pp | | | | | | 98 | | | | | | | | | | |

Re = Premium Pr = Pertamax Pp = Pertamax Turbo

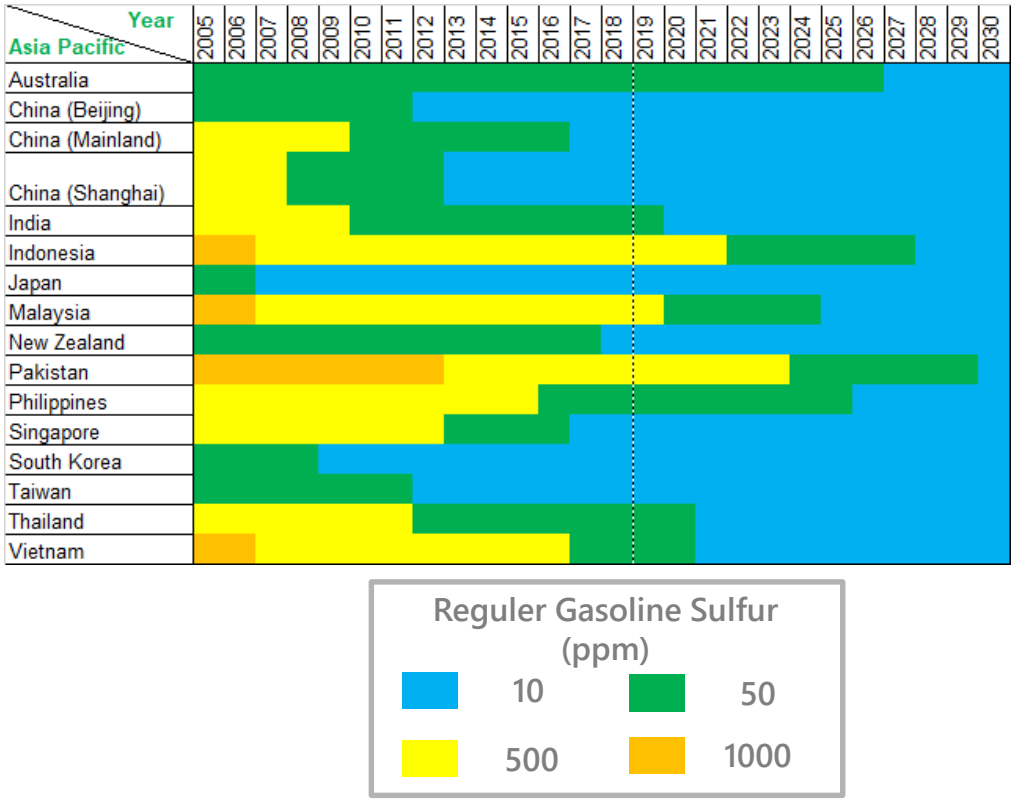
# Global Fuel Specifications 2005 – 2030

## **Sulfur(ppm)** of Regular Gasoline

**Forecast →**



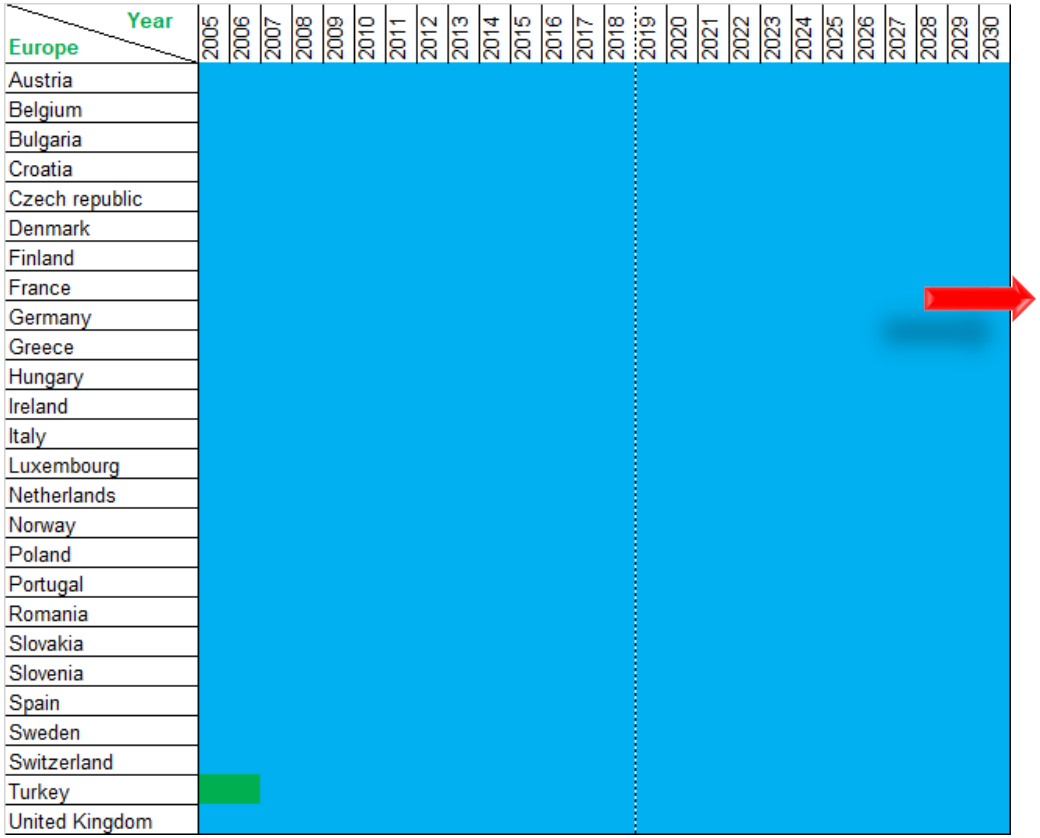

Forecast →



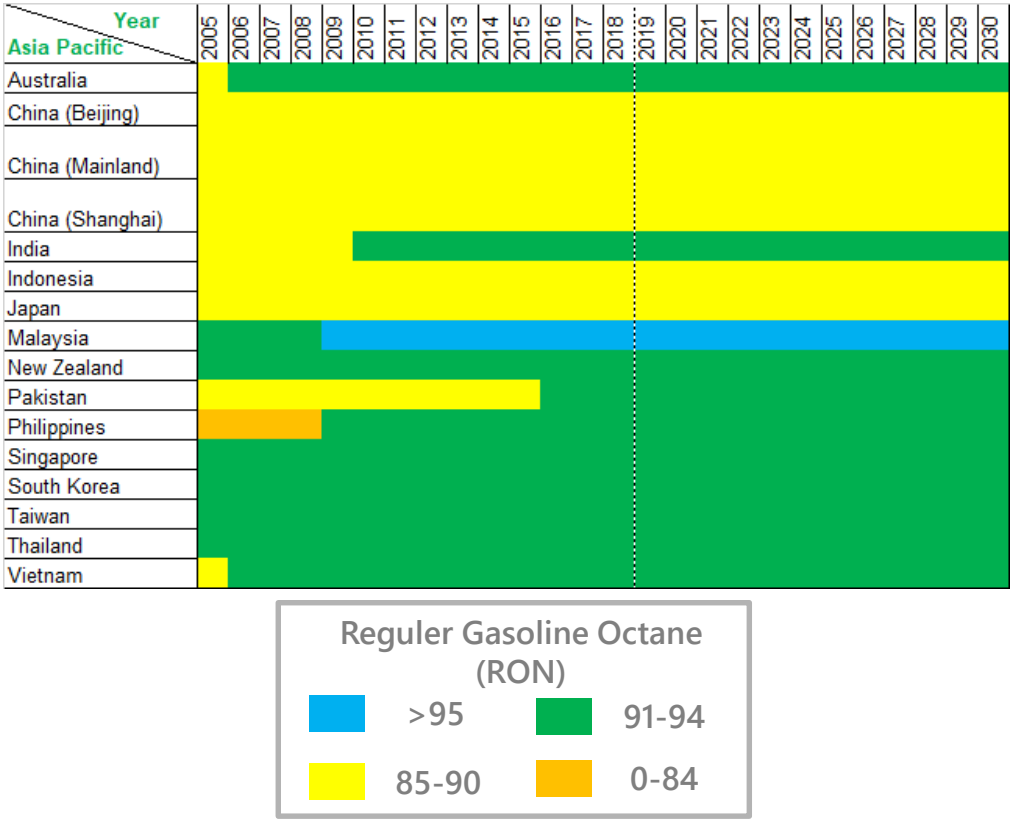
# Global Fuel Specifications 2005 – 2030

## **Octane Number** of Regular Gasoline

Forecast →



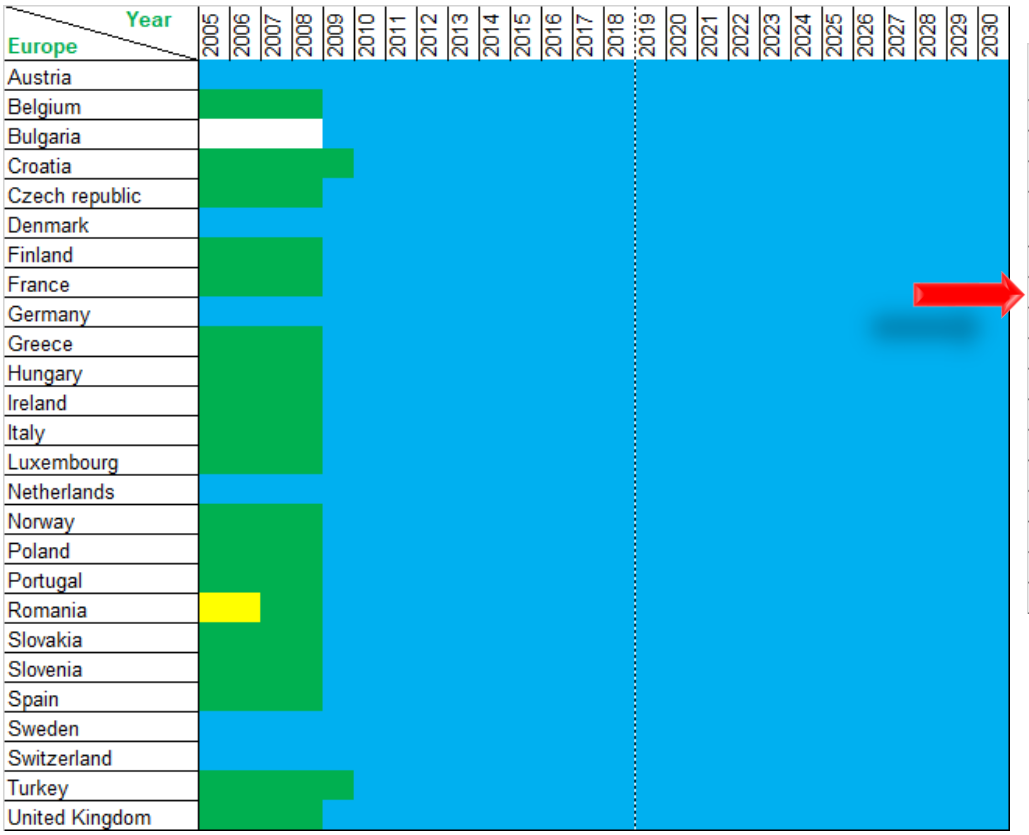

Forecast →



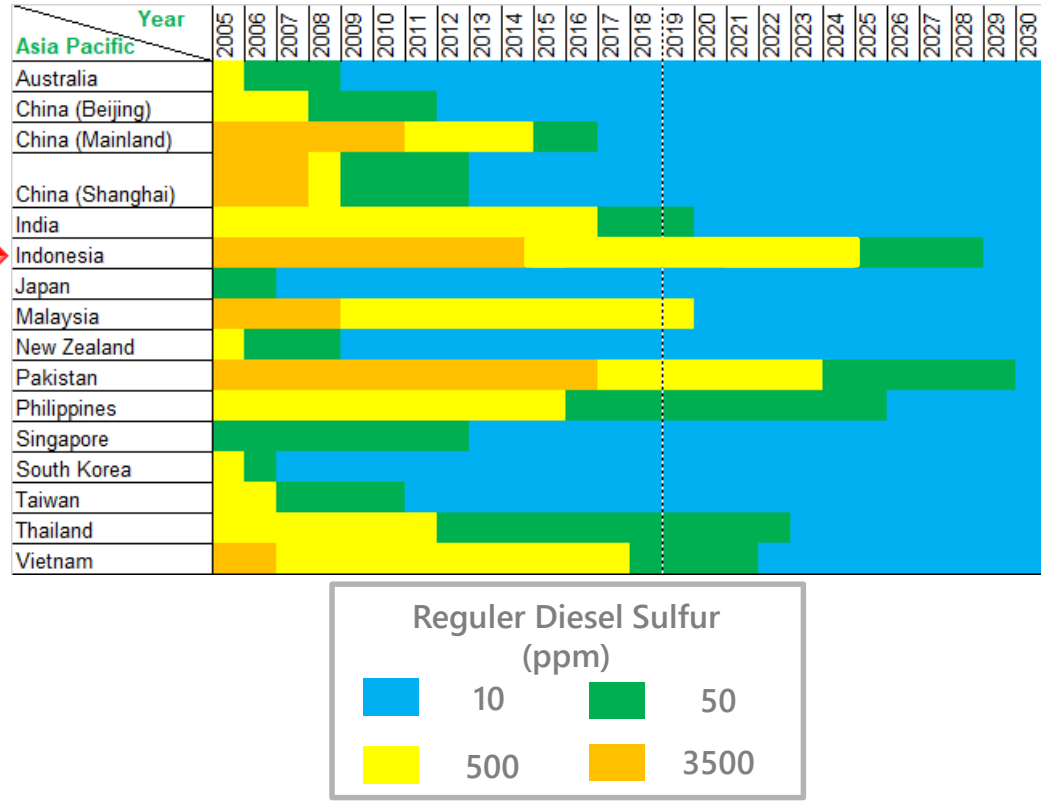
# Global Fuel Specifications 2005 – 2030

## **Sulfur (ppm)** of Regular Diesel

Forecast →



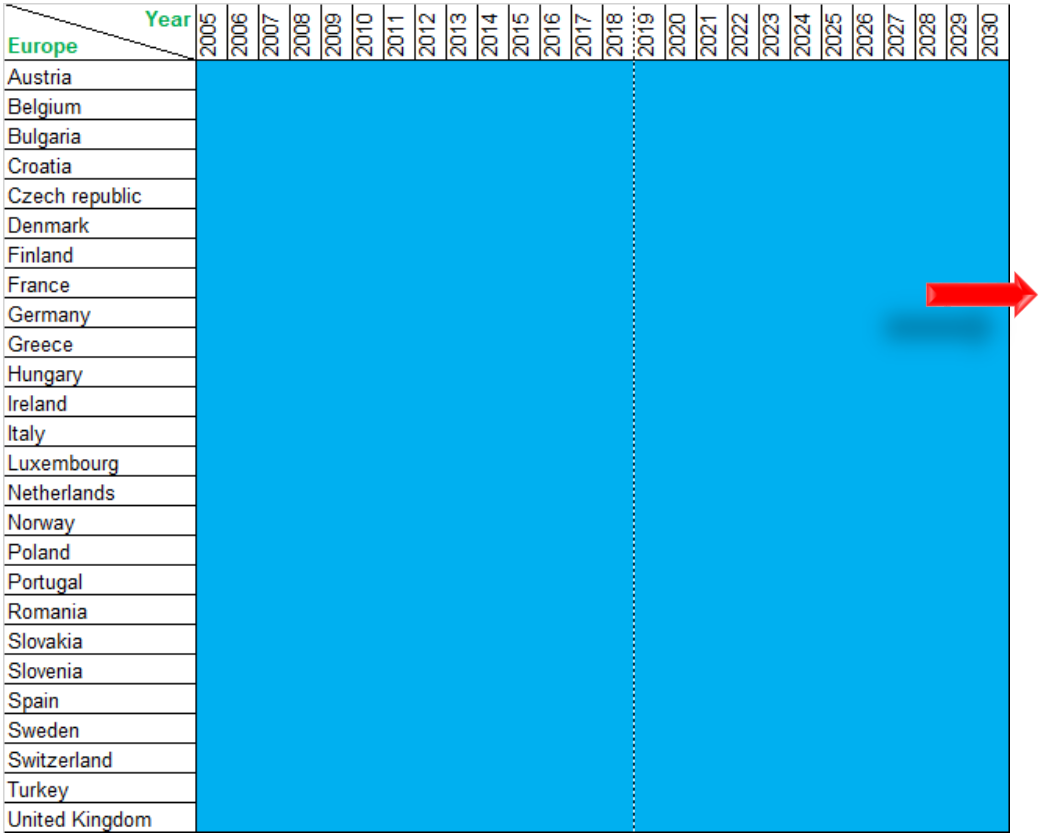

Forecast →



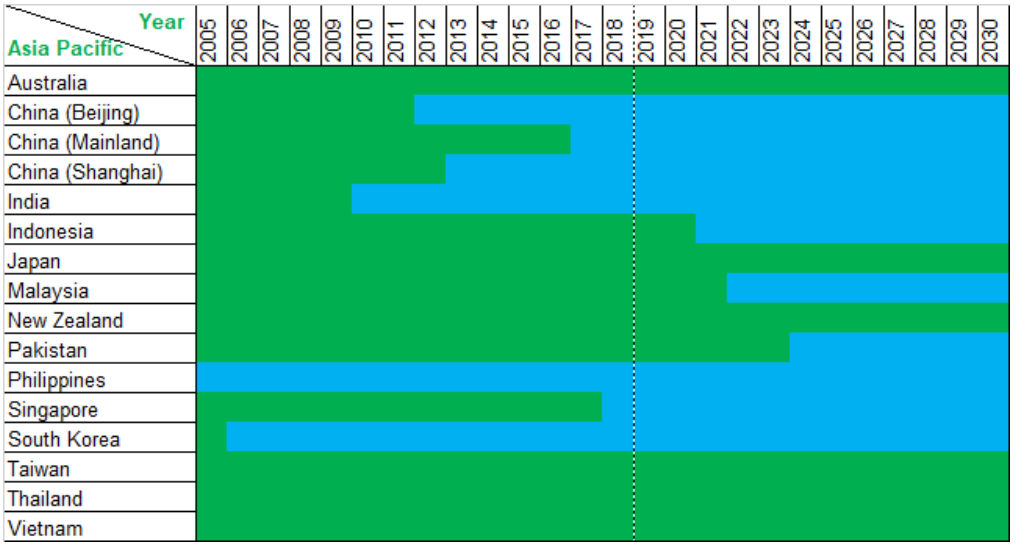
# Global Fuel Specifications 2005 – 2030

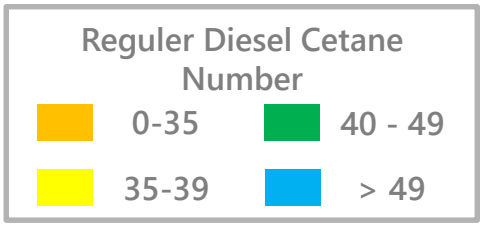
## Cetane Number of Regular Diesel

Forecast →

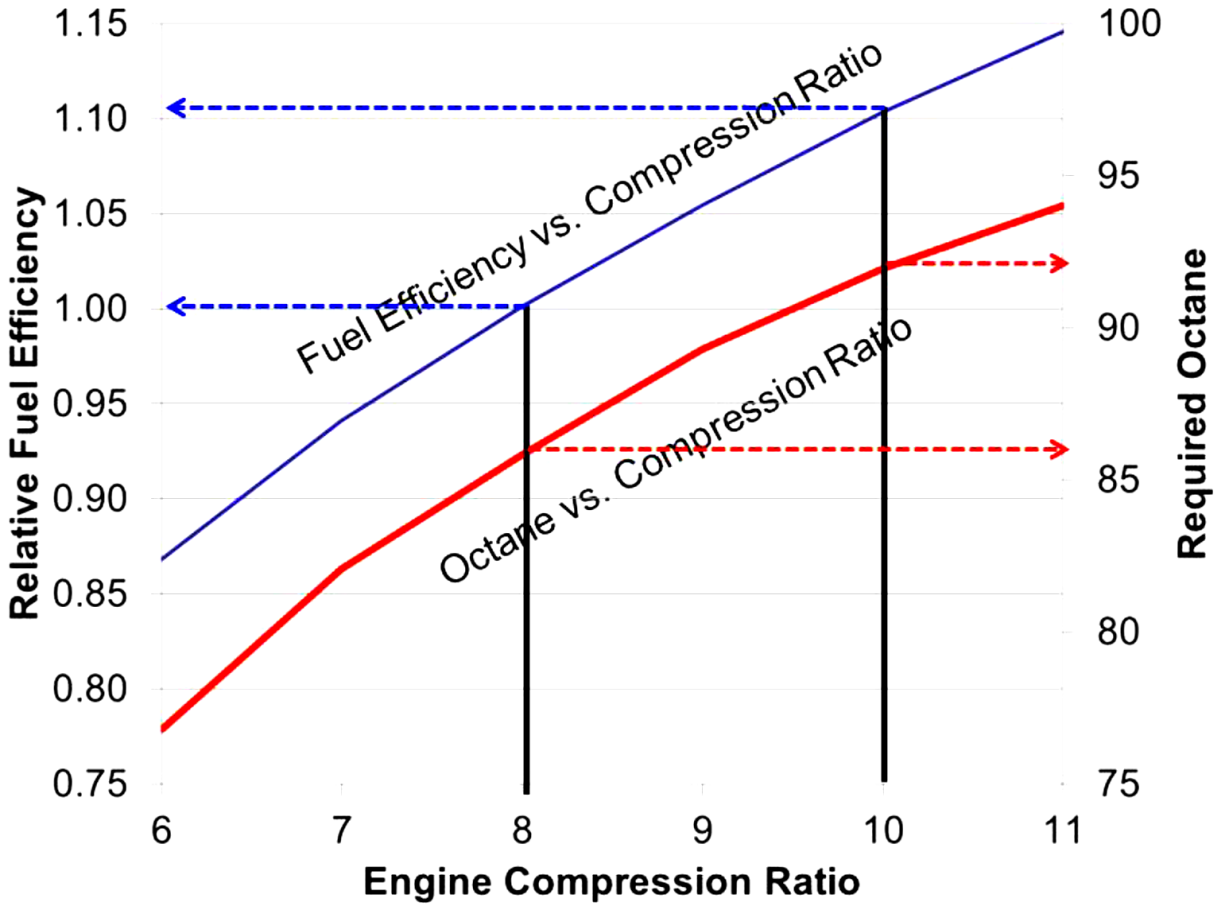



Forecast →



# High Octane Petrol Allows Improved Engine Efficiency




*Source: ACFA*



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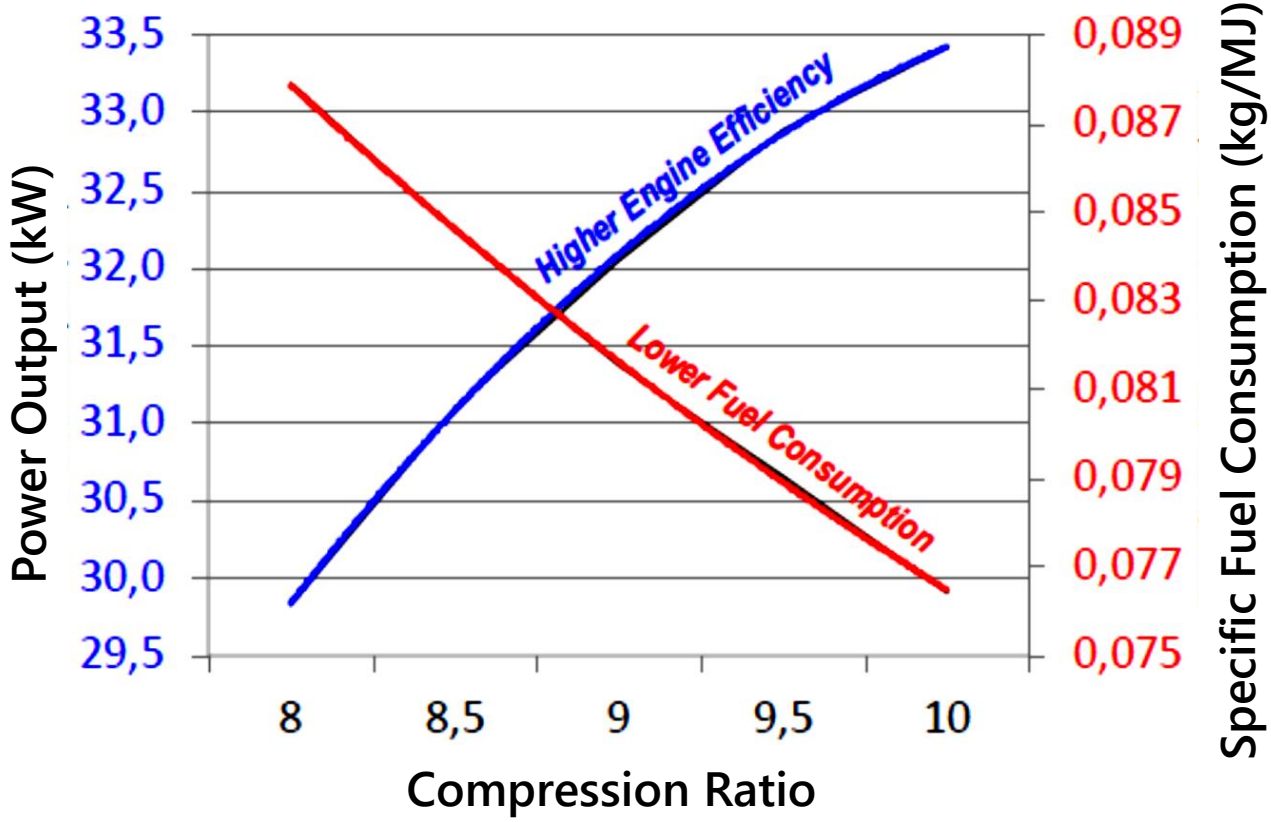
# High Octane Good for Consumers
# Enabling Lower Vehicle Fuel Consumption




*Source: ACFA & Blackmore & Thomas: "Fuel Economy of the Gasoline Engine" (1977)*



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# **Alternative** Energy to Replace Fossil Fuel

# Transport

1. Transport's share of global energy-related $CO_2$ emissions is 23%.
2. Emissions increased by 2.5% annually between 2010 and 2015.
3. This trend must be reversed to get on track with 2DS targets.
4. NDCs to the Paris Agreement targeting transport are insufficient to bring sectoral emissions in line with the 2DS.

Source: IEA



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# Global Fleet Average And New-build Plants Emissions


Key point: Tracking of different types of indicators is needed to understand both current status and future trends.

Source: IEA



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# Transport Biofuels



1. Global biofuel production increased to around 137 billion L (3.3 EJ) in 2016.

2. Conventional biofuels are on course to meet 2DS targets for 2025

3. Accelerated production of advanced biofuels is necessary to meet 2DS needs for transport sector decarbonisation.



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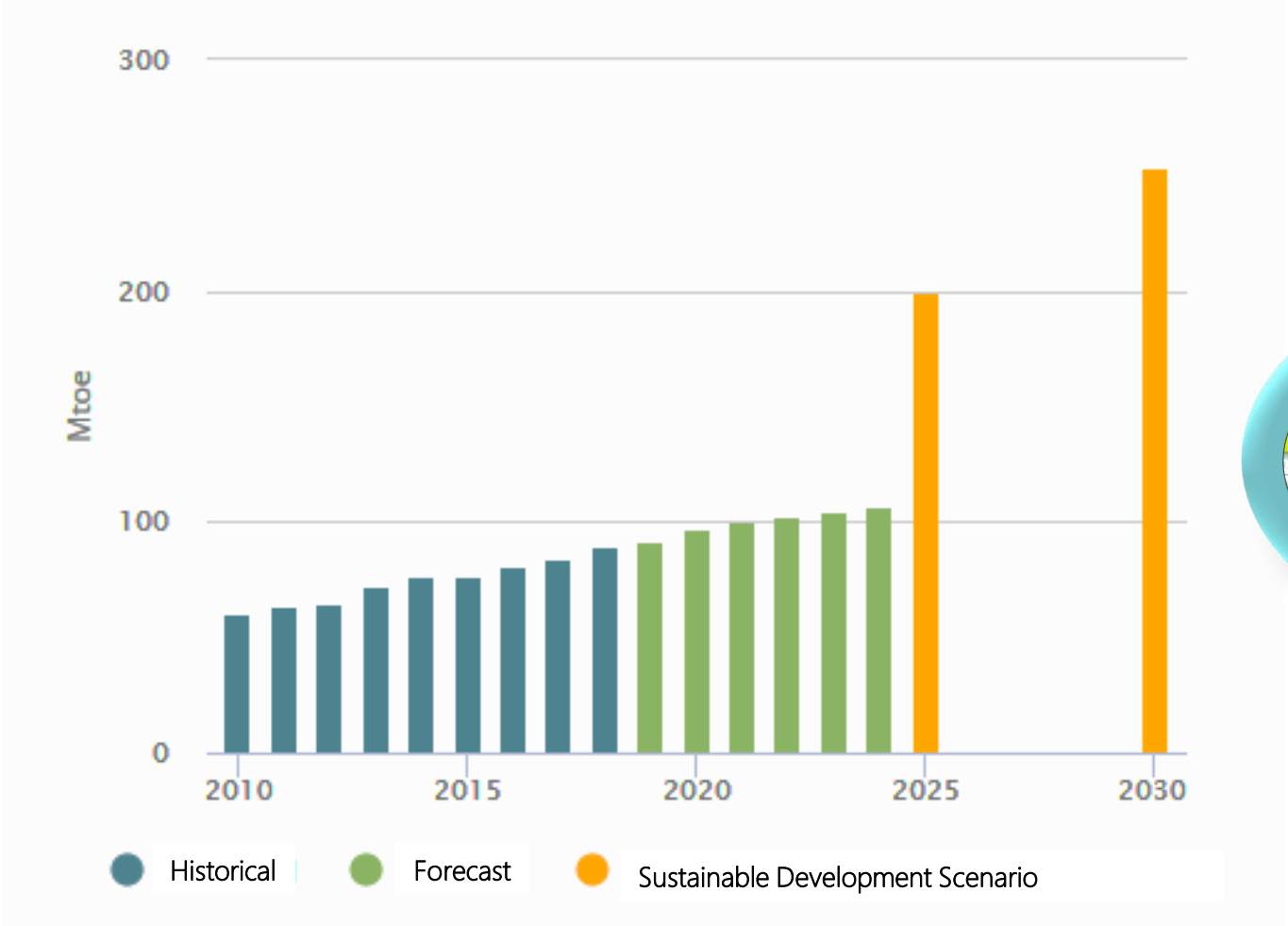
# Global Biofuel Production 2010-24 Vs. SDS

## Biofuel Consumption In 2025 and 2030




Source: IEA



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# Transport Biofuels

## Recent trends

1. In 2016, conventional biofuels accounted for around 4% of world road transport fuel. Doubledigit global production growth pre-2010 slowed to a modest 2%2 y-o-y

2. In the United States, ethanol output is anticipated to stabilise due to lower investment in new capacity. Meeting Brazil's 2030 commitment to reach an 18% share of sustainable biofuels in its energy mix would equate to over 50 billion L of fuel ethanol demand

3. Proposals for the revised Renewable Energy Directive (RED) covering 2020-30 include a scale-down of the cap on food crop-based biofuels from 7% to 3.8% (by energy) of the 2030 renewable energy target.

4. in Asia many petroleum product-importing countries have enhanced policy support for domestically produced biofuels, boosting markets for ethanol (e.g. India and Thailand) and biodiesel (e.g. Indonesia and Malaysia).



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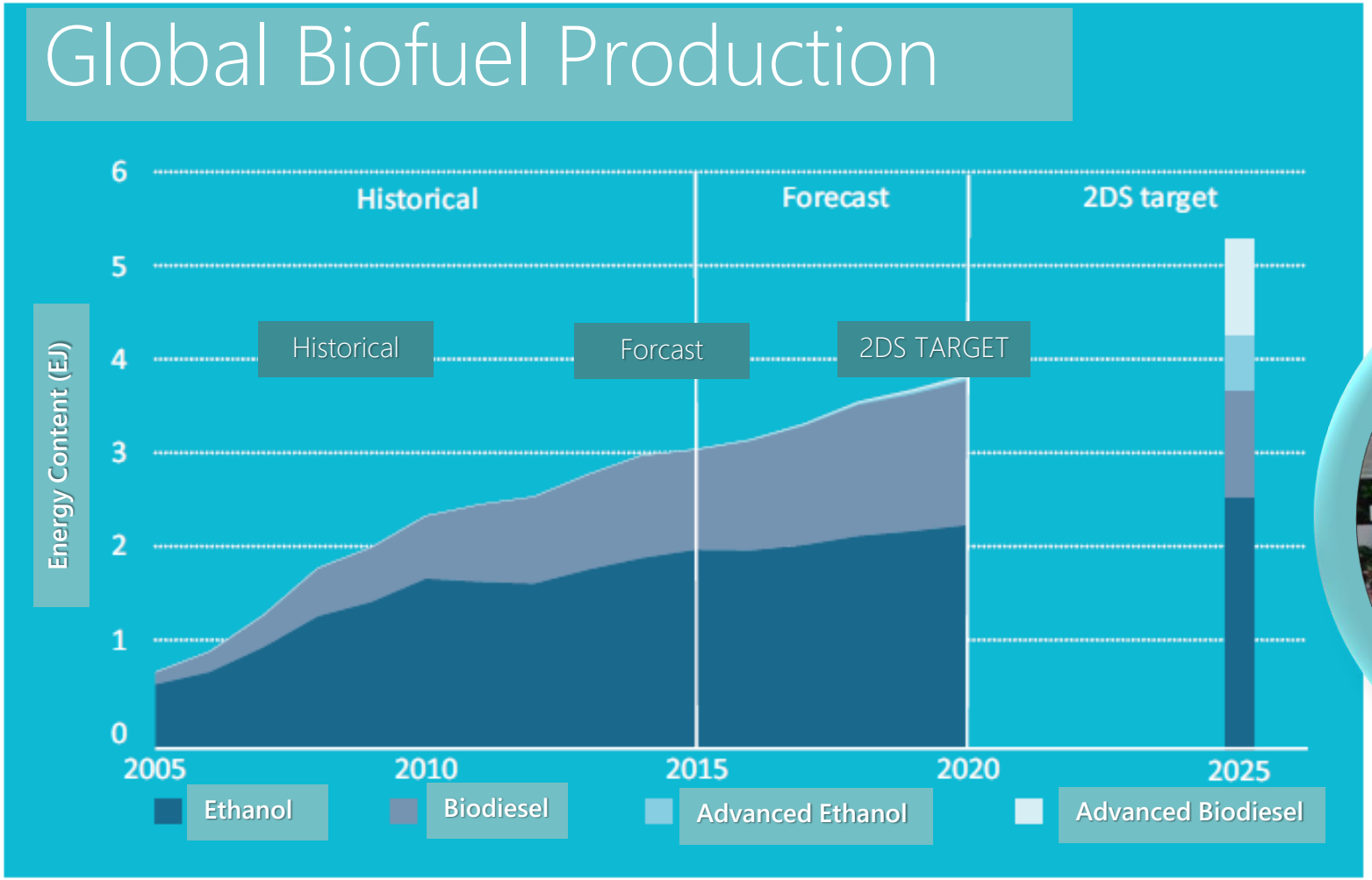
# Global Biofuel Production




Source: IEA



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# Electric Vehicles

## Tracking Progress

1. 2018 was another record-breaking year for global electric car sales (1.98 million), raising total global stock to 5.12 million.

2. Sales increased 68% in 2018, more than twice the average year-on-year sales growth required to meet the SDS level by 2030.

3. China was the world's largest market (just over 1 million electric cars sold in 2018), followed by Europe (385 000) and the United States (361 000); the three regions made up over 90% of all sales in 2018.

4. Norway continues to have the highest market share for sales (46% in 2018), followed by Iceland (17%) and Sweden (8%). Progress in decarbonising the power sector will accelerate the $CO_2$ emission reduction benefits of electric vehicles.



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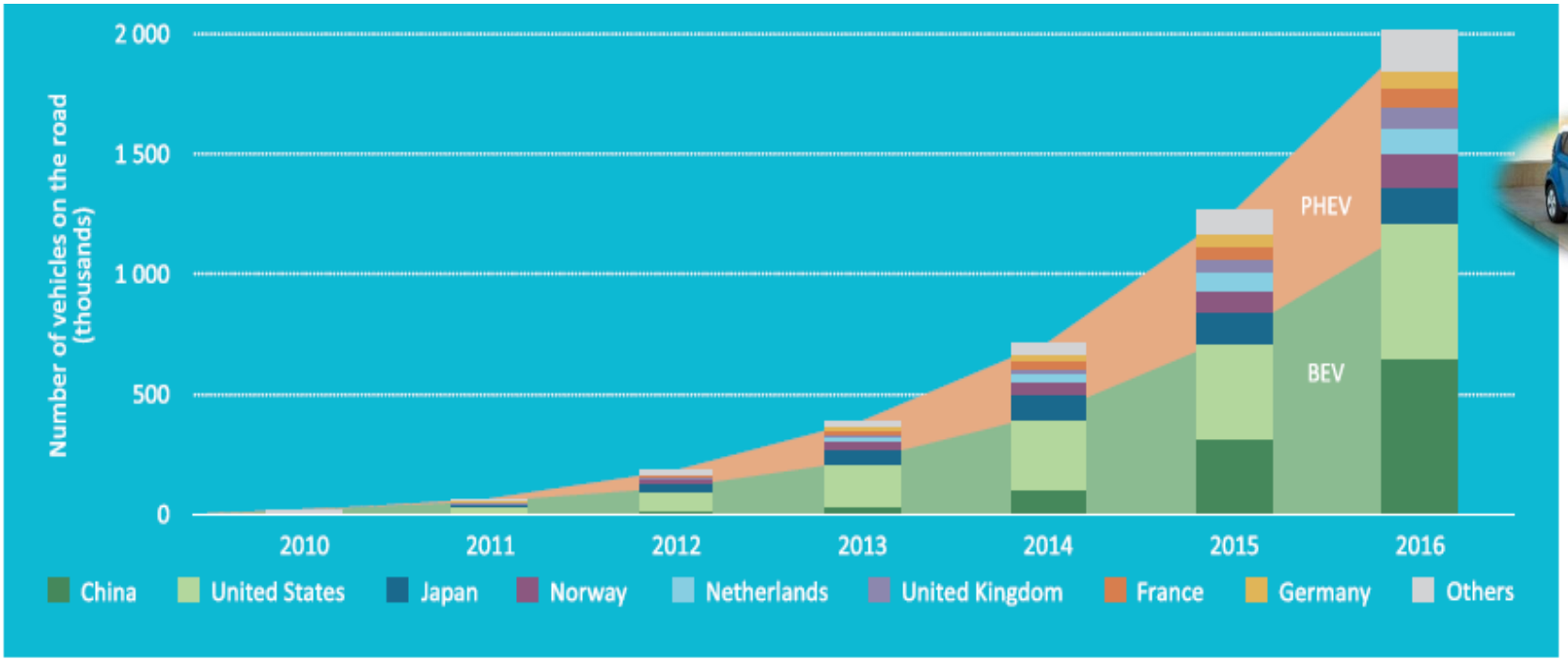
# Electric Vehicles
## Tracking Progress


**Evolution of the Electric Car Stock (BEV and PHEV), 2010- 2016**



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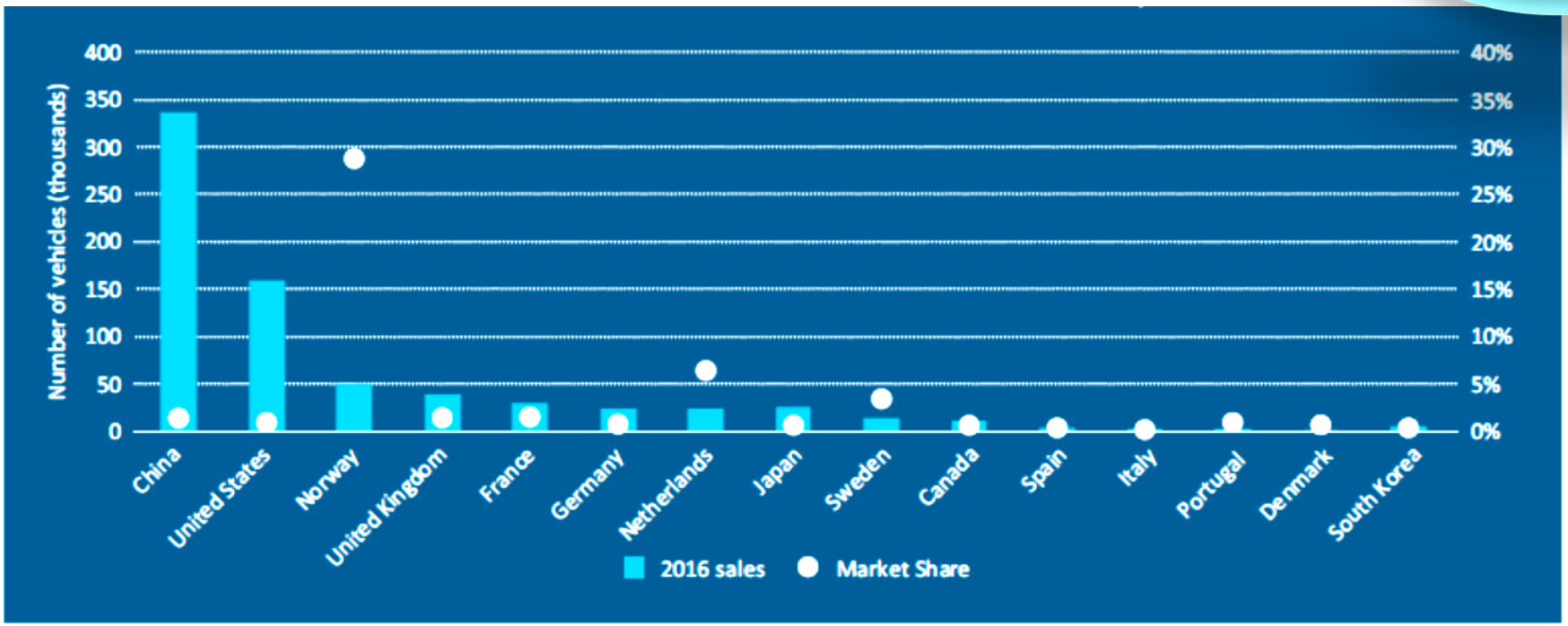
# Electric Vehicles

## Tracking Progress

### EV Sales and Market Share in a Selection of Countries, 2016



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# Electric Vehicles
## Tracking Progress

### Focus on China

More than 200 million electric two-wheelers

650 thousand electric cars

350 thousand electric buses

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.



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# **Green Fuel** as Local Endowment Renewable Energy

# Indonesia Renewable Energy

## in General

1. Indonesia has not committed to reach 100% renewable energy by 2050. By 2025, Indonesia plans to raise renewable energies from the current 7% to 23% share in the national energy mix.
2. By 2050, Indonesia seeks to raise renewables to 31% of the mix.
3. Endowments of renewable energy resources: solar, wind, marine and an estimated 40% of global geothermal reserves.
4. Indonesia's extensive coastline allows it to have a 75 GW hydro and marine potential capacity. Indonesia's coast also opens up opportunities for offshore wind energy development

# Indonesia Renewable Energy

## in General

1. Of the 80.5 GW of RUPTL new capacity to be installed in the next decade, 22 GW will be in renewable energy

2. 6,150 MW of geothermal, 13,100 MW of large hydropower, 1,365 MW of small hydropower, 444 MW of solar, 640 MW of wind, and 488 of biomass

3. Although hydro has the greatest potential, the focus of PLN remains on thermally generated sources (coal at 20 GW and gas at 13 GW).

4. To reduce GHG emissions, PLN should concentrate the unallocated energy sources in renewables, such as hydro and offshore wind.



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# Indonesia Renewable Energy
## in Automotive Industry

1. Biodiesel blend B 30 will be implemented next year
   - Full scale road test is in progress
2. Going discussion on Ethanol Fuel
   - Initial plan: Ethanol Fuel E2 for RON 92 in East Java on 2019
   - Pertamina Fuel Ethanol supply point have been well prepared in Surabaya, Jakarta, Bandung, Semarang, Balongan and Banten.
   - Ethanol price disparity will be passed through customer



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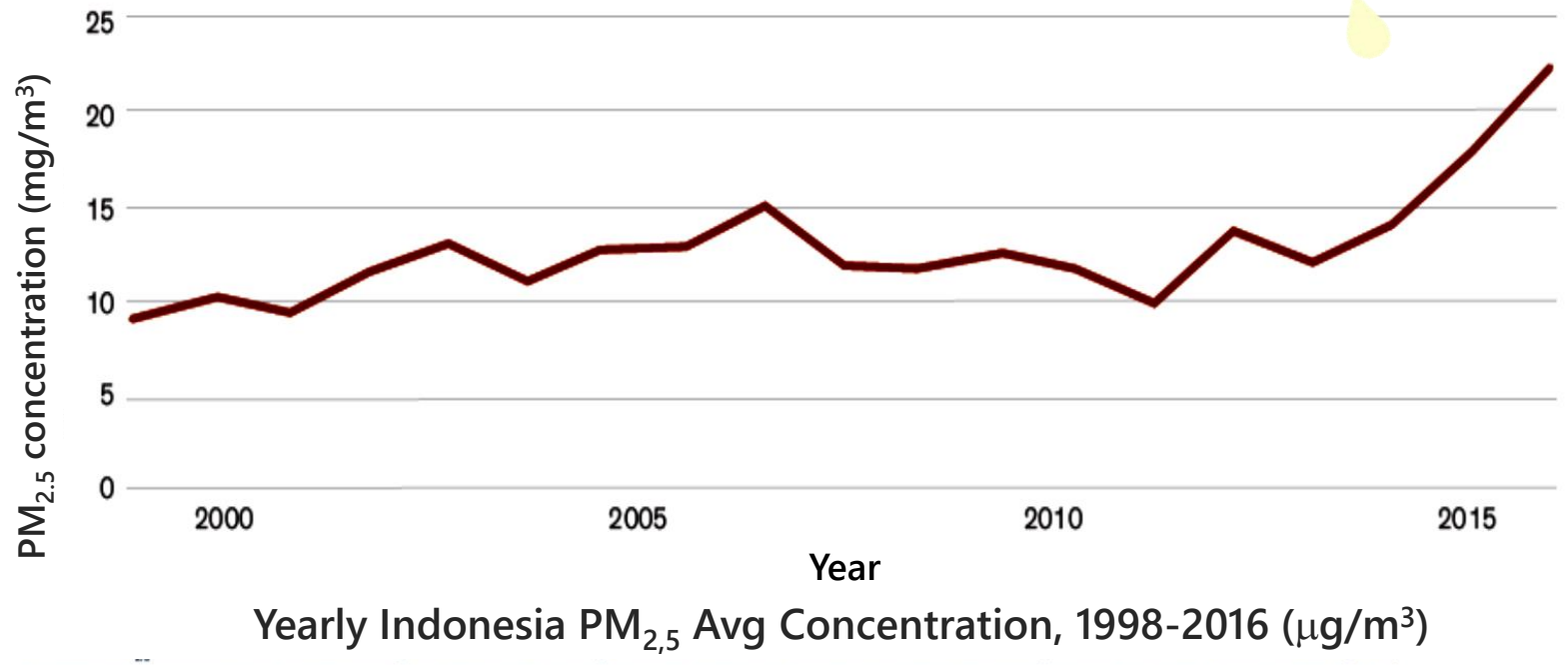
# Indonesia Renewable Energy
## in Automotive Industry

From 1998 to 2016, Indonesia changed from being one of the cleaner countries to one of the twenty most polluted country.

On March 10, 2017, Minister of Environment and Forestry (MLHK) has a new exhaust gas emission standard of Ministerial Regulation LHK NO. P.20/ MENLHK/SETJEN/KUM.1/3/2017.

# Indonesia Renewable Energy
## in Automotive Industry

Indonesia has seen air pollution concentration, increased 171%. Air Quality Life Index (AQLI) increased sharply more than 10 mg/m$^3$ since 2013 and reported doubled pollution from 2013 to 2016




Yearly Indonesia $PM_{2,5}$ Avg Concentration, 1998-2016 (μg/m$^3$)

Note: The $PM_{2.5}$ concentration shown in this figure are satellite-derived, and net of dust and sea salt to focus on human-caused pollution. Source: von Donklar et al. (2016)



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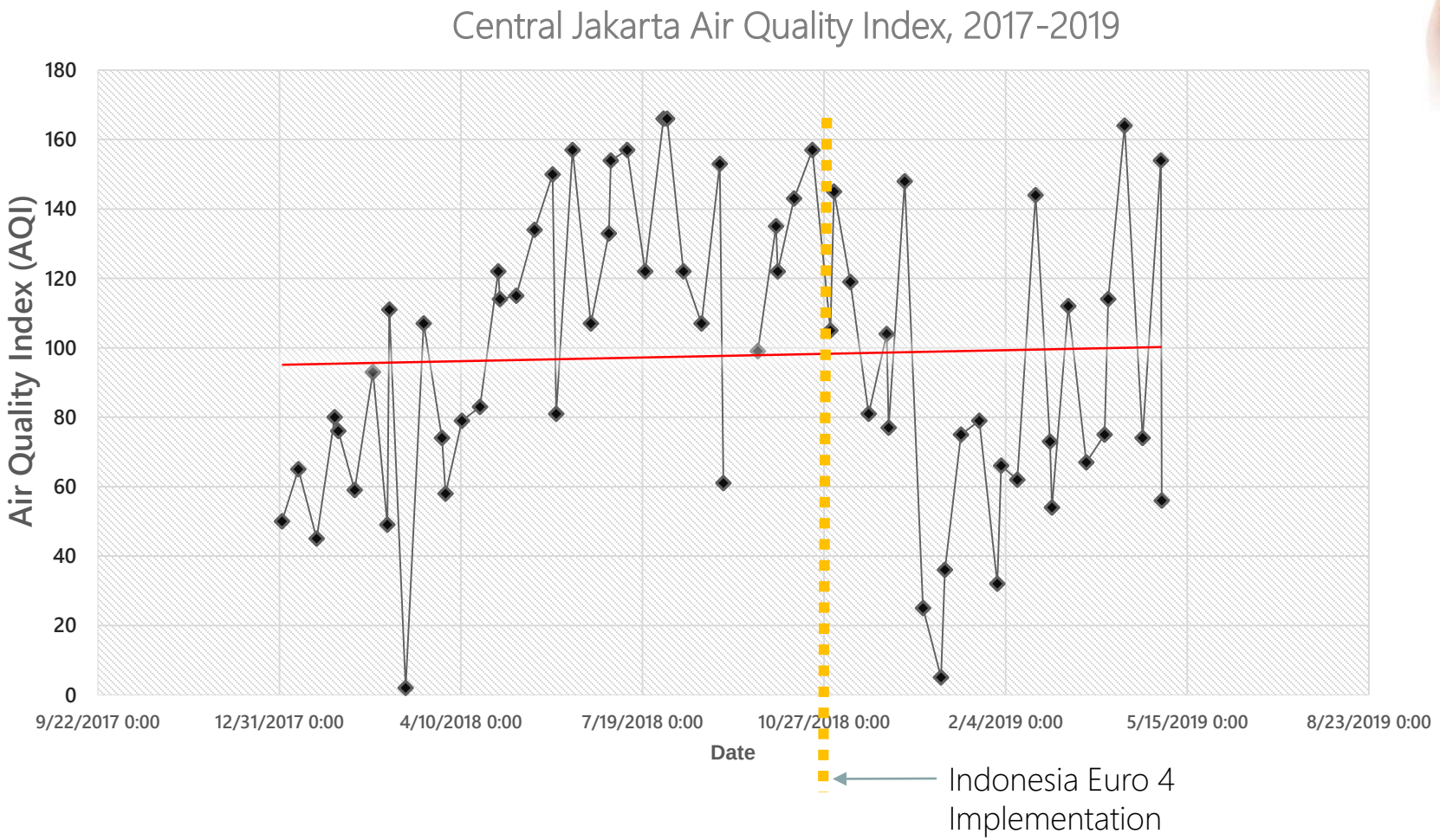
# Indonesia Renewable Energy
## in Automotive Industry




Ministerial Regulation LHK NO. P.20/ MENLHK/SETJEN/KUM.1/3/2017. works?



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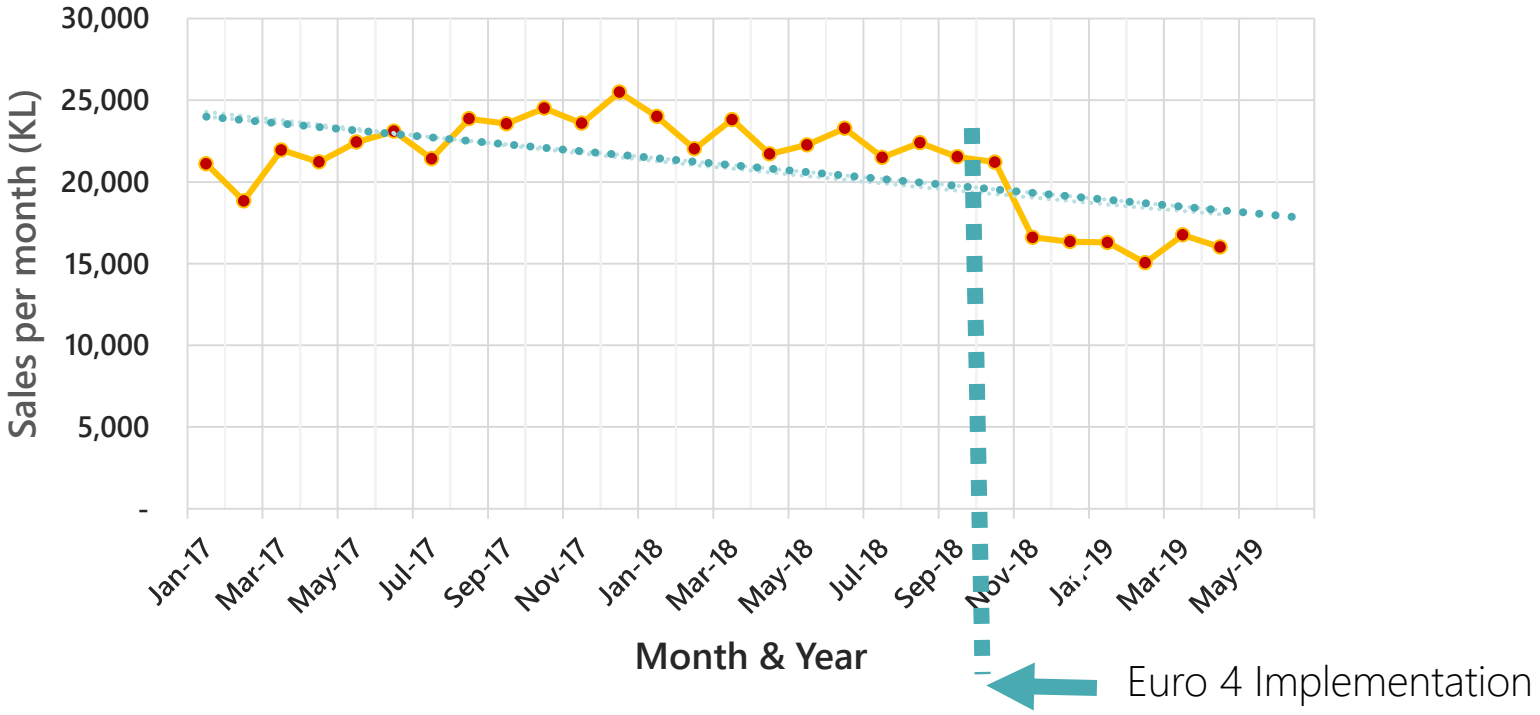
# Indonesia Renewable Energy
## in Automotive Industry

Jakarta Unhealthy Air Quality Index connected to decreasing sales trend of Pertamina Euro 4 fuel?




Monthly Pertamax Turbo Sales, 2017-2019



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# Indonesia Renewable Energy
## in Automotive Industry

### How to cope or What the causes?

1. **To limit vehicle population?**
2. **High consumption of coal for new power plant**
3. **Forest fire**
4. **High sales of Non Euro 4 fuel ("Premium" or Pertalite)**
5. **On board diagnostic is turned off**
6. **No exhaust gas emission monitoring mandatory for after market vehicles**



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# Many Thanks



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