

Does implementation date matter?

Euro six vehicle emission standards in Australia – A case study

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The aim of this paper is to examine the impact of Euro six implementation year. The research question is: does it actually matter when Euro six is implemented? As this paper will show, delay in implementation of Euro six emission standards is not a trivial issue, as vehicles remain in the on-road fleet for many years. The impacts of potential future adoption of, for instance, Euro seven and accelerated penetration of battery electric vehicles is out of scope.

1. INTRODUCTION

As is common practice around the world, Australia has adopted increasingly strict vehicle emission and fuel quality standards over time. These have progressively reduced average emissions of regulated air pollutants per vehicle kilometre travelled (VKT).

In Australia, vehicle emission standards are regulated through the Australian Design Rules (ADRs). These standards are based on European regulations for light-duty and heavy-duty (heavy goods) vehicles, with acceptance of selected US and Japanese standards as alternatives.

The current minimum standard for new light vehicles in Australia is ADR 79/04, which is based on the Euro 5 standards, and applies to light-duty vehicles produced from 1 November 2016 (DITRDC, 2020). The current minimum standard for new heavy vehicles is ADR 80/03, which is based on the Euro V standards, with equivalent US or Japanese standards accepted as alternatives. This standard applies to new heavy-duty vehicles produced from 1 January 2011 (DITRDC, 2020). Australia effectively sets vehicle standards for New Zealand, because the Australian/New Zealand market is treated as one by vehicle manufacturers.

2. EURO SIX

Adoption of international vehicle emission standards (air pollutants) in Australia has historically lagged two to seven years behind the European Union. Euro VI for heavy-duty vehicles and Euro 6 for light-duty vehicles commenced in the EU in 2012 and 2014, respectively. The maximum delay of seven years for adoption of previous pre-Euro 6/VI standards would have suggested 2019-2000 as the latest Euro 6/VI implementation year in Australia. This aligns with the earliest

adoption that was considered in the Euro Six Regulatory Impact Statement (AG, 2016). It is unclear at this stage if, and when, Euro 6/VI will be adopted in Australia. Delays in adoption of Euro 6/VI emission standards in Australia creates a similar delay in New Zealand.

The quality of fuel is closely linked with vehicle emission standards for technological reasons. In 2027 all commercially available fuels in Australia will align with Euro six requirements, marking it as a possible implementation year, and suggesting a 13-15 year delay in the adoption of Euro six in Australia and New Zealand. Since Australian diesel fuel quality standards align with Euro six requirements since 2009 (UQ, 2014), Euro six emission standards can already be adopted for diesel vehicles.

3. AUSTRALIAN FLEET MODEL

The Australian Fleet Model (AFM) software tool was used to investigate the impact of three different Euro 6/VI implementation years (2020, 2023, 2027) on the on-road fleet mix for the period 2020-2050. AFM simulates the dynamic changes in on-road vehicle population and total (vehicle) kilometres travelled (VKT) for 1240 vehicle classes for past, current and future base years. The tool is based on comprehensive analysis and integration of vehicle population data, vehicle sales data, and vehicle use data (e.g. relationship between vehicle age and annual mileage). It considers fleet growth rate and the impacts of vehicle scrappage.

AFM produces detailed vehicle population and travel (VKT) data tables for 40 vehicle categories and 31 vintages (vehicle age) categories (i.e. 1240 model classes) for each base year. The data tables are compressed to 19 ADR categories. Each ADR category spans a predefined range of vehicle years of manufacture. For instance, small ADR79/02 petrol cars include years of manufacture 2010-2013. Since not all combinations of vehicle class and ADR exist (e.g. some ADRs apply only to heavy-duty vehicles), the result is a set of compressed VKT tables with a total of 360 vehicle categories for each base year. For the scenario modelling, the range of vehicle years of manufacture for ADR 6/VI was varied to reflect different implementation years.

Figures 1a-1c shows examples of selected vehicle classes for base year 2027 – large diesel SUVs (SUV-L-diesel), petrol light-

commercial vehicles (LCV-petrol) and diesel articulated trucks (AT-diesel). The green bars show the estimated proportion of total VKT for each vehicle class. Note that Euro 6 corresponds to ADR79/05 and Euro VI ADR corresponds to ADR80/04.

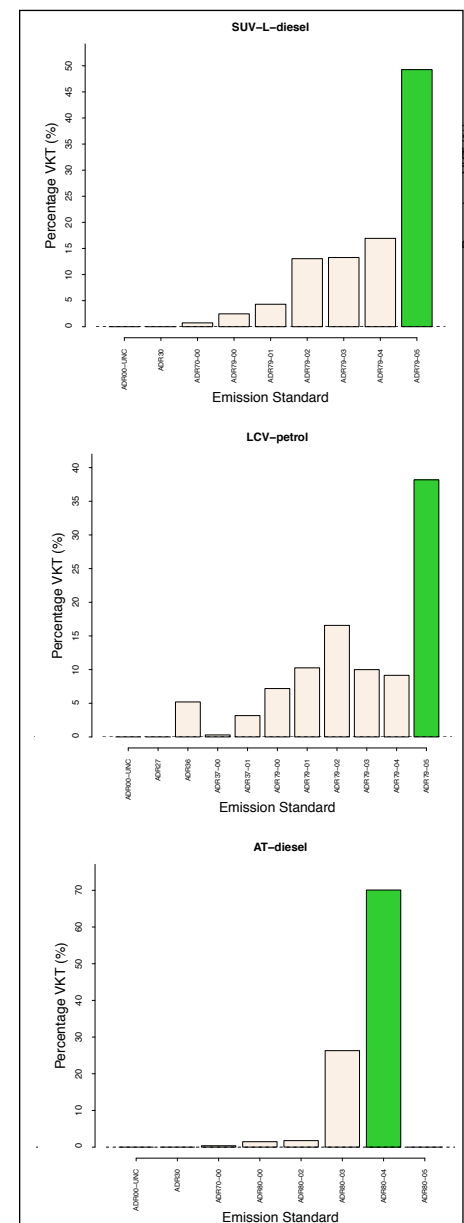


Figure 1a – Proportion of total vehicle travel (VKT) by emission standard (ADR) for base year 2027 for selected vehicle classes – Assumed Euro 6/VI implementation year is 2020

EURO SIX STANDARDS IN AUSTRALIA

The impact of implementation year is clear in Figures 1a to 1c. The proportion of total travel (VKT) for Euro six varies from approximately five percent or less (Euro six implementation year 2027), to 30-50 percent (implementation year 2023) and 50-70 percent (implementation year 2020). Even a four year difference in Euro six implementation (2023, 2027) has a significant impact on the proportion of Euro six technology vehicles in the on-road fleet in 2027.

4. COPERT AUSTRALIA

Postponing the implementation of stricter standards will effectively allow vehicles to emit higher levels of air pollution (and greenhouse gases) over their useful life. As a consequence, the choice of implementation year is important. To assess the impact of implementation year on on-road vehicle emissions, the COPERT Australia software was used in combination with AFM to predict average emission levels in on-road conditions.

First, a national motor vehicle emission inventory (MVEI) was created for Australia in 2018. The MVEI was calibrated with total annual fuel consumption data for on-road transport by fuel type (diesel, petrol, E10, LPG, CNG, biodiesel). Second, a MVEI was created for each individual base year out to 2050 for the three scenarios. The period 2020 to 2050 is of interest. NO_x emissions are taken as an example.

Figure 2 shows the results.

- The first plot (on the left) shows the estimated total NO_x emissions from Australian road transport as a function of base year and Euro six implementation year. The delay in Euro six implementation year results in a delay in emission reduction, as well as a slower rate of reduction.
- As a consequence, additional emissions due to later implementation, accumulate over time. This is shown in the second plot in the middle. The cumulative extra emissions due to a delay in Euro six implementation develop in a non-linear fashion and eventually converge after roughly 25-30 years when most vehicles comply with Euro six standards. Interestingly, there is a significant difference in cumulative

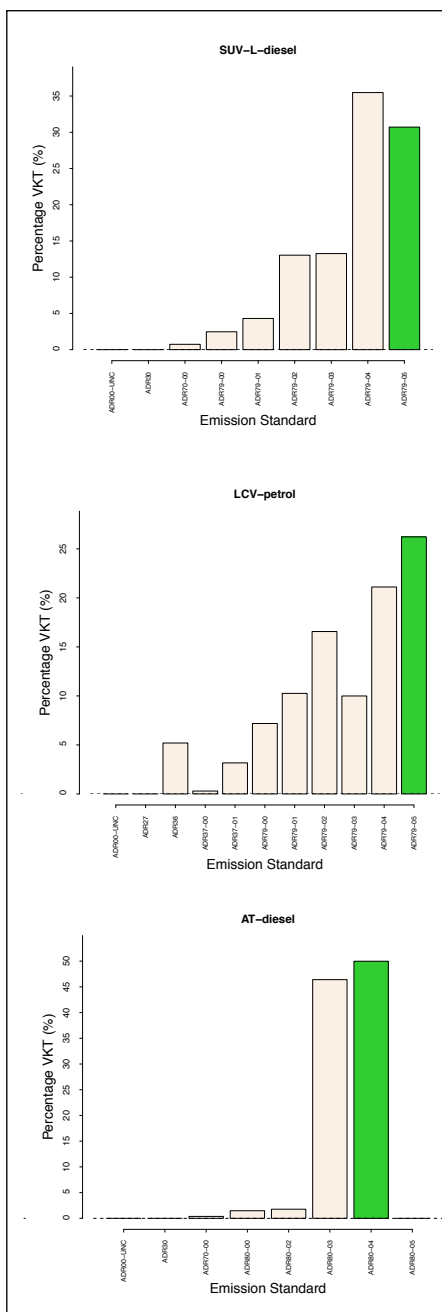


Figure 1b. Proportion of total vehicle travel (VKT) by emission standard (ADR) for base year 2027 for selected vehicle classes – Assumed Euro 6/VI implementation year is 2023

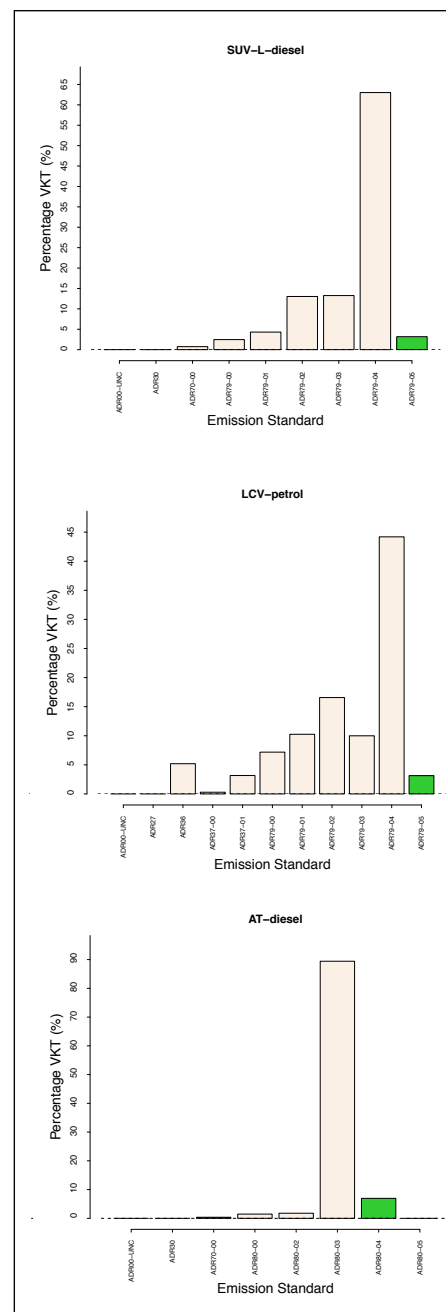


Figure 1c. Proportion of total vehicle travel (VKT) by emission standard (ADR) for base year 2027 for selected vehicle classes – Assumed Euro 6/VI implementation year is 2027

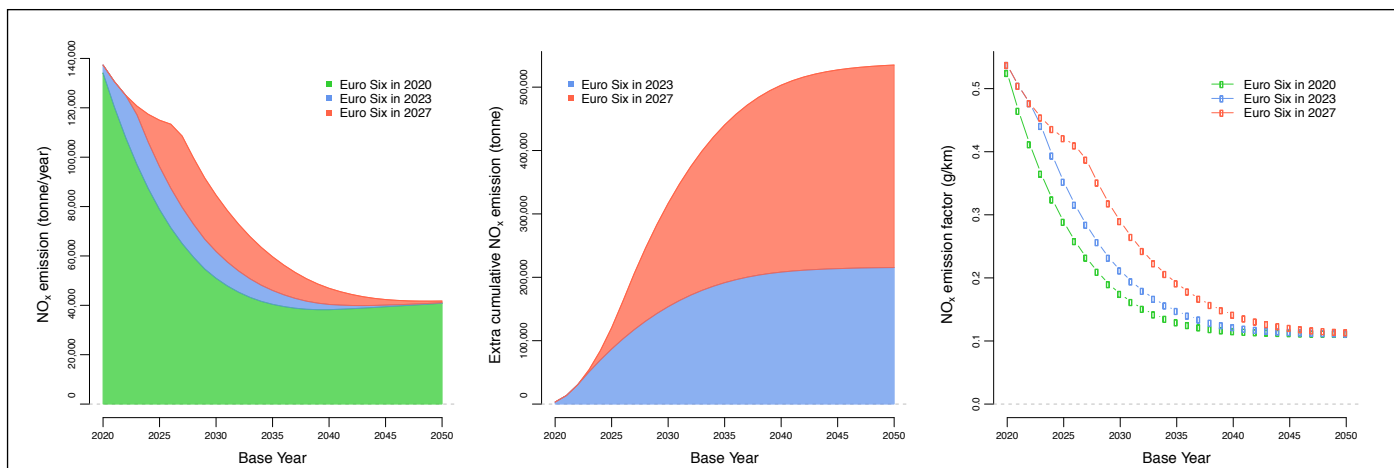


Figure 2 – Impact of Euro six implementation year on NO_x emissions from on-road transport in Australia

total NO_x emissions for 2023 and 2027 implementation, illustrating the emission benefits of adopting Euro six earlier.

- The last plot (on the right) shows the fleet averaged NO_x emission factors (g/km) as a function of base year and Euro six implementation year. These results are normalised for growth in VKT, and they are relevant for local air quality assessments. The plot shows that implementation year has a substantial impact on average emission rates in the period 2020-2035, after which they start to converge.

5. CONCLUSIONS

This study shows that implementation year of Euro six emission standards is important for vehicle emission reduction. Small changes in implementation years can significantly affect total annual (NO_x) emissions, as well as accumulated total emissions over a 30-year

time period. Earlier implementation of Euro 6/VI presents an opportunity to reduce vehicle emissions. Any decisions on future years of implementation for e.g. Euro seven and battery electric vehicle policies are expected to be similarly relevant, provided that changes in vehicle emissions per km are significant.

6. REFERENCES

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