



Motorcycle Design - Powertrains

Luke Jacobs

Andrew Noble

Wales Institute for Science & Art

BEng Motorcycle Engineering

Introduction

Motorcycle powertrains are manufactured in a variety of layouts and type, due to the wide array of requirements that consumers put onto the manufacturer these can include categories such as; sound, style, application, feeling, licencing requirements and many more.

There are other compromises that can influence or effect design of powertrains, such as local emission laws, capacity restrictions, operating location and product lifecycle.

Common Motorcycle engine types

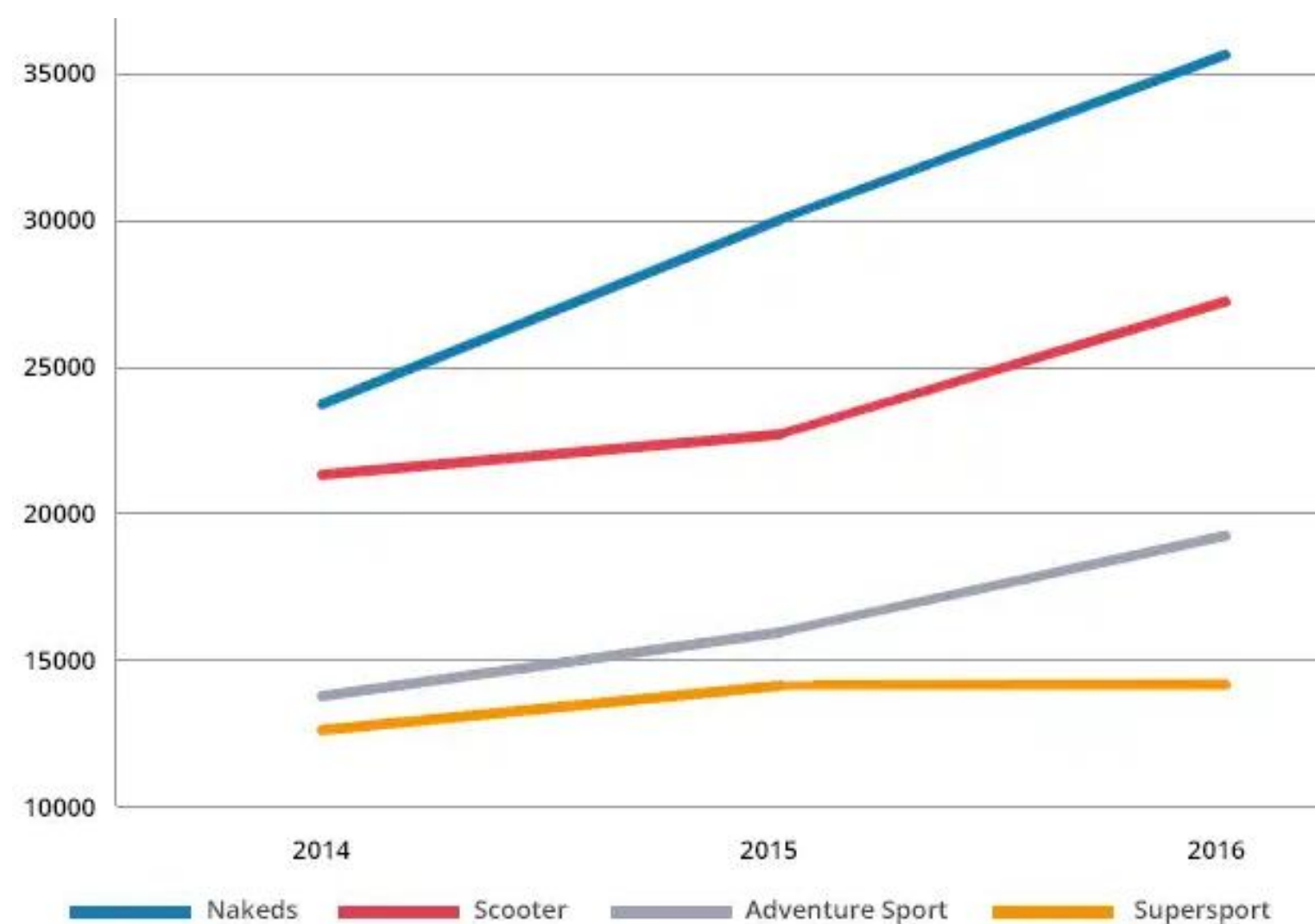
- **Inline Four**
- **Parallel Twin**
- **V - Twin**
- **Single**
- **Inline Three**

The design of powertrains is important as it directly affects factors such as safety, efficiency and emissions, as well as the final user experience.

Powertrain design is relevant to the general engineering world because it can drive research and development of fluid flow and thermal properties of materials used within the engine as well as new emission and efficiency technologies.

What Pushes Development ?

Motorcycle racing is at the forefront of powertrain development, Series such as the motorcycle grand prix (prototype series) and World superbikes (production-based), new technology is found in MotoGP as it is a prototype class with given parameters that must be met so new mechanisms and methodologies are developed to create the best machine. The production-based racing however drives development for already established powertrains, looking how to improve and optimise the publicly available technology.



*A Graph Showing the change in motorcycle type purchased (new) between 2014 and 2016.
(What's Driving the Motorcycle Sales Boom? | The Bike Insurer, n.d.)*



Alto Performance Vyrus – showing hub centre steering

*Photo Courtesy of : Alto Performance
www.altoracing.co.uk*

What Drives Sales?

Sales and Development are intertwined within the motorcycle design world, as manufacturers generally will not develop motorcycles for markets that are not in demand.

The motorcycle world is changing, the type of motorcycles being purchased has shifted, as well as the emissions regulations motorcycles now need to meet.

In the past, motorcycles would be sold based on road tests, magazine articles and functionality, however motorcycles now have shifted much more towards the leisure sector and are being sold based on internet vlogs, lifestyle and aesthetics, most recently being the nostalgic style shown in bikes such as the Yamaha XSR900GP.



*Photo Courtesy of
Yamaha UK*

Is Electric the Future ?

The tightening of emissions policies globally is reshaping the landscape for powertrain design, innovation and compliance within the engineering world.

Motorcycles have not experienced the electric boom that the rest of the automotive sector has, part of this is due to size constraints interlaced with underdeveloped battery technology.

Batteries on motorcycles have to be small to fit within the general styles of modern motorcycle chassis this already starts to put a limit on range and make inconvenience for the end user.

Consumer batteries are not yet energy dense enough to be suitable to make a mass industry change over to electric motorcycles for the public.

An approaching solution is to have a control type single battery for all manufacturers for a quick-change system to try and alleviate milage issues and charging times.

Acknowledgements

Thank you to all the staff at UWTSD for the knowledge bestowed to me through lectures and the support provided.

References

- Alto Racing (no date). Available at: <http://www.altoracing.co.uk/> (Accessed: 16 April 2025).
- Fitz-Gibbons, M. (2025) Electric Motorcycle Guide (2025) – Is the future really electric? Available at: <https://www.bennetts.co.uk/bikesocial/news-and-views/features/electric-motorcycles/guide#are-electric-motorcycles-the-next-big-thing> (Accessed: 16 April 2025).
- Lieback, R. (3034) Your Guide to Motorcycle Engine Types: From Singles to V4s. Available at: <https://www.twistedroad.com/blog/posts/your-guide-to-motorcycle-engine-types-from-singles-to-v4s> (Accessed: 15 April 2025).
- What's driving the motorcycle sales boom? | The Bike Insurer (no date). Available at: <https://www.thebikeinsurer.co.uk/riding-advice-and-guides/whats-driving-the-motorcycle-sales-boom/> (Accessed: 15 April 2025).