



## E85 Tested, here are the results

Ben Silcock <ben@hpacademy.com>  
Reply-To: ben@hpacademy.com

Wed, Oct 13, 2021 at 9:16 AM

### Knowledge Bomb

*The more you know the faster you go.*



#### Scott In this email you will learn about:

1. How Much More Power Can You Make on E85?
2. Is it actually more efficient?
3. What makes it better then?
4. We Tested it. Here are the results
5. More Ignition Timing
6. What about N/A Engines?



## How Much More Power Can You Make on E85?

Ethanol-based fuels are commonplace in the automotive world.

1

Since Ethanol is a renewable resource and a cleaner-burning alternative to gasoline, Ethanol, or more specifically ethanol blends, have become a popular choice in many countries.

Pure Ethanol or E100 isn't typically used as a fuel since its lack of volatility (compared to gasoline) can make it hard to start when the engine is cold. The most common blend we are used to is E85, consisting of 85% ethanol and 15% unleaded gasoline.

However, it's worth noting that the actual ethanol content of E85 may fluctuate quite widely in pump E85. For example, it's common to see ethanol content in a winter blend of E85 reduce to perhaps 60-70% and starting in very cold climates.



## Is It Actually More Efficient?

While E85 is great for the environment, performance enthusiasts quickly found it great for producing power. So, where does the advantage come from?

On the face of it, Ethanol has a slightly lower energy content than gasoline per kilogram, but it also has a much richer stoichiometric AFR (9.8:1 for E85 vs 14.7:1 for pump gas), which means we need to use more of it to mix with the same mass of air.

In general, when switching to E85, we will find that we need to inject around 35-40% more fuel to make the same power we saw on pump gas. E85 also contains approximately 30% oxygen by weight, and it has a higher effective

octane rating than pump gas - Which is often listed as 105. However, we have seen E85 perform as well as specifically blended race fuels with motor octane ratings of 116+.



## What Makes It Better Then?

One of the key advantages of E85 over gasoline is that it has a higher latent heat of evaporation than pump gas.

This means it absorbs more heat from the combustion charge as it goes through a phase change from liquid to vapour. This draws heat out of the combustion charge and, coupled with its high octane rating, makes the fuel very resistant to detonation.

For those interested in performance, this means we can run more boost, more compression, more ignition advance, or all three with relative immunity from detonation. Contrary to popular belief, knock can still occur on E85, but it is much less likely.



## We Tested It. Here Are the Results ♂

We recently tested our Toyota 86 fitted with a Borg Warner EFR 6758 turbo and a MoTeC M150 ECU.

In stock form, the 12.5:1 compression engine was heavily knock limited on pump gas, producing 198 kW at the wheels with 7 psi boost - That's still a decent increase from the 114 kW measured when standard, though. With a tank of E85 on board, we optimised the ignition advance at the same 7 psi, achieving 226 kW at the wheels. This gain was achieved because we could optimise the ignition timing without encountering knock. In the end, the engine took an extra 6-8 degrees of ignition advance over what it accepted on pump gas.



## More Ignition Timing

Once we had achieved MBT timing at the minimum boost level of 7 psi, we used the MoTeC's electronic boost control to raise the boost pressure. With an extra 2.5 psi boost (9.5 psi peak), the engine produced 266 kW at the wheels, and the ignition timing could still be advanced to MBT with no sign of detonation. Note that the stock FA20 engine runs a very high 12.5:1 compression, making it challenging to tune when coupled with a turbocharger.

Obviously, we could have pushed the boost further, but we would like the stock FA20 to hold together for a little longer right now.



## What about N/A Engines? 🏎️

So E85 allows a degree of immunity from knock, which lends itself nicely to high boost turbo engines or high compression N/A engines.

What happens if your engine is naturally aspirated and isn't knock limited, though? We have found that you can still expect to see an additional 5% more power even in these situations, making the switch to E85 a worthwhile consideration.

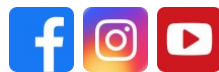
The only downside is that you will be burning more fuel, and hence your fuel economy takes a hit. On top of that, you may need to rethink your fuel system with larger injectors and fuel pumps, often an essential aspect of any upgrade to E85.



## So there you go

As you can see, there are a few reasons behind the power gain of E85. Hopefully this email has given you a bit of an insight into tuning with E85 and what its advantages and disadvantages can be!

If you are interested in learning more about tuning for Ethanol, check out our dedicated [Ethanol and Flex Fuel tuning course!](#)



[Unsubscribe](#)