



## ***10 Ways to Increase Drivetrain Efficiency -Report Highlights-***

The 15 Friction Facts efficiency reports contain over 160 pages of data, graphs, and in-depth technical material. If you are simply looking to use that data to go faster and don't have time to dive into each report individually, we've compiled the major findings and created **a go-fast cheat sheet of top-performing products and watt-saving practices.**

The information in this document provides a high-level summary of the Friction Facts report findings. Though this document provides a valuable overview of drivetrain efficiency, we highly recommend viewing the full reports for additional detailed information.

*Friction Facts tests are typically performed at 250W rider output. The watt-savings values listed below will increase with increased rider output. I.e., if you are a 400 watt rider, the watts you will save are higher than the referenced numbers, increasing typically in a linear fashion. For additional details, see the "Effects of Power Output on Chain Efficiency" report.*



## **POWER SAVING TOP-PERFORMING PRODUCTS:**

- **4+ Watt Savings:** Use a top-performing chain lubricant. Test results show a 4+ watt efficiency difference between the most efficient and least efficient chain lubes. The top performing lubes are:

- 1. Molten Speed Wax**
- 2. Squirt Lube**
- 3. Lilly Lube**
- 4. Rock n Roll Extreme**

*See the “Velo/Friction Facts Chain Lube Efficiency Test” report and graph on page 4 for additional details.*

- **3 Watts Savings:** Upgrade to an oversized derailleur pulley system. The Berner oversized ceramic pulley system saves 2.95 watts when compared to a standard derailleur cage with poor-performing 11T pulleys. The Berner system specifically saves 1.75 watts when compared to a standard short cage Dura Ace derailleur. The watt-savings seen with the Berner system is due to the larger-sized pulleys, high efficiency ceramic bearings, and lighter coil spring force resulting in lighter cage tension.

*See the “Oversized Derailleur Pulley Efficiency Test” report for additional details.*

- **Alternative 1.3 Watt Saving Pulley Option:** If you would prefer to keep your existing 11T rear derailleur cage, simply upgrade the 11T pulleys. Test results show a 1.34 watt efficiency difference between the most efficient and least efficient 11T pulleys. The top performing 11T pulleys are:

- 1. CeramicSpeed**
- 2. Tiso Ceramic**
- 3. Enduro Zero**
- 4. Hawk Racing**
- 5. TACX ceramic**

*See the “11T Derailleur Pulley Efficiency Test” report for additional details.*

- **1.8 Watt Savings:** Upgrade to a top-performing bottom bracket. Test results show a 1.8 watt efficiency difference across a sample of 35 bottom brackets. Top-performing bottom brackets manufacturers are:

- 1. Gold Race**
- 2. Enduro**
- 3. C-Bear**
- 4. Hawk Racing**
- 5. CeramicSpeed**

See the “Bottom Bracket Efficiency Test” report for additional details and to determine which model is the top-performer based on your bike’s specific bottom bracket standard.

- **1.5 Watt Savings:** Use a Top Performing Chain. Test results show a 1.5 watt efficiency difference between chain manufacturers, tested with the same chain lube. Consistent top-performing chains are:
  - **Shimano Dura-Ace 11 speed**
  - **Shimano Dura-Ace 10 speed**

Note: Some chains may not be cross-compatible with drivetrains of different manufacturers.

See the “Chain Efficiency Test: Re-Lube” report for additional details.

- **1.2 Watt Savings:** Use top-performing pedals. Test results show a 1.2 watt efficiency difference in pedals. The top performing pedals are:
  - 1. Crank Brothers**
  - 2. Mavic**
  - 3. Speedplay**

See the “Pedal Efficiency Test” report for additional details.

## **POWER SAVING PRACTICES:**

- **3 Watt Savings:** Clean and lubricate your chain prior to a race. This simple practice sounds like a no-brainer, yet not cleaning and lubing can substantially increase friction in your drivetrain. Informal testing shows normal clean-conditions road riding, *without re-lubing*, can add upwards of *3 watts of friction* to a chain (the total frictional losses are ultimately dependent on the brand of lube and specific riding conditions). If it is not possible to clean your chain prior to a race, at a minimum, apply a fresh coat of lube.
- **3 Watt Savings:** Do not ride with the chain in the small ring/small cog combination. It is better to stay in the big ring – but not all the way to the biggest cog (easiest to pedal). Use the big ring for the first two-thirds of the cog. After the 8<sup>th</sup> cog, then drop into the small front ring.

*See the “Cross Chaining and Ring Size Efficiency Report” for additional details.*

- **2 Watt Savings:** Replace a worn chain. Test results show an average of 2.02 watt increase in chain friction with every 1% of chain elongation. Data shows that the frictional losses of the drivetrain are predominantly dependent upon the worn chain itself, whereas the wear level of the ring/cogs has a much less significant effect on frictional losses.

*See the “Effects of Chain Wear on Efficiency Test” report for additional details.*

- **1 Watt Savings:** Never race on a new chain. Test results show an average decrease of 0.75 watts of friction simply by breaking-in a new chain. This gain is due to the sliding surfaces of the chain becoming polished, decreasing the microscopic asperities (surface roughness) found on the pin and plate shoulder surfaces. A minimum of one hour of break-in prior to a race will provide a measurable efficiency gain.

*See the “Effects of Break-in on Chain Efficiency Test” report for additional details.*

- **Remove the factory lube and re-lube with top a top-performing aftermarket chain lube.** The efficiency of factory lubes varies greatly. Test results show some factory lubes have the highest frictional losses of any chain lube Friction Facts has ever tested, aftermarket or otherwise. Additionally, test results show that no factory lube is as efficient as the top performing aftermarket lubes.

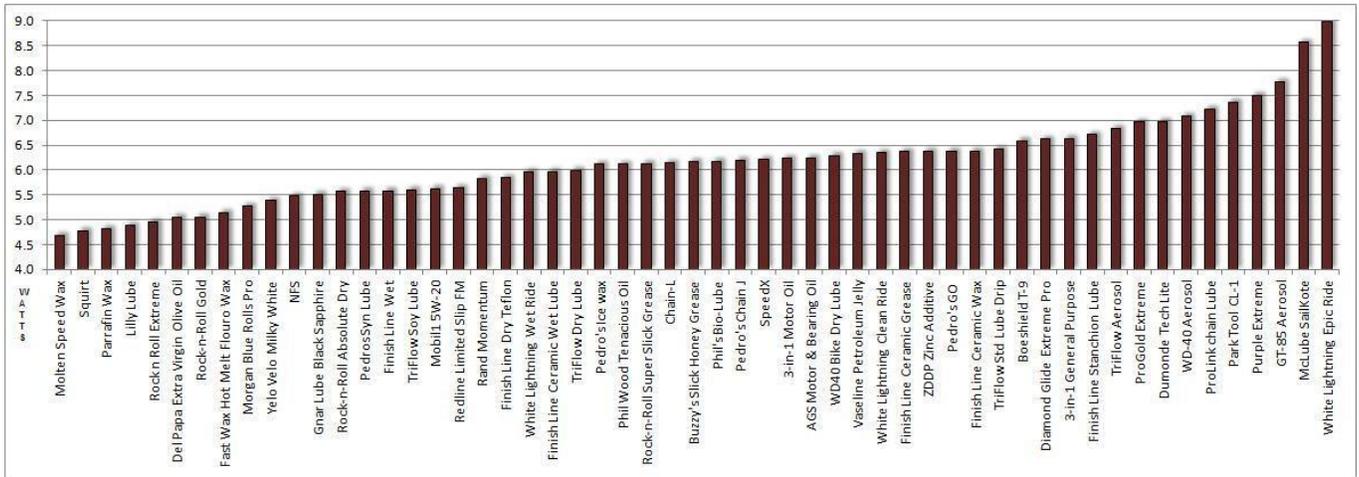
*See the “Chain Efficiency Test: Factory Lube” and “Velo/ Friction Facts Chain Lube Efficiency Test” reports for additional details.*



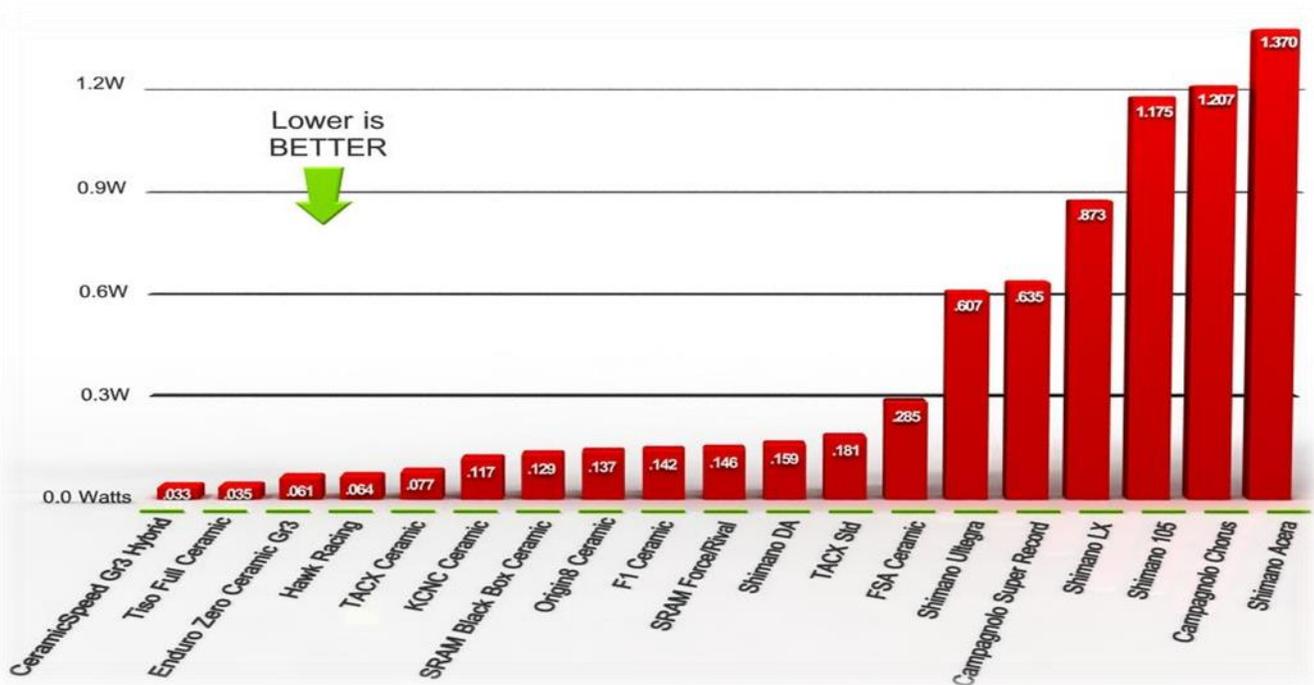
# PRODUCT EFFICIENCY GRAPHS

Lower is better on all product efficiency graphs

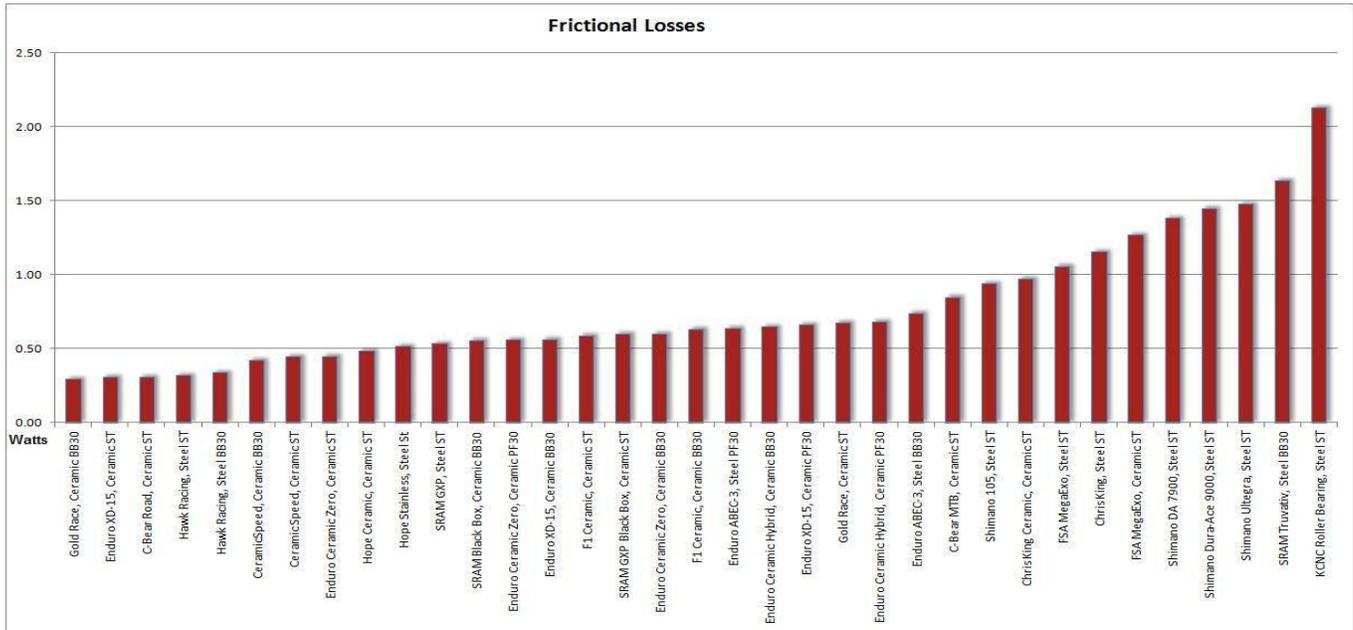
## Chain Lubricants



## 11 Tooth Derailleur Pulleys (per pair)

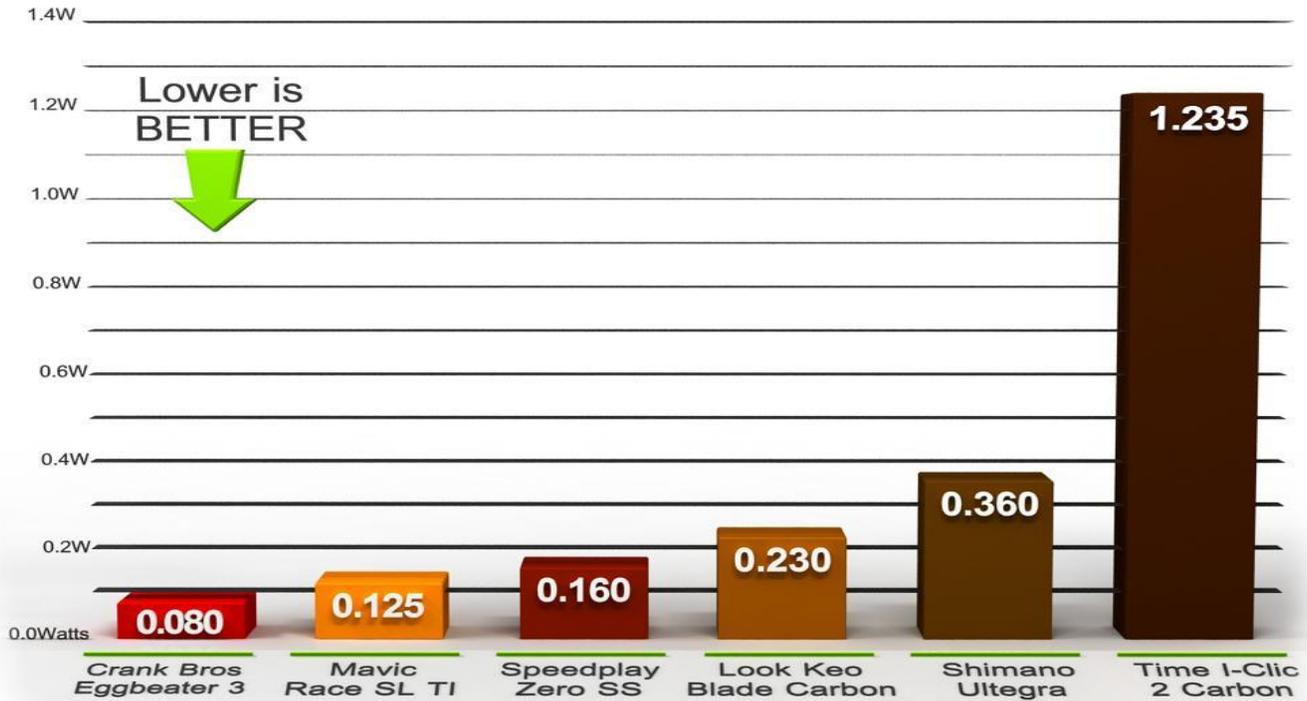


# Bottom Brackets



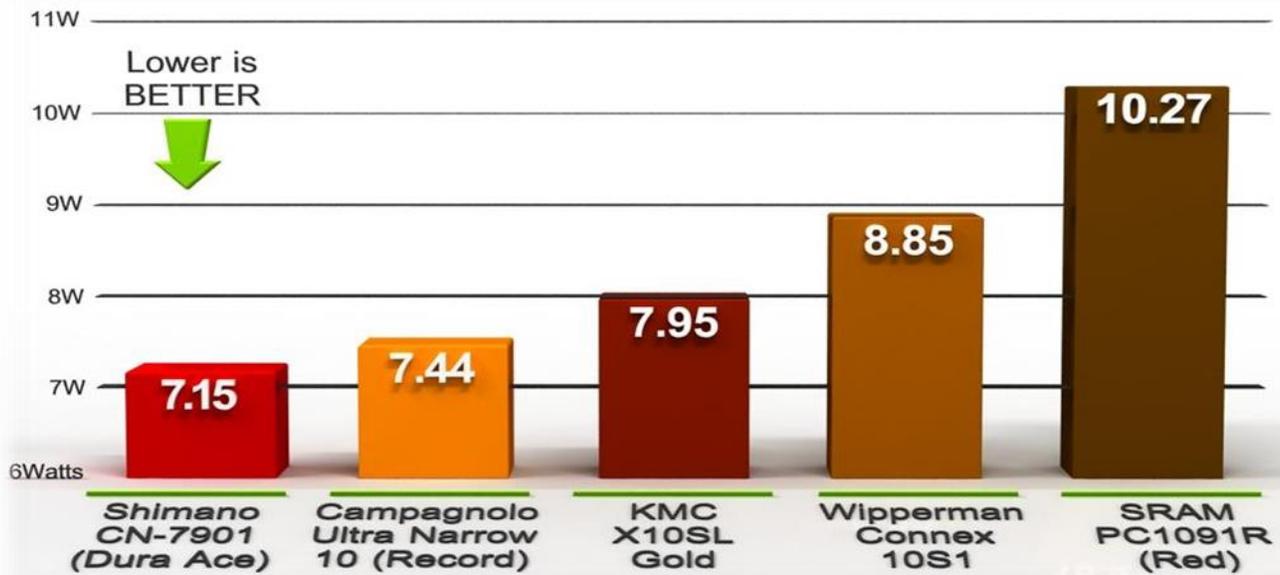
ST=Standard Threaded, BB30=BB30, PF30=Press Fit 30

# Pedals (per pair)



## Chains

(tested with factory lube)



## Chains

(factory lube removed and all chains re-lubed with the same basic oil)

