Advertising fuel burn is like advertising rate of climb. …Numbers out of context. Percentage of power is also very difficult to get a handle on. Calculating backwards from fuel flow, and some estimate of efficiency is a way to estimate power. Using Brake Specific Fuel Consumption as an efficiency factor works fairly well. That is LB Fuel per HP per Hr. BSFC. The more I fly the turbo, the more I rely on this because Manifold pressure vs rpm vary wildly in different flight conditions. Consequently, a performance table generated from a dyno run in a test cell is not directly a reliable reference to determine percentage of power in practice. The range of BSFC varies from engine to engine, but most everything is included between .4 and .6 BSFC.

Example: Continental A-65. Rated maximum power 65 - Published fuel burn is 4.3 gph at 75 percent power, or 48.75 HP - Average fuel wt 6 LB/Gal. So 4.3gal. x 6 weighs 25.8 LB. Dividing that by 48.75 gives us a BSFC of .529. BSFC numbers generally increase sharply near maximum power, and decrease at lower percentage of power.

Example HKS-700E. It is rated at 60 HP max, and 56 HP continuous. (at 5800 rpm). At 56 HP, (93 percent) it consumes 4.2 gph, or 25.2 Lb. per hr. As with the Continental example, divide the weight by the power, and read the BSFC: .450.

Now, to calculate percentage of power when all you have to work with is the fuel burn rate, and an estimate of BSFC: Divide the Lb of fuel by the BSFC and you have the estimated actual HP. Of course, divide that by maximum power to obtain percentage of power. Example: 2.6 gph is 15.6 LB. Divide by .45 comes up with 34.7 hp.

Earlier, a mention was made, of the Performance Table not being a "directly reliable reference for determining percentage of power in practice."

PERFORMANCE TABLE HKS-700T

Crank speed	Power	Crank torque	PTO torque (R/G 2.61)	Manifold pressure
r/min	hp	Nm	Nm	kpa / inches
5300	80.1	106	277	181.7 / 53.71
5200	80.1	108	282	181.7 / 53.71
5100	79.7	110	286	181.3 / 53.54
5000	79.0	111	289	180.7 / 53.36
4900	77.7	111	290	180.1 / 53.18
4800	76.3	112	291	179.0 / 52.86
4700	74.4	111	290	177.8 / 52.50
4600	71.5	109	285	176.7 / 52.18
4400	66.1	106	275	173.6 / 51.26
4200	61.5	103	268	170.8 / 50.44
4000	56.4	99	258	165.7 / 48.93
3800	49.9	92	241	157.0 / 46.36
3600	45.4	89	231	151.9 / 44.86

700T power example

The HKS-700T performance table above shows the engine producing 80 hp between 5100 and 5200 rpm, at almost 54 inches manifold pressure. We have chosen this rpm range for example, because Green Sky Adventures, Inc. has documented cross country flights at this continuous rpm. However, in cruise flight, the manifold pressure was 49 Inches, not 54. Referring to the table, a disparity between published and practice is quite large, ranging between 57 and 80 HP. By interpolation, the average between those two numbers is 68.5 HP, or about 86 percent. The linear interpolation may be subject for debate, but one hard fact during this example, is fuel burn. 5.8 gph on a 35 hr trip. …34.8 Lb per Hr. or .508 BSFC. 86 percent is arguably a large number for continuous operation in most typical flights. Please note, these numbers were based on condition of 212 Lb Pilot, 232 LB Passenger, 62 LB Baggage, 108 LB Take Off fuel. …A useful load much larger than typical.

700T economy example

Lightly loaded, we have used cruise settings of 4800 rpm and 46 inches MP. On the table, the power range is between 76 and 49 HP. Interpolating, we come up with 62.5 HP. Fuel burn in this condition is 4.46 gph, …26.76 LB per HR. or .428 BSFC.

Digesting Sales Rhetoric and Projecting Performance

The plain facts, as good as they are, sometimes grow into incredible claims. Similar to hearing reported cruise speed of the new SuperDuper is 100 mph. Once the word spreads, the reports are 100 knots. Wow, that's 115 mph. Pretty soon it is 115 knots, and so on. Similarly, reports that the HKS-700T burns less fuel than the 700E, have generally been taken out of context. The 60HP HKS-700E is considered one of the most fuel efficient production aircraft engines available. It is not uncommon to hear of operations below 2 gph, and reports of 2.2 to 3 gph are typical. Comparing the high power BSFCs of the two HKS engines, .508, and .450, are fairly close, with the 700E having a slight edge over 85 percent power.. Notice, in the 700T economy example, BSFC at 78 percent power (62.5HP) is .428. Applying that same BSFC to 56 HP (max continuous of 700E) rightly predicts a lower fuel burn for the 700T than what the 700E can possibly achieve. This is fact. The 700T burns less fuel than the 700E at any power output below 60HP. It does not burn less fuel at 80HP than the 700E burns at 60 as we sometimes hear. That would be a fairytale BSFC of .330.

There are other means of comparison using Torque Ratios, and Brake Mean Effective Pressure BMEP, but these tools may be better left for engine designers. As pilots we also take on duty of Flight Engineer. Knowing and understanding fuel flow rate, we have the tools to calculate power produced or consumed.

Gerald J. Olenik, pres.

Green Sky Adventures, Inc.