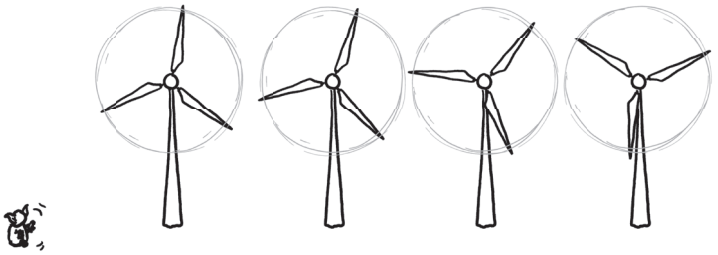
# YODA

## **Q.** How much Force power can Yoda output?

**—Ryan Finnie**

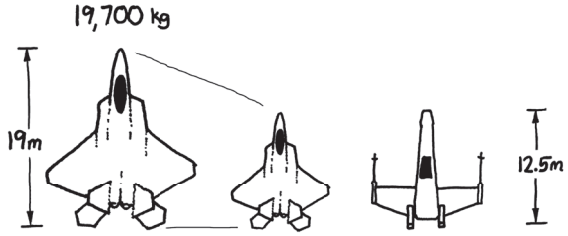


**A. I'M GOING TO —** of course — ignore the prequels.

Yoda's greatest display of raw power in the original trilogy came when he lifted Luke's X-wing from the swamp. As far as physically moving objects around goes, this was easily the biggest expenditure of energy through the Force we saw from anyone in the trilogy.

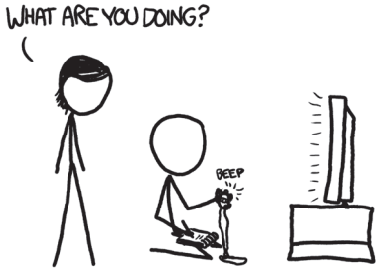
The energy it takes to lift an object to a given height is equal to the object's mass times the force of gravity times the height it's lifted. The X-wing scene lets us use this to put a lower limit on Yoda's peak power output.

First we need to know how heavy the ship was. The X-wing's mass has never been canonically established, but its length has — 12.5 meters. An F-22 is 19 meters long and weighs 19,700 kg, so scaling down from this gives an estimate for the X-wing of about 12,000 pounds (5 metric tons).




$$m_x = m_{f22} \times \left(\frac{12.5}{19}\right)^3 \approx 5600\text{kg}$$

Next, we need to know how fast it was rising. I went over footage of the scene and timed the X-wing's rate of ascent as it was emerging from the water.



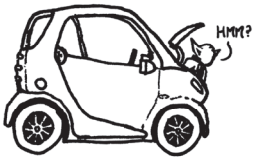

The front landing strut rises out of the water in about three and a half seconds, and I estimated the strut to be 1.4 meters long (based on a scene in *A New Hope* where a crew member squeezes past it), which tells us the X-wing was rising at 0.39 m/s.

Lastly, we need to know the strength of gravity on Dagobah. Here, I figure I'm stuck, because while sci-fi fans are obsessive, it's not like there's gonna be a catalog of minor geophysical characteristics for every planet visited in *Star Wars*. Right?

Nope. I've underestimated the fandom. Wookieepeedia has just such a catalog, and informs us that the surface gravity on Dagobah is 0.9g. Combining this with the X-wing mass and lift rate gives us our peak power output:

$$\frac{5600\text{kg} \times 0.9\text{g} \times 1.4 \text{ meters}}{3.6 \text{ seconds}} = 19.2\text{kW}$$

That's enough to power a block of suburban homes. It's also equal to about 25 horsepower, which is about the power of the motor in the electric-model Smart Car.




At current electricity prices, Yoda would be worth about $2/hour.

But telekinesis is just one type of Force power. What about that lightning the Emperor used to zap Luke? The physical nature of it is never made clear, but Tesla coils that produce similar displays draw something like 10 kilowatts—which would put the Emperor roughly on par with Yoda. (Those Tesla coils typically use lots of very short pulses. If the Emperor is sustaining a continuous arc, as in an arc welder, the power could easily be in the megawatts.)

What about Luke? I examined the scene where he used his nascent Force powers to yank his lightsaber out of the snow. The numbers are harder to estimate here, but I went through frame-by-frame and came up with an estimate of 400 watts for his peak output. This is a fraction of Yoda's 19kW, and was sustained for only a fraction of a second.

So Yoda sounds like our best bet as an energy source. But with world electricity consumption pushing 2 terawatts, it would take a hundred million Yodas to meet our demands. All things considered, switching to Yoda power probably isn't worth the trouble—though it would *definitely* be green.