A Promethean Thought Experiment

The Alstom made X40 electric passenger train has a power-to-weight ratio of 12 watt per kg (2.400 kW / 205 tons) and a maximum speed of 200 km/h (fig. 9, fig. 10).

Suppose one would flatten an X 40 electric passenger train into a disk of 205 tons with a diameter of 20 meters, fit it with in-wheel electric traction motors and put it on a pivot and a circular rail (fig. 1, fig. 2). Would the power-to-weight ratio of 12 watt per kg of X 40 train, which has a maximum speed of 200 km/h, be enough to give the disk a speed of 45 km/h (measured at the disk's edge) and rotating it 12 times per minute?

Would this be possible? Why would it not be possible? The disk has the same weight as the X40 electric train and is subject to rolling resistance, aerodynamic drag etc. just like the X40 train is. Therefore, the 12 watt per kg power-to-weight ratio should work for both.



Next, by fitting permanent magnets on the edge of the disk and by building an ironless stator around the disk, the disk turns into a generator (<u>fig. 3</u>, <u>fig.</u> <u>4</u>). Will a 12 watt per kg power-to-weight ratio (2.400 kW) still be enough to spin the disk at 12 rpm, giving it at a speed of ~ 45 km/h (measured at the disk's edge)?

If this is possible, it just generated excess energy.....

The details like the disk's diameter of 20 meters, the disk spinning at 12 rpm and the disk's speed of 45 km/h measured at its edge, are not random picks, but are data from a science paper on a wind turbine generator (fig. 7, fig. 8a). The generator's rotor has the same diameter, rpm and travels at the same speed as the disk.

The wind turbine generator (rotor and stator) weighs 145 tons and can generate 10 MW (10.000 kW) and has 94% efficiency rate (fig. 8b). The disk / rotor (fig. 1, fig. 2, (fig. 3, fig. 4) of the Prometheus generator weighs 205 tons and consumes 2.400 kW power. This means there is a net output 7.600 kW of excess energy.

The laws of thermodynamics rule out excess energy. So, where did all the power go? Surely, there is some mechanical loss created by the disk spinning around the pivot, but does that gobble up 7.600 kW?

Rolling resistance and aerodynamic drag are already covered by the power-to-weight ratio of 12 watt/kg (2.400 kW). Furthermore, full power (2.400 kW) is only needed to drive at its maximum speed of 200 km/h. The disk / rotor only needs to drive at 45 km/h in order to generate 10.000 kW. There is little or no cogging because the stator is ironless. Also the disk / rotor is powered at its circumference, which <u>consumes less energy to overcome</u> <u>rotational inertia (video)</u>. Imagine a train / generator's rotor weighing 80 tons being moved with only 1 kW of power! The weight of the disk / rotor is <u>uniformly distributed over the pivot and wheel train(-s)</u>. It is not fitted on an axis as shown in <u>fig. 7</u>.

It is possible to increase these margins by remodeling the way the disk is powered (<u>fig. 4</u>, <u>fig. 5</u>). The wheels are made stationary and fitted in a circle, just like the wheel train in <u>fig. 11</u>. The electric motors are fitted with a pinion gear that drive an internal ring gear or pin gear ((<u>fig. 1</u>, <u>fig. 2</u>) fitted on top and close the edge of the disk. This saves quite some weight since electric motors and steel wheels are heavy.

What About Eddy Currents And Hysteresis?

Do forces like hysteresis and especially eddy currents create an "electromagnetic drag" that takes 7.600 kW of power to overcome? Which is enough power to run an extra three X40 electric trains with a <u>combined weight of 615 tons</u>, which is <u>four times</u> the combined weight of rotor and stator of the generator (145 tons)!

Not very likely. Please see the power flow diagram of a DC generator below, which shows how much of the mechanical input energy is converted to electrical output power. It clearly shows that that bulk of the mechanical energy input is converted to electrical energy and that mechanical losses (friction) are larger than iron losses (eddy currents and hysteresis)! Source image: <u>Electricaleasy.com</u>



Power flow diagram of a DC generator

Also, according to this science paper a coreless (ironless stator) AFMPM generator does not experience eddy current (hence hysteresis losses).

Even if it should be incorrect, eddy current losses are likely to be small. Another team of scientists measured resistance limited eddy current loss in a 300 kW generator similar to the generator described in the thesis mentioned before.

They measured a resistance limited **eddy current loss of 900 watt**. **This is 0,3% of the generator's nominal power of 300 kW**. You can find their paper <u>here</u>.

If the rotor of the Prometheus Generator does not experience eddy currents / hysteresis losses, it only has overcome air resistance and rolling resistance, just like the X40 electric train. Ergo, a power input of 2.400 kW should be enough to give the rotor of the Prometheus Generator a speed and of 45 km/h and generate 10.000 kW....

Addendum

As <u>this feasibility study of a 20 MW superconducting wind turbine generator</u> (pdf) shows, the use of superconducting technology has a lot of potential. For instance the active mass of the 20 MW superconducting wind turbine would weigh about **45 tons versus 99 tons** for the active mass of the 10 MW iPMG wind turbine discussed on this page. Its rotor's speed is 6,3 rpm, versus 10 rpm for the iPMG.

Feedback

What do you think? Did this thought experiment make the generation of excess energy more plausible than James Maxwell's demon thought experiment?

If you want to share your views you can do so via email (feedback@prometheusturbine.info) or Twitter.

Thank you for your visit and time!

Fig. 3 - Flattened Train Morphed Into Prometheus Generator



Fig. 4 - Cross-section View Prometheus Generator



Fig. 5 - Prometheus Generator Powered Via Internal Ring Gear Fig. 6 - Cross-section View Prometheus Generator Powered Via Internal Ring Gear



References

Fig. 7 - Cross-section View Wind Turbine Driving iPMG



Fig. 8a - Comparing iPMG vs. Iron-cored PMG

Parameters	Scaled iPMG	Iron-cored PMG
Power (MW)	10	10
Speed (rpm)	12	12
Diameter (m)	20	9.9
PM weight (ton)	15.30	6.56
Copper weight (ton)	7.54	15.78
Total iron weight (ton)	22.96	41.46
Total active weight (ton)	45.8	75.4
Total active cost (M€)	1.81	1.61
Total inactive weight (ton)	99.2	206.6
Total inactive cost (M€)	1.59	3.31
Total weight (ton)	145	282
Total cost (M€)	3.40	4.92

Source: Screen shot page 84 thesis paper <u>https://core.ac.uk/download/pdf/52125891.pdf</u>

Fig. 8b - System performance comparison

Table 7.3: System performance comparison.

Parameters	Case I	Case II
Generator Line Voltage (RMS, V)	6295	6711
Generator Line Voltage THD	30.06%	5.26%
Generator current (RMS, per segment, A)	108.27	97.88
Generator current THD	10.61%	5.08%
Rectifier load (per segment, kW)	1111	1111
Filter apparent power (per segment, kVA)	0	340
Generator copper loss (whole machine, kW)	547.95	447.59
Generator other losses (whole machine, kW)	75.90	75.90
Generator efficiency (whole machine)	94.13%	95.03%

Please note that the stator has 9 segments. Load of whole machine is 9999 kW. Source: Screen shot page 124 thesis paper <u>https://core.ac.uk/download/pdf/52125891.pdf</u>

Fig. 9 - Alstom X40 Electric Passenger Train



Source: X 40 electric train on Wikipedia

X40		
In service	2006 -	
Manufacturer	Alstom	
Built at	Salzgitter, Lower Saxony, Germany	
Family name	Coradia	
Constructed	2004 -	
Number built	43	
Formation	2 cars (16 units) 3 cars (27 units)	
Fleet numbers	3301-3343	
Capacity	153 (2 cars) 252 (3 cars)	
Operator(s)	SJ	
Depot(s)	Hagalund	
Specifications		
Train length	55,100 mm (180 ft 9 in) (2 cars) 81,500 mm (267 ft 5 in) (3 cars)	
Maximum speed	200 km/h (124 mph)	
Weight	140 t (137.8 long tons; 154.3 short tons) (2 cars) 205 t (202 long tons; 226 short tons) (3 cars)	
Power output	1,600 kW (2,100 hp) (2 cars) 2,400 kW (3,200 hp) (3 cars)	

rain Fig. 10 - Alstom Specifications X40 Electric Passenger Train

Source: X 40 electric train on Wikipedia

Fig. 11 - Wheel Train Car Turntable Under Construction



Fig. 12 - Ring Gear And Pinion Gear



Source: <u>nbcgroup.co.uk</u>

Fig. 13 - Pin Gear Plus Electric Motor And Pinion Gear



Source: Unknown.

Video 1 - Truck platform in Algeciras, Spain, capable of moving a mass of <u>80 tons with only 1 kW of power</u>. Would it be possible to move an 80 tons train or turn an 80 tons rotor of a generator using a 1 kW of power?

