Questions & answers from the online Phoenix Turbine Builders Club

These are some of the questions we have received from turbogenerator clients & enthusiastic Tesla turbine hobbyists. More questions & answers may be found in the New Turbine Power newsletters & in PTBC forum archives.

- Why do some people say that Tesla turbines don't work?
- What is the best mode of operation?
- Is the output of your generator DC or AC?
- What about a 2 stage turbine?
- What is the RPM and torque resistance for an AC generating turbine system supplying 220 volts?
- Question concerning hotrotor balance
- Why is the Tesla turbine not commercially produced?
- How noisy is it on operating time?
- What are the steam requirements Mass flow? Superheat?
- Why do your plans cost so much?
- NTW: Would it be possible to use sealed bearings?
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- Will your steam turbine work with a solar hot water system?
- How do I use the CAD files on your CD to build the 7-inch Tesla turbogenerator?
- I have pressure from my chamber about 0,7 bar / differential pressure. It will be enough?
- What is the efficiency vs. steam conditions, vs. load?
- Do you have any specs for your 7 inch TT?
- Do I need to buy a generator for your 7-inch Tesla turbine? How many RPMs? Pressure, temperature?
- What is the efficiency of an organic Rankine cycle Tesla turbine?
- How much energy will your Tesla Turbine generator produce?
- Hi, may I ask if the alternator is a direct current alternator?
- Can we capture flue gas with a Tesla turbine to provide a few watts of power?

Question: Why do some people say that Tesla turbines don't work?
Answer: The reason Tesla turbines never took off commercially (as product) was that they didn't have electronic technology at that time to manage output power, which is critical in keeping the turbine within its power band.
Any turbine of any type will stall out if RPMs get too low. With disc turbines it's critical to keep RPMs at or above 60% of maximum (rated) speed. To do this, you must control the load, or power coming off the turbogenerator unit.
It's very easy to overload the turbogenerator by drawing too much power from it. - It must be a *smart* power control module that monitors RPMs, temperature, volts, amps, etc.

Question: What is the best mode of operation?
Answer: Turbines don't work well when placed in direct mechanical mode but rather by driving alternatives in hybrid electric mode.
They will also work well in aircraft modes, where they spin a turboprop or jet blades. In this mode, there is plenty of time to spool up the engine - build up speed with brakes locked - as you prepare to take off. Once airborne, you maintain constant speed.
In hybrid-electric vehicle mode, you have stored power.

Question: (*concerning an early version of Ken's turbogenerator*) Is the output of your generator DC or AC? If DC, is an inverter included so as to enable us to use AC power?
Answer: The electrical output is pulsed DC. We do not supply regulators, battery storage, or inverters at this time. (For those who order our 7-inch turbogenerator or the turbogenerator plans CD, these topics will be covered in our New Turbine Workshop discussion forum, how-to videos - or through PNGinc's consulting program.)
Before hooking up an inverter, you will need to determine what voltage and amperage (power) will be delivered from the turbogenerator at a steady state. The best way to determine power is to apply a resistive load, in series with an ammeter, along with a voltmeter in parallel with the load.

Question: I was interested to see the Tesla steam turbine mentioned. I get the feeling you think 3 or 4 stages are necessary to achieve the 90%+ efficiency that Tesla predicted. What about a 2-stage turbine with the second stage having 2 to 3 times the number of disks?
Answer: Tesla mentioned that it would take 2-3 stages with a vacuum on the final stage to achieve 90+ efficiency. Since the cost of producing this type of turbine is much higher than for a (60%) single stage turbine, we are concentrating on single stage low-cost units. If you are interested in a 2-stage systems, the second stage would have fewer disks with a much smaller spacing between them to extract the energy from the lower velocity gas.

Question: What is the RPM and torque resistance for an AC generating turbine system supplying 220 volts? How big would this unit be? Thanks for any help you can supply.
Answer: The torque resistance is dependent on the power (watts) of the generator head and the load. Usually the generators are rated in terms of kilowatts. 1.414 horsepower per kilowatt gives you the minimum needed horsepower, plus another 25% - 100% additional horsepower for efficiency losses, wear & tear on the engine, etc. Generally speaking it takes 7-10 horsepower to run a 5k@ generator at full load.

Question: Concerning hotrotor balance, do you have a suggested tolerance for vibration? We can measure displacement and RPM with current equipment.
Answer: We will cover the shaft assembly and balancing procedure in a New Turbine Workshop session.

Question: I was an early Tesla fan, and am glad to see others are rediscovering his work. One question has always bothered me, and I have finally decided to try and find out why the Tesla turbine is not commercially produced. It is apparently very simple to construct, and according to available literature, an efficient machine. It seems that it would have an economical advantage over cast turbines, since the Tesla turbine disks could be stamped out of sheet metal in a die punch machine, a very cheap process. There must be some reason that manufacturers ignore this design. Does anyone know the answer?

Answer: The Tesla type turbine never got a foothold in the industrial world due to the inherent lack of low-end torque. The piston engine is much better when applied in a purely mechanical application. Now that the world is finally going hybrid in all areas, turbines will see a greater percentage of applications in this century. Also, developmental resources have never been applied to turbines like they have to piston engines, but that is all about to change now that we have brought the disk turbine into the 21st century through our efforts. Hold on to your hat - everything is about to change for the better.

Question: How noisy is it on operating time?
Answer: We're expecting it to be relatively quiet, in the 80-db region since we're dealing with closed loop turbogenerator systems.

Question: What are the steam requirements for the turbine on your DIY Tesla Turbogenerator Project CD? Pressure? Mass flow? Superheat if any?
Answer: 40 - 60 lbs of fluid converted to 150 - 200 psi gas pressure per hour - no superheat necessary.

Question: Why do your plans cost so much? Maybe you should go for low cost, higher volume sales with very high quality. This will get you a lot more customers. I have a good job but I think your price is way too high.
Answer: Thanks for your comments but were doing just fine without your business. If you have a "good" job & refuse to pay $96 for fully developed turbogenerator plans & the valuable technical information provided in the New Turbine Workshop - you will probably never be a customer of ours.
NOTE: We do have a policy of sharing our know-how with missionaries & those who work with the poor. Those who fit this category & are interested in building a solar turbogenerator system based on our DIY plans are invited to send us your story & photos describing your work.

Question: (From a New Turbine Workshop member) My plan is to build everything to spec but I was curious as to whether it would be possible to use sealed bearings. It would eliminate the need for the oiling system and simplify the design. Ken, I'm sure you've already considered this problem but I was curious what issues I might encounter if I went with sealed bearings.
Answer: Sealed bearings are rated at a much lower operating speed compared to open and actively lubricated systems. Also, a minimally oiled bearing has a much higher operating speed compared to an oil bath system. To guarantee the best performance from a relatively low-cost bearing as specified in our design, we try to use only enough oil flow to carry away bearing heat, without causing even more heat buildup from fluid compressive resistance. - Ken Rieli

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Question: (From a New Turbine Workshop member) Have you calculated any tolerances for the (7-inch steam/ORC Tesla turbogenerator) design? I'm doing this at school to improve my skills so I'm holding everything to +- .001" for now. I'll be finishing the shaft on an OD grinder so I'll try to hold that to +.001 -0 with a fairly tight cylindricity tolerance.
Answer: For moving parts such as shafts, hot rotors, and magnet rotors, etc., tolerances should be kept to about .001". Static parts like the case, nozzles, etc. can tolerate much less tolerance - .010". The only exception is the nozzle bore - start out right on .090" and experiment up or down at about .005" increments.

Question: I would like to build a solar hot water system to heat my house in the winter and in the summer when it over heats I want to make electricity with a steam turbine. Will your steam turbine work with a solar hot water system?
Answer: Heat from solar hot water systems do not deliver the inlet pressure (180-200 psi) required to run a Tesla turbogenerator using steam. Ken has investigated ORC fluids to determine those with low boiling points that may be used (likely candidates include propane & butane) and will test them in upcoming New Turbine Workshop projects.

Question: How do I use the CAD drawings on your CD to build the 7-inch Tesla turbogenerator?
Answer: Cad/Cam drawings use the DWG format and are compatible with most Cad programs for viewing such as TurboCad,etc. To create tool paths for CNC machinery, DWG files may be imported into TurboCad/Cam or BobCad/Cam.

Question: I have pressure from my chamber about 0,7 bar / differential pressure. It will be enough?
Answer: 1 bar is approx 14.7 psi which equals 1 atmosphere. Our 7-inch Tesla turbogenerator requires a startup pressure between 180 psi (12.410541 bar) to 200 psi (13.78949 bar). Operating pressure is 10 bar. Differential pressure must equal operating pressure.

Question: What is the efficiency vs. steam conditions, vs. load?
Answer: Expect a 38% efficiency factor across the disc pack (38% of the fluid gas energy).

Question: Do you have any specs for your 7-inch TT?
Answer: Specs will vary depending on the amount of energy introduced through the inlet nozzle. Generally speaking, you can expect to get about one horsepower per hour for every 38 pounds of steam (per hour) driven through the unit at 150 - 180 psi. Our 7-inch turbogenerator should deliver 1 - 1.5 horsepower per hour.

Question: Do I need to buy a generator for your 7-inch Tesla turbine? How many RPMs? Pressure, temperature?
Answer: Our 7-inch Tesla turbogenerator is an all-in-one unit that includes a permanent magnet alternator. Maximum RPM is 26,000 with a working load RPM of about 16,000. Inlet pressure is 180-200 psi, with an outlet pressure of 1 psi. The temperature of the working fluid is dependent on your system. We use room temperature compressed air for testing, but you may use ORC or steam fluids up to 1200 degrees F.

Question: What is the efficiency of an organic Rankine cycle Tesla turbine?
Answer: ORC efficiency is not a concern when your energy source is free (solar). Also, no matter how high the efficiency of a conventional bladed ORC turbine, it's the maintenance costs that will kill you. Not so with ultra-low maintenance disc turbines.
Generally, with disc turbines you can expect 38% efficiency across the turbine, not considering the heat source. And a properly built disc turbine can - with a life cycle of a thousand years - operate for 100 years before a major overhaul.

Question: How much energy will your Tesla Turbine generator produce?
Answer: In our early experiments we've gotten instantaneous output readings of 45-49 volts at 18 amps.

Question: Hi, may I ask if the alternator is a direct current alternator? if it is DC, then why are there 6 wires protruding from the stator core, isn't that characteristic of a 3 phase AC generator?
Answer: The alternator specified on the DIY Tesla Turbogenerator Project CD is a standard part - Chrysler type alternator with a 4.75" ID clearance. All car alternators produce 3-phase alternating current, which is then rectified to direct current.

Question: We engineer biomass burning cook stoves for developing nations. We've starting to kick around the idea of capturing flue gas with a Tesla turbine to provide a few watts of power to charge a cell phone and/or run a fan to recirculate some of the exhaust case for a more complete burn. But every Tesla example I've seen relies on high-pressure fluids, not what I'd normally see in an exhaust flue of our small stoves. Are we barking up the wrong tree with this proposed utilization of the Tesla Turbine concept?
Answer: Disk turbines require at least 100 psi just to get them moving, so you may do better with a bladed design.