SETUR-L

HYDRAULIC TURBINE

USER'S MANUAL

WELCOME TO SETUR

Congratulations on your purchase of the SETUR-L Hydraulic Vortex Turbine. We believe you will find it easy to install, moreover, we are confident you will experience years of dependable service.

SETUR turbine has been designed and precision manufactured to provide the most practical and user-friendly system currently available for renewable energy electricity generation.

SETUR turbine uses vortex phenomenon to harness the kinetic energy of water to produce electricity.

This user's manual contains important safety information which will enable you to get the most from your SETUR turbine. Please, read this manual thoroughly prior to installation and operation of the equipment. Store this manual where it will be accessible at all times.

When using your SETUR turbine, always exercise due care and operate the equipment in accordance with the manufacturer's recommendations contained in this and other manuals provided with the turbine. Your SETUR turbine should then deliver years of trouble free service.

If any property loss occurs due to the failure to follow the requirements and instructions of this and other manuals provided with the turbine, Setur Energy Systems will not be liable for it.

DISCLAIMER

UNLESS SPECIFICALLY AGREED TO IN WRITING, SETUR ENERGY SYSTEMS:

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN THIS USER'S MANUAL OR OTHER DOCUMENTATION.

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

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All names, trademarks, product names or other designations given in this manual are or may be legally protected even if this is not labeled as such. SETUR® is a registered trademark.

SAFETY

Safety must be the primary concern as you plan the location, installation and operation of the turbine. Always be aware of the risks involved with mechanical and electrical installation work. If in doubt about any issue regarding your turbine, please seek further assistance before proceeding. This section addresses safety concerns as required by international standards.

Installation of the SETUR turbine should only be undertaken by suitably competent and qualified personnel. SETUR-L turbine installation requires specialized tools and lifting equipment. The inverter included with your turbine may only be installed, maintained, repaired and connected with the SETUR turbine and the electric grid by a trained and qualified electrician. The electrician is responsible for ensuring that the applicable standards and regulations are observed and implemented. Work that could affect the electrical power system of the relevant energy supply company at the site of the hydroelectric energy feed-in may only be carried out by qualified electricians expressly authorized (licensed) by the energy supply company.

MECHANICAL SAFETY HAZARDS

Although SETUR turbine uses bladeless rotor, the main spherical rotor is a potential mechanical safety risk. When the turbine is operating, the rotor performs precession movements at a relatively high speed. Never touch the rotor and other moving parts whilst in operation. The turbine is not equipped with the stop switch due to low mechanical hazard level. You must physically stop the water flow through the turbine or remove the turbine entirely from the water flow in order to shut it down.

Ensure that the turbine is installed in a suitable position where nobody can approach it or interfere with the working turbine.

Working with tools of any kind can be dangerous. Due to SETUR-L turbine's size and weight, its installation requires the use of some lifting equipment. If you are in any doubt about how to use the tools and equipment correctly, please seek advice from a suitably experienced person. Other persons' help is highly recommended.

Your SETUR turbine will inevitably be installed in water. This may mean working in water, being exposed to water and related hazardous conditions e.g. slippery floor and hidden hazards.

Always ensure that all personnel in the immediate vicinity are aware of any lifting operations that will be occurring. Check there are no loose components or tools likely to fall and cause injury during the lifting operation. Where possible, all assembly work should be completed at ground level. The installation site must be fully prepared for hosting the SETUR turbine in a safe manner.

Install your turbine during a fair day without any atmospheric precipitation or extremely cold weather. Do not attempt the installation within the high velocity water streams without other people help, specialized tools and equipment, additional safety measures.

When performing routine inspection or maintenance, always exercise extreme caution.

ELECTRICAL SAFETY HAZARDS

WARNING! An electric shock can be fatal. High danger due to grid voltage and voltage from the turbine that is operational.

- Ensure that the turbine is not operational before carrying out any connection work.
- Only an authorized electrician is permitted to connect this equipment to the public grid.

The SETUR-L turbine generates a 3-phase alternating current (AC) of up to 400 V (max <600 V), which is then rectified to direct current (DC), then inverted into a pure sine wave 3-phase 400/230 V (208/240 V USA model) alternating current (AC).

WARNING! Incorrect operation or poorly executed work can cause serious injury or damage. Commissioning of the turbine and inverter may only be carried out by trained personnel in accordance with the technical regulations.

Caution should always be used when connecting the SETUR turbine to the electric system. Please read and follow the user's manual, installation and operating instructions provided by the inverter manufacturer.

IMPORTANT! Ensure that you have followed the cable-sizing requirements to ensure that the correct size of transmission cable has been selected. If a cable of insufficient cross-sectional area is used, heat may build up in the cables causing a potential fire hazard. Using cables of insufficient cross-sectional area may also reduce the power transmission efficiency of the turbine. Always use the largest gauge wires that are practical and affordable. Local, state and/or national electrical codes take precedence over these general recommendations.

Never run the SETUR turbine 'off-load' with the output cables not connected to anything.

WARNING! Adhere to proper grounding techniques as established by your National Electrical Code. Your SETUR turbine must be installed in accordance with this manual, local and national codes, rules and regulations. Incorrect installation may void your warranty.

WARNING! NEVER PERFORM ANY ELECTRICAL WORK WHILE STANDING IN WATER OR BEING EXPOSED TO WATER! WEARING WET GLOVES OR CLOTHES IS FORBIDDEN!

Please, use common sense when installing and operating your turbine!

EXCLUSION OF LIABILITY

Any use that differs from or goes beyond the stated intended purpose is deemed inappropriate. The manufacturer accepts no liability for any damage resulting from this.

Modifications to the turbine and/or inverter are prohibited. The turbine and inverter may only be used if safe to operate and in technically perfect condition.

Only a duly authorized representative of Setur Energy Systems may open the hermetically sealed generator and magnetic coupling enclosures of the turbine.

The turbine and inverter must only be wired by a certified electrician who performs all necessary work in strict compliance with the national and local codes, all applicable standards and regulations.

Work that could affect the electrical power system of the relevant energy supply company at the site of the hydroelectric energy feed-in, may only be carried out by qualified electricians expressly authorized and/or licensed by the energy supply company. The installer must always observe the rules and regulations established by the energy supply company.

Make sure all electrical connections are tight, clean, dry, and protected from weather and damage. Make sure all fasteners are installed and properly tightened.

The SETUR-L turbine is heavy. Be careful when you move or lift the turbine. Do not attempt to do it without the specialized tools, equipment and/or other persons' help.

Do not operate or work on the equipment if mentally or physically impaired, or after consumption of alcohol or drugs. Under no circumstances children may operate, install or perform any maintenance work.

Turbine's generator and Magnetic Coupling are encapsulated within a hermetically sealed enclosure. Exceptionally strong magnetic force is present inside the enclosure. You can get severely injured by the steel parts violently attracted to the permanent magnets.

Only a duly authorized representative of Setur Energy Systems may open the hermetically sealed generator / magnetic coupling enclosure. Any unauthorized access will immediately terminate the manufacturer's warranty, guaranty and general liability.

- Never disconnect the power connections of the generator while the equipment is energized.
- Wait at least five minutes before touching any components which are normally live.
- After switching off the generator, do not touch it until it has cooled down.

Any instance of misuse or violation of any of the above stated conditions, requirements and procedures as outlined in this manual will cause the immediate termination of the warranty, guaranty and general liability of the manufacturer.

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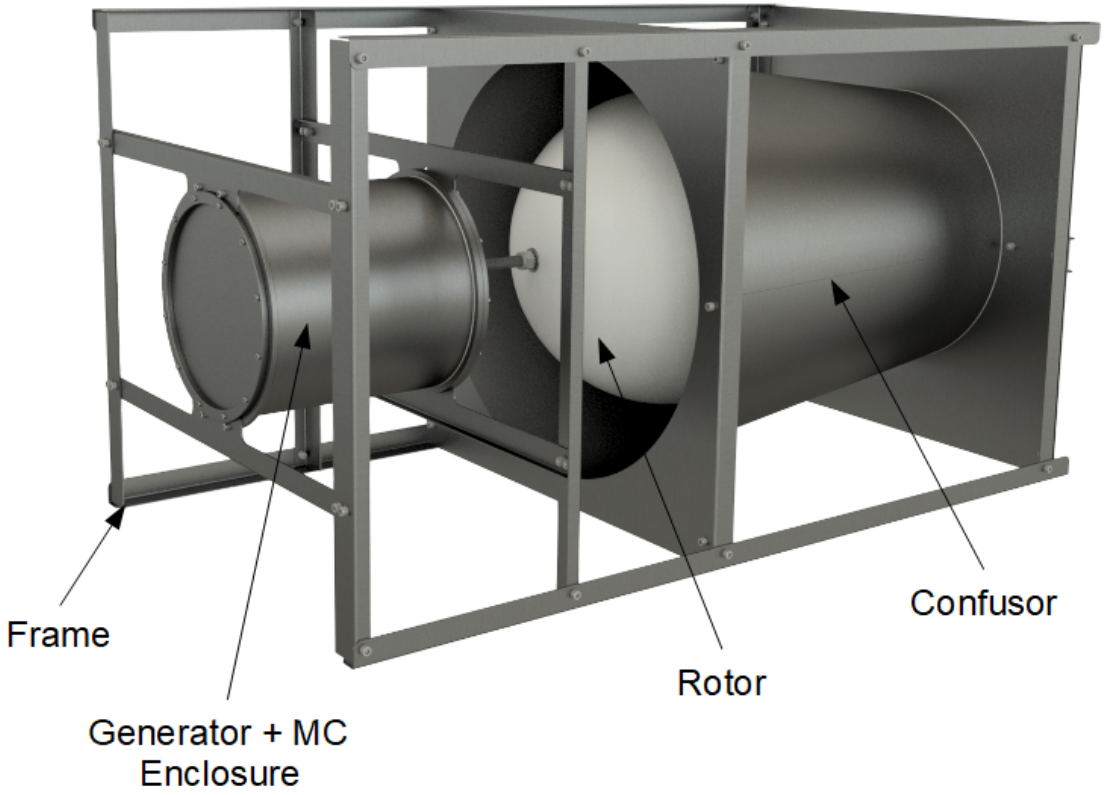
SETUR-L TURBINE: DESCRIPTION AND SPECIFICATIONS



Your SETUR-L bladeless turbine is an environmentally friendly device that uses vortex phenomenon to harness the kinetic energy of water flow in order to produce electricity. SETUR turbine can be cost-effectively used as a standalone self-contained system or in multi-unit hydropower farms.

The SETUR turbine has been in development since 2003. It has won several prestigious international awards since 2008, including Ecological Oscar, E.On Energy Globe Award, in 2014.

SETUR turbine is a versatile power generation system suitable for a wide range of applications. It can be successfully utilized to harness energy of low hydraulic head, low volume, low flow velocity water sources, including

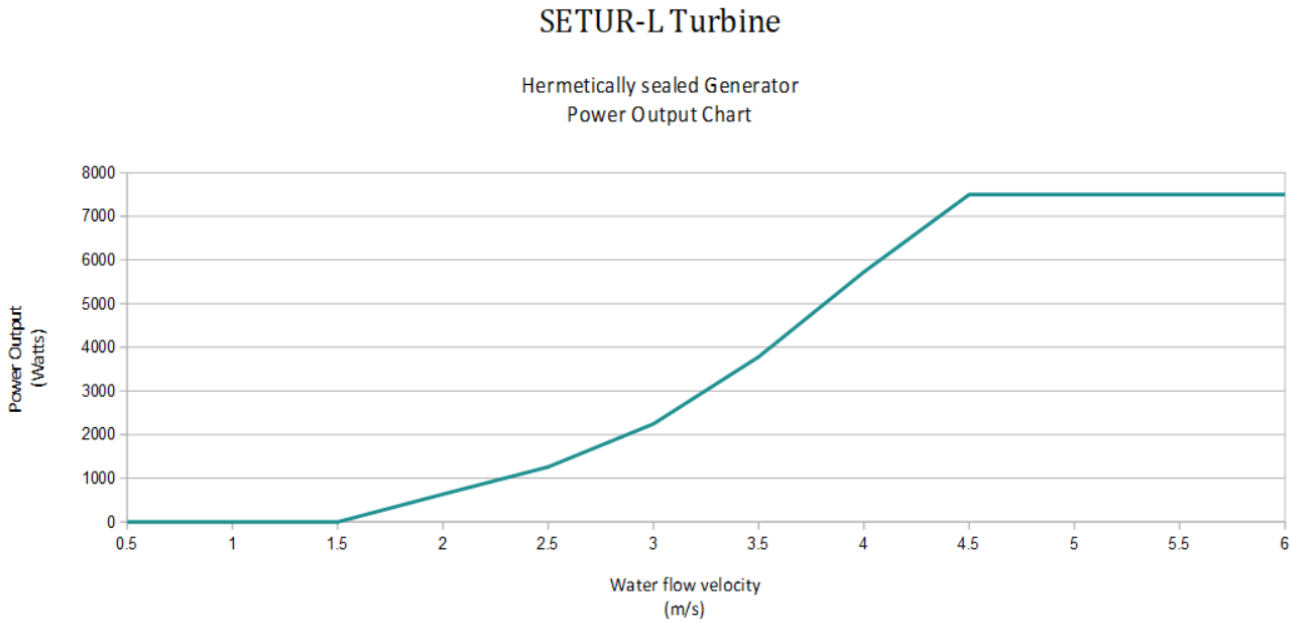
- Low head dams
- Rivers
- Irrigation canals
- Urban areas (pipelines and storm water systems)
- Ocean currents and tidal streams

SETUR-L turbine 's main parts:

- Frame
- Confusor
- Rotor (hollow sphere)
- Generator and Magnetic Coupling (hermetically enclosed)

SPECIFICATIONS AND OPERATING ENVIRONMENT

Rated power	5 kW
Maximum power	7.5 kW
Rated voltage, VAC	50 Hz (EU) / 60 Hz (USA)
- 3-NPE (3 phases, 4 wires excl. ground)	400 V (EU) or 208/240 V (USA)
Generator type	Permanent magnet generator
Hydraulic head (water height) or water flow velocity, ≥	h=1 m or v=4 m/s
Water flow rate, ≥	650 l/s
Maximum installation depth	Fully submerged up to 20 m
Mounting	frame
Turbine dimensions, mm	1012x1000x1813
Weight, kg	227
Operating temperature	0℃ (32℉) – 50℃ (122℉)
Materials	Plastics, composites, stainless steel
Protection degree (turbine only)	IP68
Warranty	Limited Lifetime Warranty
Noise, <	50 dBA



IMPORTANT! SETUR turbine must be fully submerged in water to ensure that vortex occurs. Alternatively, the water can be routed to the turbine via a pipe or an aqueduct.

LIMITED LIFETIME WARRANTY

Setur Energy Systems warrants to the original consumer purchaser of a Setur Energy Systems SETUR turbine that it will, at its option, repair or replace such product if it is found by Setur Energy Systems, in its sole judgment, to be defective under normal residential use, provided that it has been installed and maintained in accordance with Setur Energy Systems's instructions. This limited warranty applies only to the initial installation and is not transferable from the original consumer purchaser. This limited warranty covers only normal use of the product against defects in material or workmanship for parts only for as long as the original consumer purchaser owns the product.

In the event of a limited warranty claim, proof of purchase will be required – save sales receipt.

This warranty extends only to products purchased directly from Setur Energy Systems or its authorized agents and distributors.

This limited lifetime warranty does not apply to commercial installations. The warranty for commercial installations is five (5) years.

Setur Energy Systems will provide free of charge, at it's sole option, replacement part(s) or product (or if no longer available, a comparable product) to replace those which have proven defective in materials or workmanship.

The product owner is responsible for the payment, at current rates, for any service or repair outside the scope of this limited warranty.

WARRANTY EXCLUSIONS

This limited lifetime warranty DOES NOT COVER the following:

1. Defects or damages arising from shipping, installation, alterations, accidents, abuse, misuse, environmental factors, lack of proper maintenance, disasters such as an act of God (lighting, fire, earthquake, tornado, etc.), electrical spikes or surges or any other physical damage, service or alteration by anyone other than an authorized Setur Energy Systems representative, damages incurred through irresponsible use or other non-recommended practices and use of other than genuine Setur Energy Systems replacement parts, unauthorized modifications or additions in all cases whether caused by a contractor, service company, the owner or any other person.

2. Deterioration through normal wear and tear and the expense of normal maintenance.

3. Any loss of work (down time) caused by a product requiring service.

4. Labor charges incurred and/or damage sustained in installation, repair or replacement, nor incidental or consequential damages.

5. Commercial application.

6. Power Inverter and Rectifier. The power inverter and rectifier are covered by their respective manufacturer's warranties.

7. Postage or shipping costs for returning products for repairs or replacement under this limited warranty and labor or other costs incurred in connection with product removal or installation under this limited warranty.

8. ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING LABOR, ALL OF WHICH ARE HEREBY EXPRESSLY DISCLAIMED, OR THE EXTENSION BEYOND THE DURATION OF THIS LIMITED WARRANTY OF ANY IMPLIED LIMITED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY OR FITNESS FOR AN INTENDED PURPOSE. IN NO EVENT WILL Setur Energy Systems BE LIABLE FOR THE COST OF REPAIR OR REPLACEMENT OF ANY INSTALLATION MATERIALS.

9. Responsibility for compliance with local code requirements.
(Since local code requirements vary greatly distributors, retailers, dealers, installation contractors and users of plumbing and electrical products should determine whether there are any code restrictions on the installation or use of a specific product.)

This warranty is null and void if the defect or malfunction was due to damage resulting from operation not within manufacturer specifications. It will also be null and void if there are indications of misuse and/or abuse. Setur Energy Systems has the option of voiding the warranty if any one other than a Setur Energy Systems technician attempts to service the product without the explicit authorization in writing.

Under no circumstances will Setur Energy Systems be responsible for any refund or remuneration exceeding the original purchase price of the product less any shipping fees.

Setur Energy Systems will not be held responsible for the customer's failure to read and understand any information posted on our website, user's manual or any other documents related to the product or the sales transaction. Setur Energy Systems's website in English is primary. The other language versions may or may not be as complete as the English one.

Setur Energy Systems will not be held responsible for unintentional errors and omissions on our website and/or in the User's Manual. Setur Energy Systems makes every effort to make sure all information on our website and/or in the User's Manual is correct.

This warranty is applicable only to Setur Energy Systems SETUR turbines manufactured after March 1, 2025.

THIS WARRANTY IS EXCLUSIVELY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

FOR COMMERCIAL INSTALLATIONS: For all industrial, commercial and business usage the warranty period is five years, from date of purchase, and except for duration all other aforementioned warranty terms apply.

For both Residential and Commercial warranties, power inverter and rectifier are not included in this warranty, and are covered under their respective manufacturer's warranties.

PROCEDURE FOR OBTAINING WARRANTY SERVICE
RMA (Returning Merchandise Authorization) POLICY

If repairs are required, the customer must obtain a RMA number and provide proof of purchase. RMA and services are rendered by Setur Energy Systems and/or its authorized dealers, distributors or representatives only. All returned parts must have a RMA number written clearly on the outside of the package along with a letter detailing the problems and a copy of the original proof of purchase. No COD packages will be accepted. No package will be accepted without a RMA number written on the outside of the package. RMA numbers are only valid for 30 days from the date of issue.

Please follow these procedures to obtain the service:

1. If you have purchased the product via our website, contact Setur Energy Systems Customer Service via e-mail support@seturturbine.com, attach a copy of your invoice and the wire transfer.

3. If you have purchased the product from the authorized agent/distributor, please contact it first.

4. When RMA number (Return Merchandise Authorization Number) is issued, please follow the instructions given by Setur Energy Systems technical support staff to ship your item. Setur Energy Systems will not accept any shipments without a RMA number.

5. Pack the item in its original box or another well-protected box, as will be outlined in the Return Shipping Instructions. Setur Energy Systems will not be responsible for shipping damage/loss of the product. It is very important that you write the RMA number clearly on the outside of the package. Ship the item with a copy of the proof of purchase as outlined above, your name, address, phone number, description of the problem(s), and the RMA number you have obtained to the address provided by the technical personnel.

6. Upon receiving the product, Setur Energy Systems will inspect it, and if found covered under this limited warranty, repair or replace your product (at Setur Energy Systems's discretion) and will ship it back to you within 4-12 weeks (depends on parts availability).

7. Cross-exchange (Parts only): You will need to provide a valid credit card number as a return shipping cost guarantee when the RMA number is issued. Once approval has been obtained on your credit card, the part(s) will be shipped.

8. The customer assumes full liability for losses or damages resulting from shipping as well as all responsibility to pursue remuneration for such issues with their selected carrier.

SERIAL NUMBERS

Turbine serial number is engraved on the turbine's confusor's rear plate or any other suitable part, and consists of the following alphanumerical sequence:

1) Turbine type: L
2) Turbine's 9-digit number

Turbine components e.g. generator, magnetic coupling, inverter might have their own serial numbers assigned by their respective manufacturers.

REGULATIONS AND COMPLIANCE

The turbine components are in full compliance with CE and comply with the requirements of Machinery Directive 2006/42/EC, Low Voltage Directive 2004/95/EC and Electromagnetic Compatibility Directive 2014/30/EU.

All SETUR turbines and their components have been evaluated against major international standards.

INSTALLATION

REQUIREMENTS

It is the user's responsibility to follow the national and local codes, rules, regulations, as well as the zoning restrictions.

All SETUR turbines are assumed to be installed under the following standard conditions:

- Turbine must be installed by, with a help of, or under a supervision of an experienced professional.
- Turbine must be fully submerged in water unless the water flow is routed to the turbine via a pipe.
- Turbine must be installed in clean water free of any corrosive and dangerous chemicals, as well as debris. Turbine can be installed either vertically or horizontally.
- Turbine must be safely installed at a properly prepared installation site. The turbine's frame can be mounted in a variety of ways. To determine the best of them is the user's responsibility.
- Turbine must be installed in such a way that it withstands with a safe margin the maximum anticipated pressure of the water flow.
- Turbine must be electrically grounded in full compliance with the national and local codes, rules and regulations.

- The access to the installation site must be via a terrain that allows safe turbine carrying, use of lifting equipment, pipe, if any, power cable laying, etc.
- The user must make sure that the site is not slippery, icy, flooded, exposed to falling rocks or trees etc. Where such conditions exist, it is the user's responsibility to rectify or avoid.
- Turbine must be installed at the site in such a way that prevents any possible physical access by the general public, especially children.
- Appropriate intake screen should be installed to prevent any mechanical damage to the turbine by any debris that might be in water.
- The turbine should not be exposed to excessive water pressure and/or water flow velocity, which must not exceed the safe maximum of 11 m/s.
- The user must read and follow this and the inverter's manual before starting the installation.
- The user must follow all the installation and connection instructions provided in the inverter's user's manual.

The following items are not included in your purchase:

1. intake screen (-s)
2. pipe flange
3. pipes
4. power cables.

GETTING READY

Upon receipt of the turbine, unless purchased from and installed by the authorized Setur Energy Systems distributor/dealer, make sure that all boxes are not damaged.

Check part conformity with the delivery list and ensure there are no damaged or defective parts; should there be any, please inform Setur Energy Systems immediately.

The parts are manufactured by their respective manufacturers for Setur Energy Systems. Do not contact these manufacturers directly in an attempt to resolve any issues as it could void our limited lifetime warranty to you unless specifically authorized by Setur Energy Systems.

RECYCLE! Any packing materials should be disposed of via correct waste disposal methods. Do not discard waste materials into the environment.

The SETUR-L turbine is heavy. Be careful when you move or lift the turbine. Do not attempt to do it without the specialized tools, lifting equipment and/or other persons' help.

The following parts are normally shipped in separate boxes:

- Assembled turbine
- Bridge rectifier
- Inverter

Users must pay attention to weight of the turbine. It is necessary to use appropriate eye-bolts and/or cargo straps to lift and move the heavy parts.

ELECTRICAL WORK

WARNING! An electric shock can be fatal. High danger due to a grid voltage and voltage from the turbine that is operational.

- Ensure that the turbine is not operational before carrying out any connection work.
- Only an authorized electrician is permitted to connect this equipment.

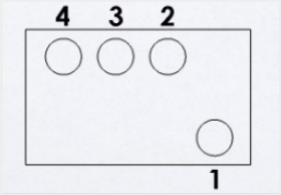
SETUR-L turbine generates a 3-phase alternating current (AC) of 400 V (max <600 V), which is then rectified to direct current (DC), then inverted into a pure sine wave 3-phase 400 V (208/240 V USA model) alternating current (AC).

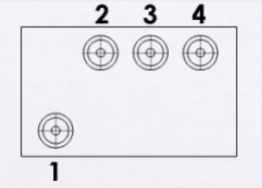
- Never disconnect the power connections of the generator while the equipment is energized.
- Wait at least five minutes before touching any components which are normally live.
- After switching off the generator, do not touch it until it has cooled down to ambient temperature.

The turbine is equipped with a waterproof power connector located on the generator enclosure. It consists of a) bulkhead connector attached to the generator enclosure and wired to the generator; b) cable connector with around 60 cm of cable.

a) Extend the power cable to achieve the desired length. Hermetically insulate.

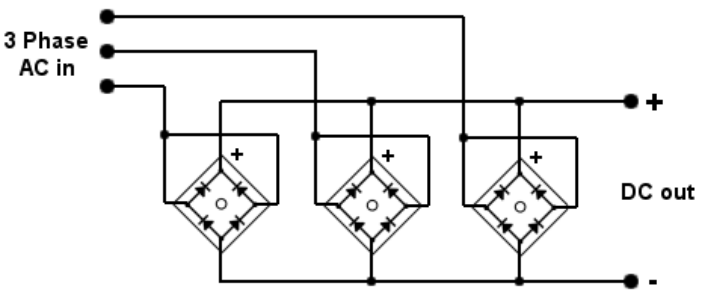
Wire 1- Black
Wire 2 - White
Wire 3 - Red
Wire 4 - Green





b) Connect the part of the connector with cable to a bulkhead part attached to the turbine.

c) Connect the power cable and a 3-phase bridge rectifier, which has to be installed by a certified electrician in accordance with national and local codes, rules and regulations.



d) Connect the rectifier and the inverter. The installer must follow all the instructions outlined in the Inverter's User's Manual.

SYSTEM ELECTRICAL CONFIGURATION AND WIRING

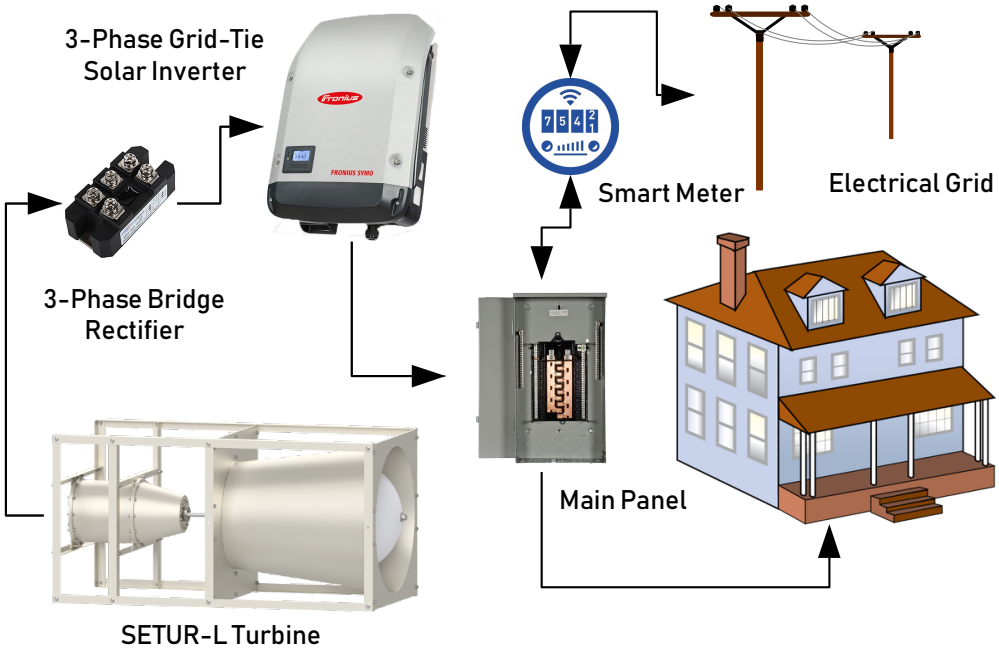
On- or off-grid electrical system? SETUR turbine can be used in on- and off-grid systems.

If you are able to connect to the utility grid and it is reliable then it is advisable that you choose an on-grid system without batteries. This will be simpler, cheaper and more environmentally friendly. Batteries need careful attention, regular maintenance and periodic replacement. Production and disposal of the batteries hurt environment.

If you are on-grid then order your SETUR turbine with an on-grid inverter to connect to the grid and save on your electricity bills or maybe even earn substantial amounts of money by selling excess electricity generated by your SETUR turbine.

ON-GRID	OFF-GRID

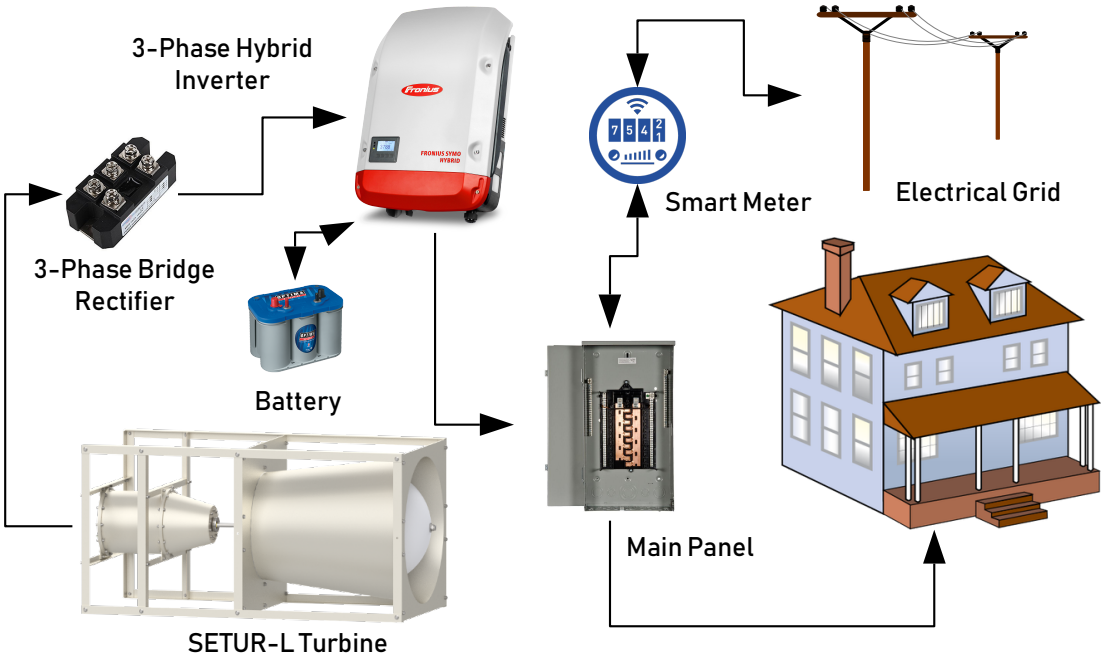
GRID-TIE SETUR SYSTEM



Optionally, the SETUR turbine may be equipped with the HYBRID inverter in support of both on- and off-grid system configurations. This inverter combines a battery charging system, battery inverter, hybrid inverter, controller and system monitoring solution in one device.

With AC power of 5.0 kW, the inverter is able to process up to 8.0 kW in order to supply household consumers with energy and to temporarily store surplus energy from the SETUR system in the Battery Bank (to be purchased separately).

ON-GRID / OFF-GRID SETUR SYSTEM



ENERGY STORAGE SELECTION

There are many energy storage solutions available on the market. The selection depends entirely on your needs and financial ability.

We do not endorse any specific system, the choices are practically limitless.

If you have an existing battery system then you will probably wish to add the turbine to this system alongside the solar, wind or engine driven sources of energy that you already use.

WARNING! An electric shock can be fatal. High danger due to grid voltage and voltage from the turbine that is operational.

SYSTEM WIRING

This manual does not fully cover the SETUR system wiring, as this must be done by a certified electrician in accordance with the national and local codes, rules and regulations.

NEVER work on your renewable energy system with the turbine in operation.

Setur Energy Systems will not be liable if you get electrocuted, injured or killed due to connecting this system by yourself and/or disregarding the warnings and instructions provided in this and inverter's user's manuals, or if you connect this equipment incorrectly and in doing so damage other equipment in your system.

SITE SELECTION

Home-scale SETUR electric system can give the best renewable bang for the buck. With the right situation and implementation, you can have a low-impact, low-maintenance, reliable system that supplies clean energy over the long haul.

SETUR turbine is a true low-impact, low-hydraulic head, low-water flow velocity, low-water flow rate system.

What's the first step to identifying a good hydro site?

The primary components of hydro-electric power are hydraulic head (vertical water drop or water height), water flow velocity and water flow rate. A good site needs a combination of these components. Higher head sites may be more cost-effective to tap, since the resulting water flow velocity is higher.

Ideally, you want water tumbling down the river or canal with a nice gradient — these are some signs of a potential hydro site. Water that is dead "flat" and barely running won't do much for you — if there is no head or gradient there is no flow velocity, there is no power. In this case the turbine can be installed within a small dam or an old mill. 1 m of the head results in a water flow velocity of around 4 m/s through the turbine. If you double the head, you double the power available. Higher hydraulic head is the least expensive way to generate more power.

SETUR-L requires only 4 m/s (max 11 m/s) of water flow velocity which corresponds to approximately 1 m (max 6 m) of hydraulic head, and at least 650 l/s of water flow rate.

WATER FLOW VELOCITY	HYDRAULIC HEAD	WATER FLOW RATE
4 M/S (MAX 11 M/S)	1 M (MAX 6 M)	650+ L/S

Higher than max speed or hydraulic head values won't result in higher power output.

A steady flow from a perennial stream or an irrigation canal with an adequate water flow speed or a small dam is ideal. Seasonal streams that suffer wide fluctuations in flow linked to wet and dry seasons can also be used, but require compromises in the design parameters.

Look for a good site rather than the closest site. With high voltage transmission coupled to grid-

connected or hybrid inverters, wire cost for longer distance is often not the biggest issue.
Other good attributes are a convenient and environmentally friendly site with easy access and permitting.

Before you even consider hydro sites, realistically assess your energy needs. A common error is overestimating actual electricity needs. We live in a wasteful society, and use a lot more energy than is necessary due to inefficient appliances and lack of attention to conservation.

The trouble with overestimating your energy needs is that it makes systems larger and more expensive, and often such large and expensive projects have a way of not getting done. In a hydro system, building a system for a wasteful home may mean using more materials and taking a larger portion of the stream flow although the water is not wasted and returned into the environment.

What types of water sources are not appropriate for SETUR systems?

Because available power comes from head, flow velocity and flow rate, water sources with inadequate flow rate and velocity or low head will not work. Flat-water rivers of very low velocity are difficult or impractical to capture energy from.

Large, gently flowing rivers like the Amazon, Nile and Mississippi are generally unsuitable for any microhydro systems other than paddle-wheel floating designs that seldom generate more than a token amount of power. A “low-head” site typically needs to dam the whole river or divert a required amount of water into a canal with a small dam to create some head.

Obviously, water that is not moving has no energy in it. And water that is being pumped is not a source of renewable energy, since it takes more energy to develop the pressure than can be gotten back from it.

Some fish-bearing streams may not be a wise choice for development due to environmental impact. And of course, you need to have legal access to the water source, and the ability to tap it without undue restrictions.

Very high-head sites (above 500 feet) can be costly to tap because of unnecessary high pressure. Tapping a part of the available head can be a viable solution.

Also note that water sources that have very high water at some time in the year make for difficult intakes. High water often means a lot of debris comes down the stream, which can clog or damage intakes.

ATTENTION! The turbine's intake must be fully submerged in water and protected from debris by a screen (mesh).

Once you’ve identified a potential site, what measurements do you take to assess the site’s production capacity? What are the best methods for taking these measurements?

Several measurements are needed, and there are multiple ways to obtain most of them. Most important is to take accurate measurements of head and/or flow velocity and flow rate. This will tell you how much power is available.

Since SETUR turbines require a head of only 1 m (max 6 m) to generate nominal power output, measuring should not be difficult and needs no additional explanation.

To measure flow rate, the float method (also known as the cross-sectional method) is used. It is found by multiplying a cross sectional area of the stream by the velocity of the water.

To measure the flow rate using the float method:

1. Locate a spot in the stream that will act as the cross section of the stream.
2. Using a meter stick, or some other means of measurement, measure the depth of the stream at equal intervals along the width of the stream. Once this data is gathered, multiply each depth by the interval it was taken in and add all the amounts together. This calculation is the area of a cross section of the stream.
3. Decide on a length of the stream, typically longer than the width of the river, to send a floating object down.
4. Using a stopwatch, measure the time it takes the float to travel down the length of stream.
5. Repeat it 5-10 times and determine the average time taken for the float to travel the stream. Throw the float into the water at different distances from the shoreline in order to gain a more accurate average.
6. Divide the stream length by the average time to determine the average velocity of the stream.
7. Alternatively use a water flow velocity meter to measure the speed.
8. The velocity must be multiplied by a friction correction factor. Since the top of a stream flows faster than the bottom due to friction against the stream bed, the friction correction factor evens out the flow. For rough or rocky bottoms, multiply the velocity by 0.85. For smooth, muddy, sandy, or smooth bedrock conditions, multiply the velocity by a correction factor of 0.9.
9. The corrected velocity multiplied by the cross sectional area yields the flow rate in volume/time. (Be sure to keep consistent units of length/distance when measuring the cross section and the velocity e.g. meters, feet).

To measure the water flow velocity perform steps 3-7.

https://www.appropedia.org/How_to_measure_stream_flow_rate

What are considered to be the maximum feasible distances for transmission wire run?

This depends on the scale of the system, the power available, cost of alternatives, the system voltage, and the terrain, among other factors.

There are too many variables involved to generalize on distance limits. Financial feasibility is usually the governing factor. How much is the power worth? Note that transmitting small amounts of energy, such as an energy-efficient household would use, can be pretty inexpensive over long distances.

Every site is unique, and careful balancing of factors is required. Ultimately, the maximum feasible distance is directly related to the depth of your checkbook and what is “worth it” to you.

Bigger diameter wires allow for longer distances but they also cost more.

What are the advantages of the SETUR system compared to other renewable electricity systems (wind turbine, PV array)?

SETUR system will generate continuously, if it has a constant water supply. This alone is a significant advantage over either wind or solar power because a battery bank may not be required, and a smaller battery bank will suffice if one is needed.

Also, SETUR is generally less expensive per kilowatt-hour than either wind or solar electricity. It's working all day, every day. If you had a site where all three systems had equal potential near to the point of use, SETUR would probably be the least expensive choice per delivered watt-hour.

Hydropower is there when you need it. When the sun goes down and the wind stops blowing, your hydro turbine will continue generating electricity.

What are common challenges encountered in installation?

Each site has its own challenges, but most are overcome by the use of common sense and some basic engineering skills.

Steep, wooded terrain and rocky stream courses can make installation more difficult.

Specific challenges include:

- Site selection and installation
- Proper pipe, if any needed, installation, including dealing with poor access and long distances
- Routing pipeline or power line over rough or steep terrain
- Avoiding private land, public land, or road crossings
- Air blockage in pipes laid with an uphill slant
- Proper transmission cable selection, installation, and protection
- Inaccurate measurements of head, flow, and distances
- Protection of the turbine from slides, debris, excessive water pressure and other physical damage
- Permitting and regulatory issues
- Freezing conditions (i.e., ice plugging screens at low water levels)

Another significant challenge in SETUR installation is finding local, experienced installers. Many more people install solar-electric systems and some also install wind electric systems with some level of expertise, but microhydro is the most obscure of the renewable technologies.

What kinds of maintenance do SETUR systems require?

As with all machines, hydropower systems require maintenance. Bearings must be checked occasionally, although the bearings used in the SETUR turbine are ceramic or composite corrosion-resistant and lubricant free.

Intake systems must be cleared of debris that might hinder water flow. In some cases, ice at intakes can be a problem.

For battery-based systems, you need to care for your batteries, ensuring that they are sized correctly to start with, and that they are fully charged most of the time to get the best life from them. Strictly follow the instructions of the battery manufacturer.

Properly maintained SETUR system will run reliably for many years.

Water usage with minimum impact on the environment

Your SETUR turbine is the most environmentally safe micro-hydro system in the world, the winner of ECOLOGICAL OSCAR 2014. However, as any other hydropower system it may potentially affect:

- Plants and fish in the water
- Plants and animals outside the water
- River banks and surrounding land

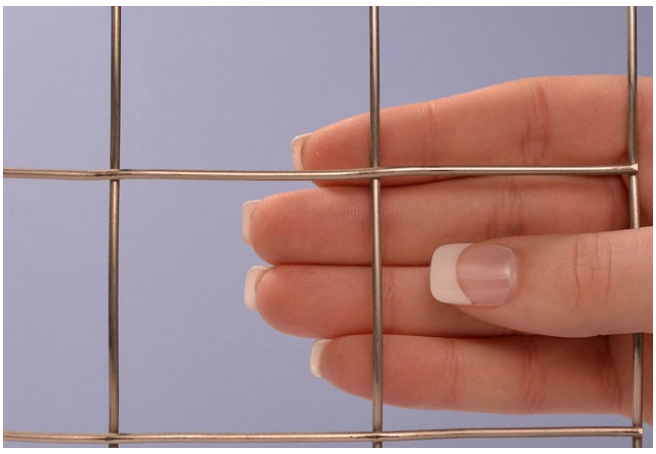
You must check with your local authorities to see if you need to obtain consent either to build any structures or to take/return water from/into a waterway. The impact of your system on stream/river ecology will usually be considered during this process.

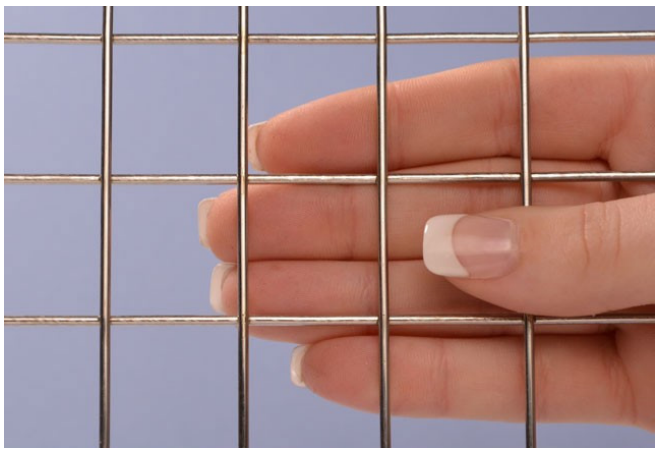
Unlike most other micro-hydro systems SETUR does not divert any water flow from the water source. SETUR turbine is designed to work directly within the available water source e.g. river, stream, canal. A good intake screen will minimize the chance of fish, leaves, debris etc entering the turbine.

Your local wildlife protection authorities might have specific requirements as to the size of the mesh screen. Please refer to any rules and regulations your locality might have in place.

We recommend a two stage protection of the turbine.

- Outer 50 mm mesh screen to prevent larger debris from damaging the system
- Inner 25 mm mesh screen to prevent from leaves and smaller pieces





It is highly advisable to make the screen protuberant towards the water flow in order to deflect the debris, plants, fish etc.

Taking less than 50% of the minimum seasonal flow rate in your water source means there is no impediment to fish moving up or down stream and hence gives aquatic life a better chance to survive.

In case you choose to route the water to your turbine via a pipe or an aqueduct, you should take care to ensure that the exhaust water from the turbine returns to the water source e.g. river, stream, canal.

TURBINE MOUNTING

Your SETUR turbine has a frame design with 4 (four) outer L-profiles that can be used for mounting the turbine.

There are many mounting choices. The most popular of them is to build a preferably concrete base or use the existing one. Then use anchor bolts to attach the turbine to the base. You may drill a few holes of up to ∅12 mm in the above mentioned L-profiles for this purpose. 4 holes would be enough to mount the turbine.

The other option is to attach the turbine to a frame that is installed across the stream or suspended from a bridge. You can also attach your turbine to a concrete river bank, seawall or mount it within a new or existing dam or mill.

Whatever your mounting choice is, the SETUR turbine must be safely attached to a solid structure that prevents any movement, slippage, fall or detachment.

It is best to wait until your turbine has arrived before you complete this task. There is nothing better than having the turbine on site to avoid errors.

Insert a triangular piece of styrofoam, plastic, rubber or soft wood between the spherical rotor and the confusor, big enough to prevent the precession movement of the rotor before the turbine is fully installed and wired. Remove it when the turbine is already safely mounted within a water stream, electrically connected to the load via a rectifier and inverter, and is ready to get operational. In case the water is delivered to the turbine via a pipe, it must have a on/off valve.

OPERATING YOUR SETUR SYSTEM EFFICIENTLY - MAINTANANCE

Although your SETUR turbine has been designed to run for long periods with minimal maintenance, moving parts must be maintained to ensure maximum performance and reliability. As part of complying with the conditions of the Limited Lifetime Warranty, please follow the requirements below.

The SETUR turbine is a durable machine, it's designed to run 24/7/365. The most advanced components and materials are used in its production. The turbine is intended and designed for continuous underwater use. Lubricant free dry- and wet-run ceramic and composite bearings require no maintenance for years if the turbine was installed and works under the conditions and requirements as provided in this manual.

The magnetic coupling operates through a gap without any friction between the parts. As there is no friction, there is no wear.

CAUTION: Never approach or touch the turbine during the operation. Always shut down the turbine before any maintenance work.

COMMISSIONING

Check, and if necessary tighten all fasteners and electrical contacts before deploying your turbine.

Remove the triangular stop from the confusor or turn the valve off if pipe fed. Your turbine should start rotating.

MAINTENANCE

Monitor the power output. Lower than normal output under otherwise similar operational conditions may indicate technical problems or simply a clogged intake screen.

Periodically check the intake screen for dirt and debris, clean as necessary. Frequency depends on your local conditions.

Periodically check all electrical connections to make sure they are tight and free from corrosion.

Every 7 years check the spherical rotor for any cracks and dents.

Make relevant notes that will be of assistance to our service personnel.

If the turbine's moving parts have substantial algae growth or fouling, you may power wash or soft-brush clean the affected parts or the entire turbine.

CONTACT DETAILS

For after sales service and information, spare parts and repairs, contact us

e-mail: support@seturturbine.com