

# FREQUENTLY ASKED QUESTIONS

understanding

## SWS – Small Windmill System

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Question-1: Why, in-general, the conventional small **Permanent-Magnet-Generator (PMG)** windmills are not as-popular-as solar? In spite of being in existence much before the solar.

The conventional-windmills (PMG: **Permanent-Magnet-Generator**) could not create a niche and survive the market completion with respect to solar for because of the following technical and commercial reasons.

It takes more than average-city-winds to start the PMG(s) from the standstill. Every tried but failed attempt to set itself in rotation, adversely affect the structure internationally also known as the Wakeup-Losses.

Similarly, as soon as the given wind exceeds the upper limit, conventional PMG has to be either braked or decoupled (run free), to protect from over-voltage.

Otherwise also, within the average & max-rated winds, PMG's regular high-speed generation creates Loud-Operational-Noise and Erosion-of-Blades.

To sustain these stress caused at the lower as well as higher winds, PMG requires extra-strong structure, resulting in **skewed Weight-to-Power Ratio** and **poor UP-TIME**.

The continuous dependence & consumption of external-power for regulation, even-while not generating (negative-metering: when consumes more than it generate), and the inability to provide electrical back-up / off-grid-power, further limits versatility and revenue.

So, PMG's higher - raw-material, transportation-&erection and O&M costs along with lower net-generation delays the Return-on-Investment. Put-together all-these made the conventional PMG unattractive, commercially, compared to Solar.

Explanation:

1. While any conventional **PMG** windmill, once already in the state of motion can keep-on generating even in the average-winds, but unfortunately the PMG's omnipresent magnetism doesn't simply lets the rotation begin from the standstill state, in the same average-winds, because the large magnetic-withholding-force requires a very high starting-torque, which in-turn requires winds higher than the average-winds. Though this average-winds good-enough to generate are always there at the certain height but still as PMG's can't start the rotation so the generation has to wait till the occasionally available higher-winds sets the initial rotation.
2. In contrast, if the winds become too high, again the PMG windmill has to stop the generation to avoid the over-voltage that may be caused by the higher-rotational speed.  
As for the PMG, electrical power is proportionate to the Voltage which is proportionate to speed, higher the speed more the Power. But the electronic panels is designed to sustain only certain voltage spikes so it's becomes a compulsion to either brake the windmill or decouple the blades and let it rotate wildly.

So, be it either the low-to-average winds or the higher-winds there are NO generation, leading to poor up-time and adversely affecting the efficiency or the Capacity-Utilization-Factor (CUF). **This generation in the small wind speed bandwidth made PMGs technically unviable.**

Also to overcome the initial wakeup-losses at average-winds and to sustain the large momentum of higher-wind, the structure / foundation has to be made extra-strong, which leads to skewed weigh-to-power ratio and escalation in the initial and subsequent maintenance cost, leading to delayed recovery of your investment. **Making the conventional PMG-windmills economically unviable, too.**

Note: (i) each-&-every failed attempts to bring PMG into rotation in the average-winds leaves a counter/ negative forces on the structure and foundation know as WAKEUP-LOSSES, and (ii) similarly to absorb the higher centrifugal-forces & momentum at very high speeds, or (iii) braking the blades altogether to protect the over-voltage and there-by again lets the high-winds to thrust / push the blades and the structure instead of rotating it, requires heavy extra-strong tower & foundation.

Frequently - Asked - Questions about SWS Small-Windmill-System, by  
'Wind-for-All Powetech LLP'

Question-2: How the modern SWS – Small Windmill Solution is better than the other prevalent conventional Permanent-Magnet-Generator Windmills?

The SWS has the first-in-class patented SEiSG (Self-Exited inverted Synchronous Generator), which unlike other conventional PMG's, lets SWS sets itself into motion in the winds lower than the average, as there is no starting torque requirement in absence of any magnetic withholding forces, hence 'No Wakeup-Losses' too.

Similarly, the patented, a never-before, "Digital- Mechanical Speed to Electrical-Torque Converter" regulates the Power, Voltage & Speeds at sources itself, allowing the generation even in the much-much higher winds, without decoupling or braking, something a PMG lacks.

This much needed expansion of the generation bandwidth (wind speed range) being 'an early & low-wind start' and 'maximum & safe generation even in the higher-winds than rated', ascertain SWS's 'Higher UP-TIME', better generation and hence the best-in-class CUF - Capacity Utization Factor.

SWS off-grid capabilities lets save @ billing unit-rate of around Rs 8, far more than the any Power Purchase Agreements unit rates.

The SWS is the only patented renewable which is NOT dependent upon any external power for delivering it's output power, making it not only self-powered / self-sufficient but also adds to economics by not consuming your power to deliver its own power. Unfortunately, the conventional PMG's consume your power first before delivering any power back to you, and sometimes consumes more than it produces (negative-metering). PMG's depends upon external-power making PMG impotent when needed the most i.e. at the times of power failures.

The patented dynamic-load-management lets SWS attune itself, in real/run time, to ever-changing winds, making an impossible possible of having an A/Wind windmills. So the SWS can be installed almost everywhere; unlike PMG(s) which has to have different models for average windy sites and altogether a different variation for high-winds.

Unlike PMG(s), the SWS's Output-Power is NOT proportionate to the Rotational-Speed and hence can continuously generate in all / any winds, safely amongst the crowd, without compromising the efficiency. Even in the regular winds, the dynamic load management ensure linear acceleration & retardation and generation at low and constant speed, irrespective of winds, drastically minimizing the operational-noise, blade-chipping and stress on the structure, ensures SWS's low maintenance and long-life.

Low initial & maintenance cost, higher generation without external-power-consumption (beneficiary reverse-metering) and the SWS off-grid capabilities to save at the higher unit rate; put together ensures speedier Return on Investment than the other conventional PMG(s).

Question-3: How **safe** is the patented SWS – Small Windmill System compared to conventional PMG(s)?

The SWS (a) ‘early & low-wind smooth start (without any wakeup-losses)’ and (b) subsequent “Digital-Mechanical-Speed to Electrical-Torque Conversion” that ensure linear-acceleration and first-in-class ‘low-&-constant speed generation’ even in the winds higher than rated. This makes SWS safe, not just for itself but for the very surrounding.

The regulated voltage and the meaningful output power is available right from the 60 RPM and the rated-power at 130 RPM while the terminal-voltage always remains safe within the range!! Irrespective of how wild are the winds as for the SWS the generation is always proportional to consumption / electrical-load. So even if something goes wrong or grid is under maintenance the SWS will automatically stop the generation and ensures safe speed, irrespective of winds.

This low-speed and gradual-acceleration ensure low operational-noises and minimize the surface erosion or the chipping of the prime-mover blades, apart from securing the structure from the centrifugal forces.

The very electricity required for the Auto Electrical-Braking is always available irrespective of availability of any external power, being self-powered, makes the SWS utter-safe.

Similarly SWS’s ‘Auto-Changeover Switch’ ensures that the connected end electrical-loads are always fed, seamlessly, firstly with SWS own generated power or when it is not available for any reasons then through the mains, and toggling back as-soon-as SWS power is available again. This not only keeps the end load safe but also ensure maximum utilization of SWS generated power first, leading to the speedier ROI.

SWS being a non-PMG is not adversely effected from the temperature making it safe to be used amongst the higher temperature areas.

Question-4: How the patented SWS – Small Windmill System is better than the popular solar?

A typical 10KW SWS requires just 3% surface area on ground or roof-top when compared to solar that needs whopping 120M<sup>2</sup> of precious land.

Unlike Solar Panel, SWS lets dual use of installed space.

Solar Panels if not at the right tilt-angle or there is shade of even 5% on the surface area than the Solar Panel efficiency drops by whopping 50%, while the SWS auto align in the line-of-wind for best out-come.

Solar panels are likely to be covered by dust & sand, leading to the fall of generation if not regularly cleaned. The SWS does not requires day-to-day cleaning and maintenance.

For every 1°C of over-heating of solar panels it's efficiency drops by another 0.5%, SWS's output and life is not dependent upon the temperature, being a non-PMG and air-cooled.

Solar (grid-tie) requires or consumes your external power for its electronics, while the SWS is self-powered!

If there is no-grid then irrespective of how good is the sun, there will not be any power available from the Solar System, i.e. when needed the most. So solar grid-tied can't be used for back-up while SWS offers unconditional power back-up irrespective of availability of external power.

The **Capacity Utilization Factor** – CUF, of the solar is considered to be half of the conventional windmills. So it safe to assume that our **Small Windmill System** will generate twice the power as can be generated by solar that too through-out the day and without consuming any external power.

Generation is NOT condensed but almost spread 24\*7 through-out the year, being a patented A/Wind technology – higher up-time, earns more money.

Unlike solar, SWS does not require any change in the existing Infrastructure (electrical) – saves time & money otherwise needed for other renewable.

Question-5: Which are the available models of the SWS – Small Windmill System and how it can be used?

The SWS – Small Windmill System, being designed for domestic, remote and off-grid usages are available in 10KW, 15KW and the 20KW models only.

All this models are typically designed for the max output of 600VDC@150RPM in all the winds above 13M/S. The max - rotational speed of 150RPM and the output of 600VDC is always maintained irrespective of any winds above 13M/S!

The meaningful generation starts from around 60 RPM or 2.5M/S wind-speed, for all three models.

SWS can be either grid-tied or off-grid. Any grid-tied (solar) inverter can be integrated with the SWS. Similarly, any off-the-shelf pure-sinewave off-line Inverter or UPS may directly be fed with SWS output, which may be connected to their respective battery banks.

Alternately, SWS generated power can directly be fed for water-pumping through the proprietary V/f Direct Drives for variable loads, just like solar pumps but with added advantage of more-power through the day & night.

A SWS can be customized and all the above three consumption option can be availed in one.

SWS is customizable and dynamically sets it's output as per the connected end load needs. For example when a 10KW SWS is used with a 15KVA / 360VDC Inverter / UPS, then it's output voltage will not exceed 440VDC. Similarly if the same model is to be used with a 15KVA grid-tied on-line inverter, then the output voltage will be 600VDC.

On a given site, SWS can be integrated in parallel / pooled economically to scale-up the capacity without adding to the cost of the control panels for each individual SWS. Being in parallel also lets the freedom to maintain the few while rest still can work and feed the power.

## Question-6: What are the main components of the SWS – Small Windmill System?

A typical SWS consists of Prime-mover, YAW assembly, Generator, Tower, Control Panel and either of off-grid or on-grid Invertor for consumption.

1. Prime-mover is responsible for converting wind's kinetic energy into rotational-torque input for the generator. The Prime-mover assembly consists of FRP Blades, Nose-cone & Hub (proprietary). The Blade diameter for 10KW SWS is 8 meters.
2. YAW ensures the blades are always in-the-line of winds, automatically, mechanically. This consist of proprietary Yaw, Tail (MS trusses structure 4M in length) and transmission (customized slip-ring & brushes) assembly to collect power from the 360-degree rotating generator to the control panel at the bottom of the tower.
3. The power-house or the generator is a patented SEISG (SELF-EXCITED INVERTED SYNCHRONOUS GENERATOR). SEISG as name suggest is not a conventional PMG. Customized - stator (field) and (rotating being inverted) armature stamping & windings lets generate high rated power at constant & low voltage at dismal speed of 120RPM. Being hollow-rotor and with large surface area, the temperature is always maintained through air-cooling even-while delivering whopping for 100AMP.
4. The Tower is the proprietary MS-round-pipe trusses structure, light-weight yet strong enough to sustain the static weight and the dynamic forces. Apt for roof-tops. Height-15M, Base-2M\*2M & weight is 900KG.
5. The patented Control Panel is responsible for:
  - a. Early and no-load start
  - b. Self-powered & empowers generation
  - c. Regulation of voltage & speed
  - d. Over-voltage / speed protection
  - e. Auto electrical and manual braking
  - f. Variable AC to pure regulated DC
  - g. Auto changeover switching
  - h. Data-logger.

## Question-7: How much does the patented SWS – Small Windmill System costs?

A typical 10KW SWS (ex-factory) costs 1.3 times of unsubsidized or commercial solar, as there are no subsidy, but the SWS can generate almost twice the electricity and occupy just 3% (4M<sup>2</sup>) of space.

Moreover as SWS do not consume any external power so it can generate and empower even when there is no external power available.

A typical 10KW SWS consist of following goods and services:

1. Aero-generator (WTG) – Patented that can deliver:
  - a. Average: 3.5KW/360VDC @60RPM;
  - b. Rated: 10KW/480VDC @130RPM (~13M/S wind);
  - c. Max: 12.5KW/600VDC@180RPM upto 45M/S wind
2. Prime-movers Blades, Nose-cone & HUB (proprietary):  
D-8M+, Weight-45KG. Chordwidth-400MM+
3. In-line of Wind: Yaw, Transmission & Tail/Vain
4. Tower (MS round-pipe trusses Lattice proprietary structure):  
Height- 15M, Base- 2M-by-2M, Weight-900KG, Sand-blasted with Hot-Zinc Coating.
5. Control Panel Self-powered i.e. Independent of any External-Power (patented & proprietary):  
Auto over-speed/voltage protection, Auto-Changeover Switch, Data-logger, manual electrical braking.
6. Either '10KVA Grid-tie Invertor for Revers-Metering' OR 'V/f Drive (proprietary) for water-pumping'
7. SWS can also be integrated with any of your existing or off-the-shelf available Off-grid (on-line) Invertors or UPS. Similarly
8. Packaging-&-forwarding, Erection-&-Installation is optional or at actual.
9. 1 + 2 years of extended Warranty free and subsequent AMC is optional or @Rs2.5/unit-generated, i.e. SWS will earn for it's own maintenance cost! No generation no maintenance for you.