TECHNICAL about SWS – the Small Windmill System:

Though Small-Windmills were there for more than a century now, much before the large MW and domestic Solar came into existence, but could not survive because of many techno-commercial reasons. These limitations have been dealt-with, in our invention as follows:

Our patented and tested-&-certified ***Small Windmill System - SWS*** comes with many **First-in-Class** & **Never-Before** features (technical) which are as follows:

1	Electrically Self-reliant & Self-sustainable
2	Early Start - Always Already in Motion
3	No additional Terminal Voltage or the Charge Controller
4	Maximum Power per Rotation irrespective of Magnitude of Wind/ RPM
5	Generation at Low & Constant RPM with linear acceleration

(1) Electrically Self-reliant & Self-sustainable:

SWS does NOT consume ANY external electricity (AC or DC) for ANY of it functioning be it generation, voltage/charge controlling, Auto Changeover Switching, Energy Metering, Data Logging or even for the emergency Braking etc. Hence there are NO hidden NEGATIVE METERING and just the profitable REVERSE METERING.

(2) Early Start - Always Already in Motion:

SWS is a (i) non-PMG, (ii) Direct-Drive and a (iii) No Electrical Load Start. So there are NO MAGNETIC WITHHOLDING or FRICTIONAL FORCES to overcome and hence ***SWS*** has NO STARTING TORQUE. Further its unique hollow rotor adds to higher moment of inertia acting as large Fly Wheel then the other Windmill's solid shafts of same weight, which again helps in prolonged rotation even with momentarily unavailability of wind. Hence, windy sites are NOT a compulsion for ***SWS***, i.e. it can be used anywhere in *All* Winds with same ease & efficiency being an early start and always already in motion.

(3) No additional Charge Controller:

Regulation of Charge or Terminal Voltage is done at generation level itself through the invented Digital Dynamic Load Management System, hence NO electronic bucking & bulky electrical step-downing, leads to reliable controlling even in harsh weathers.

Further generation at low voltage with high current results into lesser number of costly battery cells, ultimately saving the initial and O&M cost significantly.

(4) Maximum Power per Rotation irrespective of Magnitude of Wind/ RPM:

SWS is attains this through a never-before, non-discrete Dynamic Digital 'mechanical power to electrical torque convertor'.
The output current (torque) is increased while the voltage is kept low & constant. Attaining the rated power with low voltage reduce the cost of storage.

(5) Generation at Low & Constant RPM with linear acceleration:

The proprietary digital 'mechanical Speed to electrical Torque Convertor' keeps the rate of change of speed low & linearly constant, so there are no sudden electrical or mechanical jerks, low operational Noise & minimum blade surface erosion.
No wake-losses & negligible wear & tear lead to very little O&M and low speed generation makes it **safe** to be used among the humans.

All the above features & technology behind the SWS is to attain:

(1) 'Maximum Power Generation in any/ all winds' at the (2) 'Affordable Cost' while (3) 'Securing itself and the very surrounding', (4) even when there is NO external power available.

These objectives of Invention are achieved through:

1	Electrically Self-sufficiency by virtue of its Self-Excited Synchronous Generator and its Regulated Power Supply from its own variable power.
2	Maximum Utilization of any or all the given Wind, for highest UPTIME.
3	'Maximum Generation per Revolution' for highest CUF – Dynamic Load Management System.
4	Maximum Utilization of Generated & Stored Power First – Regulation of Voltage at Source/ Generation and Intelligent Auto Changeover Switching.
5	Safety of Windmill itself and the very surrounding – Dynamic Speed to Torque Conversion.
6	Quantifying & registering cumulative NET output –Smart Metering & Data-Logging.
7	Minimum Initial, and other Operating & Maintenance Cost – being indigenous, low & constant RPM O/P without much of Electrical & Electronics and always protected being independent of external power for the same.

These seven important features are explained below as follows:

(1) Electrically Self-sufficient – the invented **E**lectrically **S**elf-**P**owered **W**indmill **S**ystem (ESWS), uses 'SEiSG' Self-Excited Inverted Synchronous Generator (non-PMG), i.e. it's own initial bleak power is stepped-up in a closed loop till the threshold and uses itself own Regulated Power Supply, making SWS a truly self-reliant & self-sufficient windmill system apt for remote unmanned operations.

(2) 'Maximum Utilization of any given Wind' is achieved through:

(i) *Early Start* - being a *Direct Drive* so no friction, *non-PMG* so No withholding forces and *No Load Start* being a self-excited electromagnets, put together ensures *No Starting Torque.*

(ii) Subsequent *gradual* & *dynamic loading* as well as *unloading* so that SWS always remains *in state of rotation*', and

(iii) Higher moment of inertia because of its unique hollow rotor design.

These merits put together ensures ESWS is "always already in the State of Rotation" and this high UPTIME translates into higher CUF.

(3) 'Maximum Generation per Revolution, irrespective of magnitude of wind & RPM, is achieved through:

(i) A never before non-PMG Generator's unique design,

(ii) Digital Dynamic Load Management System where the O/P KVA is always matched to the changing (wind speed) I/P KW such that SWS is never too loaded or under-loaded with respect to the given wind and the End Load, through Speed to Torque conversion.

(iii) 'High generator efficiency'

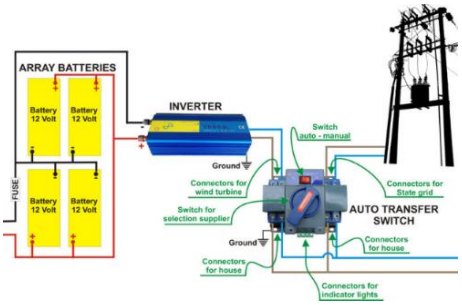
(iv) Low self-consumption & negligible losses of Electronic & Microcontroller being PWM further ads to maximum (net) generation/ rotation.

(4) Maximum utilization of produced & stored power is achieved through:

(i) Regulation of charging or the terminal voltage at the generation level itself that leads to high Charging Current while keeping the Voltage within the desired range

(100% to 120% of battery VDC to avoid sulphonation & corrosion, for battery long life),

(ii) The proprietary **Auto Changeover/ Toggling Switch** that pushes the Windmill Power first & than the Stored Power (beyond the back-up needs) even when the AC Grid power is available,



This put together ensures maximum utilization of generated/ stored power from the day one and further helps in Speedier Return on Investment by:

(i) Offsetting the costly Electrical Units from the day-one,
(ii) Maximum utilization of battery on day-to-day basis which otherwise would have been lying unused till power back requirements arises,
(iii) No continuous charging & discharging so save the battery life.
(iv) Regulation of Voltage at source minimizes the number of batteries while adds to Ampere-Hour capacity. Note: toggling between Windmill Power & AC mains is done without using any external power!!

(5) The Invented ESWS ensures utter safety for itself & the surrounding by protecting itself from: Over-speeding through its unique self-reliant Digital Dynamic Speed to Torque convertor which not only keeps (i) the RPM under check but also ensure (ii) gradual & linear acceleration/ retardation. Further, the Digital Dynamic Dump Load Management System protects from Open or No load Voltage which indirectly leads to high RPM and mechanical instability and the Short Circuit.

True to its name, ESWS never fails to protect itself & surrounding for because of unavailability external electrical power.

(6) ESWS comes with <u>True RMS Smart Digital Energy Meter</u> and an in-built <u>Data-logger</u>. The proprietary energy KWH meter digitally measures & cumulative stores the NET True DC RMS Power. The Data Logging, stores other vitals like Maximum RPM attained Maximum Power

delivered, Windmill Up-time and other performance related statistics for end-user's information. It does not require any external power; power measured is net of the power used by the meter too!!

(7) The invented ESWS's 'Low Maintenance' & 'Long Life' is achieved through:

(i) No wake Losses & Minimum Mechanical wear-&-tear being:
   a. Direct Drive (no gears so no friction),
   b. No Withholding & Starting Torque being non-PMG
   c. 'No Load Start' being Self-excited,
   d. Subsequent Digital Dynamic Loading & Unloading with respect to changing wind & end load ensures smooth transition from 'no load' to 'load' till 'full load'.

   e. Early Start & Low and Gradual Speed Generation ensures:
      i. Low Operational Blade Noise & Erosion,
      ii. Exponentially less centrifugal forces on blades & Hub roots,
      iii. Low moment of inertia while Yawing (in-the-line of wind),
      iv. Simplified high-end electrical & electronics and durable mechanical structure,
      v. Electrical self-reliance and independence,
      vi. Invented Generator type has no de-magnetization risk with time & temperature or faults, as in the case of other PMGs.

All this leads to low O&M cost and long Life too.

Aforesaid summarizes the present invention's main objectives i.e. (i) perpetually self-reliant & self-sufficient windmill system that can harness (ii) maximum power out of Any/ All unpredictable winds, with (iii) minimum cost and (iv) uttermost safety.