C&I WIND-SOLAR HYBRID PLANT

CASE STUDY

Plant Developer: CleanMax
Location: Jagalur, Karnataka

December 2022

Actual site image

JMK Research & Analytics

JMK Research & Analytics is a specialist consulancy firm that provides research and advisory services to Indian and International clients across Renewables, Electric mobility, and the Battery storage markets.

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GLOSSARY

Abbreviation	Definition
APX	Amsterdam Power Exchange
AC	Alternating Current
APPC	Average Power Purchase Cost
AS	Additional Surcharge
BOS	Business Operating System
C&I	Commercial & Industrial
CUF	Capacity Utilisation Factor
CSS	Cross Subsidy Surcharge
CAPEX	Capital expenditure
CO2	Carbon dioxide
DC	Direct Current
DISCOM	Distribution Companies
ED	Electricity Duty
EPC	Engineering, procurement and construction
ESI	Environmental and Social Performance Standards
GW	Gigawatt
GHG	Greenhouse Gas
HSE	Health, Safety, and Environment.
INR	Indian Rupee
IFC	International Finance Corporation
kWh	Kilowatt-hour

Abbreviation	Definition
kV	Kilovolts
L	Liter
m	meter
MUs	Million Units
MNRE	Ministry of New and Renewable Energy
MW	Megawatt
MCS	Module Cleaning System.
MWh	Megawatt-hour
m/s	Meter per second
NIWE	National Institute of Wind Energy
OA	Open Access
O&M	Operation & Maintainance
PPA	Power Purchase Agreement
PV	Photovoltaic
PSS	Pooling Substation
RPO	Renewable Purchase Obligation
RE	Renewable Energy
SERC	State Electricity Regulatory Commission
TIGR	Tradable Instruments for Global Renewables
WSH	Wind Solar Hybrid
Wp	Watt-peak

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INTRODUCTION

What is a Wind Solar Hybrid System?

Hybrid systems combine two or more modes of electricity generation together. Hybrid systems provide high level of energy security through the mix of generation methods, and often may add a storage system (battery, fuel cell) to ensure maximum supply reliability and security.

The combination of renewable energy sources of wind & solar used for generating the power are called as Wind Solar Hybrid system. This system is designed for using the solar panels and wind turbine generators simultaneously for generating the electricity.

WSH systems are becoming popular in India with approximately 1.3GW solar capacity installed under hybrid power projects and about 11 GW under pipeline across the country.

Comparison of Wind Solar Hybrid, Standalone solar & standalone wind

Parameter	Wind Solar Hybrid	Standalone Solar	Standalone wind
Description	Wind and solar capacity bundled to form a hybrid system.	Only solar capacity is present.	Only wind capacity is present.
Energy Generation profile	Energy generation spread throughout the day as well as night.	Energy generation during solar hours (daytime).	Peak energy generation during periods of high wind speeds, i.e., early mornings and evenings.
Capacity Utilisation Factor (CUF)	40-55%	16-20%	30-35%
Renewable Purchase Obligation (RPO)	Help C&I consumers to fulfil both solar and non-solar RPO	Only solar RPO is fulfilled	Only non-solar RPO is fulfilled

Source: JMK Research

Note: Actual project CUF may vary basis methodology used for determining interconnection capacity of the project

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Benefits to stakeholders

Continuous Generation: 24*7 clean energy.

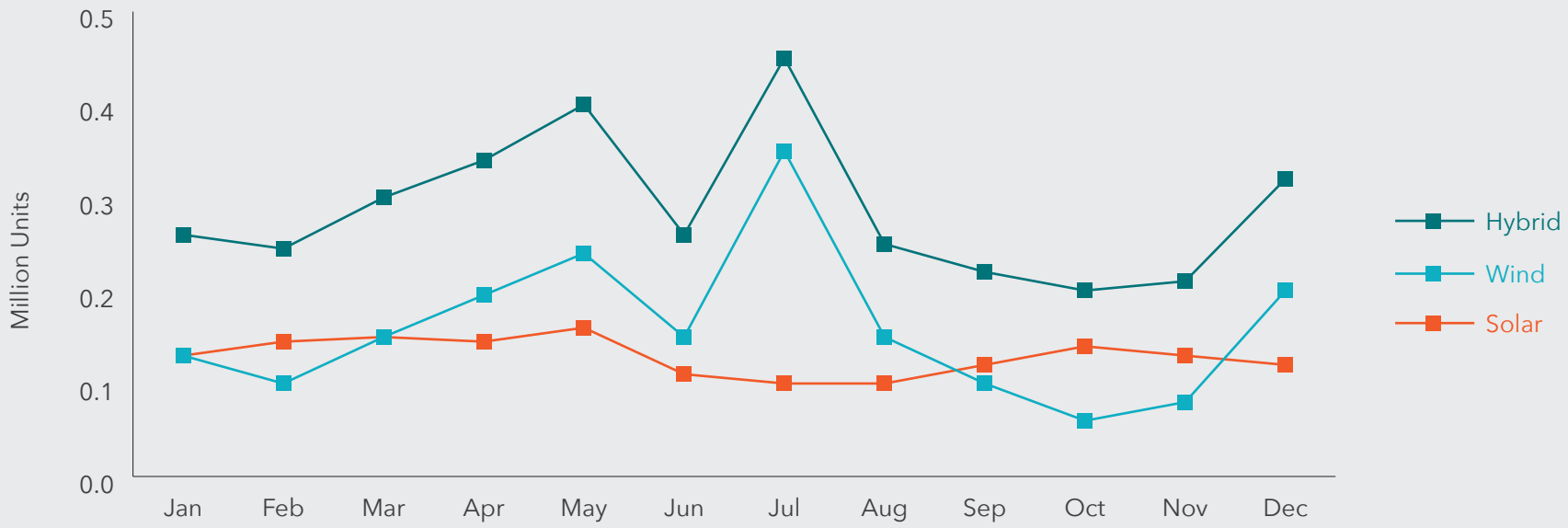
Stable & Reliable: Very less curtailments of excess units due to stable and smoother generation profile.

Concessions to the beneficiaries: Several state policies award waivers on open access charges and incentives for setting up hybrid projects.

Reduced capital cost: Better and more efficient use of land & infrastructure, especially in case of co-located WSH plants. For co-located plants, maintenance costs are also lesser as the wind and solar plants are usually spread across only a few kms away.

The below figure represents the monthly WSH generation in India and it clearly shows that wind generation is higher than solar from April to August. From September to November, this scenario is reversed as solar radiation is higher and wind speeds are lower.

India's Monthly Wind, Solar and Hybrid Generation Profile



Source: National Institute of Wind Energy

POLICIES & REGULATIONS

In India, it is becoming increasingly important for policy makers to promote wind-solar hybrid projects considering the intermittent nature of standalone wind & solar power sources.

National Wind-Solar Hybrid Policy 2018

To boost the development of hybrid projects in India, the Ministry of New and Renewable Energy (**MNRE**) announced the Wind-Solar Hybrid Policy on 14 May 2018. The objectives and detailed framework of the policy are mentioned as below:

Policy Objectives

- Reduce Variablity in renewable power generation
- Achieve better Grid Stability
- Policy framework for efficient utilization of transmission infrastructure and land for large grid-connected wind-solar photovoltaic (PV) hybrid system.
- Promote hybrid projects: Both new as well as hybridisation of existing wind/solar projects.
- Encourage new methods and way-outs involving combined operation of wind and solar PV plants.

National Wind Solar Hybrid Policy Highlights

- To be recognised as a hybrid power plant, the rated power capacity of one resource should be at least 25% of the rated power capacity of the other resource and the power procured from the hybrid plant is used for fulfilment of both Solar RPO as well as Non-solar RPO.
- No additional connectivity/transmission capacity charges shall be levied for already existing plants; however, transmission charges will be applicable for additional transmission capacity.
- The policy provides for integration of both the energy sources i.e., wind and solar at alternating current (AC) as well as direct current (DC) level.
- The additional solar/wind power generated from the hybrid project is used for Captive purpose for self-consumption (or) sale to third party through open access (or) sale to the distribution companies i.e., either at tariff determined by the respective State Energy Regulatory Commission (SERC) or at a tariff discovered through transparent bidding process or Average Power Purchase Cost (APPC) under Renewable Energy Certificate (REC) mechanism and avail (REC)s.

STATE POLICIES

Based on the MNRE Wind-solar Hybrid Policy, Various RE rich state governments have come up with their own policies to provide an effective regulatory landscape for the WSH segment. Gujarat introduced its Wind-Solar Hybrid policy in June 2018, later followed by Andhra Pradesh, Rajasthan and Karnataka. This was the onset of Open Access Wind Solar Hybrid projects in India.

Compared to all States, Gujarat introduced the most favourable policy among the preferred states for wind-solar hybrid installation back in 2018. Its provisions, such as a waiver on electricity duty are very attractive. Further, compared to other states, Gujarat's policy offers better clarity regarding energy banking, settlement aspects, etc

However, the on-ground development for WSH in Gujarat kickstarted only after Gujarat issued the complete tariff framework for the policy in April 2021. The tariff framework provides detailed values of all OA charges at different voltage levels. It also provides technical details about power evacuation and interconnection that must be adhered to while designing the wind-solar hybrid projects in Gujarat.

MNRE issues NATIONAL Wind Solar Hybrid policy
MAY 2018

These policies mention various waivers on open access charges and incentives which is very much useful to developers who set up wind solar hybrid plants. To promote this sector various state governments have mentioned deferred payment of transmission charges and electricity duty etc.

RPO Obligation: RPO can be fulfilled separately for both solar and non-Solar
Banking Charge: 2%, **Banking settlement period**: Annually
Additional Surcharge (AS): 75% exemption on AS
Electricity Duty (ED): Waived off for intra state consumption, applicable for third party
Transmission/Wheeling Charges: No additional connectivity/ transmission capacity charges shall be levied for already existing plants; however, transmission charges will be applicable for additional transmission capacity.

Karnataka
APRIL 2022

RPO Obligation: Mandatory for Discom to purchase power equivalent to 5% of their RPO targets under this policy.
Banking Charge: 10%
Banking settlement period: Annually
Electricity Duty (ED): Waived off for intra-state consumption
Transmission/Wheeling Charges:
Hybrid: 50% concession for captive/third party sale for 7 years from project commissioning.
Hybrid+storage: 75% concession for captive/third party for a period of 7 years from project commissioning

Rajasthan
JANUARY 2019

Andhra Pradesh
DECEMBER 2019

The state introduced waivers on January-2019 and soon withdrew all waivers related to open access.

Gujarat
JUNE 2018

RPO Obligation: RPO can be fulfilled separately for both solar and wind/non-solar.
Banking Charge: Nil
Banking settlement period: Monthly
Cross Subsidy Surcharge (CSS) & Additional Surcharge (AS): 50% concession for 3rd party sale
Electricity Duty (ED): Waived off for intra state consumption
Transmission/Wheeling Charges: 50% concession for captive consumers on wheeling charges & losses. Waivers are applicable only at 11KV voltage drawl.
No waivers for Third party sale.

Source: JMK Research

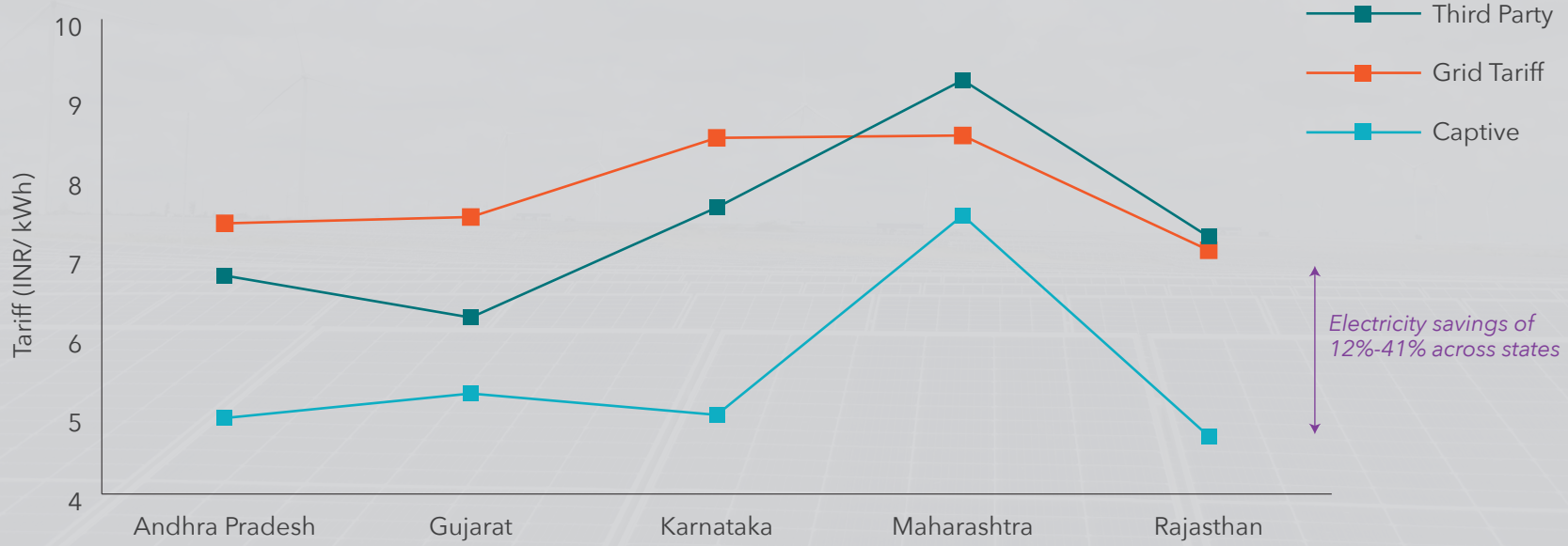
LANDED COST CALCULATION

C&I consumers in India consume open access(OA) power primarily through three power procurement options. They can either wheel power from third-party power plants, or through captively owned power plants or power plants owned by a group of consumers, also known as group-captive plants. As similar policy provisions and waivers are applicable on captive and group-captive plants, they are usually referred together as "captive/group-captive plants".

Because of the significant OA charge waivers, group-captive model is currently the most preferred option for OA procurement by C&I consumers in India.

The graph below represents the Power Purchase Agreement (PPA) price to be paid by a company consuming open access power from hybrid projects. As can be seen, only captive model is best suited for hybrid projects in the states indicated.

Landed cost of wind solar hybrid power for C&I consumers in key states



Source: JMK Research

Assumptions: (1) Wind solar hybrid cost is fixed at Rs. 4/kWh across states to highlight changes due to open access charges; actual tariffs will vary. (2) The landed cost is calculated for industrial consumers connected at 33 kV voltage (3) For hybrid project 75:25 ratio is considered for solar to wind.

Actual site image

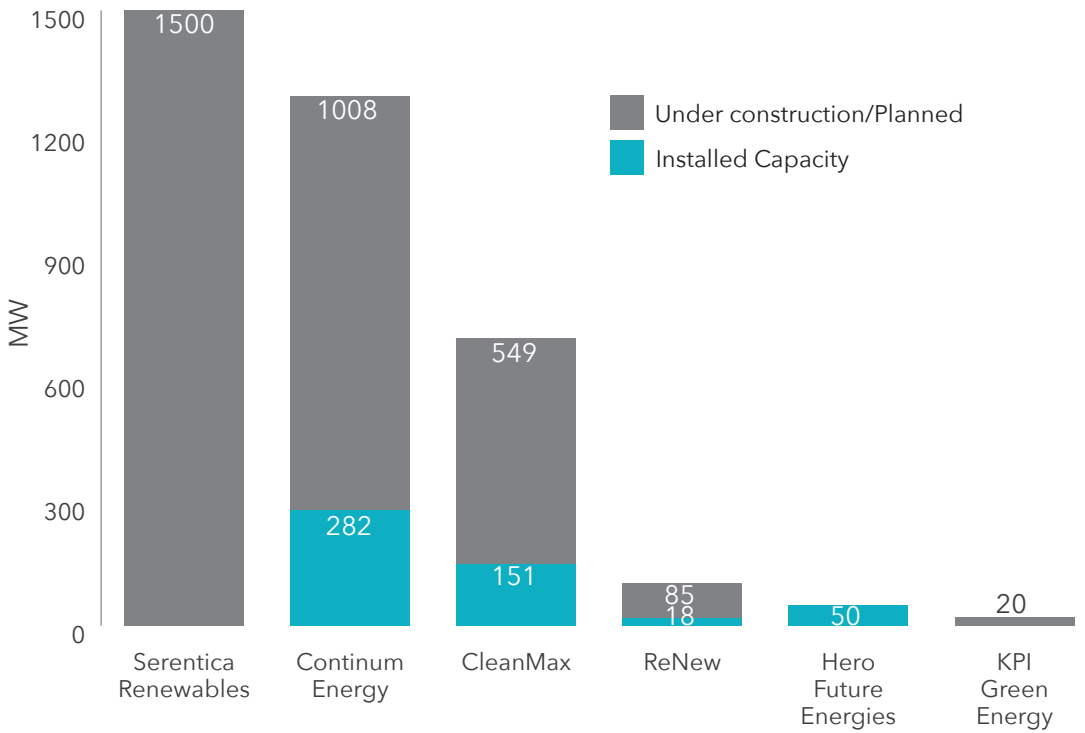
KEY PLAYERS

Before the introduction of National Wind Solar Hybrid policy, the focus of key Indian developers was only on the plain vanilla solar and wind plants. CleanMax was the first develper who started exploring this opportunity for C&I segment. Later many other players like Continuum Energy, Renew Power, Hero Future Energies also ventured into this segment.

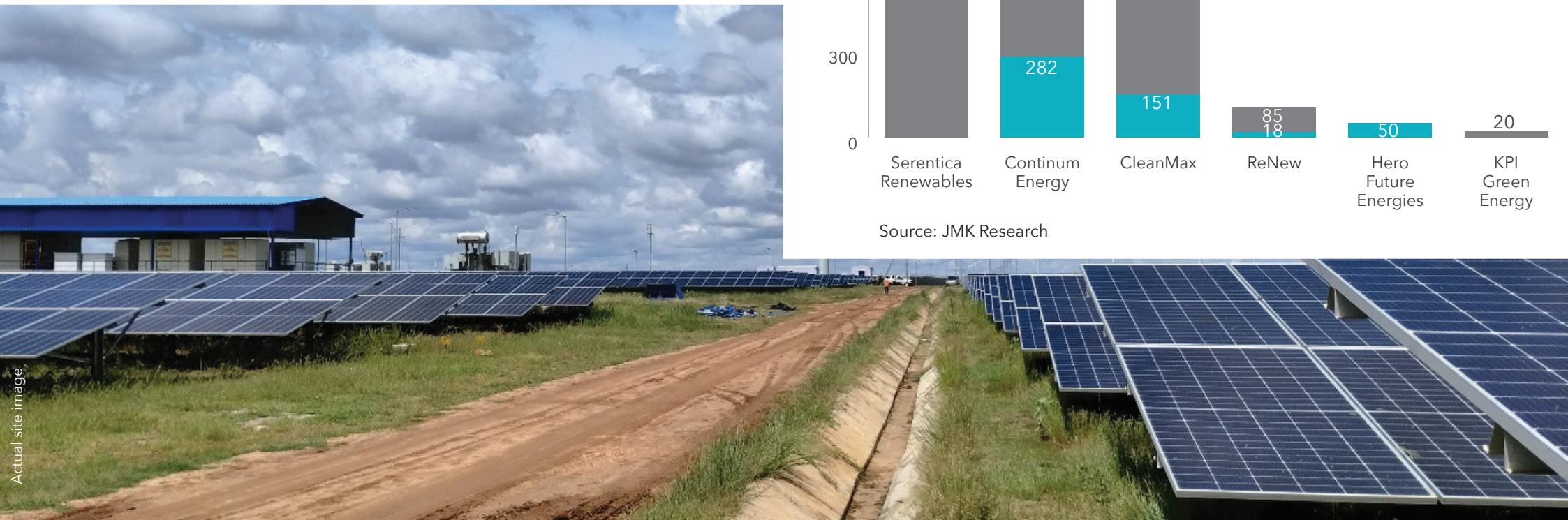
Continuum Energy owns and operates India's largest wind-solar co-located hybrid project in Tamil Nadu, with a capacity of 226.8MW and CleanMax operates wind-solar co-located hybrid project in Karnataka with a capacity of 151 MW and another 149 MW under construction.

Renew Power commissioned the Gujarat's first wind-solar hybrid project (~18MW) in February 2022. Further CleanMax is constructing a 400MW Wind-Solar Hybrid plant in Gujarat.

Leading Wind-Solar Hybrid Project Developers



Source: JMK Research



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PROJECT CASE STUDY

CleanMax Wind Solar Hybrid Project, Jagalur, Karnataka

As explained in the previous section, solar and wind technology have complementary daily and seasonal energy generation profiles. Realizing this, the combination of these technologies, WSH offered an innovative solution to address inherent variability of renewable energy sources. All stakeholders (DISCOMs, C&I consumers, investors etc) prefer more stable and invariable power output, that WSH plants provide. Additionally, if the WSH plant is co-located, it helps in savings of inter-connection and infrastructure costs as it is shared between wind and solar. Hence, through this case study of an already operational WSH plant, we will analyse in detail the complexities associated with this emerging technology.

CleanMax is one of the leading renewable energy developers in Asia with ~1GW of operating assets. The renewable energy solutions provided by CleanMax include solar rooftop projects, solar farms, wind farms, and wind solar hybrid farms.

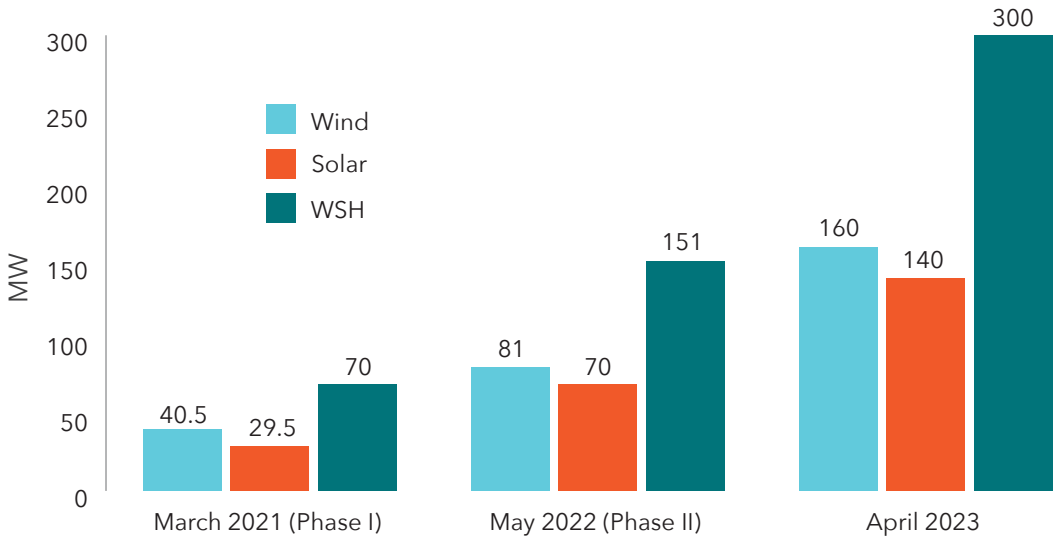
JMK Research visited their Wind-Solar Hybrid plant in Jagalur location which comes under Davanagere district, Karnataka and is around 250 km away from Bangalore. CleanMax chose the Jagalur Site for development of WSH for following reasons:

(i) **High energy generation potential** Wind speed for this site is very good and solar irradiation is equally better. Ministry of New and Renewable Energy (MNRE) also certified this area as one of the best sites in India for WSH development .

(ii) **Suitable power evacuation infrastructure** The project is located nearby a 400/220kV DISCOM substation. The substation is connected to major load centres across Karnataka and has an evacuation power capacity of 2000MW.

(iii) **Easy logistical accessibility** Jagalur is connected to major national and state highways which allows easy transportation of large equipment's for project installation such as wind turbines and transformers.

CleanMax WSH Jagalur Installed capacity timeline



Source: CleanMax, JMK Research

Out of the total planned project capacity of 300 MW, CleanMax has installed 151 MW of Wind-solar hybrid plant in two phases. Phase-I was commissioned in March 2021 with an installed capacity of 70 MW (Wind: 40.5MW & Solar: 29.5 MW). Phase-II was commissioned in May 2022 with an installed capacity of 81 MW (Wind:40.5MW & Solar-40.5 MW). Rest of the total planned project capacity i.e., 149 MW is under construction. Group captive is the most prominent OA procurement model in the CleanMax WSH Jagalur plant.

Actual site image

Project Configuration

Site Name	CleanMax Enviro Energy Solutions 150MW Wind-Solar Hybrid farm in Jagalur.		
Date of Commissioning	Phase-I: March-2021,Phase-II: May-2022	**Location**	Jagaluru, Karnataka
Total Installed Capacity	151 MW	**Project layout**	Co-located
Operation & Maintenance(O&M)	Self	**Developer Name**	CleanMax
Project type	Wind-Solar Hybrid	**EPC**	Self EPC

Solar

AC Capacity : 70 MW		DC Capacity : 97 MW	
Solar Modules			
Capacity	Make	No of Modules	Type
530 Wp	Jinko Solar	3,876	Mono PERC
535 Wp		30,861	
540 Wp		8,046	
545 Wp		1,22,222	
550 Wp		4,418	
650 Wp	Trina Solar	5,016	
Inverter Details			
Capacity	Make	No of Inverters	Type
200kW	Sungrow	245	String
225kW	Sineng	71	String

Wind

Make	GE 2.7
No of Wind Turbines	30
Capacity of each wind turbine	2.7 MW
Ac Capacity	81 MW
Cut In Speed	3 m/s
Cut out speed	18 m/s
Power curve	10 m/s
Hub height of the turbine	130m
Rotor Diameter	132m
Frequency	50 Hz

Inter Connection	Capacity	150 MW (75 MW X 2)
	Voltage	220 KV
Project Cost (CAPEX)	~INR 6.59 crores/MW (~US$ 811,641)	
Yearly Maintenance Cost	~INR 5 lakhs/MW (~US$ 6069)	

Actual site image

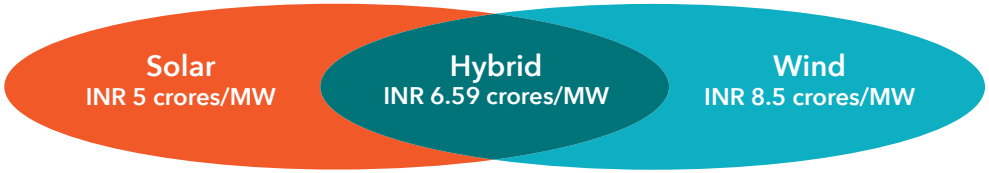
PROJECT COST

CAPital EXpenditure (CAPEX)

This wind solar hybrid (WSH) project is implemented by CleanMax on the build-own-operate model. Thus, all project CAPEX as well as maintenance costs are mainly borne by them. Tata Cleantech Capital Limited is the other major financer in the project.

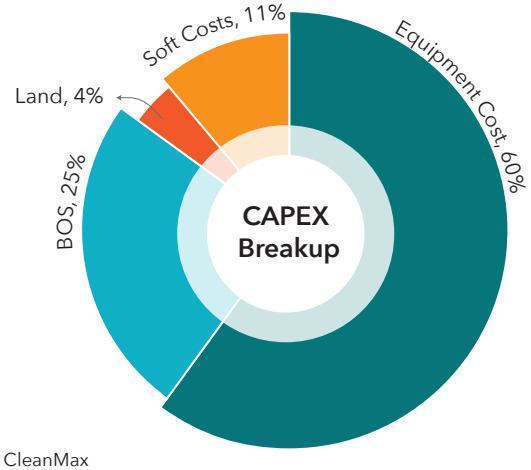
Out of the total targeted capacity of 300 MW for the entire project, 151 MW has been completed. The completed 151 MW consist of 70 MW solar (AC capacity) and 81 MW wind. The DC capacity of the solar plant is 97 MWp.

Project Capex per MW comparison of Solar, Wind and Wind Solar Hybrid



The current CAPEX for the project is around INR 6.59 crores/MW (considering the DC capacity of the solar project). Thus, for the entire project (operational as of date), CAPEX comes out to be ~INR 1174 crores.

This CAPEX includes all project costs such as land procurement, equipment procurement and installation, financing cost etc.



Source: CleanMax
Note: The Project CAPEX does not include interconnection cost. The interconnection cost for a hybrid project is ~INR 84 lakh/MW.

Operational And Maintenance Cost

CleanMax currently incurs annual operational & maintenance (O&M) costs of around INR 5 lakh/MW for this project. This translates to current annual O&M costs of ~INR 7.5 crores for the entire operational project.

As a significant portion of transmission and evacuation infrastructure is shared in case of WSH plants, the CAPEX and O&M costs are shared as well. Thus, the CAPEX and O&M costs are much lesser vis-à-vis standalone wind or solar plants.

Measures To Save Project Costs

Following cost saving measures were implemented by CleanMax that helped them to save significantly on project costs:

- Location of pooling substation (PSS): The PSS for wind and solar power is located just 320 m from the 220 kV government substation. Developing PSS in such proximity to the evacuation point saves a significant amount of transmission infrastructure costs and aids easy scalability of the PSS in the future.
- Utilization of high-wattage modules: All solar modules employed in the plant are rated more than 530 kWp. Utilising high wattage modules reduce the land area required to set up a solar plant. This design choice has led to more efficient utilisation of project land area and land related costs.
- Leveraging in-house capabilities: The entire project from engineering procurement construction (EPC) to O&M is being handled in-house by the developer. In addition to the better cost controls, utilization of in-house resources for complex project tasks has helped them in developing their expertise to handle future projects of such nature.

PLANT PERFORMANCE

The site is located in Devanagari district of Chitra Durga division in Karnataka. The site location has high potential for solar and wind generation. MNRE also certified this area as one of the best locations in India for wind solar hybrid. As of October 2022) installed capacity of the WSH plant is 151 MW (81 MW wind + 70 MW solar). Below table illustrates performance of the plant in terms of generation.

Project generation and performance parameters (July 2022 to September 2022)

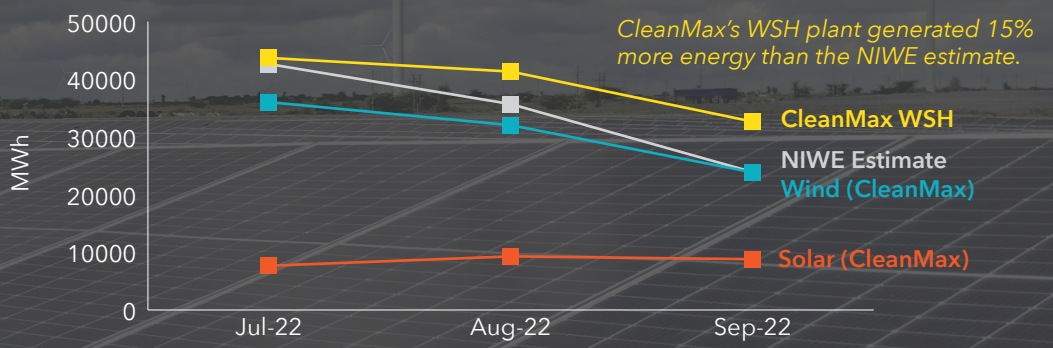
Technology	Parameter	Value
Solar	Solar Irradiance (kWh/kWp)	415
	Solar generation (MWh)	25768
Wind	Wind speed (m/s)	7.4
	Wind generation (MWh)	91936
Hybrid	Plant generation (MWh)	117704
	CO2 abatement (tonnes/annum)	376652

Source: CleanMax, JMK Research

The wind generation for the period from July and September (as considered for the analysis) was quite high as these months generally have peak wind generation in India. However, for the same period the Solar generation was a bit on the lower side because of lower solar generation.

Next, to gauge the performance of the WSH plant, the plant generation is compared to the generation as determined in a National Institute of Wind Energy (NIWE) study . NIWE estimated monthly generation trend from a hypothetical 2 MW hybrid (1MW wind + 1 MW solar) plant throughout a calendar year. Upon Scaling up the generation and comparing, CleanMax's WSH plant generated 15% more energy than the NIWE estimate.

Energy generation trend (July 2022 to September 2022)



Source: CleanMax, JMK Research
Note: NIWE assumed site location (near Haikal in Karnataka) is at a distance of around 5-10kms from CleanMax WSH project

Factors attributing to better than anticipated performance of the CleanMax WSH plant :

- Lower energy losses due to lesser transmission distance and using high efficiency transmission conductors (ECO MAX, discussed in detail in next section).
- Optimal placing of wind turbines through detailed micro-siting of 200 potential sites.
- Lower downtime and curtailment of the energy generated.

PROJECT HIGHLIGHTS

Water Positivity To Clean Solar Modules

There is water scarcity in the project site location and the nearby districts Of Karnataka. Ground water table depth in the area is generally low, around 400 feet. Thus, it is imperative to use water judiciously for project related purposes. Solar PV Plants consume a significant amount of water for its operation & maintenance, mainly for cleaning its PV panels.

CleanMax WSH Jagalur project use an innovative module cleaning system (MCS) using a network of hoses spread throughout the site location which are in turn, connected to centralised water tanks. This MCS allows significant amount of savings in water consumption requirement vis-à-vis the general method, i.e., using water tankers. Annually, on project level, using hose wet cleaning saves around 5338 kilolitres of water (equivalent to water contained in 2 Olympic sized swimming pools).

Comparison of solar module cleaning methods

Parameter	Solar module cleaning method		Water consumption savings by using hose wet cleaning (Ltr)
	Using water tankers (Ltr)	Hose wet cleaning (Ltr)	
Water requirement (per module/cycle)	5	2.5	2.5
Water requirement (per MW/cycle)	9171	4586	4586
Annual water requirement (for project)	10675373	5337687	5337687

Source: CleanMax, JMK Research

Additionally, CleanMax have created four large rain-water recharging pits at the site location. The pits are of a depth of 2m each and surrounded by shrubs to prevent soil erosion. These pits further helps in reenergising the water table in the project site area.

Local Employment

The project employed a significant portion of local population around the site during project construction and continue to do so during the project operations. 90% of the employees (~300) during the project construction phase were locals from the nearby villages. The key benefits of integrating the local population with the project are job creation, Lesser instances of regulatory disputes arising between the developer and locals.

Utilizing Novel High Voltage Transmission Conductor (ECO MAX)

While designing the 33 KV transmission line, transmission efficiency of 99.5% was targeted as compared to 98% considered by usual EPC players.

To achieve this, Sterlite's ECO MAX conductor was used, rather than commonly used PANTHER conductor. ECO MAX is made up of pure aluminium unlike PANTHER conductor which is made up of aluminium+galvanised iron (GI).

Utilising ECO MAX reduced the transmission losses and increased power carrying capacity of the 33kV transmission lines by 40% (from 25 MW to 35 MW).

Additional Revenue Stream For CleanMax

Furthermore, CleanMax gains additional revenue by converting environmental attributes of the project into tradable green certificates. This is achieved with the help of a US based online platform called Tradable Instruments for Global Renewables (TIGR) which is developed and maintained by a global power exchange APX. Only one party can utilize green attributes - either the consumer or the developer. In this project, only for specific cases, CleanMax is able to utilize these attributes where they could to negotiate as part of their PPA terms.

CHALLENGES

Main challenges faced during the project design and construction phase include land availability and site selection as well as local connectivity due to lack of dedicated infrastructure in the area. The developer faced various challenges during the covid induced lockdowns.

SITE SELECTION (INCLUDING MICRO SITING)

There are certain states like Rajasthan where the solar generation is better than the wind and other states where the wind generation is better than the solar. Thus, for WSH projects (especially for co-located projects), it is crucial to identify sites with ample wind and solar resources. Further micro siting of wind turbines is required to determine the exact location of wind turbines complying several requirements regarding existing wind resource, distance from other wind turbines, and approach the roads, etc.

For both wind and solar power plant projects in the CleanMax WSH Jagalur plant, a detailed analysis was conducted to predict the wind or solar power generation across various sites, considering distance from nearest evacuation substation and availability of historical wind data. Further for micro siting of wind turbines, CleanMax analysed over 100 locations to finalize the exact locations for the wind turbines. Due to this detailed micro siting exercise, CleanMax was able to reduce the length of the road network inside the wind park by 25% from the initial budget estimated and achieve 4% higher energy output compared to initial assessment

TRANSPORTATION

The remoteness of the location and the enormous size of wind turbines posed a challenge in handling the logistics of the Project. Given the scale of the project and the labour force, safety and synchronisation across teams became extremely important, both during and post installation of the project to ensure a safe and timely execution.

The height of each wind turbine is 132 m which is equivalent to a 35-storey building. It requires 40 trucks to assemble as well as dismantle the crane utilised to erect a single wind turbine. Due to lack of local dedicated transportation infrastructure in the area, the movement of vehicles for logistic supply of these large machines was a major challenge.

To resolve this issue, 16 km of Kutcha road was upgraded and widened. Also, 9 km of new road was additionally built by CleanMax.

COVID-19 RESTRICTIONS

The COVID-19 pandemic created major disruptions and slowed down the installation rate of renewable energy projects in 2020 and 2021. The project was executed during the multiple waves of the COVID-19 pandemic.

END CONSUMER BENEFITS

In the past few years, DISCOMs as well as commercial & industrial (C&I) consumers are increasingly preferring WSH power over plain vanilla solar or wind power. The reason for the same is smoother power output profile and reduced seasonal variability as compared to plain vanilla solar or wind projects.

Type of Consumers and Their Location

CleanMax WSH Jagalur plant currently has 12 consumers in total. All the C&I consumers utilise open access (OA) for sourcing power from this WSH plant. Group captive model wherein a group of consumers jointly own at least 26% of the project, is the most prominent OA procurement model in this project.

Nearest industrial hub is Bellary which is located at a distance of around 100 km from the project site. In addition to Bellary, C&I consumers sourcing power from this project are also located pan Karnataka in locations such as Bangalore and Hubballi.

Key Consumers

Cargill	LM WIND POWER a GE Renewable Energy business	Manjushree 2.0	NTT
Food Processing	Manufacturing	Plastic Packaging	Data centers (IT)
ROQUETTE	Cipla	BILL FORGE	SANSERA ideas@work
Food Processing	Pharmaceuticals	Manufacturing	Automotive OEM

PPA Tariff Details

All power purchase agreements (PPA) are long term with a tenure of 25 years. The PPA tariff for all the projects is around INR 4-4.5/unit viz. at least 20-40% lesser than the prevailing respective grid tariff.

NTT is one of the largest Data Centre and IT infrastructure company in the world. In India, it has large data centre parks in Mumbai (Maharashtra), Bengaluru (Karnataka), Chennai (Tamil Nadu) and Delhi. In line with company's Net Zero target by 2030, NTT also invests heavily in setting up and using RE power for its operations. It's subsidiary (NTT-Net Magic) is one of the major consumers of CleanMax WSH Jagalur plant with 32.5 MW contracted capacity (19 MW solar and 13.5 MW solar). Further details have been summarized below:

> *"Our intention is to achieve Net Zero targets by 2030"*
>
> **– Sharad Sanghi, CEO, NTT Ltd.**

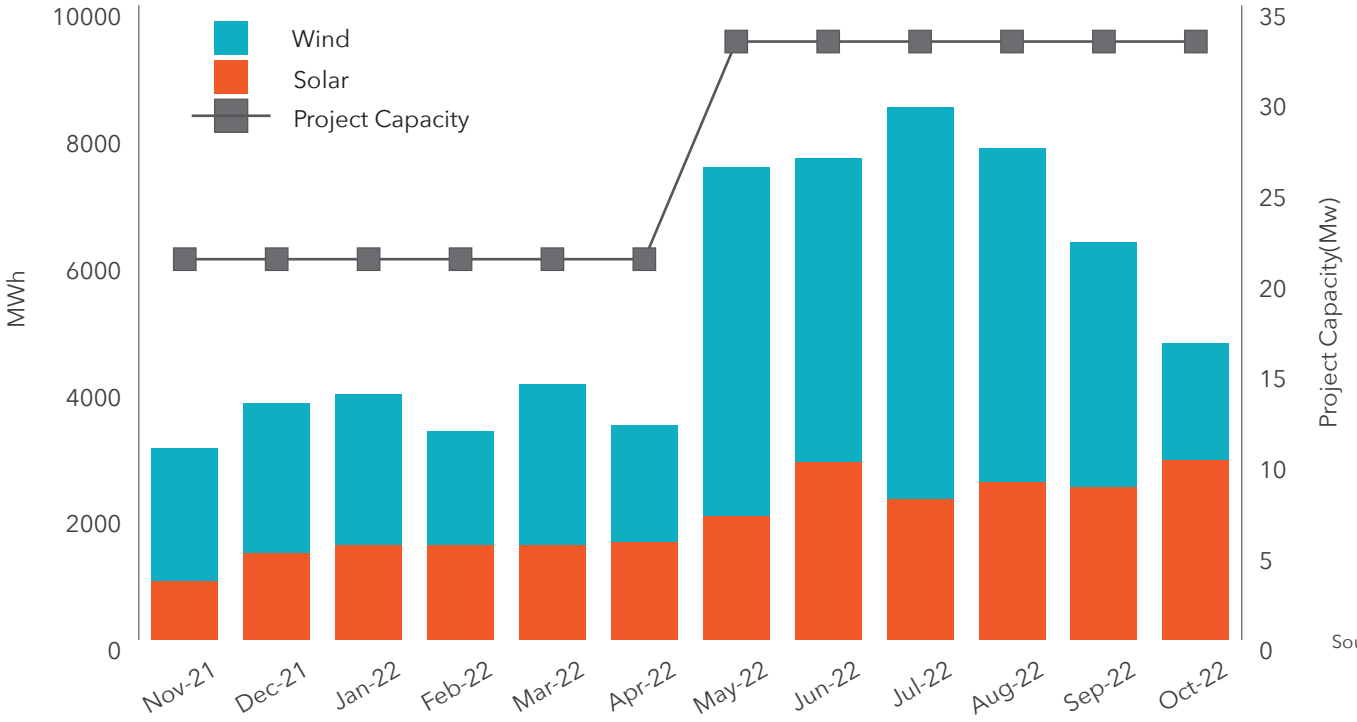
"NTT-Net Magic" power procurement from CleanMax WSH Jagalur

Parameter	Description
Contracted Capacity	32.5 MW (Solar: 19 MW, Wind: 13.5 MW)
Date of Commissioning	July 2021
OA procurement type	Group-captive
Energy Consumption met from the WSH	63,446 MWh/annum
% of total energy consumption	90% of the electricity required in NTT facility in Bangalore is met through this project
Annual electricity bill savings	~INR 20.93 crores (~ US$ 2.55 million)
CO2 emission reduction	53,929 tonnes/annum
Tariff details	40-50% lower than the prevailing grid tariff

Source: JMK Research

The contracted 32.5 MW WSH capacity is utilized to power NTT's data centre located in Bangalore. Over the course of PPA tenure (25 years), RE procurement from the WSH plant will help save NTT over ~INR 523.25 crores (~ US$ 63.97 million) in electricity bill expenses.

Energy Generation trend (November 2021 to October 2022)



Source: CleanMax

Annual Electricity bill savings: ~INR 20.93 crores (~ US$ 2.55 million)

Over the course of PPA tenure (25 years), RE procurement from the WSH plant will help save NTT over ~INR 523.25 crores (~ US$ 63.97 million) in electricity bill expenses.

The above figure represents the energy generation data of the project for the period of November 2021 to October 22. During initial commissioning of the project, only 7 MW of solar was commissioned. In May 2022, 12 MW solar was added to the initial solar capacity of 7 MW. Hence, as observed in the figure, the project generation increased from May 2022.

Cargill is a US-based global food corporation, and it is actively expanding its global renewable energy portfolio. This is in line with Cargill's commitment to reduce Greenhouse Gas (GHG) emissions in its global supply chains by 30% per tonne of product by 2030.

> "To help us meet our climate commitments, we're focused on operating more efficiently, pursuing emissions-reducing technology and investing in renewable energy to power our operations or offset our emissions"
>
> – Jill Kolling, Vice President of Sustainability at Cargill

Cargill have contracted a WSH capacity of 15.2 MW (6.8 MW solar + 8.4 MW wind) in the CleanMax WSH Jagalur project. The energy supplied from this project cater to 81% of the electricity needs of Cargill's facility located nearby in Davangere, Karnataka. Cargill target to increase this share to 95% by the end of 2022. Further details have been summarized below:

"Cargill" power procurement from CleanMax WSH Jagalur

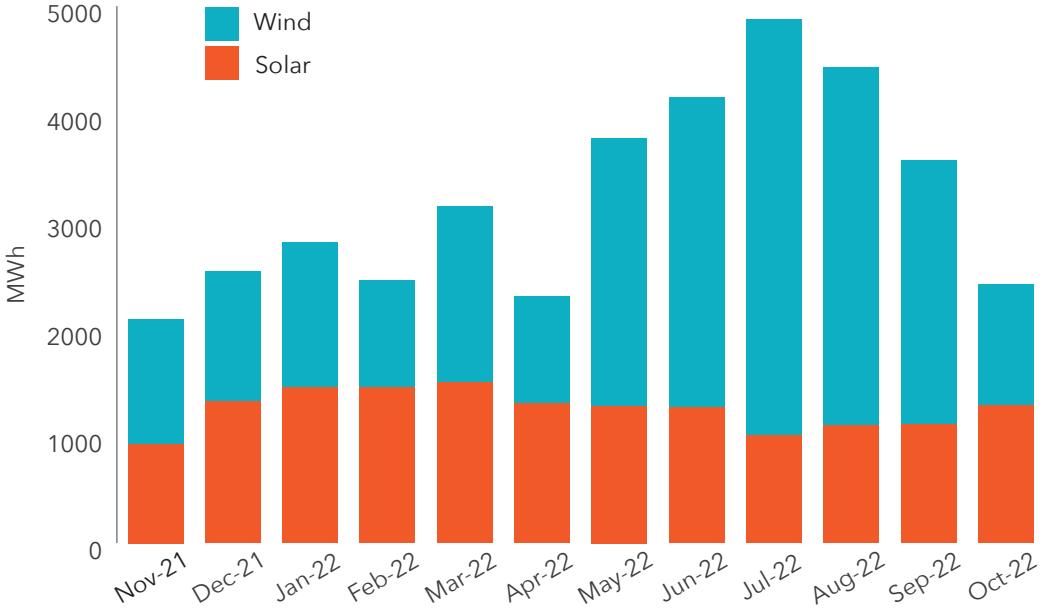
Parameter	Description
Contracted Capacity	15.20 MW (Solar: 6.8 MW, Wind: 8.4 MW)
Date of Commissioning	March 2021
OA procurement type	Group-captive
Energy Consumption met from the WSH	41535 MWh/annum
% Of total energy consumption	81% of the electricity required in Cargill facility in Davangere, Karnataka is met through this project
Annual electricity bill savings	~INR 12.87 crores (~ US$ 1.57 million)
CO2 emission reduction	35304 tonnes/annum
Tariff details	40-50% lower than the prevailing grid tariff

Source: JMK Research

Annual Electricity bill savings: INR 12.87 crores (~ US$ 1.57 million)

Over the course of PPA tenure (25 years), RE procurement from the WSH plant will help save Cargill over ~INR 321 crores (~ US$ 39.2 million) in electricity bill expenses.

Energy generation trend (November 2021 to October 2022)



The above figure represents the energy generation data of the project for the period of November 2021 to October 22.

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