

WIND SECTOR PROSPECTUS - KENYA



WIND ENERGY DATA ANALYSIS AND
DEVELOPMENT PROGRAMME



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Ministry of Energy
Republic of Kenya

Client:
Ministry of Energy (MoE)



Consultant:
WinDForce Management Services Private Limited

Disclaimer : This document has been prepared solely for the purpose of an understanding of the wind power scenario in various states of India and facilitates future discussions with potential developers solicited by the client. It shall not be used for any other purpose.



EXECUTIVE SUMMARY

Energy is essential to economic and social development and to improve the quality of life of the people and is also an important development indicator, which provides vital inputs for economic development. The African continent has abundant energy resources, which still remains untapped. Renewable Energy in form of hydro, geothermal, wind and solar is a major energy resource spread out across Africa. The energy which can be extracted from these resources can solve the most prominent problem that persists in the continent - 'Shortage of Power'. The potential of these renewable energy sources is so high that it can solve the problem of shortage, as well as provide the power to everyone at affordable rates.

Kenya, the country with immense renewable energy sources in the form of geothermal, wind and solar also faces huge power problems like many of other countries in the African continent. Though there have been initiatives to harness these renewable energy resources in Kenya, but this potential is at large untapped especially for wind and solar. To utilize the energy from this potential requires significant investments and adequate infrastructure in terms of a stable grid network to be able to link these potential resources to demand centers.

One of the key sources of renewable energy in which the Government of Kenya is investing effort and money is wind power. The Government of Kenya has estimated that 500 MW of wind capacity will be installed in Kenya over the coming two to three years and 2 GW of installed wind capacity by 2030. The Government of Kenya is encouraging independent investment in the wind sector and has introduced a feed-in tariff (FiT) similar to those that exist in Europe in order to attract investments in the wind sector.

Kenya has vast unexploited wind energy resource that can fulfill power requirements for the whole country. To utilize this immense wind resource potential, Ministry of Energy, Kenya with funding from World Bank commissioned WinDForce Management Services Private Limited to provide



consultancy services for Wind Energy Data Analysis and Development Programme under Energy Sector Recovery Project.

The Wind Resource Assessment carried out by WinDForce shows that over 73% of the total area of the country experiences annual mean wind-speeds more than 6 m/s at 100 m above ground. This fact establishes the immense potential for wind energy utilization in this country. The wind regimes in many parts of Kenya especially the northern and eastern regions such as Marsabit, Ngong and the Coastal region can support large scale utility electricity generation as these regions enjoy extremely good annual mean wind speeds in the range of 6-10 m/s throughout the year.

This Wind Sector Prospectus for Kenya will act as an introduction and a guideline to wind potential in Kenya for domestic and foreign investors/developers to suitably assist relevant stakeholders in public as well as private sector to invest in Wind Power Projects in Kenya with confidence.



KENYA'S WIND ENERGY SECTOR

In Kenya, the main sources of energy are wood fuel, petroleum and electricity accounting for 69%, 22%, and 9% of total energy use¹ respectively. More precisely, 67.5% of electricity is generated using renewable energy sources which are predominantly Hydro with 47.8%² and Geothermal with 12.4% respectively, while 32.5% is from fossil fuels. The total electricity which is generated is shared by less than 20% of population of the country, and more than 80 percent of the population remains without access to the electricity. The present contribution of wind as a source of energy is only 0.3%, which with encouragement from the Government of Kenya after introduction of an attractive feed-in tariff is expected to jump upwards significantly in the next few years.

The Kenyan economy, population and industry are all expanding at such a rate that there is currently a 13.5% annual increase in electricity demand in the country, with demand expected to reach 15 GW in 2030 (current peak demand is around 1.5 GW). In order to help progress the growth of the renewable energy sector, the Government of Kenya (GoK) plans to invest up to US\$ 50bn over the next 20 years in order to cope with the 13.5% annual increase in electricity demand. In these huge investment plans, wind is going to play a vital role in meeting the continuously increasing demands of the country.

¹http://marsgroupkenya.org/pdfs/2011/01/Ministry_PDFS/MINISTRY_OF_PLANNING/Strategies_for_Securing_Energy_Supply_in_Kenya.pdf

² A Globally Competitive and Prospectus Kenya, Kenya Vision 2030



Kenya can benefit a lot from the wind energy in the coming years for several reasons such as:

- **Immense wind energy resource**

Kenya has vast unexploited wind energy resources that can fulfill power requirements for the whole country at an affordable price. The potential to generate electricity out of wind power is so high; it can successfully solve the problems persistent in the country since decades and can make electricity available to the entire nation. At present, the country has an installed capacity of 5.1 MW windfarm operated by KenGen at the Ngong site near Nairobi. In spite of high wind potential assessed by WinDForce in a this study, for various reasons such as insufficient wind resource data, lack of financial resources, inadequate infrastructure and extent of grid, wind energy development on a utility scale could not take place. To amend these issues and to attract investments in wind power development, Ministry of Energy, Kenya (MOE) has embarked on initiatives to attract investments through appropriate policy mechanisms under PPP frameworks. The MOE with funding from the World Bank commenced a wind monitoring program in 2011-12 and the analysis of the data from this monitoring exercise across the country, carried out by WinDForce are very encouraging, as vast tracts of lands have been identified with rich wind energy resource potential, especially in many parts of northern and eastern Kenya. The Wind Resource Assessment shows that the country is bestowed with immense potential and certain models of wind turbines such as Vestas - V100 and GE - GE103 have been assessed by WinDForce to have a Capacity Utilization Factor (CUF) or Plant Load Factor (PLF) generation potential of 40% or more at sites in Marsabit and Turkana counties which would lead to extremely attractive equity returns to investors.



- **Technological advancements in wind energy**

Wind energy is one of the fastest developing energy technologies across the globe. Countries around the world are making serious efforts to harness wind energy on a utility scale. Wind Energy is being considered as the most mature option among renewable energy sources for meeting the energy demand from various perspectives such as environment, energy security and socio-economic aspects without foregoing economic development. The technology advancement to harness power from wind energy would help in cost reductions in generation. Also, wind energy poses a unique opportunity for Kenya to directly leapfrog the path taken by industrialized countries, to renewable sources of energy directly.

- **Diversification of energy sources to reduce over-dependency on hydro power**

Kenya depends heavily on hydro power (around 50%), and during dry seasons, the power generation drops quite significantly. Implementation of wind energy projects would significantly reduce the country's dependence on hydro projects. It is also a well know fact that hydro power and wind power complement each other and in power systems with a high component of hydro, it also possible to integrate larger capacities of wind power. Therefore, Kenya is uniquely placed to harness wind energy on a larger scale.

- **High cost Diesel Generation**

The thermal generation not only in Nairobi but also in other smaller towns takes place with either diesel or oil which are very costly options. Wind energy at the assessed PLFs of 30% and more can be far more competitive than diesel generation.



- **Energy Security**

Kenya, a developing country of Africa needs to secure its energy needs from price and availability fluctuations. Since fuel based projects will always be subject to these risks, the country needs to diversify towards indigenous RE sources. Vast wind energy potential assessed should enable the country to achieve self sufficiency in Energy.

In order to promote renewable energy projects like wind energy development programme on a commercial scale, the Government of Kenya (GoK) has also introduced Feed-In Tariff (FIT) policy to attract private investments. The policy provides a fixed tariff of around 11 US Cents for electricity generated by wind-farms in grid connected mode. This tariff applies to all individual wind power plants whose effective generation capacity is above 500 kW, and does not exceed 100 MW. For electricity generation from wind resource, the Ministry has established FiT for a span of 20 years from the date of commissioning.

The key benefit for Kenyan wind sector in the form of feed-in-tariff of 11 US Cents per KWh for potential wind sites which would generate around 1.5 to 2 times of the output as is generated in the countries pioneering across global wind industry presents with an exciting opportunity for investments in Kenya which is to unfold in a big way in the coming times.



ATTRACTIVE POLICY AND REGULATORY FRAMEWORK FOR WIND PROJECTS IN KENYA

The Government of Kenya recognizes implementation of renewable energy sources (RES) to enhance country's electricity supply capacity and diversification of generation sources. The Energy Act 2006 on 'Promotion of Renewable Energy and Energy Conservation' empowers the Ministry of Energy to promote development and use of renewable energy technology.

The main policies concerning RES are:

- (i) Least Cost Power Development Plan (LCPDP),
- (ii) The Energy Act of 2006,
- (iii) The Feed-in Tariff (FiT) Policy,
- (iv) The Kenya National Climate Change Response Strategy and Kenya Vision 2030.

The Government of Kenya adopted various policies to accelerate the facilitation of RES to meet electrical supply and consumptions:

- The Energy Act 2006³ brings enforcement of energy sector activities under one body, the Energy Regulatory Commission (ERC). The Act also created the Rural Electrification Authority (REA) to manage the Rural Electrification Programme and the Rural Electrification Fund.
- The Ministry of Energy established a Feed-in Tariff policy (FiT) in 2008 covering wind, small hydro and biomass sources. It provides investment security and market stability for investors from RES whilst encouraging private investors to operate their power plants prudently and efficiently to maximize returns;

³ <http://www.erc.go.ke/energy.pdf>



- Development of National Climate Change Response Strategy in 2010⁴ to strengthen and focus nationwide actions towards climate change adaptation and GHG emission mitigation;
- The Government intends to set up a Green Energy Facility to pool donor contribution which will help firms and other institutions to generate clean energy and manufacture energy-efficient appliances.
- The Government has zero-rated import duty and removed Value Added Tax (VAT) on renewable energy, equipment and accessories.

Feed in Tariff Policy

Feed in Tariff (FIT) is a policy strategy which aims to increase investment in renewable energy technologies. FIT strives to attract private and public investors by offering a lower cost of per unit energy generation from renewable energy sources such as wind, bio-mass, geo-thermal, solar etc.

To promote renewable energy, especially wind energy development on a commercial scale, the Government of Kenya (GoK) has introduced FIT policy⁵ to attract private investment. The FIT policy provides for wind generated electricity a fixed tariff of the order of US \$ Cents 11.0 per kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point. This tariff applies to individual wind power plants (wind farms) whose effective generation capacity is above 500 kW and does not exceed 100 MW. For electricity generation from wind resource, the Ministry has established FiT for a span of 20 years from the date of commissioning. The FiT provides a fixed tariff not exceeding USD 0.11 per Kilowatt-hour for wind generated electricity up to an installed capacity of 10MW. For project above 10MW capacity, similar standard fit would be applicable. This is intended to attract private sector investments in setting up wind-farms in Kenya.

⁴ http://cdkn.org/wp-content/uploads/2012/04/National-Climate-Change-Response-Strategy_April-2010.pdf

⁵ <http://www.erc.go.ke/erc/fitpolicy.pdf>



The Feed in Tariff values for Wind project is tabulated below:

Table 1: Feed in Tariff values for Wind project

Renewable Energy Source	Installed Capacity (MW)	Standard FiT (USD/kWH)	Percentage Escalable portion of Tariff	Min. Capacity (MW)	Max. Capacity (MW)	Max. Cumulative Capacity
Wind	0.5-1.0	0.11	12%	0.5	10	-
Wind	10.1-50	0.11	12%	10.1	50	500

As a result of the publication of the FiT, there has been a considerable interest among potential investors to invest in Kenya's renewable energy sector. The Ministry of Energy has received 49 applications under this mechanism for a combined capacity of 1521 MW, while 42 were approved with cumulative capacity of 1,311 MW under different technology types. On wind technology, the Government received a total of 236 applications, with a combined capacity of 1118 MW which constitutes 74% of the total renewable energy sources. Out of these 20 applications totaling 1,008 MW were approved.

⁶ <http://www.erc.go.ke/erc/LCPDP.pdf>



Salient Features of FIT in Kenya

1. There is a uniform PPA arrangement, which is offered only on the basis of technical and legal feasibility. Only minor clauses are flexible. This is done to eliminate any bias.
2. The FIT values are given in USD, these values will be fixed for the period of 20 years
3. In case of Wind Power projects, a detailed technical and financial feasibility study has to be undertaken
4. GoK has set up 95 wind monitoring sites (Wind Masts), the selected sites should not be beyond 50 kms from the monitoring sites

Objectives of FIT

1. To promote Renewable Energy
2. To Encourage participation from private sector: Plants run by the private sector are generally run more efficiently
3. Increased number of projects producing renewable energy will result in
 - a. Reduced dependency on Fossil Fuels
 - b. Carbon Credit Benefits
 - c. Reduced GHG emissions
4. To guarantee energy supply throughout the country
5. Diversify the country's energy production sources
6. Generate local employment, infrastructure development and increase grid connectivity



7. All projects implemented under the Feed-in-Tariff system shall comply with all other relevant technical, legal and regulatory requirements of Kenya

Benefits of FIT

1. Investment stability guaranteed by a long-term feed-in tariff contract such as 20 years in case of Kenya
2. Low administrative and regulatory barriers
3. Reduce transaction and administrative costs and delays associated with the conventional procurement processes
4. There is no bidding for availing access to renewable sites or resources. It is based on "First come first served".
5. There is a standardized PPA arrangement which is offered to only those projects which demonstrate technical and legal feasibility
6. Projects applying for FIT will have guarantees to ensure implementation

The feed-in-tariff of 11 US Cents per KWh for wind sites with immense generation potential is an investment opportunity which would largely benefit investors with first mover's advantage.



WIND RESOURCE POTENTIAL IN KENYA

WinDForce has carried out detailed assessment for development of wind Atlas for Kenya. The assessment is carried out in GIS environment using wind mast datasets, NCEP/NCAR Reanalysis, SRTM Digital Elevation Model and Global Land Cover (GLC 2000) datasets. The wind speed for entire Kenya is categorized as Class I (>8.5 m/s), Class II (7.5 - 8.5 m/s), Class III (6.5 - 7.5 m/s) and Class IV (6 - 6.5 m/s).

At 100m height, It is observed that Marsabit in Eastern division has the largest potential area with a maximum of mean annual wind speed of 9.27 m/s and minimum of mean annual wind speed of 5.32 m/s followed by similar wind speeds in Turkana County in Rift Valley province.

WinDForce has estimated Kenya's potential area at various intervals of wind speeds for heights at 60m, 80m and for 100m. For example, at 100m height, 2825 sq km of potential area is categorized in Class I, 28228 sq km in Class II, 288715 sq km in Class III, 107410 sq km in Class IV and 166035 sq km as not suitable.

Table 2: Area under different wind speed classes at 100 m.a.g.l

	Wind Speed Interval	Potential Area	Wind Speed	
Wind Speed at 100m height	2 - 2.5	7	Not suitable	
	2.5 - 3	435		
	3 - 3.5	1007		
	3.5 - 4	1643		
	4 - 4.5	6932		
	4.5 - 5	20794	Class IV	
	5 - 5.5	56435		
	5.5 - 6	78782		
	6 - 6.5	107410		
	6.5 - 7	142352		Class III
	7 - 7.5	146363		
	7.5 - 8	21318		Class II



Wind Speed Interval	Potential Area	Wind Speed
8 – 8.5	6910	Class I
8.5 – 9	2586	
9 – 9.5	239	

Geographically, in Central provinces, counties such as Nyeri experience fairly good wind speeds with maximum value of mean annual wind speed of 7.44 m/s covering a potential area of 3359 sq km followed by Kirinyaga with 7.41 m/s and 1481 sq km. In the coastal division, counties such as Tana River, Lamu and Kilifi also possess good wind speed with maximum value of mean annual wind speed of 8.32, 8.26 and 8.26 m/s and potential area of 38610 sq km, 6878 sq km, and 12310 sq km respectively. In the eastern division, Marsabit County has maximum of mean annual wind speed of 9.27 m/s with potential area of 75596 sq km followed by Meru, Embu and Isolo with 7.61, 7.5 and 7.83 m/s and potential area of 7172 sq km, 2760 sq km and 24881 sq km respectively. In the north-eastern provinces, counties such as Garissa, Mandera and Wajir have potential area of 44459 sq km, 28302, sq km and 53413 sq km with maximum of annual mean wind speed of 7.73, 7.73 and 7.75 m/s respectively. In the Rift Valley province, counties such as Turkana has maximum potential area of 61353 sq km with maximum of annual mean wind speed of 7.11 m/s followed by Nakuru with 29286 sq km and 6.52 m/s. Baringo also possesses fairly good potential area with 10942 sq km and wind speed of 6.79 m/s.

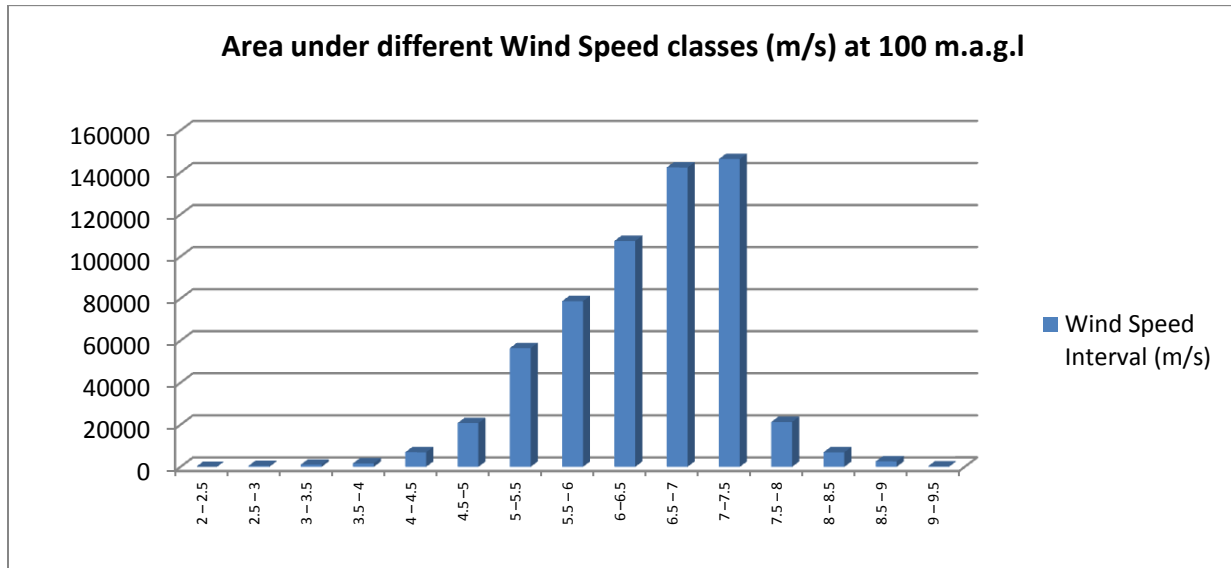


Figure 1: Potential Areas with defined interval of wind speed at 100 m.a.g.l.

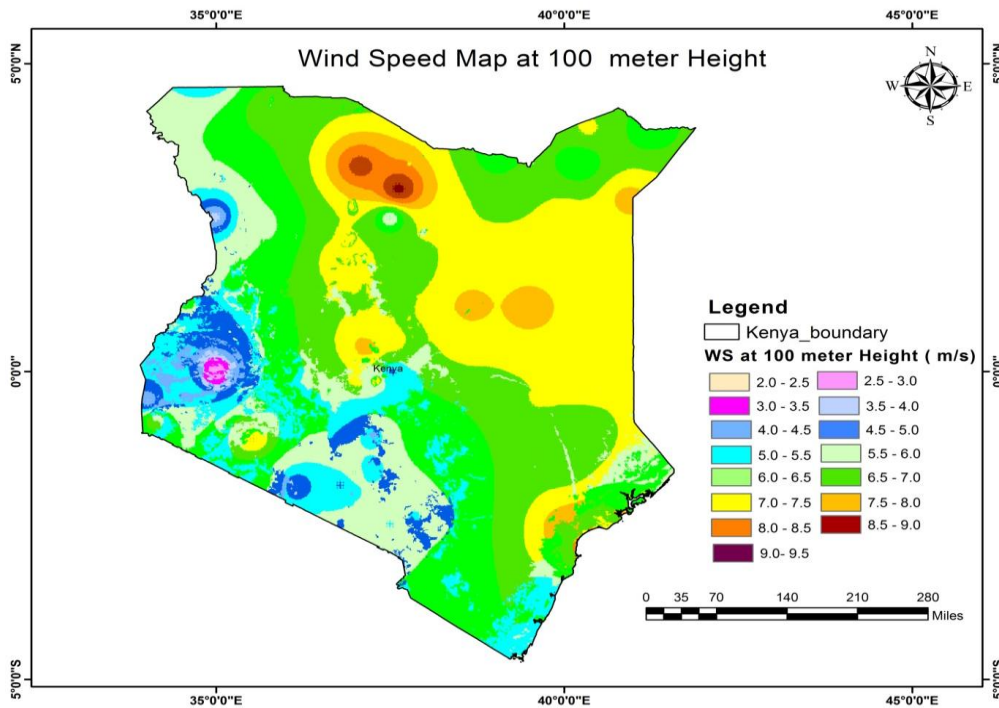


Figure 2: Wind Speed Map of Kenya at 100m height



Furthermore, comparative analysis of Wind speed was carried out at different height of 60m, 80m and 100m heights respectively.

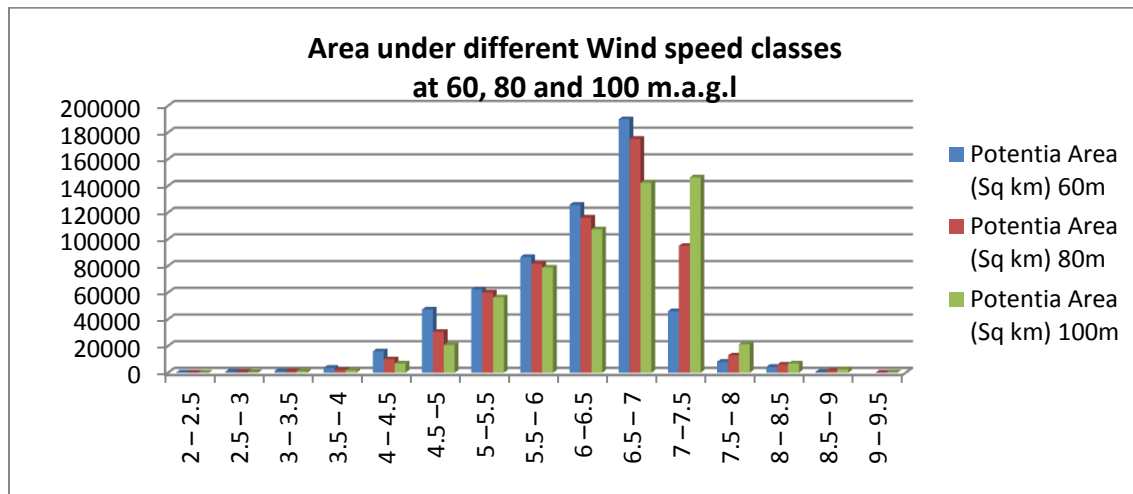


Figure 3: Comparative Analysis of Wind speed at 60m, 80m and 100m

In addition, WinDForce has assessed wind power density (WPD) for entire Kenya at each 1 sq km and at different heights of 60m, 80m and 100m. The density is categorized as poor ($< 150 \text{ Watt/m}^2$), fair ($150\text{-}250 \text{ Watt/m}^2$), good ($250\text{-}350 \text{ Watt/m}^2$), or excellent ($> 350 \text{ Watt/m}^2$)⁷.

⁷ <http://www.renewableenergyst.org/wind.htm>



Table 3: Potential areas with equal intervals of wind power density at 100 m.a.g.l.

	Wind Power Density Interval (m/s)	Potential Area (Sq km)	Wind Power Classes
Wind power density at 100m height	0 – 50	1969	Poor
	50 – 100	13577	
	100 – 150	53724	
	150 – 200	74313	Fair
	200 – 250	78468	
	250 – 300	88697	Good
	300 – 350	104745	
	350 – 400	117821	Excellent
	400 – 450	35934	
	450 – 500	12214	
	500 – 550	4009	
	550 – 600	2998	
	600 – 650	2558	
	650 – 700	1375	
	700 – 750	512	
750 – 800	256		
800 – 850	1		

It is estimated at 100m height; 69270 sq km is categorized as Poor, 152781 sq km is categorized as fair, 193442 sq km is categorized as good and 177678 sq km is categorized as Poor.

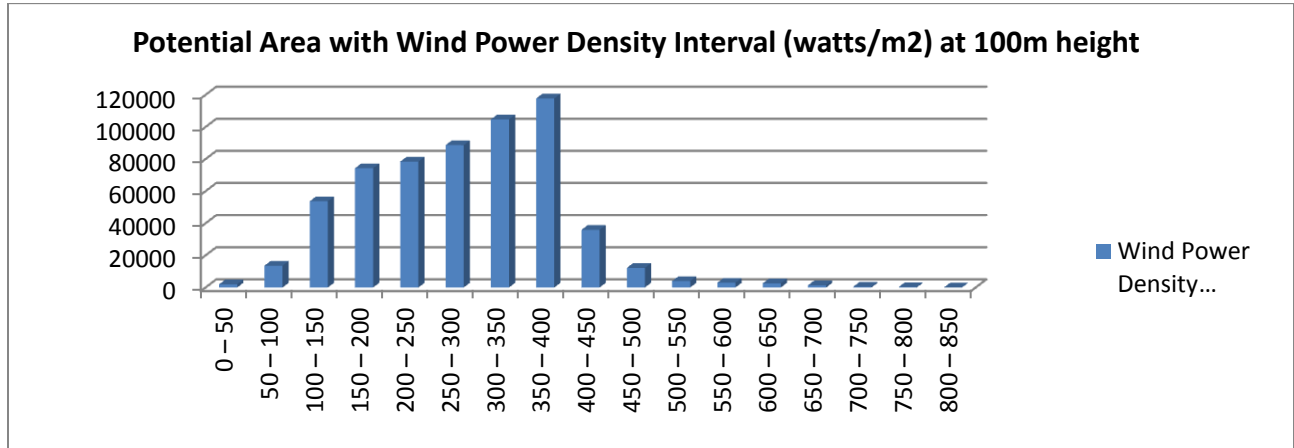


Figure 4: Potential Areas with defined interval of wind power density at 100 m.a.g.l.

Furthermore, as is shown below in Figure 5; comparative analysis of WPD was carried out by WinDForce at different height of 60m, 80m and 100m heights respectively.

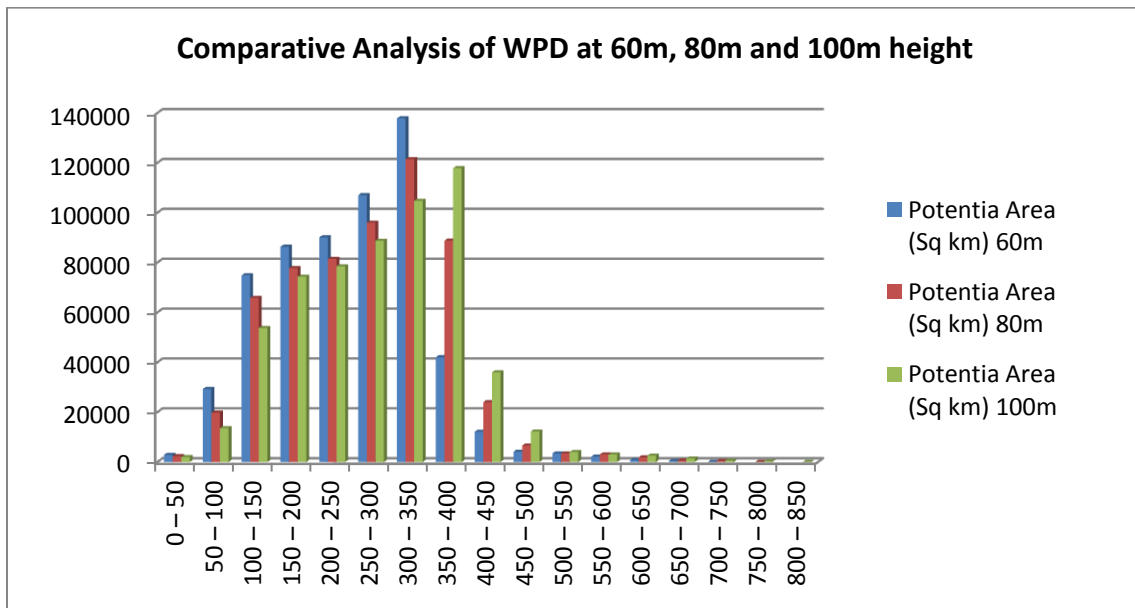


Figure 5: Comparative Analysis of WPD at 60m, 80m and 100m



Many locations in Kenya have significant wind resource, as is identified by WinDForce during the assessment carried out in GIS environment using wind mast datasets, NCEP/NCAR Reanalysis, SRTM Digital Elevation Model and Global Land Cover (GLC 2000) datasets. Since, detailed measurements over the course of a year or more are typically required to generate “bankable” data sufficient to obtain a loan for construction of a wind power plant; the data sets captured by the 95 wind masts installed in Kenya covering all seasonal parameters for at least a year’s time is considered. The seasonal and daily pattern of wind speeds at each site affects the amount of power that can be generated from that site at different times and hence the revenues that can be generated from the potential wind sites.

WinDForce has developed wind speed maps of Kenya at 60m, 80m and 100m height for development of wind Atlas for Kenya. Figure 6 & 7 represents the wind speed and wind classes map of Kenya developed by WinDForce at 80m height.

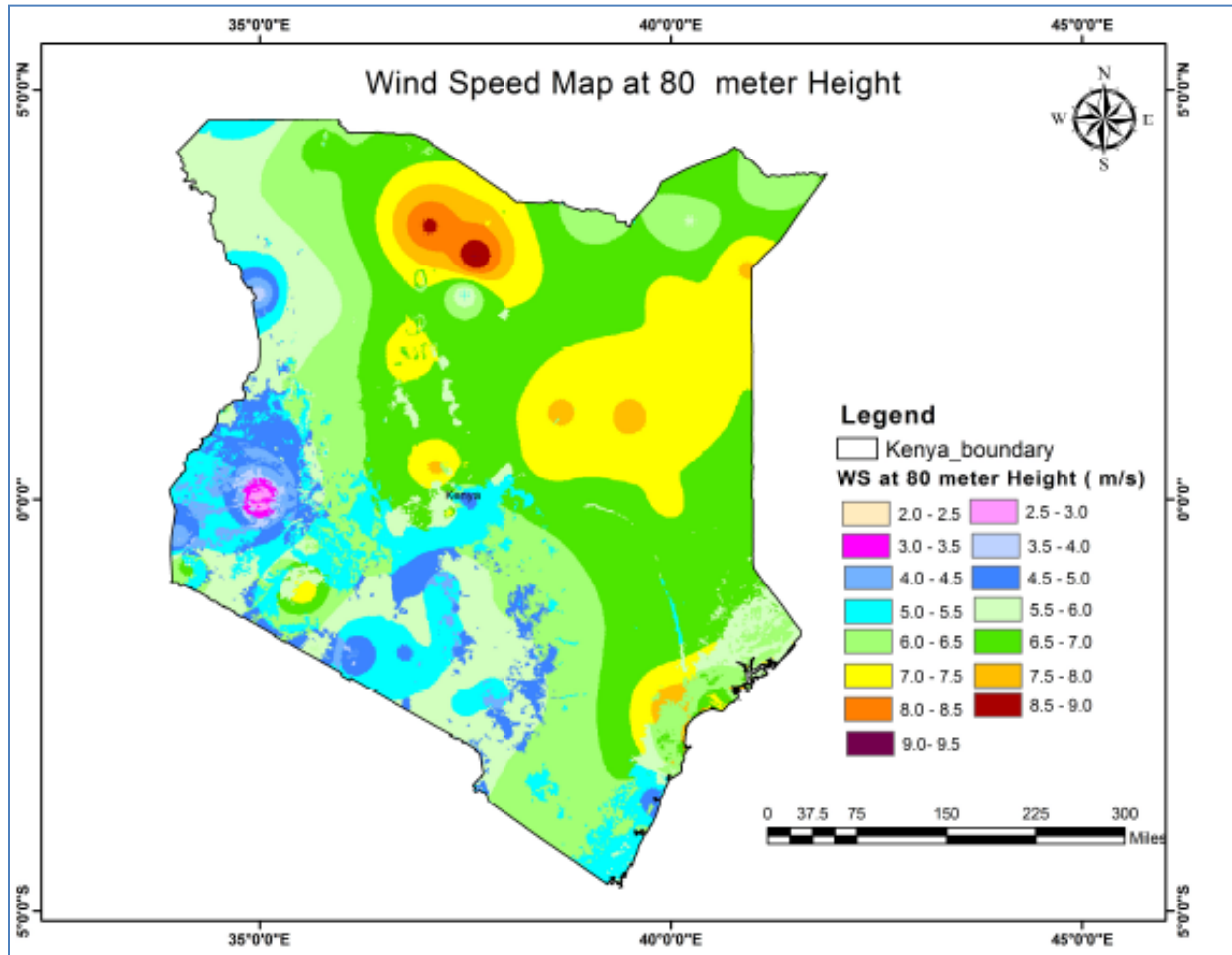


Figure 6: Wind Speed Map of Kenya at 80m height

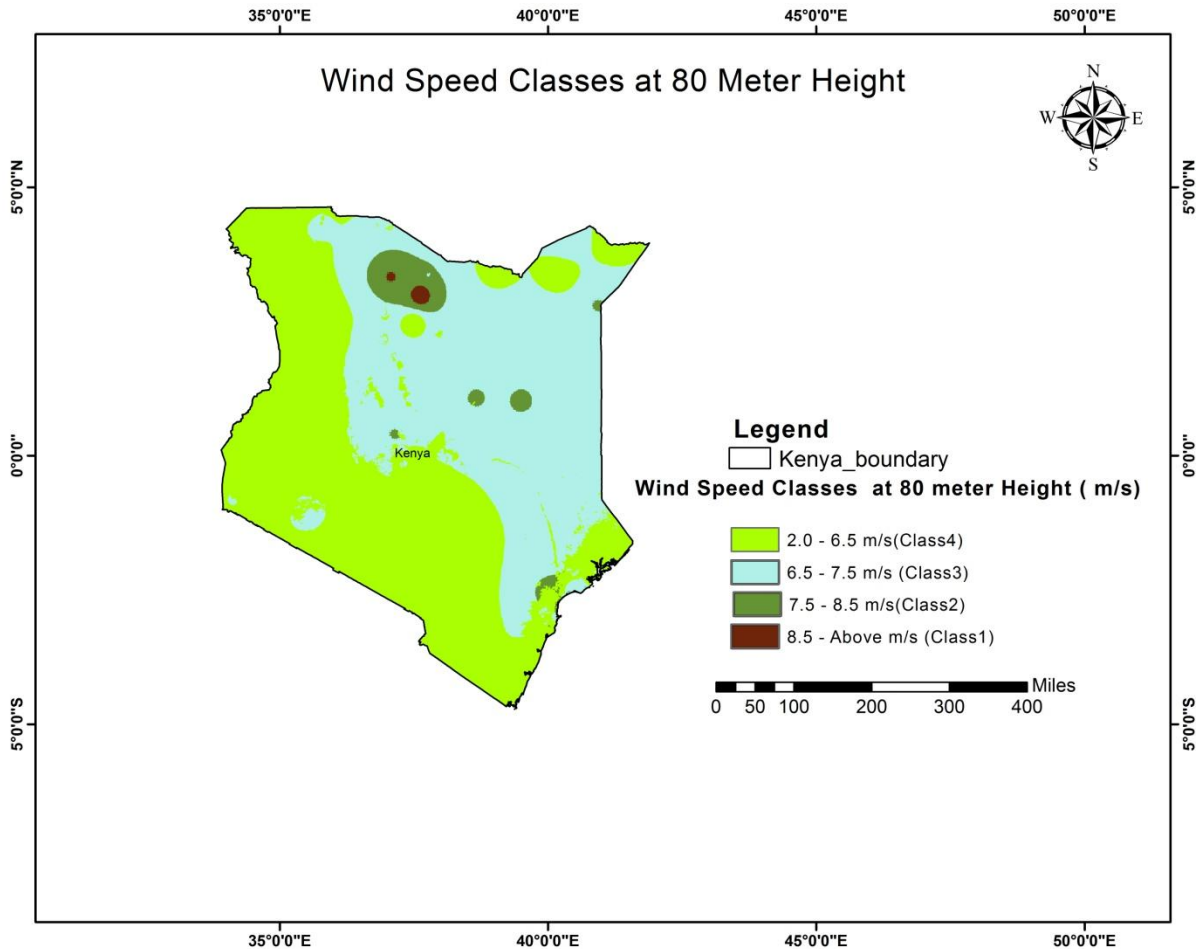


Figure 7: Wind Classes Map of Kenya at 80m height

Following the Wind Data Analysis and Wind Atlas Development, WinDForce carried out pre-feasibility study in terms of Wind Resource Assessment in terms of annual energy output. The Atlas development resulted into identification of 8 potential wind sites potentially viable for generating energy using different wind turbine models and further onsite resource



assessment calculation. The selection of appropriate sites involved consideration of many aspects such as distance from transmission system, terrain, logistics, environmental issues etc. The 8 sites identified are given in the figure 8.

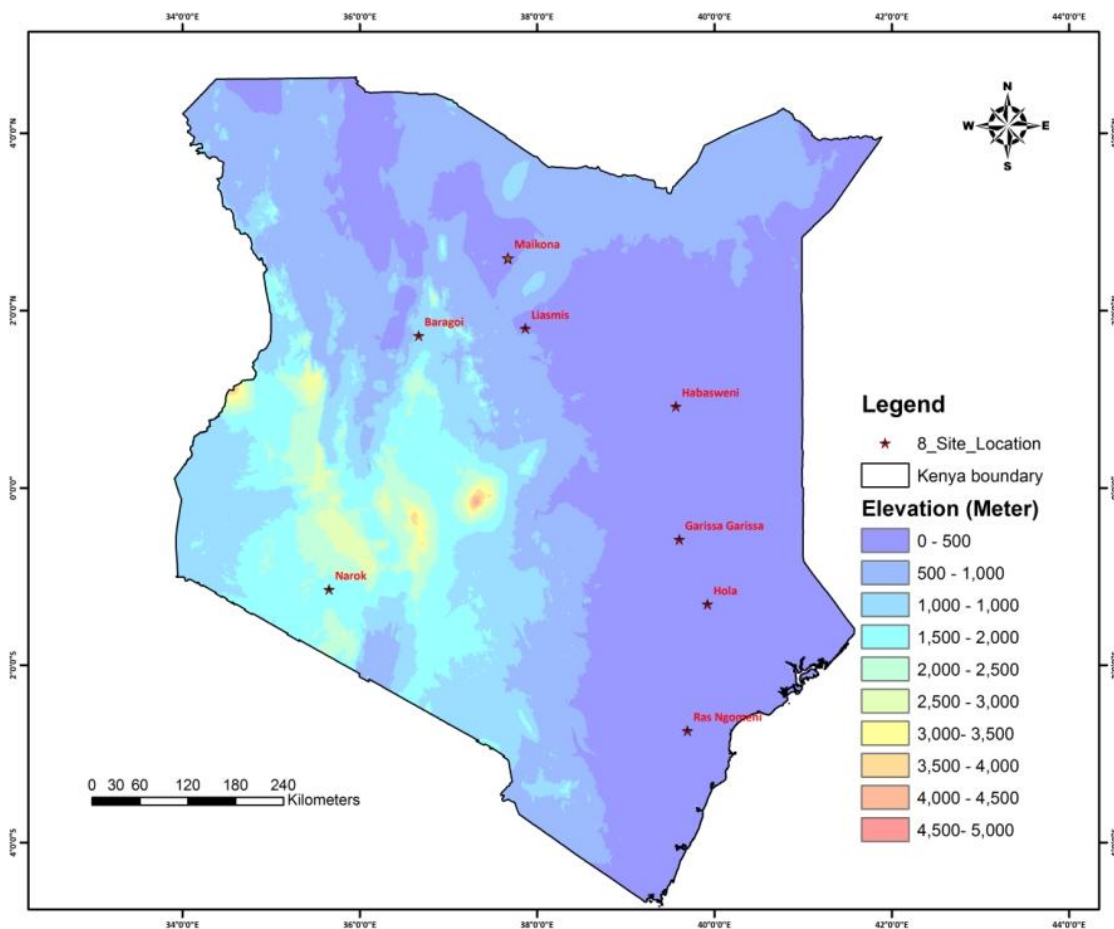


Figure 8: Identified 8 sites for pre-feasibility study

The resource assessment is carried out for a capacity of 50 MW wind farm at each selected site. The number of WTGs location chosen for Annual energy



output varies for different WTG models at hub height of 80m as shown in the table 5 for 2 WTG models as an illustration. Annual energy output is derived for each Wind-farm sites to arrive at optimal layout of the Wind-farm with minimum spacing of 7D and 5D as per industry accordance. The optimal layout of the Wind-farm is based on WinDForce WRA optimization model considering a maximal boundary area of 80 sq km near to the site and mast locations respectively.

For the short-listed 8 sites, the plant load factor in the range of 25% - 40% using Class II wind turbine model such as GE103 and V100 with 80 hub height. WinDForce has also computed PLF results for these 8 sites with other WTG models including Gamesa 97 with 78m hub height, Sinovel82 with 80m hub height and Suzlon97 with 90m hub height.



Table 4: Identified 08 potential sites for WRA

Measured Mast locations	Easting	UTM Zone Northing	Zone	Distance from proposed wind farm site (km)	Average Wind Speed at 40 meter height (m/s)	Mast Elevation (m)
Baragoi	253842	197457	37 N	15	5.42	1250
Garissa	579391	995788	37 M	24	5.72	225
Habaswe	554768	111534	37 N	13	6.33	207
Hola	614292	983374	37 M	25	5.05	66
Liasmis	367192	176467	37 N	24	5.18	585
Narok	781629	987821	36 M	15	5.55	1964
Maikona	352373	286391	37 N	40	7.06	405
Ngomeni	630450	966566	37 M	62	5.61	11

Table 5: Net Annual Energy Output using different WTGs Model for each site

Site Name	WTGs Model >>		GE - GE103		Vestas - V100	
	Annual Mean Wind Speed at 40 m.a.g.l.	Average Site Elevation (m)	Net AEP (GWh/year)	Net PLF (%)	Net AEP (GWh/year)	Net PLF (%)
Baragoi	5.42	1288	155.4	34.8%	146.8	34.5%
Garissa	5.72	204	150.1	33.6%	136.6	32.1%
Habaswe	6.33	217	176.6	39.5%	164.6	38.7%
Hola	5.05	78	158.8	35.6%	145.1	34.1%
Liasmis	5.18	619	136.9	30.6%	124.2	29.2%
Narok	5.55	1957	107.4	24.0%	97.5	22.9%
Maikona	7.06	404	181.2	40.6%	171.5	40.3%
Ngomeni	5.61	1	185.1	41.4%	173.1	40.6%



With Plant Load factors for 2 WTG models for short-listed sites ranging between 30-40%; the 500 MW wind capacity estimate over next 3 years by the Government of Kenya looks like an achievable objective.



WIND PROJECTS IN KENYA

At present, wind energy shares only a meagre 0.3% of total energy installations in Kenya despite immense potential. The Government of Kenya, over the past few years have received 23 proposals for setting up wind projects in the country of which 20 proposals have been accepted. These projects amount to more than 1000 MW of wind energy production.

On-going Project: Ngong Wind I, Phase-I

Ngong Hills wind project consists of six windmills generating 5.1 MW of clean electricity. It is a source of low cost and reliable energy to the national grid of Kenya. The wind farm consists of 6 turbines of 850 KW each. The wind farm is owned by Kenya Electricity Generation Company (Kengen). Ngong Hills wind project is the first and only wind project set up in Kenya and was predicted to pay back its initial installation cost in a period of 3 years⁸. Kengen secured an agreement for the execution of Ngong Hills Wind Power project with TPF-Econoler SA (TPFE), Belgium on October 27, 2007.

As the existing wind speeds in Ngong Hills region highly favorable and the location is fairly close to Nairobi, the largest load centre in Kenya; Kengen plans to expand the existing wind farm from 5.1 MW to 25.5 MW capacities in the coming years. As part of Ngong hills wind power development initiatives, Ngong Wind I Phase II will be commissioned soon. This addition of 6.8 MW Project will increase the total capacity to 13.9 MW⁹.

⁸ http://en.openei.org/datasets/files/720/pub/sweraprodoc_6.pdf

⁹ <http://www.kengen.co.ke/index.php?page=business&subpage=current>



Existing and Proposed Wind Projects in Kenya:

Table 6: List of Existing and Proposed Wind Projects in Kenya

No.	Project Title	Project Location	Capacity (MW)	Description
1.	Ngong Wind I Phase II	Ngong Hills, Kenya	6.8	<ul style="list-style-type: none"> • Contract signed with TPF-Econoler in 2011 • Financial closure achieved in Jan 2013 • Contract commenced on February 2013 • Contract valid for 18 months • Involves supply, installation & commissioning of 8 Vestas V50 wind turbines for 12 Mn Euros • Advance payment effected • Turbine micro-siting is in progress
2.	Ngong Wind II	Ngong Hills, Kenya	13.6	<ul style="list-style-type: none"> • Contract signed with iberdrolla/ Gamesa consortium in 2010 • Financial closure achieved in Jan. 2013 • Contract commenced on February 2013 • Contract runs for 19 months • Involves supply, installation & commissioning of 16 Gamesa wind turbines for 20 Mn Euros • Advance payment effected • Turbine micro-siting is in progress
3.	Lake Turkana Project	Turkana, Kenya	300	<ul style="list-style-type: none"> • Project will be about 20% of the existing installed capacity • Site located in Marsabit District of Kenya – A very high wind potential zone



Sr. No.	Project Title	Project Location	Capacity (MW)	Description
4.	Lake Turkana Project	Turkana, Kenya	300	<ul style="list-style-type: none"> • A 200 km road stretch would be brought to the wind farm from Laisamis¹⁰. • Wind Farm will consist of more than 350 turbines • Financial Closure achieved – Funded by a consortium of lenders led by AfDB
5.	Isiolo Wind	Isiolo, Kenya	50	<ul style="list-style-type: none"> • Planned to be executed in two phases • Phase I: 50MW and Phase II: 100MW • Estimated Cost of the project is US\$ 400 million (Phase I: US\$ 130 and Phase II: US\$ 270MW) • Feasibility Study Completed

Payment Security and other benefits

The financial risks associated with implementation of a wind energy project can be due to various factors like increasing exchange rates, payment security risks, CDM related risks etc. Each kind of risk has a different impact, and also some have high potential of occurrence and some have low.

¹⁰ <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Kenya%20-%20Lake%20Turkana%20Wind%20Power%20Project%20-%20ESIA%20Summary.pdf>



Major risks and their mitigation strategies identified are:

Risk	Risk Description	Probability of Occurrence	Potential Impact	Risk Mitigation Strategy
Exchange Rate Risks	Construction costs estimate may change due to changes in exchange rate for foreign currency	Low	Low	Could be managed if hedged and therefore transferring the risk to a Financial Institution.
Payment Security Risks	Risks that the buyer does not pay agreed tariff / subsidy to the project developer	Medium	Medium	This risk could be minimized by having specific payment security clause in the subsidy letter / sale of power agreement with Government Agencies / Buyers
CDM Related Risks	Risks related to future and prices of CERs generated through programmatic CDM of renewable energy projects	Low	Low	Standard derivative product may be used to hedge CER Price risks.



CONCLUSION

Kenya as a growing economy in Africa presents an attractive investment option in the area of wind power generation in the coming years. The country faces a unique challenge of yet to build nearly 90% of the additional capacity needed in 2030, as projected in Kenya Vision 2030. The country will benefit from the recent global progress in renewable power generation technologies and their cost reductions to leapfrog the development path taken by industrialized countries and move directly to a renewable-based systems.

Kenya has ambitious plans to increase the share of renewable energy especially wind in their electricity mix as the country is looking to derive 2036 MW from Wind energy by 2030.

The implementation of wind energy projects would reduce country's dependency on hydro power projects. It is generally known that wind power complements hydro power. To simplify, in Kenya, it is a combination of wind and hydro which is going to be the long term solution for meeting the power requirements.

The GOK has come up with attractive policy frameworks to result in high equity returns to any investor in wind energy projects. In this regard, the country has gone ahead with a comprehensive programme on wind speed monitoring across the country and WinDForce has come up with a revised wind atlas of Kenya, which can be a very useful tool for identification of wind sites for further developments. Analysis has shown that Kenya is rich in wind energy resource, which in combination with the GOK policies should result in financially feasible and highly successful wind-farm projects for investors.



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