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Studying the Suitability of Roads for Transporting Wind Turbines to Proposed Wind Farm Location

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Abstract

The aim of most researchers is to complete full projects for establishing renewable sources stations. The project depend on many variables, which is called criteria, that's makes the project workable or not. The criterion which studied in this paper is roads suitability for transporting turbines from the loading ports to construction site. One of the important factors which must provide paved roads for transportation and within standard. Southern Um-Qasr port is the best choice to receive wind turbine equipments. The nods down to the construction region will face 0 turns, 2 bridges that crosses over and 23 bridges that passes underneath.

Keywords: Roads suitability, GIS, Wind Turbines.

دراسة ملائمة الطرق لنقل توربينات الرياح للمواقع المقترحة لمزارع الرياح

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الخلاصة:

الهدف الذي يسعى له اغلب الباحثين هو انتاج مشروع متكامل لانشاء محطات للطاقات المتجددة، يعتمد المشروع على عدة متغيرات، والتي تدعى المعايير، والتي توضح امكانية انشاء المشروع من عدمه. المعيار الذي تم دراسته في هذا البحث هو ملائمة (معيارية) الطرق لنقل التوربينات من موانئ التحميل الى موقع انشاء المحطة. واحدة من المعاملات المهمة هو تهيئة طرق مرصوفة (معبدة) للنقل وضمن المعيارية. ان ميناء ام قصر الجنوبي هو الاختيار الامثل لاستقبال معدات توربينات الرياح. ان العقد التي ستواجهها عملية النقل من الميناء وصولا الى موقع البناء هو 0 استدارة، 2 عدد الجسور التي يعبرها، و 23 عدد الجسور التي يمر من تحتها.

الكلمات المفتاحية: معيارية الطرق، GIS، توربينات الرياح.

Introduction

Installations wind farm is one of the important factors for any establishment of a long-term source of energy strategy, because it is natural and available as well as it generates clean energy, So there is no affect in environment in terms of pollution , which revered in a vast different sources of energy other such nuclear fuel and which generates remnants difficult to deal with.

This study is one of the most important factors of wind farm establishment, which is the road assessment for transporting turbines from the loading entrances (ports) to wind turbine site. The implementations of remote sensing are the creator of the flowchart for this study with the aid of GIS techniques.

This work built on the previous studies which they are evaluate the wind power and the existence of sufficient wind speed at this regions. The previous studies reached several locations that have the required properties to run the wind turbines economically feasible. One of the located area to establish

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wind farm is Nasryah [1]. Nasryah lies between (3381352 to 3540354) m northing and (564478 to 717269) m Easting as illustrated in figure-1. The wind farm site lies at the south of Nasryah surrounding the point (607292 m East, 341487 m North) [2].

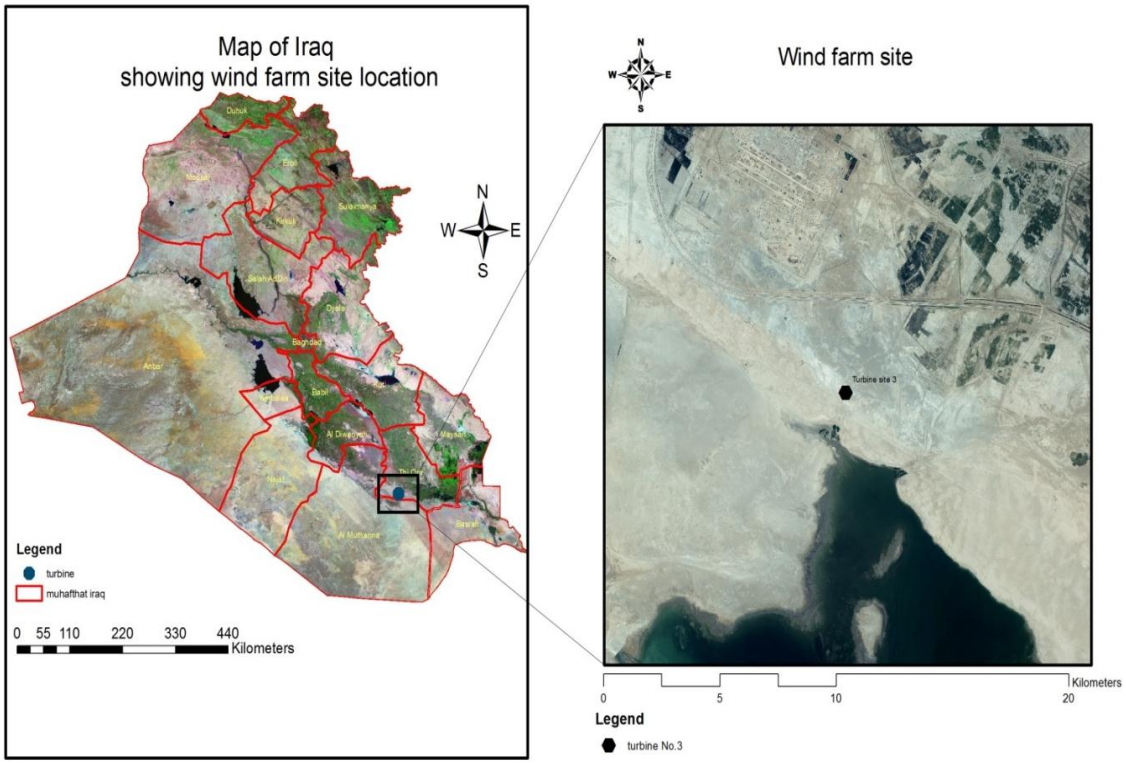

Figure 1- Iraq photomap with administrative boarders and intended wind farm.

Locating the wind farm is very important factor, Its depends on the analysis and field studies of the important factors which must provide paved roads for transportation and to choose where factors be within the wind tunnel at a rate allows the minimum level of production.

The study focused on finding the best location for the establishment of a wind farm ,choosing wind farm site depend on the following factors wind speed ,the distance of project from residential areas, roughness of Terrain to prevent and reduce wind speed, and approaching from the electricity lines, roads, transmission, [3].

There are several studies conducted to gather data on wind behavior of multiple zones and several times of the year for the whole of Iraq of these studies were conducted a study to relevant places proposed for the establishment of wind farms where or collect data for the year to a thunderous full year and for different areas and according to the schedule

Turbines equipment's

The turbine units consist of: the tower, nacelle, blades, and the other components required such as generators and transformers. The wind turbine industry is one of improving designs and developments and the best possible turbine to use in environmental, technical and economic terms for any particular site can change over time [4]. A three bladed turbine Vestas V90 – 3.0 MW capacity is the favored option for the site, with a hub height of up to 105 m and a rotor diameter of up to 44 m, see Figure-2.

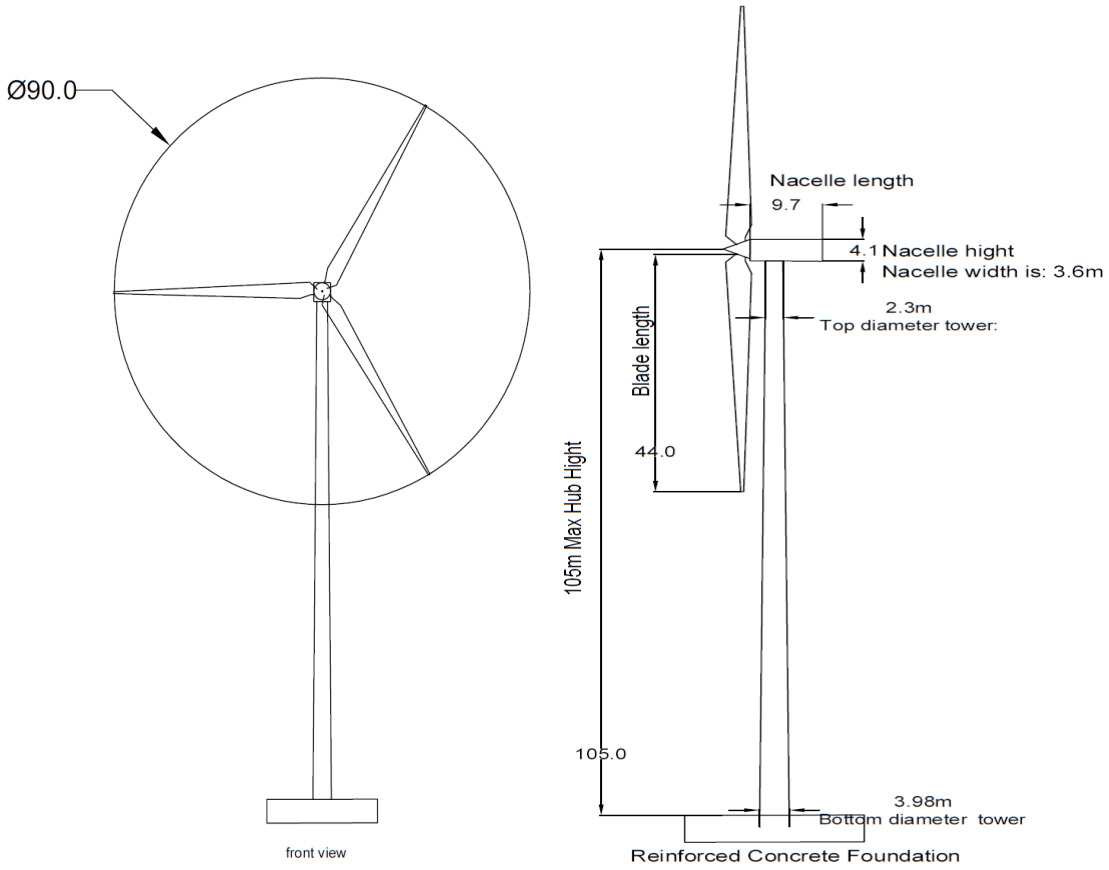

Figure 2- Vestas 90 wind turbine

These turbines begin generating electricity automatically at a wind speed of about 4.0 m/s and shut down when the wind speed reaches 25 m/s. Initially output increases with wind speed until the turbine generates its full rated power output at a wind speed of about 16 m/s.

This turbine provide with Opti Tip system and variable speed operation and the yaw bearing system enables the nacelle to rotate on top of the tower. This can maximize the power output by giving the optimal product in low wind speed, see Table-1.

Table 1- Vestas 90 descriptions

Part name	Dimensions	Wight
Rotor	90m diameter	Weigth:6600kg/pcs
Hub		Weigth:8500kg
Blades	Length:44m Chord: 3.512 - 0.391 m	
Generator	Length max:2800mm Diameter max:1100mm	Weigth max:8500kg
Transformer	Length:2340mm	Weigth:8000kg
Gearbox	Diameter:2600mm	Weigth:23000kg
Nacelle	Length: 9.65 m Width: 3.6 m Height: 4.05 m	Weight app.:68000 kg
Tower	Diameter:2.3-3.9m Hub hight:65-105m	Weigth:70.0t

Transportations Vehicles

There are too many a company that's deal with heavy transportations like wind turbine components. Normal truck is unable to transport these components because of the abnormal length and weight, therefore tracks is designed extra-long that able to expand 3 & 4 times from the initial length.

Also for heavy parts there are special design [5], Table-2 illustrated the trucks that capable transport wind turbine items.

Table 2- Trucks specifications

Name	Max. Length m	Max. Load kg	Loading height	No. Of axels	Single axle load ton	
SPZ-L	55,0	26000	1,200mm	3-4	12	
SPZ-P	62,0	26,000	1,200mm	3	12	
SPZ-P Super Lift	57,8	35,000	Variable	3	12	
STZ-P	13-27	132	815mm	6-11	12	

The vehicles designed especially to be useable to the existing road infrastructure, or should be modified the roads to suit transportation requirements. The examples of trucks in the former table highlights the problems could be faced through transportation process.

The ports

Iraq have a good set of ports is characterized by its propensity absorptive and their linkages to the transport ways, but to find a suitable port depends on the capacity of it and the possibility of its own cranes and provide appropriate ways to transport the wind turbine equipment.

There are five commercial ports in Basra, as shown in Figures-3 to 8, known as Northern Um-Qasr Port, Southern Um-Qasr port, Khor-Alzubair Port, Abu-Flus Port, and Almaaqel Port .each port has the absorptive capacity and the number of Decks that illustrated in Table-3.

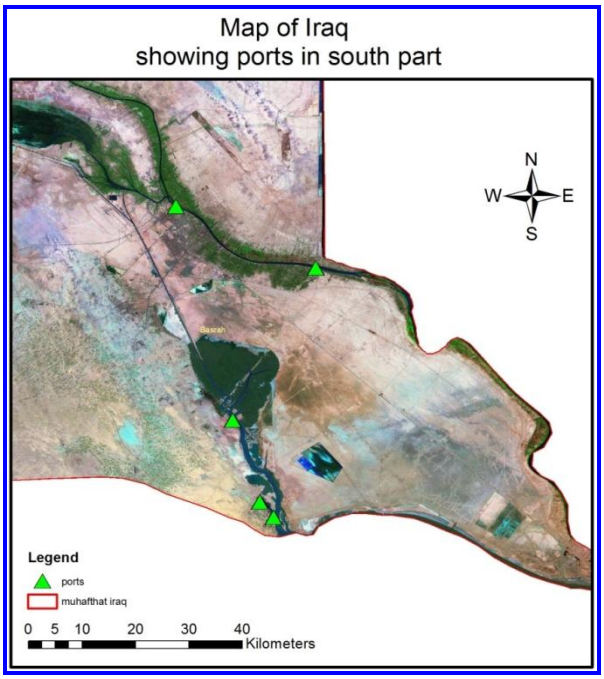

Figure 3- Iraqi Ports in South part of Iraq

Figure 4- Abo-flos port

Figure 5- Almaaqel port

Figure 6- North Um Qasr port

Figure 7- Khor-Alzobear port

Figure 8- South Um Qasr port

Table 3- Ports specifications

Port name	Capacity ton/year	No. of crains	Area of single dock	Number of docks	Istablitiong date
Northern Um-Qasr Port	8.85			21	1960
Southern Um-Qasr port	8.85			21	1960
Khor-Alzubair Port	6	12		12	1979
Abu-Flus Port	0.75	9	1350	3	1974
Almaaqel Port	2.75	35	4000	12	1916

The southern Um Qasr port is more convenient ports in terms of transportation requirements associated highway No. 1 directly wild docks, cranes ability and load capability commensurate with the needed equipment.

The transportation of wind turbine components has several ways, by land, sea and air. The airborn transportation is very expensive and for the sea way, Iraq has the mentioned ports at Basrah. The only way is the land way to transport the equipments, and for that, this paper focused on the roads ability.

Results and Discussions

This paper overcomes the transportation of the turbines items. Table-4 illustrated the nods that face transportation from each port down to wind farm location. The pot which is more suitable for load equipment is southern Um Qasr port, due to its cranes ability and load capacity, more over the highway connected to the port directly.

Table 4- the nods corresponds to each port down to wind farm location

Path from port	No o Bridges that pass underneath	No of Bridges that crosses	No of turnarounds	Road length
Northern Um-Qasr Port	23	2	5	218.885 k
Southern Um-Qasr port	23	2	0	221.606 k
Abu-Flus Port	20	5	9	205.088 k
Almaaqel Port	20	4	6	216.906 k
Khor-Alzubair Port	18	2	17	213.01 k

Figures-9 to 12 illustrated the kinds of nods for each way. The number of bridges that pass underneath its varies between 18 for Khor-Alzubair Port to 23 for Um Qasr ports. The number of bridges that crosses have 2 foe Um Qasr to 5 for Abu-Flus Port. The number of turns is 0 for southern Um-Qasr pot to 17 for Khor-Alzubair Port.

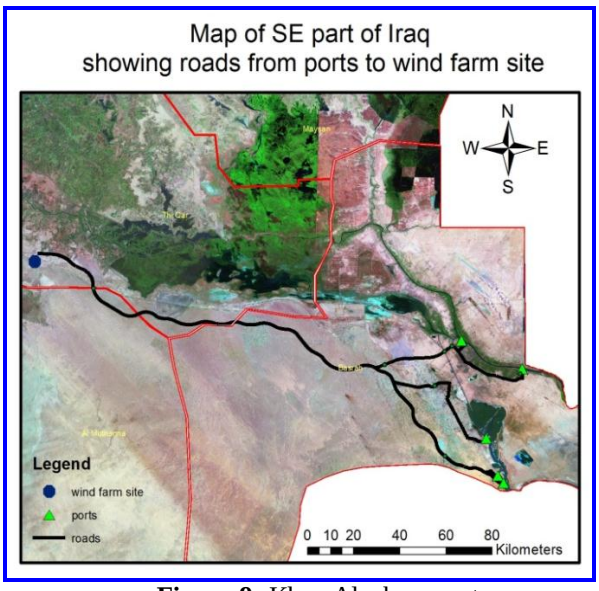

Figure 9- Khor-Alzobear port

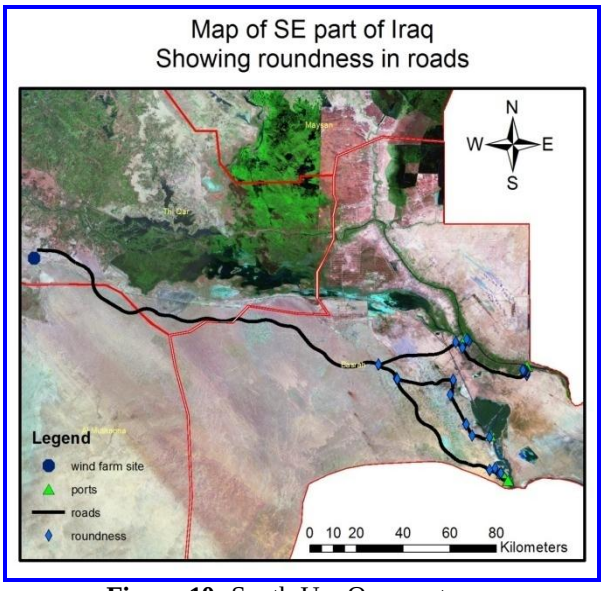

Figure 10- South Um Qasr port

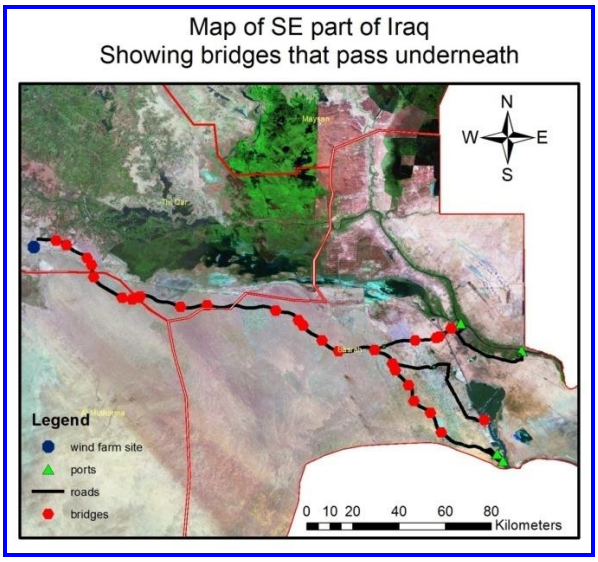

Figure 11- Khor-Alzobear port

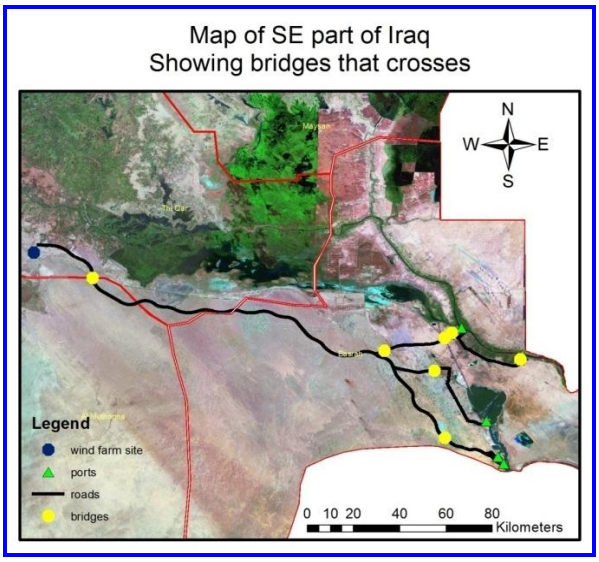

Figure 12- South Um Qasr port

Conclusion

Southern Um-Qasr port is the best choice to receive wind turbine equipments. The nods down to the construction region will face 0 turns, 2 bridges that crosses over and 23 bridges that passes underneath.

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