RESEARCH ARTICLEOPEN ACCESS

Wind Energy Proposed In Kurdistan-Iraq

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Abstract
The global wind-energy resource is very large and widely distributed. wind energy has the potential to provide an energy output equal to about three times the present electricity consumption. Although the wind is not very reliable as a source of power from day to day, it is a reliable source of energy year by year, and the main role for future wind-energy systems will be operating in parallel with electricity grid systems or, in remote locations, in parallel with diesel engines, so saving fuel.in this paper prepare design an application for wind energy via ArcGIS Application tools in Kurdistan region, while used application for searching for wind energy resource for each governorate in Kurdistan region-Iraq. This application help a designer to find any information about wind resources and archaeological and their geographical locations. in this paper proposed the location of the 30km proposed substation and 132kv proposed substation in the three governorates (Erbil, Duhok and Sulaimanyah) in Kurdistan region.

Keywords : Kurdistan Region,geographic information system,ArcGIS, wind resource , wind energy ,geographical location, substation.

I. Introduction

Windpower technology dates back many centuries. There are historical claims that windmachines which harness the power of the wind date back beyond the time of the ancient Egyptians. Hero of Alexandria used a simple windmill to power an organ whilst theBabylonian emperor, Hammurabi, used windmills for an ambitious irrigation project as earlyas the 17th century BC. The Persians built windmills in the 7th century AD for milling andirrigation and rustic mills similar to these early vertical axis designs can still be found in theregion today. In Europe the first windmills were seen much later, probably having beenintroduced by the English on their return from the crusades in the middle east or possiblytransferred to Southern Europe by the Muslims after their conquest of the Iberian Peninsula.

It was in Europe that much of the subsequent technical development took place. By the latepart of the 13th century the typical ‘European windmill’ had been developed and this becamethe norm until further developments were introduced during the 18th century. At the end ofthe 19th century there were more than 30,000 windmills in Europe, used primarily for themilling of grain and water pumping.[1]

Wind possesses energy by virtue of its motion .Any device capable of slowing down the mass of moving air can extract part of the energy and convert into useful work.

Following factors control the output of wind energy converter : -

- The wind speed
- Cross-section of the wind swept by rotor
- Conversion efficiently of rotor
- Generator
- Transmission system

Theoretically it is possible to get 100% efficiency by halting and preventing the passage of air through the rotor. However, a rotor is able to decelerate the air column only to one third of its free velocity.

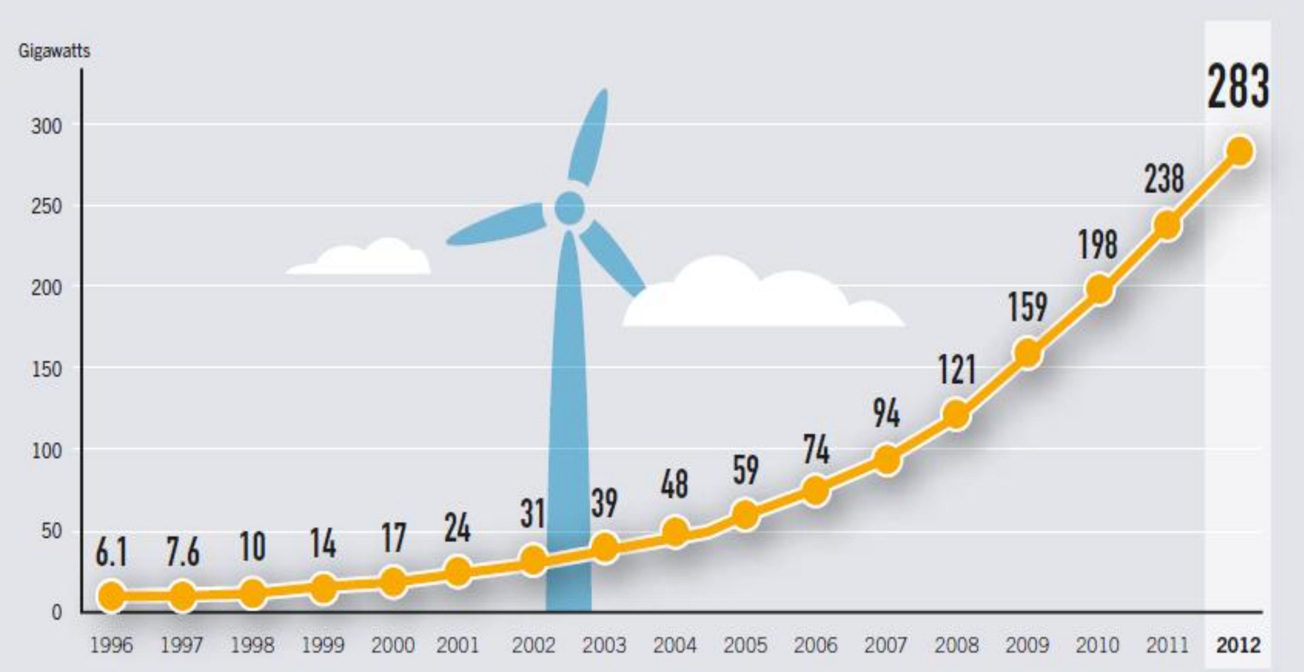

Figure-1- Wind Power Global Capacity

A 100% efficient wind generator is able to convert maximum up to 60% of the available energy in wind into mechanical energy. In addition to this, losses incurred in the generator or pump decrease the overall efficiency of power generation to 35% [2]. During 2012,almost 45GW of wind power capacity began operation, increase global wing capacity as shown in figure-1-.[3]

1-1 Energy content of the wind.

The following section will be used to mathematically explain where the energy in the wind comes from and what factors it depends on. Power is defined as:

$$P=E/t=(0.5).A.p_a.v^3 \text{ ----------} \quad (1)$$

Where
E: kinetic energy
A: area
p_a: specific density of the air
v: wind velocity

Therefore, it is also proportional to the cube of the wind speed, v3. From figure 2, it can be seen that the power output per m2 of the rotor blade is not linearly proportional to the wind velocity, as proven in the theory above. This means that it is more profitable to place a wind turbine in a location with occational high winds, than in a location where there is a constant low wind speed. Measurement at different places shows that the distribution of wind velocity over the year could

approximate by a Weibull-equitation. That means that at least about 2/3 of the produced electricity will be earned by the upper third of wind velocity.

From a mechanical point of view, the power density range increases by one thousand for a wind speed change of just 10 m/s, thus producing a construction limit problem. Therefore, wind turbines are constructed to harness only the power from wind speeds in the upper regions.[4]

II. Geographic Information System(GIS)

A geographic information system (GIS) is a computer-based tool for mapping and analyzinggeographic phenomenon that exist, and events that occur, on Earth. GIS technology integratescommon database operations such as query and statistical analysis with the uniquevisualization and geographic analysis benefits offered by maps. These abilities distinguish GISfrom other information systems and make it valuable to a wide range of public and privateenterprises for explaining events, predicting outcomes, and planning strategies. Map makingand geographic analysis are not new, but a GIS performs these tasks faster and with moresophistication than do traditional manual methods.

Today, GIS is a multi-billion-dollar industry employing hundreds of thousands of peopleworldwide. GIS is taught in schools, colleges, and universities throughout the world.

Professionals and domain specialists in every discipline are become increasingly aware of theadvantages of using GIS technology for addressing their unique spatial problems.

We commonly think of a GIS as a single, well-defined, integrated computer system. However,this is not always the case. A GIS can be made up of a variety of software and hardware tools.

The important factor is the level of integration of these tools to provide a smoothly operating,fully functional geographic data processing environment.[5]

In general, a GIS provides facilities for data capture, data management, data manipulation andanalysis, and the presentation of results in both graphic and report form, with a particular emphasis upon preserving and utilizing inherent characteristics of spatial data.[6]

III. The Tools of this Application

3-1 ArcGIS Desktop

ArcGIS Desktop is a GIS product created by ESRI (Environmental Systems Research Institute) that allows you to analyze your data and author geographic knowledge to examine relationships, test predictions, and ultimately make better decisions.
It is a family of three packages—ArcInfo, ArcEditor, and ArcView—that share the same core applications, user interface, and development environment. Each package provides an additional GIS functionality as you move from ArcView to ArcEditor to ArcInfo.
Key Features: ArcGIS allows performing basic visualization (map authoring), spatial query, editing and data integration, and basic modeling and analysis of your data.

 Visualization: Map authoring: e.g. predefined map templates to save time, easy to create a consistent style maps, etc.

 Spatial query: e.g. measure distances and areas, find features in the map, select data by location or attribute, switch the selection, access layer properties, etc.

 Simple feature editing and data integration: e.g. create/edit point, line, and polygon features and attributes, integrate variety of data types including demographics, facilities, CAD drawings, imagery, web services, and multimedia.

 Basic modeling and analysis: e.g. model spatial relationships, generate charts/reports from findings, etc.

 Ready-to-Use Datasets: e.g. ESRI Data & Maps Media Kit, which is updated annually and preconfigured to work specifically with ESRI software.

 Enabled for extensions: e.g. add even more capabilities - Analysis, Productivity, and Solution-based extensions perform extended tasks such as raster geoprocessingand three-dimensional analysis.[5]

IV. Proposed system

The application consists of three sections meaning of three governorates (Erbil, Duhok and Sulaimanyah) in kurdistan. The three Governorates(Erbil,Sulaimanyah and Duhok) are located inthe northern part of the Republic of Iraq known as Kurdistan. The region lies betweenlatitudes 34° 42' N and 37° 22' N; longitude 42° 25' and 46° 15' East. The lowest point inthe region is Kifri, which has an elevation of 140 meters from mean sea level, and thehighest point is the peak of Hasarost mountain in Erbil Governorate, measuring 3607meters above mean sea level[7]
The area of Kurdistan has been evaluated at a high level to identify any potential barriers to wind farm development and assess the capacity for large scale wind projects. A constraints based desktop study, based on supplied and information from the public domain, has been carried out in order to identify search areas for wind projects that are within close proximity of an electrical grid connection and main roads to transport large turbine components. Areas within 30 km of a 132 kV substation or power station have been proposed in this paper. Figure 1 shows the key to the maps. For each of the threeregions assessed (Duhok, Erbil and Sulaimaniya), areas have been identified that would bemost suitable for wind development, due to proximity to transport and electrical infrastructure.These areas are indicated by red shapes on the maps.

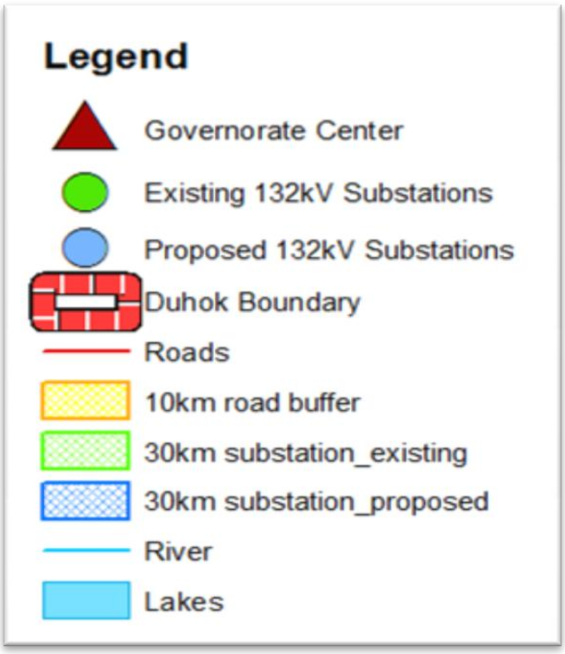

Figure-2- Legend of the map

4-1 Duhok

This small region to the north of Kurdistan has several areas that would be favourable forwind power developments. The region has large areas of cultivated land, with several longridges running through the landscape. The north of the region (towards the Turkish border)is more mountainous.
Figure 3 shows constraints within this area. The region has two major roads running throughtit, one in the north and one in the south west. This makes a large proportion of theagricultural area in the south-west accessible to wind power development. Almost the entireregion is within 30 km of a 132 kV substation, reducing connection costs for large scale winddevelopment.

4-2 Erbil

Erbil is a much larger region than Duhok, with much of the area dominated with flat cultivatedland. Within this lowland area lies some significant urban areas, which would provide ademand for wind power development within the area. Mountains occupy the north-east ofthe region towards the Turkish and Iranian borders. Figure 4 shows the constraints for this area. Much of the lowland area in the center of theregion lies within 30 km of the 132 kV electrical networks, allowing for development of largescalewind power projects.

4-3 Sulaimaniya

Sulaimaniya is much more mountainous than the other two regions, although it still hasextensive area of flatter land to the south-west. Within this flat region lie several urban areaswhich would provide a good demand for wind power projects within the region. For these reasons, the largearea indicated by the red shape would be the most suitable area in the region for large scalewind power projects. Figure 5 shows the constraints for Sulaimaniya.

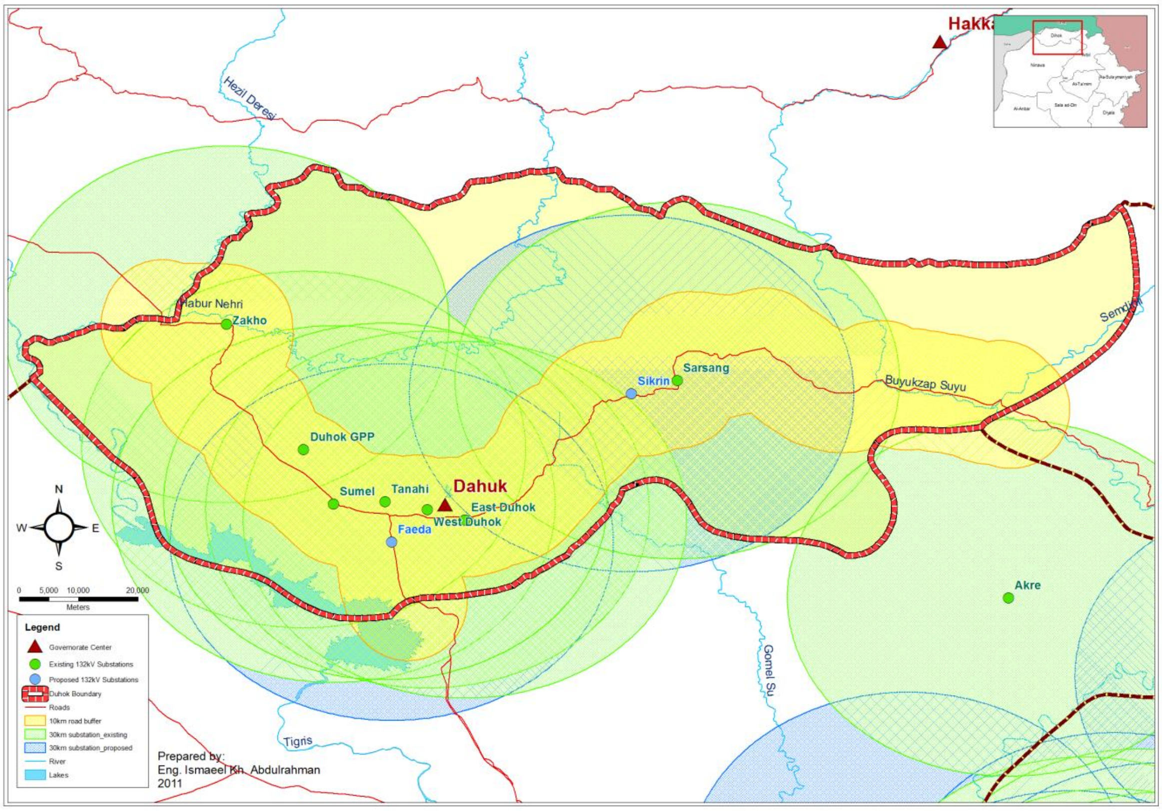

Figure-3-Dohukarea with proposed system

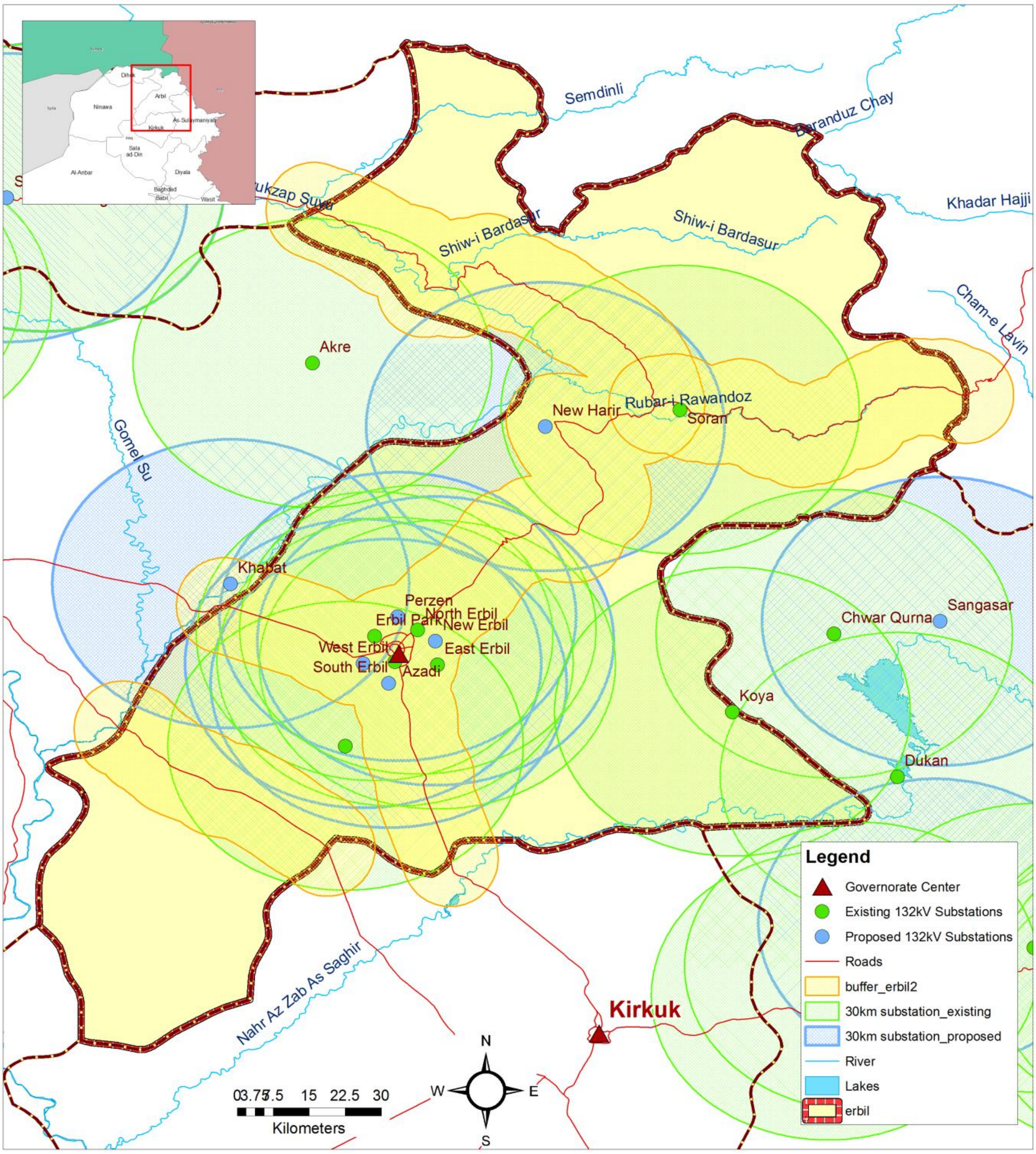

Figure-4-Erbil area with proposed system

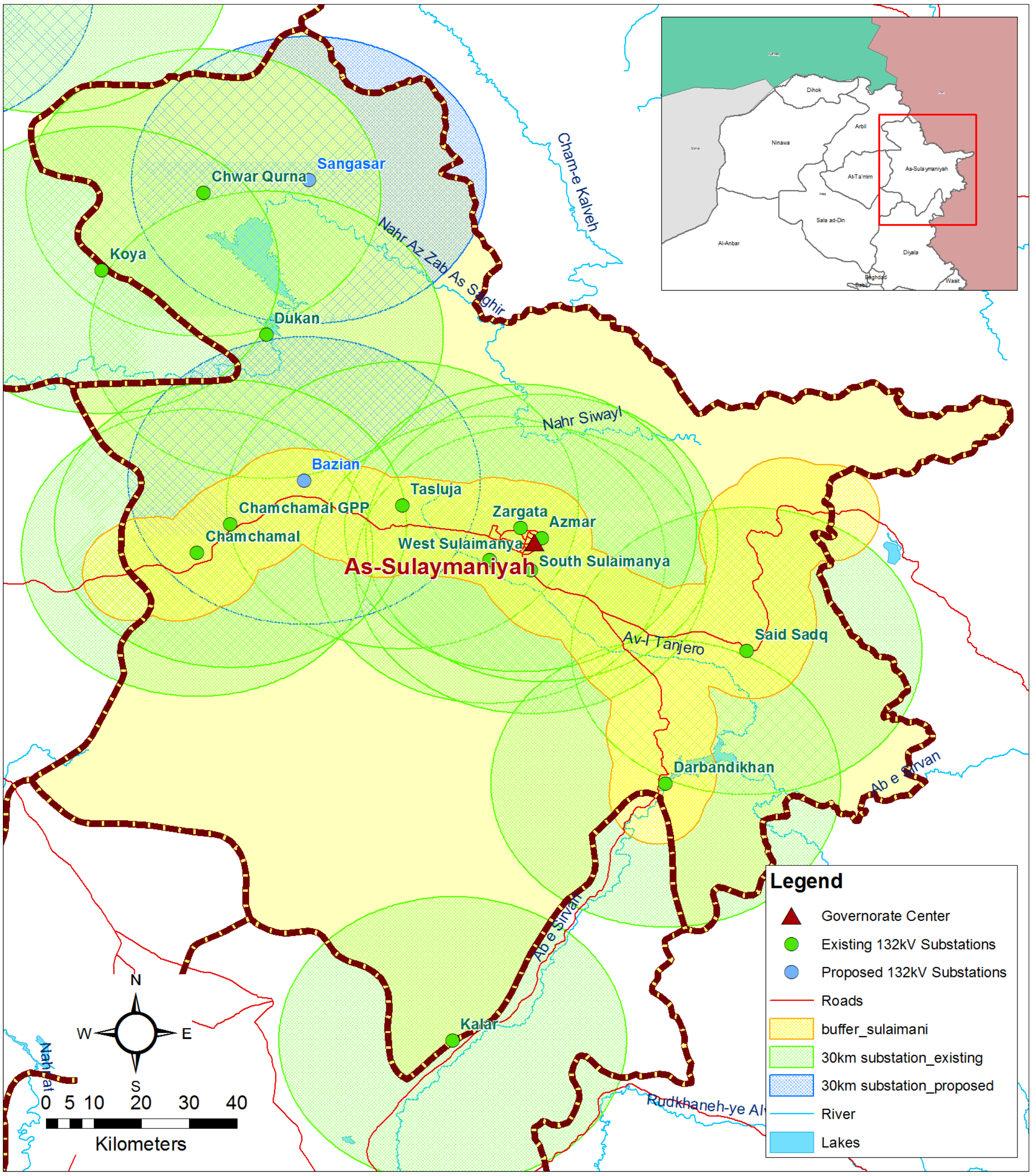

Figure-4-Sulaymaniyaharea with proposed system

The proposed system depended on the some average wind speed information based on Agriculture Ministry Weather Reports.

V. Conclusion

- The result of the proposed system shown below in the table-1- that shown proposed location for wind energy in Kurdistan by using the following data shown in the table-1-.where E is east in longitude ,N is North in latitude ,X &Y are in meters refer to UTM

Table -1- Proposed location

Name	E	N	X	Y
New Harir	44.29052	36.60561	436548	4051357
Sikrin	43.28234	37.0346	347232.6	4100090
New Erbil	44.08497	36.20425	417742.8	4006991
Khabat	43.70143	36.31144	383421.9	4019275
West Erbil	43.9494	36.16185	405504.2	4002411
Perzen	44.0142	36.24993	411431.8	4012121
South Erbil	43.9971	36.12471	409752.1	3998246
Faeda	42.9185	36.8092	314323	4075728
Sangasar	45.03008	36.241	502703	4010680
Bazian	45.02074	35.67543	501877	3947950

- The relatively low wind speed identified from World Wind Atlas results in a low capacity factorand a relatively high cost of energy. Further analysis of detailed wind data may identifyspecific sites with greater economic viability.
- Depending on field of applications, various schemes can be adopted to get optimum output. Various option of storage facility makes it versatile source of energy. Modern turbines are totally controlled by computers that are totally safe. Since wind is clean source of energy, the power conversion does not pose any environmental hazard.

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