Application of Wind Energy in Urban Regional Planning Toward Ecological Sustainability(Case Study: Hashtgerd)

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Abstract

The remarkable development of sciences and technologies in the world of today has apparently brought mankind comfort and well-being, but it has also created new problems for humans including environmental pollution, widespread changes in world weather conditions, etc. Fossil fuels cause numerous environmental pollutions. In other words, on the one hand poisonous gases enter the environment following the burning of fossil fuels, make breathing difficult for people, and pollute the environment. On the other hand, accumulation of these gases in the atmosphere prevents heat from escaping the earth, leading to temperature increases and widespread weather changes on earth called the greenhouse effect. The best way to stop the increasing trend in the concentrations of these poisonous gases is to use clean energies such as solar, wind, geothermal, and hydrogen energies instead of energy obtained from burning fossil fuels and thus to prevent environmental pollutions and the problems they caused. Since cities are the major consumers of energy, the need for utilizing clean energies (including wind energy) becomes more obvious because attention to the way energy is provided for cities, and the management of this energy, will influence the preservation of environmental health and the optimal use of energy resources of the earth. With this purpose in mind, optimizing energy consumption and utilization of new energies in cities will be taken into account from the very first in urban and regional planning. Through utilizing renewable energy in cities, we will achieve the above-mentioned goals, including reduced use of fossil energy and saving costs, and movement towards sustainable development and environmental health. In this project, the SWOT table of utilizing renewable energy was prepared for the region of Hashtgerd in order to analyze the available information and offer a strategy suitable for the subject of the research. Following that, a flowchart of studies and conditions required for utilization of this energy, with emphasis on ecological sustainability, was prepared to select suitable conditions for utilizing wind energy in cities. Important and effective indicators in these processes were then used to draw up tables for analyzing and estimating various conditions, amounts of generated electricity and reduction in emission. Moreover, using the KLIMM software, two regions around Hashtgerd were selected for establishing wind farms, taking the required areas for the farms and electricity consumption in Hashtgerd into consideration. Finally, a region south of Hashtgerd was judged the most suitable site with respect to location and other characteristics.

Keywords: Environmental Pollution, Greenhouse Gases, Ecological Sustainability, Renewable Energy, Fossil Resources, Wind Energy

1. Introduction

Nowadays, the daily rise in energy needs and the limited fossil resources, the catastrophic increase in environmental pollution resulting from burning of fossil fuels, the problem of climate / change global warming, the effects of the greenhouse phenomenon and the need to balance CO2 concentrations necessitate saving fossil fuels and consider utilization of renewable energies (Shaaban, Petinrin, 2014). Air pollution damages people, animals, water, soil, and other materials, and most of this damage cannot be economically estimated and is irreversible (Hansanuwat, 2010). Combustion of fossil fuels is one of the main factors polluting the environment and entails numerous consequences Kasmaei has listed as follows:

- Acid rain that reduces pH, stops plant growth, and acidifies waters in lakes.
- Production of carbon dioxide, which is a very poisonous gas, produced by very varied sources, and is considered one of the main factors causing pollution in urban areas.
- Production of nitrogen dioxide, which is considered a poisonous gas at 5 ppm and, if inhaled at high concentrations, will lead to lung problems over time (Kasmaei, 1998).

Considering the above-mentioned points, great concern has arisen regarding air pollution, and the World Health Organization has been forced to deal with controlling air pollution and implement a United Nations environmental initiative called the United Nations Global Environmental

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Monitoring System (Luther, 2010). Therefore, long-term and planned actions must be taken with the goal of achieving sustainable development to find solutions for the environmental problems we face today. From this perspective, renewable energy resources seem to be one of the most efficient and capable solutions (Izadyari, 2012).

2. Theoretical principles

Considering the advantages of utilizing renewable energy and the fact that this energy does not pollute the environment, most countries are now trying, depending on their climatic conditions and their advances in utilizing renewable energy, to make greater use of this type of energy (KhalajiAssadi, Tavaghani, 1997). Therefore, they have started activities, conducted research, and taken steps to prevent the creation of an energy crisis. Noohi, in his article entitled "Clean Energies, Beautiful Energies" mentions these activities, research, and actions as follows. Investments for discovering and extracting fossil energies in other countries, and strategic, military, political, and economic planning for political suppression of oil-rich countries and for keeping prices of fossil energies down, and building underground storage reservoirs to be used as strategic reserves of fossil energies. So are optimization of energy consumption in industries and buildings through various ways such as encouraging the building construction system and the public to install and enhance thermal isolation in building, giving information and upgrading culture and directing public taste towards reducing energy consumption and greater utilization of diverse energies in the building industry. Devoting considerable work force and national funds for implementing research projects in the fields related to sustainable energies and optimization of energy consumption, production of equipment for, and building of, sustainable power plants, and allocating subsidies for using sustainable energies in various applications are other steps taken for the same purpose (Noohi, 1995).

Advantages of renewable energy

Renewable energy resources have numerous and very useful advantages that can be summarized as follows:

1. Since renewable, it does not cause natural sources depletion.
2. They it have high capacities for energy generation
3. They involve establishing decentralized energy generation centers
4. They it do not pollute the environment
5. They it help solve problems in the electricity industry (Nassiri, 1997)

Problems faced in using renewable energy

Despite of numerous advantages indicated above, one can mention the following as problems:

1. High investment requirements
2. Temporal and spatial limitations (Sadeghi, 1997)

Table1
Comparison of the influences of various energy resources on the environment

Energy resources	Energy	Air pollution	Climate change
Coal	Very high energy content	A main air pollutant	Plays a very major role
Petroleum	Average to high energy content	An average to main air pollutant	Plays a major role
Natural gas	Low to high energy content	A minor to main air pollutant	Plays a small to average role
Biomass	Low to high energy content	A minor to average air pollutant	Plays a small to major role
Wind	Almost zero energy content	Almost not an air pollutant	Plays a minor role
The Sun	Almost zero energy content	Almost not an air pollutant	Plays a minor role
Geothermal energy	Almost zero energy content	Almost not an air pollutant	Plays a small role
Nuclear energy	High energy content	Almost not an air pollutant	Plays a small role

Rudolf Schafer and Florian Stellmacher in their article about research program on German megacities stated that the global urbanization trend and the greater spreading of megacities are continuously taking place, especially in emerging markets and in newly industrialized countries. Planning decisions and investments made today will determine saving energy consumption, economic production ability, social life quality, and environmental carrying capacity of growing cities for many years to come. The ascending trend of urbanization in societies, the need for urgently responding to climate change, and the strategic importance of energy security in the macro policies of governments, have led

policy makers to demand greater and more accurate understanding (compared to the past) of the way energy is consumed in cities. Today, cities account for more than two-thirds of the total world energy consumption, and predictions suggest this will rise to three-fourths in 2030. On the other hand, the provision of energy requirements of cities is not the only critical point because climate change and the health of urbanites also cause great concern (Schafer, Stellmacher, 2010). Iran is among the countries with the highest per capita energy consumption, and utilization of new technologies (called green strategies) can play a very important role in its sustainable development in the energy sector. Residential buildings and offices account for about 35% of the yearly energy consumption, and since this energy is not used in production, reducing energy costs can play an important role in development (KarimiDaamaneh et al., 2013).

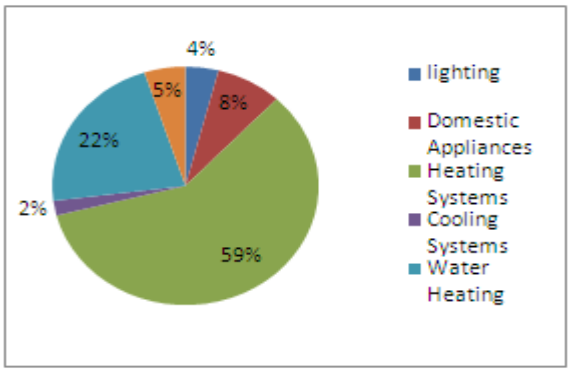

Fig .1. Energy consumption in different parts of houses in Iran (Source:www.ifco.ir)

Lighting 4%; Domestic appliances 8%; Heating systems 59%; Cooling systems 2% ; Water heating 22%; others 5% Moreover, solutions for energy generation have been extensively sought for various places by studying the potential energy in winds, and specific goals are set regarding utilization of wind energy in future. Economic factors, water, air, in addition to technical and organizational factors, are dealt with in evaluating feasibility studies (Kaniyal, 2012). According to available statistics, each kWh of wind-derived electric energy can prevent emission of about one kg of CO compared to power plants using fossil fuels (Millward& Colleagues, 2013). In general, emission of greenhouse gases can be reduced by replacing wind-derived energy for electricity generated in power plants that use fossil fuels.
Considering the advantages of utilizing wind energy, which are briefly listed below, strategies can be suggested for improving environmental conditions:

- Providing part of the increasing demand for electricity on the present system that both makes Iran dependent on foreign countries and creates environmental problems
- Wind turbines do not need any fuels and employing them creates an opportunity to export these materials (or not to import them), ends our dependence on other countries, and increases our foreign currency revenues
- Relatively lower cost compared to that of energy generated from fossil fuels
- Negligible current costs and declining investment costs over time
- Wind-derived energy generation occupies little space
- Water or ancillary facilities are not required
- Domestic industries will become active and a labor market will be developed
- Diversification in energy generation will be achieved and a sustainable energy system will be created
- Utilization is possible at any required capacity and size (Kami Shirazi, 2012).

Considering the mentioned points regarding utilization of renewable energies in cities and buildings, it is necessary that accurate potential surveys be carried out in the area under consideration to study feasibility of utilizing renewable energies. Therefore, studies are carried out taking factors such as wind speed in the area into consideration.

3. Methodology

First, the existing records concerning the project are of special importance. Studying these records will provide sufficient background to determine the policy and framework for executing the project. Next, the limits of the framework are determined for collecting and organizing information. That is why the purpose in writing this article, which was written by using the analytic-descriptive method and through collecting documentary and library information, was to introduce sustainable energies and their utilization in regions, cities, and buildings with the goal of achieving sustainability and reduced environmental pollution. Following that, considering the available information at the Renewable Energy Organization of Iran and at the Development Corporation of New Towns, the conditions and situation regarding the case study (Hashtgerd) were studied for utilizing wind energy, reducing pollution, and for creating sustainable areas in cities and regions. A SWOT table was prepared and summarized in a flowchart to identify the

advantages and shortcomings of utilizing this energy in the region, to draw up the framework of requirements for utilization of wind power in cities, to reduce the use of fossil fuels, and to help in decreasing the demand on the network. This flowchart presents the steps in the stages of the study and the potential survey in a completely general and summarized form. The KLIMM software was then employed to find a site for establishing a wind farm in Hashtgerd.

4. Studies and investigations

By studying the potential energy of wind in a location, solutions for large-scale energy generation are investigated and specific goals are determined in relation to utilizing wind energy in future. In evaluating potential survey, factors such as economic considerations, water, air, in addition to technical and organizational factors, are dealt with. Average wind speed, alternating distribution of wind speed, atmospheric conditions, surface roughness with increasing height, etc. must be considered in calculating the quantity of generated wind energy. Increases in wind speed are always expressed with increasing height usually using logarithmic functions. Wind speed also changes hourly and daily. These changes are very important for companies generating electricity from wind power (Gang, 2014) because they have to adjust energy generation in coordination with the demand for electrical energy. Information regarding changes in wind speed at the scales of minutes and seconds is important for manufacturers because it helps them design optimal wind turbines. To measure wind speed, each wind station has at least three anemometers (wind sensors) installed at heights of 10, 20, and 40 meters. In addition to being windy enough, the site of a wind farm must have the highest economic productivity and have the least detrimental effect on its surroundings (should not require changing the conditions in the region, nor should it need complicated equipment) (Lee, Gurung, Brick, 2012).

Therefore, the region selected and its structure will play a very important role in the optimal performance of the wind farm. Obviously, the site where the turbine is installed must have a high average wind speed and suitable continuity of wind blow. Therefore, the first and most important step in evaluating the potential of a region for installing wind turbines is to study wind and parameters related to it. The following steps are involved in a potential survey for selecting a suitable site to install wind turbines:

- Determination of the estimated wind potential
- Determination of the type of ownership of the land
- Proximity to power transmission lines and the network situation (possibility of short distance connection, quality of power transmission lines)
- Access to roads
- Climatic conditions
- Other factors (being earthquake prone, study of the concentrations of particulate matter in the air)

Information and steps to be taken related to wind in the region include the following:

- Topographic information of the region
- Installation of meteorological tower
- Win continuity

After carrying out the above studies regarding the selection of a suitable site, the appropriate turbine model or models are selected. This includes:

- Estimation of the power output of the plant, which is mainly performed by computer software
- Selection of suitable heights
- Calculation of power factor, maximum power, and turbine effects on the network
- Controlling noise from the turbines
- Technical access factor
- Economic justifiability of turbine installation in terms of reduction of payback period
- Selection of the type and number of turbines that can be installed

According to available statistics, each kWh of electrical energy derived from wind energy can reduce CO emission by 0.7-1 kg compared to power plants that use fossil fuels. In general, emission of greenhouse gases can be reduced by replacing energy generated from fossil fuels by that derived from wind. When wind turbines supply the power required by the network, power generation in other power plants decreases and fossil fuel consumption is thus reduced. This will decrease emission of environmental pollutants depending on the quantity of power supplied to the network by wind turbines. On the other hand, the natural attractions and landscape of wind energy systems, which are perceived by people to be symbols of clean energy, will be in their view. Moreover, 99% of the land area devoted to the establishment of wind farms can be used for other purposes. Although wind turbine blades are typically more than 10 meters in diameter, they are installed at a height of over 20 meters and, therefore, agricultural and animal husbandry activities can be carried out right up to the turbine tower side. Evidence confirms that domesticated and wild animals are not harmed when they are around wind farms. Furthermore, studies conducted in countries that are leaders in this technology

indicate that turbines occupy only about one percent of the area devoted to wind farms. Therefore, considering what was said above, utilization of wind energy is justifiable because it reduces social costs of energy generation compared to power plants that use fossil fuels and that have negative externalities. The electricity derived from wind can be used as sustainable energy in the economic, social, and cultural development of the country.

Renewable energy resource in urban and rural regions can be controlled locally and independently from the network, and no national electrical power distribution networks or complicated systems of power transmission are required. Regional inhabitants can select a technology with higher efficiency appropriate for the local conditions and the amount of electricity they need. As a rule, each region will need a different amount of electricity, and this is one of the advantages of renewable energies because they can be adapted to the type of control and technology available in the region. Therefore, using suitable studies and research that are conducted for each region, it will be possible to investigate the possibility of utilizing these inexhaustible resources.

5. The case study of Hashtgerd

Hashtgerd has an area of 4461 hectares, latitude of 35˚56 □ to 36˚ 3 □ north, longitude of 50˚43 □ to 50˚46 □ east, and is located on the southern slopes of the Alborz mountain range west of Tehran Province midway between Karaj and Ghazvin. It is 60, 25, and 75 kilometers from Karaj, Tehran, and Ghazvin, respectively. Hashtgerd has a cold semi-arid to cold and Mediterranean climate. Its climate type is influenced by geographical factors such as topography, elevation, topographical aspect, proximity to plains on the one hand, and by the nature of air masses entering the region from faraway places and by pressure centers at local or regional scales on the other.Study of seasonal and monthly wind currents shows the dominant annual wind directions are from the west and northwest, but that winds also blow from the southeast and south influencing the climate of the region. Spring is the season when wind blows most often and most powerfully and intensely. Moreover, during various seasons winds blow over the city usually from all directions. In general, this region never lies in the tranquil range at night during any month of the year. However, with climatic moderations resulting from the existing geographical factors and soft night winds, it can be inferred that summer nights are pleasant. In all, the region has a cold and dry climate and that is why winter nights are very cold and lie in the freezing range. As a result, during many days of the year thermal and mechanical heating devices are required. Provision of energy for heating can be said to be more important than provision of energy for cooling in this region. Therefore, reducing heat exchange between closed environments and the free air outside buildings is one of the main architectural solutions and strategies the regulations regarding which must be developed.

Considering the mentioned points, accurate potential survey in cities and regions must be carried out to study feasibility of utilizing renewable energies. Taking the mentioned factors such as geographical location, wind intensity and speed, weather conditions, etc. into consideration, the area under study is examined.

Utilization of renewable energies in regions revives them by providing new opportunities for people and helps them achieve sustainable development. On the other hand, renewable energies will be useless without having a correct planning framework. Therefore, a special approach and strategy, or a combination of them, and especially strategic planning, is required in order to be able to utilize renewable energies. One of the very important tools for the process of developing these strategies is the SWOT technique that is used to compare information. SWOT is, basically, a tool for strategic planning (HomHaacke, 2001:3), and a conceptual framework for systemic analyses (Noori et al., 2006:26). In this article, SWOT is used to analyze wind energy and, since it is possible to use wind energy in wind farms (and independently in buildings), potential survey and wind energy design are performed for cities and regions (by considering their specific conditions). Therefore, study of the requirements for potential survey regarding renewable energies (including wind energy) can have its most frequent application in achieving ecologically sustainable development and in helping to have healthy cities.

Table 2
SWOT table for wind energy

Wind energy				
Strengths		Weaknesses	Opportunities	Threats
SWOT	Geographical position of the region Replacement of current costs with investment costs of wind energy in the long run Possibility of delivering the generated electricity to the network Ability to provide pat of the required electricity Relatively lower cost of wind-derived electricity compared to that generated from fossil fuels Approaching sustainable development through using renewable energies in cities and regions Considerable maneuverability with regard to capacity and size (from a few Watts to several megawatts) No air and environmental pollution compared to using fossil fuels Increased reliability in energy generation	Cannot be utilized in most geographical regions High cost of initial installment Suitable and wide areas are needed to establish wind farms Accurate potential survey of the regions is needed Wind technology must be developed Expert training is needed Lack of awareness of and information about advantages of utilizing renewable energies	Possibility of using wind energy to generate electricity in the region (considering its geographical position) (it is located along Manjil's wind tunnel) Presence of wind with suitable speeds (7-8 m/s) Reduction in consumption of network electricity Saving energy resources and fossil fuels Utilizing wasteland and unused land to establish wind farms Reduction in air and environment pollution and provision of clean air in the region Job creation Possibility of establishing wind farms in the southern part of the region Possibility of diversifying resources for energy generation	- Lack of suitable land in the northern part of the region (mountain slopes) - Shortage of experts in utilizing renewable energies - Shortage of banking facilities for engaging in generation of renewable energies

Application of renewable energies with an emphasis on ecological sustainability

- Planning to utilize renewable energies such as wind energy in suitable cities and regions with an emphasis on ecological and environmental sustainability
- Planning for and encouraging the public and private sectors to use wasteland and unused land for establishing wind farms
- Developing suitable regulations and providing requirements for Housing and Urban Planning Organizations, New Town Development Company, Municipalities, and related government and private sector organizations to make maximum use of renewable energies
- Developing an extensive plan for preparing comprehensive and accurate research programs in various regions for the purpose of utilizing renewable energies with the focus on sustainable development
- Creating financial incentives through banks and financial and governmental institutions and offering banking facilities for utilization of renewable energies
- Offering financial incentives to families through giving them low-interest loans to utilize renewable energies in buildings and by assuring them of returns on their private investments
- Offering facilities to families for utilizing renewable energies, and receiving the facilities extended to them in installments added to their energy bills
- Stepwise raising of costs related to use of fossil fuels for industries that pollute the environment in order to encourage them to use renewable energies
- Giving information and offering educational

programs at various levels of the society including management organizations and sectors, universities, etc. regarding the advantages of utilizing renewable energies with an emphasis on ecological and environmental sustainability

Ecologically sustainable development through utilization of wind energy

Economic productivity is the most important deciding factor in developing a framework for utilizing wind energy in cities. Therefore, studies were made to develop a framework for showing the requirements for utilization of wind energy in cities, for reducing fossil fuel consumption, and for helping to reduce the burden on the network. This framework was summarized in the form of a flowchart that presents the trend of the study and potential survey stages in a completely generalized and brief way.

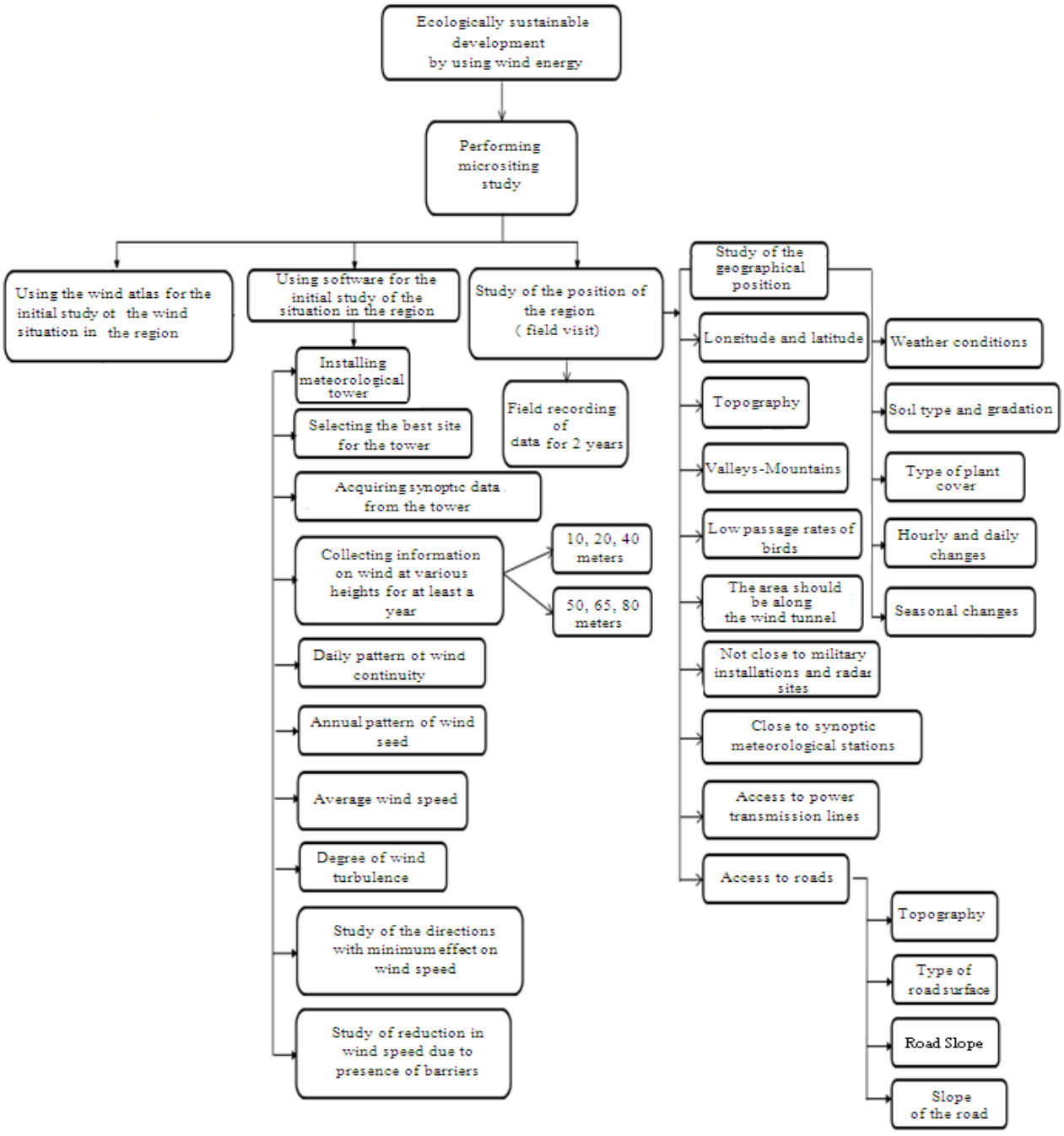

Fig.2.

Winds in the regions are expressed in terms of wind speed, energy, and turbulence. It is also stated if the regions lie along a wind tunnel, how far they are from synoptic stations, their access to power transmission lines and plant cover (whether the plant cover is a barrier to wind movement and reduces its speed). Topography of the regions, type of road surface and its width and slope (which determine the possibility of transporting equipment and turbines), presence of barriers around the wind farms, and passage rates of birds are also expressed. All the specifications of the three mentioned regions are stated in general terms (good, average, unsuitable) in the following table:

Table 3
Classification of the regions based on regional conditions

Conditions	Favorable (1)	Average (2)	Unfavorable (3)
Wind speed	7.4 – 8.6 m/s, > 8.6 m/s		
Wind energy	122-142 W/m2 , > 142 W/m2		
Wind turbulence	Low	Average	High
Lying in a wind tunnel	Completely in the wind tunnel	Near the wind tunnel	Far from the wind tunnel
Distance to synoptic station	Very close to them	Relatively close to them	Far from them
Access to power transmission lines	Very close to them	Relatively close to them	Far from them
Plant cover	Scattered	Semi-dense	Dense
Topography	Flat	Semi-flat	Rough
Type of road surface	Asphalt	Gravel	Dirt road
Road slope	Low	Moderate	High
Road width	Wide	Low width	Narrow
Presence of barriers around the wind farm	No barriers	Few	Many
Passage rates of birds	Low	Moderate	High

After the region is classified, a specific land area is considered and, using the conditions listed in the table above, the size, number, and capacity of turbines, economic justification of establishing a wind farm (considering the regional conditions and the price of electricity in the region) can be estimated and analyzed.

Table 4
Characteristics of the regions

Characteristics	Region (1)	Region (2)	Region (3)
Size of the farm (in hectares)	100	100	100
Size of turbines	Larger with greater efficiency	Smaller with lower efficiency	Very small with very low efficiency
Number of turbines	Fewer	More	Many more
Capacity factor of turbines	55-60%	40-50%	< 30%
Turbine arrangement	Optimized by software in relation to number of turbines	Optimized in relation to number of turbines	Optimized in relation to number of turbines
Economic justification	Economic	Somewhat justifiable	Not justifiable

Using the points discussed in the two tables above, and with the help of KLIMM, it will then be possible to estimate the approximate amount of electricity generated in a specific area of land in the three different regions, which will also indicate the reduction in emission of pollutants.

Table 5
Expectations and suggestions related to the regions

Regions/ characteristics of regions	(1)	(2)	(3)
Area of the specified site (in hectares)	100	100	100
Wind speed			
Amount of generated electricity (Mwh/year)	27593.72	21958.2	10522.32
Population	10000	7300	3500
Reduction of emission into the air (Tons)	19315.6	15370.7	7365.6

Analysis of information by KLIMM

With the completion of phase zero in the preparation of the wind atlas of the country in 2006, the available data was collected, the KLIMM software program (which has been developed for wind studies) was executed, and Iran's phase zero color atlas was prepared. Information at 80 digital ground stations recording information related to wind in 10-minute intervals was then extracted to prepare Iran's color wind atlas. As mentioned before, information received from meteorological stations (where wind speed and direction, temperature, relative humidity, solar radiation intensity are recorded digitally at 10-minute intervals), and information contained in Iran's wind atlas is used. This information is matched with World Geographical Map (Google Earth) at the heights of 30, 10, and 40 meters to determine and calculate the site, the size of wind farm, the type of turbines and their number, etc. KLIMM has performed these calculations for the Hashtgerd region. According to the collected information and the information presented in the tables above, Hashtgerd, as shown in Table 6, can be considered an average, region (2) site.

Table 6
Average wind speed in the region

Average annual wind speed in Hashtgerd	6.7-8.1 m/s
Wind speed at the height of 80 meters	7.5 m/s
Proposed Turbine capacity to be used	660 kW to 2 Megawatts

At first, two sites were considered. One is in the north of Hashtgerd but not economically justifiable because it is situated on the slopes of Alborz Mountains, near the city, there are many barriers around the site, and average wind speed is not sufficient to make establishment of a wind farm economically justifiable. The second site is almost flat, lies about 20 kilometers south of Hashtgerd close to Najmabad, and can be used to establish a small wind warm of about 100-150 hectares with an annual electricity production of 15000-25000 Mw. This will be sufficient to meet the average yearly demand for electricity in Hashtgerd. It is expected this wind farm can greatly reduce CO2 emission and decrease environmental pollution.

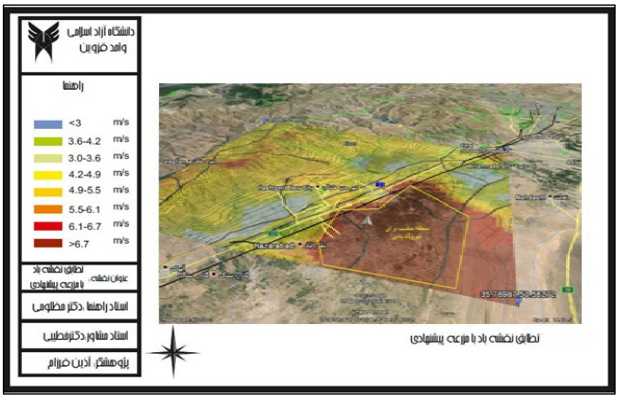

Fig. 3. Sites considered for the establishment of a wind farm considering wind maps

Table 7
Suggestions proposed by the software

Proposed software	
Studied region	Hashtgerd
Geographical position	50˚ 43□ , 35˚ 56 □
Area of the proposed wind farm	100-150 hectares
Average wind speed	6.725 m/s
Proposed number of turbines	3-5
Energy generated by each turbine	5613.08 kWh /y
Type of turbine	Suzlons 88- 2.1Mw
Approximate amount of generated electricity	15000- 25000 Mw
Population covered by the wind farm	220000

After studying the establishment of a wind farm using the LKIMM software around Hashtgerd, the maps and the software output indicate the site near Najmabad (with average wind speed of 6.725 m/s and lying close to Hashtgerd) is a suitable place to establish a wind farm. This place has an area of about 100-150 hectares, and annual electricity generation will be about 15000-25000 Mw (equal to the average annual electricity consumption in Hashtgerd).

6. Conclusions

Global developments in the environment and exhaustibility of fossil fuels, and the remarkable increase in environmental pollution (especially emission of greenhouse gases), have accelerated the tendency to use renewable energies, and attract more attention every day. The only way out of an energy catastrophe is to re-coordinate civilization with natural energy cycles. Research activities, modeling, and mass production under present conditions have prepared the ground for the increasing economic justifiability of utilizing renewable energies, especially in some of its forms such as wind energy. These energies, in spite of their advantages, have some limitations, but they can be best utilized by employing correct and effective technologies

Since cities, and buildings at a smaller scale, receive a major part of the energy consumed in the country, it seems optimal use of energy and, hence, saving energy, is necessary. This will lead to a substantial reduction in expenses and, at the same time, will help to achieve correct interactions with the environment. Utilizing renewable energies, we can attain all the above-mentioned goals, which include reduced use of fossil fuels, saving expenses, and moving in line with sustainable development and in harmony with the environment.

In this article, analyses based on the SWOT model indicate the strengths and weaknesses of wind energy utilization and show that Hashtgerd, despite enjoying the capacity to use renewable energies, has not received the attention it deserves due to lack of accurate studies and because of the low price of energy in Iran. However, considering the increasing air pollution, the effects of greenhouse gases, and the limited supply of fossil fuels, and because of the strategic position of Hashtgerd in relation to the Tehran metropolis (which has the highest level of pollution), it seems study of renewable energies, and their utilization, will become a necessity in the not so far away future. After using the KLIMM software to study the possibility of establishing a wind farm around Hashtgerd, the maps and software output indicate a small wind farm of about 100-150 hectares with annual electricity generation of about 15000-25000 Mw(which is the average annual consumption of electricity in Hashtgerd) can be established at a place called Najmabad (close to Hashtgerd). In the final analysis, the important point in using the inexhaustible renewable energies is to conduct correct potential surveys in cities and various regions. Therefore, it seems necessary that urban planners and developers should draw up local and wide-scale plans in cities and regions for today's generation and for the generations to come based on preserving the environment and the existing natural resources and on logical

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