RELATIONS BETWEEN ECOSYSTEM AND WIND ENERGY

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ABSTRACT

The study explores the amount of energy production by wind turbines in Turkey, in Europe, and in several other countries around the world. Annual production of electric energy through the wind turbines in Turkey is only 2493 MW, which accounts for only 5.8% of the total energy consumption in the country. We discussed the possibilities of how this amount can be increased to 10%, over the next 3-5 years.

Turkey, which has 502 bird species, is a part of the Palearctic, and is located on important bird migration routes. As a result, birds prefer the migration routes on the areas where the wind intensity is quite high. Certain areas in Turkey, such as Kapıdagi peninsula, Iskenderun, Izmir, Belen, or Adana, are located on high wind intensity routes. Continuous monitoring programs for migratory bird species must be carried out for several years before the wind turbines are built on such areas.

In this work, we discussed the collision effects of wind turbines on birds and bats, based on information obtained from literature and field observations both in Turkey and in several other countries. For example, the wind turbines in four states in the eastern part of the United States have only 0.003% share for bird deaths in the region. Similarly, it was found that only 0.23 individual bats died per year by wind turbines in Brandenburg, Germany. Similarly, the death rates of birds and bats caused by wind turbines are quite low compared to other human factors in Turkey.

The available data indicate that death rates of birds and bats by wind turbines in relation to the other factors (e.g. by clashing up against glass windows of buildings) is quite low. Therefore, public oppositions against wind turbines are not well justified. Considering the ever lasting energy needs of mankind and environmental deterioration due fossil fuels and nuclear energy, establishment of wind turbines as green energy sources must be encouraged in appropriate places accomponied by bird observation programs along with recommended implementations proposed by ornitology reports.

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KEYWORDS: Wind turbines, wind energy, bird migration, monitoring program, bird deaths, bat deaths

1. INTRODUCTION

The energy need of countries is steadily increasing. This need is met mainly by traditional sources of energy, as well as coal, petroleum and natural gases. About 81% of energy used on earth derives from the classic energy sources, namely, fossil fuels energy. Also, everlasting negative effects of nuclear power plants on the environment have not yet been eliminated; nevertheless, 6.2% of energy in the world is met by nuclear energy sources [1]. The increasing trend towards the use of fossil energy sources around the world has also accelerated their negative influences on environment and human health. All of these factors result in various social and economic problems, including climate change on global scale. The energy consumption in Turkey as well as in many other countries of the world is met mostly by the fossil sources. Because Turkey depends on imports for most of its energy requirements and allocates about 72% of its budget for this purpose, and needs to eliminate the negative environmental effects of fossil fuels, the country needs to invest for alternative energy sources. Turkey has a great chance for alternative green energy and, in this respect, has to activate its solar energy and wind energy potentials [2-4]. Also Hötker [5] has suggested that, as already known before, wind turbines have smaller impact on breeding birds than on migrant birds [6-8].

Intensive use of fossil fuels as energy sources has been the major cause of global climate change, and this destroyed the balance of the environment due to resulting CO_2 derivatives [9, 10]. In particular, lives of almost all living things have been distorted and influenced through the negative impacts of fossil energy in the environment and the ecosystems.

In recent years, wind energy appears to be replacing the place of the primary energy sources. According to Moidl et al. [11], about 86 000 MW of wind energy has been produced per year in Europe. A medium-sized wind turbine produces enough energy per year to meet the needs of more than 1250 houses. By the year 2020, the European

Union countries aim to increase the amount of wind energy to meet 20% of their annual energy consumption [12].

This article evaluates the current situation of wind energy in Turkey, Europe and several other countries around the world. Although expansion of wind energy seems to be inevitable, the impact of this energy source on the environment also needs to be investigated. This article covers the relationships between wind turbines and their environments, specifically the effects of wind turbines on birds and bats.

2 THE CURRENT SITUATION OF WIND ENERGY PRODUCTION IN THE WORLD, EUROPE AND TURKEY

The amount of electrical energy from the wind was 40 000 MW in the world, in 2003. Following the announcement of the law on renewable energy in 2004, amount of wind energy has increased considerably within a relatively short time. As one result, amounts of CO_2 emission in the world were reduced by about 32 700 000 tonnes (www.ig-windkraft.at/fakten). In Tables 1 and 2, the highest wind energy producing countries (and few others for comparative purposes) are presented in their wind energy production, in 2011, 2012 and 2013 (end of June).

In 2013, five countries in the world have produced more than 10,000 MW of wind energy. Together, these five countries produced over 215 726 MW of energy which accounts for 73% of all WE in the world. Here, China is the first one with 80 824 MW (26.7%), the United States is the second with 60 009 MW (17.6%), Germany is the third with 32 422 MW (12.0%), Spain is the fourth with 22 907-MW (8.8%), and India is the fifth (19 564 MW, 6.8%) (Table 1).

According to the data from wind farm Atlas TUR-SAT-2012/2 [4], the amount of energy produced by wind turbines in Turkey is 2041.35 MW with additional 452.65 MW under process of construction. It can be said that the amount of current wind energy production was increased by two times in 2010. The amount of electrical energy consumed per year in Turkey is about 43,000 MW. The amount of wind energy represents only 5.8% of the electrical energy consumed in Turkey. The country must strive to raise this amount to at least 10% in a very short time.

On the continental scale, European countries produce 32.5% of the world wind energy production, Asian countries 34.6%, North Americab countries 22.4%, and other countries 8.8 % (Table 2). The European Union countries get only 10% of their energy needs through the wind. It is expected that the share of renewable energies (including wind energy) in the total energy production in the European Union will raise to 20% by 2020. However, propor-

TABLE 1 - The first fifteen wind energy producing countries in the world in 2011, 2012 and 2013 (Status: end of June) and the status of Turkey (from: [13-14]).

Rank	Name of the country	Total capacity in June 2013 (Megawatts) (=MW)	Capacity increase (MW) in the first half of 2013	Total capacity at the end of the 2012 (MW)	Capacity increase (MW) in the first half of 2012	Total Capacity at the end of the year 2011(MW)	Increase in wind energy capacity from the end of 2011 by the end of June, 2013	
							Growth (MW)	Growth Rate %
1	China	80 824	5 500	75 324	5 410	62 364	18 460	22.8
2	USA	60 009	1,6	60 007	2 883	46 919	13 090	21.8
3	Germany	32 422	1 143	31 308	941	29 075	3 347	10.3
4	Spain	22 907	122	22 785	414	21 673	1 411	5,4
5	India	19 564	1243	18 321	1 471	15 880	3684	18.8
6	UK	9610	1331	8228	822	6018	3592	37.4
7	Italy	8415	273	8152	320	6877	1538	18.3
8	France	7821	198	7623	650	6640	1181	15.1
9	Canada	6578	377	6201	246	5265	1 313	20,0
10	Denmark	4578	416	4162	56	3927	651	14.2
11	Portugal	4564	22	4542	19	4379	185	4.1
12	Sweden	4066	526	3743	-	2798	1268	31.2
13	Australia	3059	475	2584	-	2226	833	27.2
14	Brazil	2788	281	2507	118	1429	1359	48.7
15	Japan	2655	41	2614	-	2501	154	5.8
Turkey * 2041.35+452,6[1]= 2494**				712.35*		1329	712.35*	65.1
Other Countries		26 204	2030	24 174	3026	18 778	7 426	28.3
TOTAL		296 255	13 980	282 275	16 376	237 717	58 538	19.8
End of 2011-		199 739	Increase	Increase %				
End of 2013		318 000	118 261	37,2				

*: Turkey Wind Farm Atlas TURSAT_2012\2 (Turkish Wind Energy Atlas_2012\as of July 2, 2012; * *) as of the end of June 2013 after construction, WEC production Megawatt (MW)

TABLE 2 - World wind energy (WE) production on continental bases in June (Sources: [14, 15].

Countries By Continents	Wind Energy (WE) Production In MW			WE Production	
	2010-2012	From 2012 to the End of June in 2013	% Increase	From 2010 to the End of June 2013	% Increase
European Countries	86.075	96 877	32,5	10 802	11.2
Asian Countries	58.641	103 043	34,6	16 968	16.5
The Countries of North America	44.189	66 587	22,4	22 398	33.6
Other Countries	21 023	26 204	8,8	5 181	19.8
TOTAL		292 711			

tion of fossil fuels energy (coal, natural gas and oil) in the total energy consumption in the Union is still more that 70%. It means that it will take much longer time to replace fossil fuel energy by renewable energy sources. Therefore, it appears necessary that each country in the Union should take initiatives to take necessary steps on this important issue.

In its 2012 report WWEA indicated that wind energy production in Europe will double in the next five years. [16], at Global Wind Energy Council on the European wind energy Conference and exhibition in Copenhagen, noted that worldwide wind energy production in 2011 increased 40 500 MW (which amounts to 20% increase), and this increases is expected to be even more in the year 2012. Here the leading country is China. Despite the fact that Europe is a leading continent with 96 600 MW, China alone is approaching to Europe with 82 000 MW. About 80 countries in the world, 20 of which with wind energy center (WEC) capacity of more than 1000 MW, have been producing and using wind energy. Especially, nuclear power plant accident in Fukushima in 2011 has been an influential factor to avoid nuclear energy and, at the same time, to urge the development of renewable energy sources. The tsunami and earthquake completely immobilized few of the 55 nuclear reactors in Japan. However, all of the 190 WEC started to fully operate within short time following the earthquake disaster. Similarly, a wind turbine, which is 300 km away from the center of earthquake and hit by five-meter-high tsunami waves, started to operate again only three hours after the tsunami hits. Fossil energy sources have multidimensional negative impacts on the environment. In addition, their prices are steadily increasing and creating various economic crisis. All these are the indicators why alternative energy sources should be sought and encouraged.

The argument that the fossil energy is cheaper than renewable energy is a wrong statement when considered in wide time and space perspectives. For example, each person in Europe, on the average, spends about 700 euros every day for the fossil energy [17].

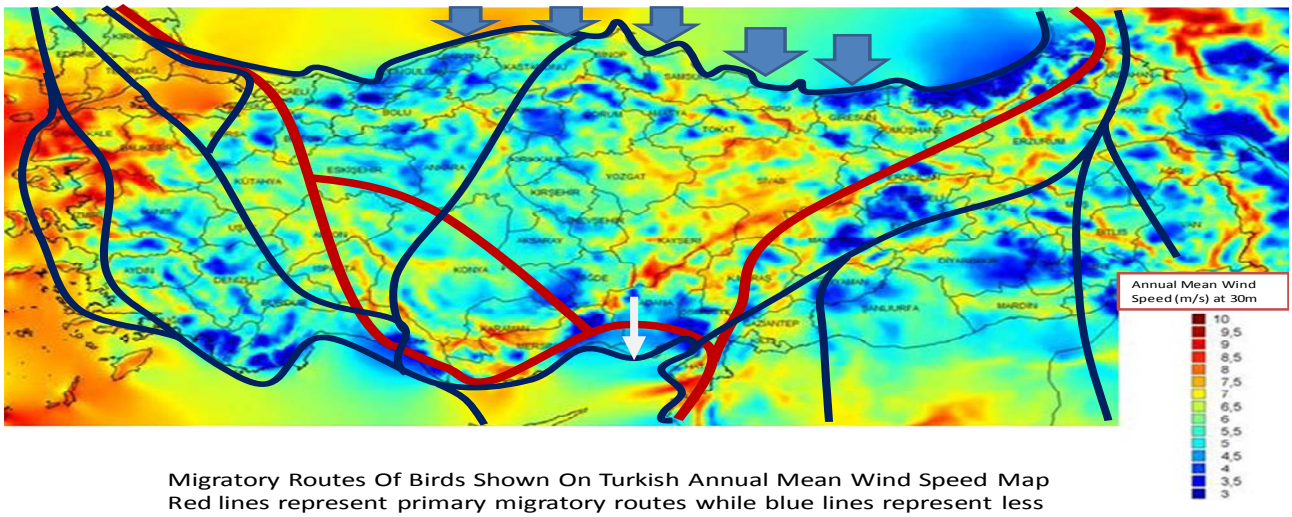
Germany plays a leading role in Europe in using the wind energy. Currently, there are twenty-five thousand wind energy turbines in Germany, and these turbines are producing more electrical energy than the electrical energy produced by 30 nuclear reactors [18]. Therefore, replacing new technological applications instead of the old technology for wind energy turbines are on the agenda [18]. The same argument is supported by "http:\\ www. Wind-Energie.de-Portal". Indeed, numbers of WECs using the old technology established since 2002 have been decreasing each year. This is attributed to low capacities of old technologies of wind turbines. For this reason, developments of new technologies on wind turbines have been in process in Gemany. Therefore, establishment of wind turbines with old technology is not recommended in Turkey. In particular the low capacity 2.5 and 3.5 MW wind energy should not be used (see for example: http://www. enercon.de/ de-de/2-3mw.htm).

3. BIRD MIGRATION PERIODS AND MIGRATION ROUTES IN TURKEY

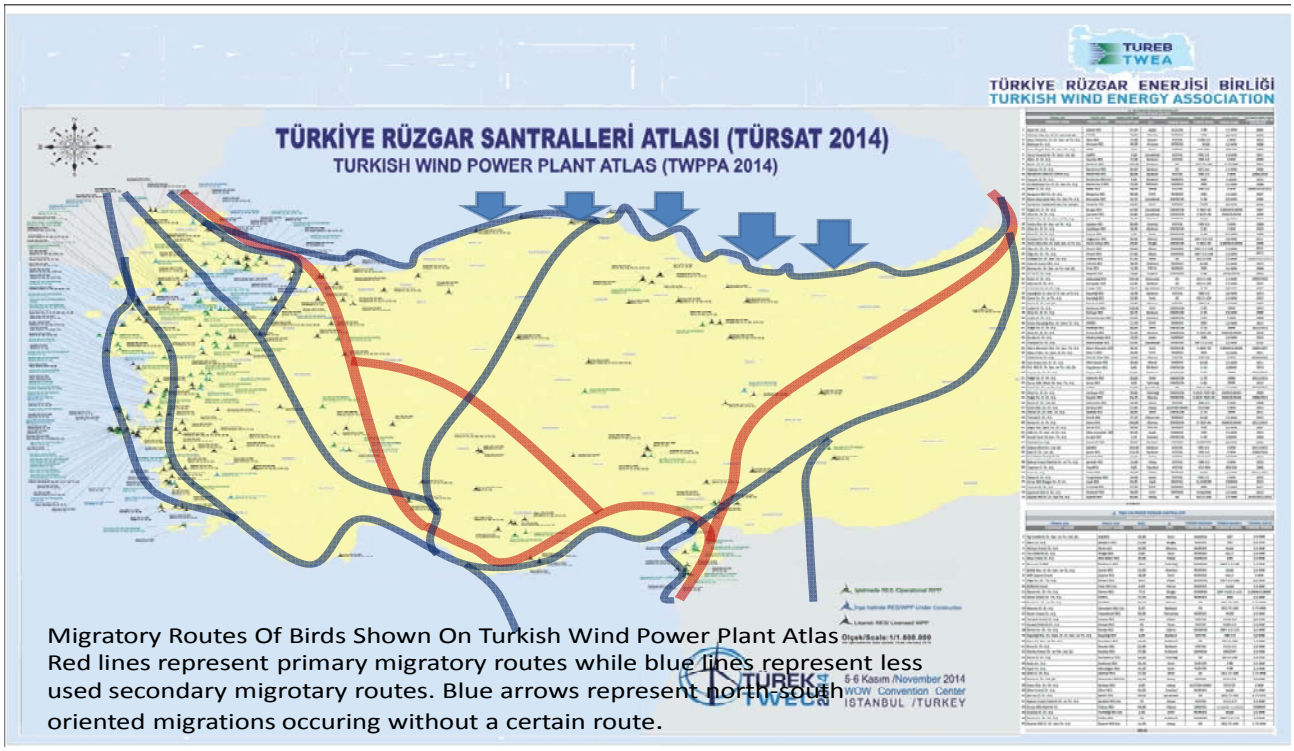
Common migration routes of birds proceed north to south (or vice versa), depending on season, either in spring or late summer [3, 19-22]. Spring migration season over Turkey starts in March and lasts until the end of May. Autumn migration starts at the end of August and continues until the end of October. One of the most important migration routes in Turkey comes from Europe and goes through Bosphorus strait in the western part of the country. The other equally important route comes from Caucasia and goes over Artvin Province in the eastern part. Both of these routes are used mainly by storks and some predatory birds. The third route, which is of great importance mainly for cranes and common quail, comes over Black Sea and crosses the Anatolian peninsula [19-22] (Map 1 a and b).

Monitoring programs need to be established and continued in areas with high wind intensities where WECs are already present and/or to be established (for examples, areas such as Kapıdağ peninsula, Iskenderun, Izmir, Adana and Belen, Map 1 a and b). In Map 1b, the localities of WEC and the most important routes of migratory birds are specified. An important route for migratory birds (especially of storks, Eurasian buzzard, black kite, short-toed snake eagle, European honey buzzard, greater spotted eagle, lesser spotted eagle and white pelicans) is located in the north of Istanbul. After 2-year monitoring of a wind turbine in the area, only a few dead seagulls were found, but no dead storks nor birds of prey were observed.That does not mean that in the course of time, no collision of birds of prey to WEC with twelve turbines in Arnavutköy at Istanbul will occur.

The height of wind energy facilities, especially in areas on migration routes for migratory birds, can present some disadvantages. They act as obstacles in the sky for free movement of birds. Therefore, wing rotors reaching heights of 80-100 m (modern wind turbines can reach up to 200 m) should be questioned. They may or may not be harmful to the bird's navigation, depending on whether they are on migration routes or not. Maps 1a and 1 b show the overlapping between the flyway of migratory birds and the distribution of wind turbines. For example, in recent years, RES tribunes were built in Kapıdağ peninsula, which is used by white pelicans as migration route. Monitorings have just been started in these localities. Therefore, relevant results have not yet published. Here,



Migratory Routes Of Birds Shown On Turkish Annual Mean Wind Speed Map
Red lines represent primary migratory routes while blue lines represent less used secondary migrotary routes. Blue arrows represent north-south oriented migrations occuring without a certain route.



Migratory Routes Of Birds Shown On Turkish Wind Power Plant Atlas
Red lines represent primary migratory routes while blue lines represent less used secondary migrotary routes. Blue arrows represent north-south oriented migrations occuring without a certain route.

MAP 1 - a) Migratory routes of birds shown b) on Turkish annual mean wind speed map (red lines represent primary migratory routes while blue lines represent less used secondary migrotary routes. Blue arrows represent north-south oriented migrations occuring without a certain route. White arrow is representing Belen Pass).

the altitude of migration route is very important in that radar records cannot be used for low-flying birds. Therefore, radar data sets for the low flying birds are questioned whether they could be suitable [23].

Dürr (2013-2014) [43] has given a number of deaths of birds and bats by years as reported by various sources in several European countries and several states in Germany. Such results are not present for Turkey, mainly because there are no sufficient and reliable monitorings and records on such deaths. This study evaluates the general information available so far.

The flying altitude of birds is very variable. In general, small birds fly close to the ground level [24]. Flight altitude could be quite high for large bird species. Birds migrating at night can achieve greater height than birds flying at day time [24]. Bird species flying by wing flapping prefer to fly at lower altitudes than the birds flying through the help of air drafts. Birds flying against wind direction also prefer to fly at lower altitudes. Bird species that prefer wind direction coming behind during migration can achieve 400, 700, 900 m above ground level. It was stated that this level is achieved especially during the autumn migration [25-26] (s. Map 1 a and 1 b).

4. DEATHS OF BIRDS AND BATS BY WIND ENERGY TURBINES

During a monitoring of a wind-turbine-farm on Belen Pass by Hatay [27] (Map 1a), flight altitudes of the following bird species were determined: white stork, lesser spotted eagle, greater spotted eagle, crane, short-toed snake-eagle, western marsh harrier, Eurasien hobby, Eurasian sparrowhawk, European honey buzzard, northern harrier, common buzzard, long-legged buzzard, common kestrel and European beeeater. It was noted that common kestrel, Eurasian sparrowhawk, however, flew above the height of the turbine more than the smaller bird species, over 300 NN or 500 m of sea level. This means that wind turbines have negative impacts on the life of few small bird species.

It appears that wind energy expansion seems to be inevitable; therefore, the potential impacts of these facilities on bird species should be investigated before constructions. In this context, the primary concern focuses on the relationship between WEC and birds and bats [28, 29]. In addition, bird species show intra-species variation in their behavioural patterns. For this reason, the respective species of migratory birds, especially on the optimal migrational zones, need to be monitored. To prevent the negative effects of wind turbines on the environment, various investments have been made in different countries. In spite of this, the prevailing public opinion and concerns are that wind energy power plants cause deaths of larger birds and bats.

4.1 The Dilemma of Bird Deaths and Wind Power Plants

Isselbächer [30] pointed out that the wind turbines have minimal negative impact on native birds. It is because birds are able to assess the technical structures not as a threat or danger. In particular, they can see wind turbines as not being a problem in the region and in the thickets of semi-open areas [6]. Because birds have their own internal biological clock, they can easily adapt to new conditions and then exhibit almost natural behavior [3, 8, 31-33]. In Denmark [34] and Germany [35], it has been found, according to the radar measurements, that birds change their flight direction before reaching 100 to 200 m close to the rotor of a WEC, and can thus avoide any probable damage. The birds can adapt to the regions where WEC power plants are installed, in the course of time. However, such cases need to be further clarified in further works and continued monitoring of the respective areas.

According to (http://www.wind-energie.de/en/topics/protection-of-birds) portal, Arctic geese used to reach altitudes of 500-1000 m, but now they fly about 30-100 m above ground level around the cities. This is especially common when organisms do not change their body temperature according to the ambient conditions (homoiothermal) [33]. Even it is known that some species of migratory birds are able to prefer a new route with new conditions instead of going through a distorted geographic area.

4.2 Death Impact on Birds

The numbers of deaths of birds by WEC are not greater than with other human activities. In this context, one of the most extreme examples is as follows: in Sweden, 43 bird died in one night on a WEC, which was under illumination but not in operation [36]. Similaly, the number of bird deaths by various human-related factors in the United States exceeds millions, or even billions. In four States in the eastern part of the USA, the proportion of bird deaths by WEC accounts only for 0.003% of all bird deaths in the region [37]. A study by [38] has shown that, through the various means, 20 million birds are killed each year. Such deaths were mostly due to glass constructions on buildings in residential, high voltage lines, communication lines and traffic. In other words, the deaths of the birds by the WEC rotors is much lower than the deaths by various other human factors. According to a study by [39], each year, 60 to 80 million individual birds die by vehicles in traffic, 98 to 980 million by clashes against the glasses on buildings, and 4 to 50 millions by communication lines. On the other hand, in the same study, it was highlighted that the number of birds killed by WEC is only 10-40 thousand in a year. As it is seen, the bird deaths from wind turbines compared to the other sectors are rather small. It was also found that the numbers of birds and bats killed by WEC in Turkey is much lower than the deaths by other sectors; for example, through the traffic [40]. For these reasons, the number of birds and bats killed by WEC alone must not prevent the development of this alternative energy source. Also, it is assumed that the number of bird deaths from clash against glass windows of buildings is much larger in Turkey than deaths due to WECS. Therefore, it is suggested that bird pictures must be glued on the glasses so that the birds avoid clashing against the glass windows and walls of particu-

larly tall official buildings. If it is assumed that one bird dies by hitting windows of every single house, it can be estimated that the number of birds dying in Germany becomes enormous [41]. It was found out by Hötker et al. [42] that between 1989 and 2004, 269 individual birds were killed by WEC. Among them, red kite with 41 and buzzard with 27 individuals reached the highest numbers.

It was also found that the number of birds killed by the WEC plants, near a village (Fehmarn, Germany), representing an important bird migration route between Scandinavia and Central Europe, was only 13 individuals [44]. This number was much lower than the results obtained from WEC farms located in the western part of Schleswig-Holstein and in Netherlands [45-47]. Birds dying by WEC in Fehmarn compared to traffic was quite low. The results of the studies cited above indicate that bird deaths due to WEC installations is much lower than the bird deaths caused by other human activities. If one makes a comparison between the mortality rate of birds and bats by traffic and by WEC installations in Turkey, it could easly be stated that WEC installation is almost innocent [40].

4.3 The Bat Deaths by Wind Energy Centers

Glasner [26] indicates the number of bats killed per year in a wind farm is 0.23 individual in Brandenburg in Germany. It was reported that three individuals of serotine bat (*Eptesicus serotinus)* died in a year in North Rhine-Westphalia in Germany, and the number of deaths of noctule (*Nyctalus noctula*) was larger [48]. The important reason for low bat deaths was that bats in the air will not move when the rotors operate at high speeds [49]. Also in August and September wind speed is quite low (5.5 m/sec) and the rotors are closed down at this period. However, there is a possibility that bats die when the rotors exert a pressure on them as it was observed in Canada [50]. It can well happen in other countries, too. Indeed, hundreds of dead bats were observed on a WEC

TABLE 3 - Bird deaths caused by the WEC (SVLU, GV, Brandenburg, 7th October 2013, Dürr) (http://www.mugv.brandenburg.de/cms/detail.php/bb2.c.451792.de) [43].

Species/Countries	(B)	(G)	(S)	(F)	(UK)	(Nl)	(N)	(P)	(Sw)	TOTAL	
Bubulcus ibis			96					4		100	
Anas platyrhynchos	48	76	36	2		7	2	1		185	
Gyps fulvus			1877							1882	
H.albicilla		87				1	39		24	157	
Milvus milvus		213	13	4	3				12	246	
M.migrans		22	66	13						101	
Buteo buteo		245	21	2				3	3	281	
Falco tinnunculus	5	55	220	14		4		20		321	
L.arus ridibundus	328	72	2	33	9	29				474	
L. argentatus	787	45	1		36	8			2	889	
L.fuscus	200	5	4		1	1				211	
Sterna hirundo	154	1								155	
Apus apus	2	75	73	20		1		5	3	181	
Alauda arvensis		72	89	19		2		22		219	
Delichon urbica		23	37	1		1		40	6	134	
Emberiza calandra		28	162	2				20		212	
Sturnus vulgaris	26	60	2	8				2		115	
Countries Total (Europa union)	59	539	878	122	14	46	16	141	68	p	2004
	1698	1305	3020	121	119	102	110	59	62	np	6671
	1757	1844	3892	243	133	148	126	200	130	8675	

(B) Belgium; (G) Germany; (S) Spain; (F) France; (UK) United Kingdom; NL) Netherlands; (N) Norway; (P) Portugal; (Sw) Sweden; p= Passers; np=Nonpassers.

TABLE 4 - Types of bat species died due to WEC in various countries ([43] (Dürr, 2013).

Countries / Species	B	G	S	F	UK	NL	P	Sw	TOTAL
Nyctalus noctula		689	1	12	10		1	1	746
N. leislerii		99	19	39	58		152		371
Eptesicus isabellinus			117				1		118
Pipistrellus pipistrellus		409	211	226	24	14	200	1	10195
P. pygmaeus		503		76	34		24	1	144
TOTAL	6	1982	1219	743	199	22	689	11	5024

(B) Belgium; (G) Germany; (S) Spain; (F) France; (UK) United Kingdom; (NL) Netherlands, (P) Portugal; (Sw) Sweden

farm near Brandenburg, Germany. It was soon understood that the deaths were not due to physical harm to the bats, but rather due to pressure on bats while they were resting under standstill rotors [43] (Table 4).

5. CONCLUSIONS AND RECOMMENDATIONS

In the USA, it is considered that wind turbines can be deadly for birds and bats, and the focus has been on how to prevent such deaths. This will take 1- to 1-year periods of monitoring on seven thousand wind turbines and over one thousand observations [51].

Observations indicated that birds of prey species are the most affected by deaths through the clash with rotor blades. Through observations and scientific studies, it has been established that maximum 0.5 bird per turbine is under threat in Germany [52-54]. However, certain bird species, such as common quail, corncrake, common buzzard, long-legged buzzard, Eurasian sparrowhawk, short-toed snake-eagle, red kite, crane, and various duck species are affected by wind energy rotor blades. Therefore, it appears necessary to monitor and study how bird species breeding in the close vicinity of WEC installations are affected. Such monitoring studies around WEC installations should also continue on non-migratory birds as well as migatory birds both during the summer, spring and autumn periods. The location of WEC installations must be inspected and monitored by ornithologists, at least for 1- to 2-year periods before the WEC establishments and during the WEC operations [3, 27, 55-57].

The candidate zones where WEC facilities to be established need to be investigated in terms of predatory and, especially, in terms of migratory birds. On this context, especially predatory bird species in danger of extinction should be given special consideration in monitoring programs. When the results of such studies become apparent, people will be able to better understand that WEC installations are not as harmful to bird populations as it has been thought. As the establishment of WEC plants extended, it is expected that harming affects of fossil fuels energy and nuclear energy on our environment would decline rapidly.

Energy resources other than coal reserves in Turkey are rather limited. Turkey has to meet about 72% of its energy needs through paying foreign exchange money. At present, annual energy consumption in Turkey is about 43 000MW. By 2023, it is expected that this amount will double. To meet the growing needs, Turkey has to make investments for alternative energy sources. As seen in Table 1, the amount of wind energy production in Turkey has reached 1329 MW in recent years. On the other hand, potential wind energy sources in Turkey are estimated to be about 40 times higher, i.e. around 40 000 to 50 000 MW. Another advantage of Turkey in terms of energy system is that the country has been surrounded by seas, and efficient WECs can also be established in offshore areas.

Several studies by ornithologists showed that bird species exhibit certain intraspecific variation in their behvioural patterns, which may results in changes of their interaction with WEC areas. It appears that WEC areas should be studied and monitored due to ornithological reasons for the period of at least 2 years before and after the WEC establishments [3, 27, 55-57]. Although the available data strongly indicate that bird deaths caused by wind turbines are almost negligible compared to deaths caused by other human activities, it is still necessary to obtain new data by continual monitoring and additional studies.

Dürr [43] has presented various data (see Tables 3 and 4) and evaluated them in his study. When some bird species, such as storks, pelicans, red kites, sea eagles, buzzards and bee-eaters, are considered in Bosphourus and Belen Pass in Turkey, similar evaluations as by Dürr [43] seem to be not possible at this stage, because there are not enough data based on monitoring and field observations. As such data become available, we will be able to make more reliable assessments whether or not the WECs have negative, positive, or neutral impact on the birds.

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