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Harnessing Solar Potential for Sustainable Development of Karachi-Pakistan through Geo-Spatial Assessment

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ABSTRACT

Pakistan has the potential to produce renewable energy, which is critically needed in areas such as Korangi, a district in Karachi, Pakistan, that faces major challenges, such as rapid urbanization and pollution. In this study, Google Earth Pro was used to analyze solar panels' location using historical data from 2017. It was found that there are fewer solar panels in the industrial belt of Korangi. Korangi is situated in the southern part of the country, approximately 24.8 degrees north of the equator at latitude, which is relatively close to the equator, contributing to the high level of solar radiation and warm climate. Thus, this area is considered favorable for solar panels or energy production and 95 sampling locations were selected for the pollution assessment. Of these, 52 were those sites where solar panels are installed, and the remaining were at residential and commercial locations. Compared to 2017, the variables assessed in the existing research's pollutants are higher in the non-industrial zone (residential and commercial localities) for 2023. Air Quality Hazard zones are also found along the areas of conventional power generating plants. This study concludes with recommendations for city planners, policymakers, and energy professionals to frame appropriate strategies for Korangi-Karachi; which has implications for other regions in the country with potential for solar energy.

Keywords: Solar panel, Renewable energy, Green energy, Sustainability, GIS, Environmental pollution.

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INTRODUCTION

Pakistan has the potential to produce renewable energy. According to the World Bank, Pakistan's current electricity demand would be met using just 0.071 percent of solar photovoltaic (solar PV) power generation (World Bank, 2020). On average, Pakistan receives approximately 1000 watts per square meter (W/m^2) of solar energy for about 6 to 7 hours daily (Ulfat et al., 2012). The annual solar irradiance varies in different cities, some areas receive up to 4,459.15 kWh/m^2 annually, while others may receive as little as 7.65 kWh/m^2 (Adnan et al., 2012). The reliance on thermal sources, specifically oil and natural gas, poses numerous financial and environmental challenges for the country. Despite this, Pakistan utilizes oil, natural gas, and coal as fuel sources, and is largely based on thermal power plants to generate electricity. Thermal power, as of January 2024, accounts for around 62% of the total installed production capacity, transforming to about 28,811 MW out of a total capacity of 46,035 MW (Global Data, 2023). Radiation can also vary by geographical location, for instance, Islamabad, Karachi, and Lahore have been monitored for solar energy potential. Empirical models developed to estimate solar radiation on the behavior of local climate conditions reveal that Pakistan has various solar energy environments (Aggarwal, 2021).

Pakistan could generate over 2.9 million MW (megawatt) of solar energy. Despite having great potential in producing renewable energy using solar power, Pakistan has yet to fully tap this resource, contending with severe energy shortages, depending mainly on non-renewable sources. The energy shortage is projected to reach 50,000 MW by 2022, requiring urgent incorporation of renewable sources like solar power into the national grid (Latif et al., 2018). A boom in industrial activities in this area has been seen, with around 4,500 industrial units operating in the Korangi industrial area alone (Khalid et al., 2017). Korangi experiences high concentrations of particulate matter (PM10 and PM2.5), sulfur dioxide (SO2), nitrogen oxides (NOx), and carbon monoxide (CO). These pollutants go beyond the levels set by the Sindh Environmental Protection Agency (SEPA) (Idress et al., 2023).

The Korangi power plant, particularly the Korangi combined cycle power plant, contributes to pollution, due to its reliance on fossil fuels for electricity generation. Korangi as a gas-fired power plant which emits pollutants such as sulfur dioxide (SO2) and nitrogen oxides (NOx), and are known to create environmental problems. While the production of solar panels involves energy-intensive materials and hazardous chemicals, the overall environmental impact is mitigated by the fact that solar energy systems can generate clean energy for up to 30 years, offsetting the initial energy and resource inputs within 1 to 4 years. Thus, regardless of the environmental costs associated with manufacturing and disposal, solar power remains a more sustainable and less polluting option compared to conventional electric power plants (U.S. Energy Information Administration, 2024). Karachi's air is highly contaminated with a high value of Air Quality Index (Kausar et al., 2024). Korangi district in Karachi is the most affected area, mainly due to the concentration of $PM^{2.5}$. The Sindh government has announced plans to provide solar systems to 200,000 households across the province, including 50,000 homes in Karachi. Access to low-cost loans and financial incentives can facilitate solar adoption (Haq et al., 2020).

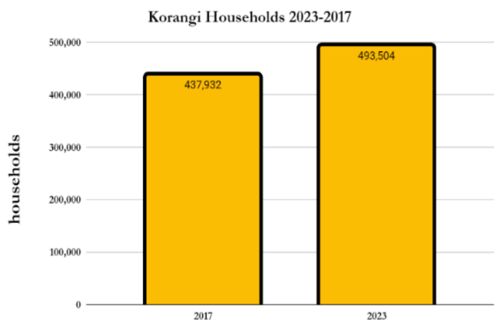
Research Problem

An increased susceptibility of the country's dependence on energy imports puts upward pressure on electricity prices for consumers and enhances exposure to global commodity price volatilities (Voluntary National Review, 2019). Pakistan has been facing a shortage of between 3000 MW and 6000 MW within the supply and generation, subsequent in many hours of load-shedding. With Karachi facing frequent power outages and reliance on fossil fuels, scholars argue that the transition to renewable energy has the potential to reduce carbon emissions and improve energy security (Kalhoro et al., 2019). However, some barriers include poor rooftop utilization for solar panels, limited access to real-time solar radiation data, and encounters posed by urban density and planning (Kabir et al. 2018). Existing studies underline the critical role of leveraging Geographic Information System (GIS) tools and satellite data to provide actionable visions for urban planners and other stakeholders to advance solar adoption in Karachi (Shahid et al., 2019).

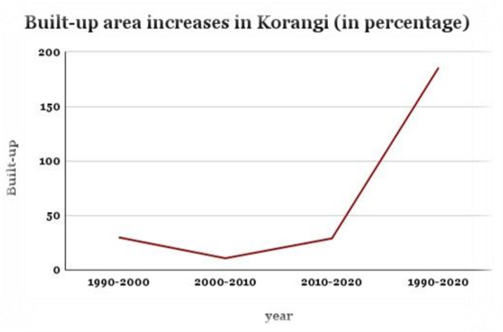
Korangi district is the largest industrial region in Karachi, Pakistan, and faces major environmental challenges, such as rapid urbanization and pollution (NASA Earth Observatory, 2013). The district has a mixed development of industrial, commercial, and residential zones. The area's growth has led to pressure on local infrastructure and natural resources, causing environmental degradation. The number of households in Korangi increased from 437,932 in 2017 to 493,504 in 2023 Figure 1 (a). Both urbanization and industrial growth increased rapidly in the region, with Figure 1 (b) depicting the population growth from 1990 to 2020. We can see that population growth increased very fast from 2010 onwards creating immense pressure for more energy.

Figure 1

Study Area: Korangi-Karachi- a) Household 2017-2022 b) Built-up area in Korangi, Karachi



a)



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Objectives

The objectives of this study included: 1. To mark the installed solar panels on high-resolution images for the years 2017 and 2023; 2. To collect Ground Control Points (GCPs) of reading collection spots (sample collection points) around the installed solar panels area and assess the solar potential study area; 3. To estimate pollution level (VOCs, NO_2, CH_4 and SO_2) within the range of electric power plant; 4. To analyze the pollution levels in industrial and non-industrial sectors for the years 2017 and 2023; and 5. To assess solar potential in Korangi.

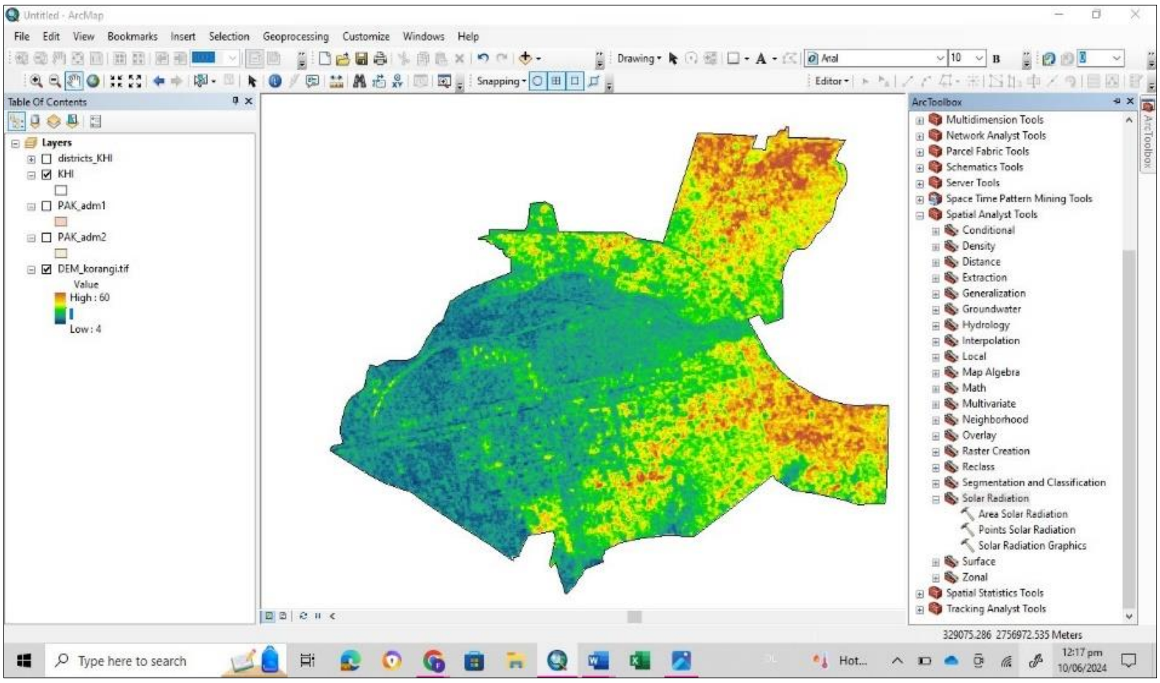
MATERIAL AND METHODS

Google Earth Pro

By using Google Earth Pro (Kausar et al., 2022), solar panels' location in industries has been identified for the years 2017 and 2023. In addition, Objects Based Identification (OBI) have been conducted (Kausar et al., 2023a; Kausar et al., 2024; Taylor & Lovell, 2012).

Figure 2

*ArcMa**p**- Area Solar Radiation Tool is used in the Arc toolbox*



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ArcMap 10.8 has been used for further analyses i.e., calculation of solar radiation, for this, the area solar radiation tool has been used that is present in the Arc toolbox, to set the analysis parameters into the geographical location and configure the setting of atmospheric effects (Figure 2). Finally, the tool was used to generate solar radiation maps by adding DEM data (year 2014). Therefore, a digital elevation model has been executed to get the final product.

Pollution Data

The pollution data was acquired and assessed through solar panel identification. Several parameters i.e., CO_2, CO, PM^{10} $PM^{2.5}$, VOCs, SO_2, and NO_2 were monitored through different instruments (Table 1).

Table 1

Parameters and Instruments

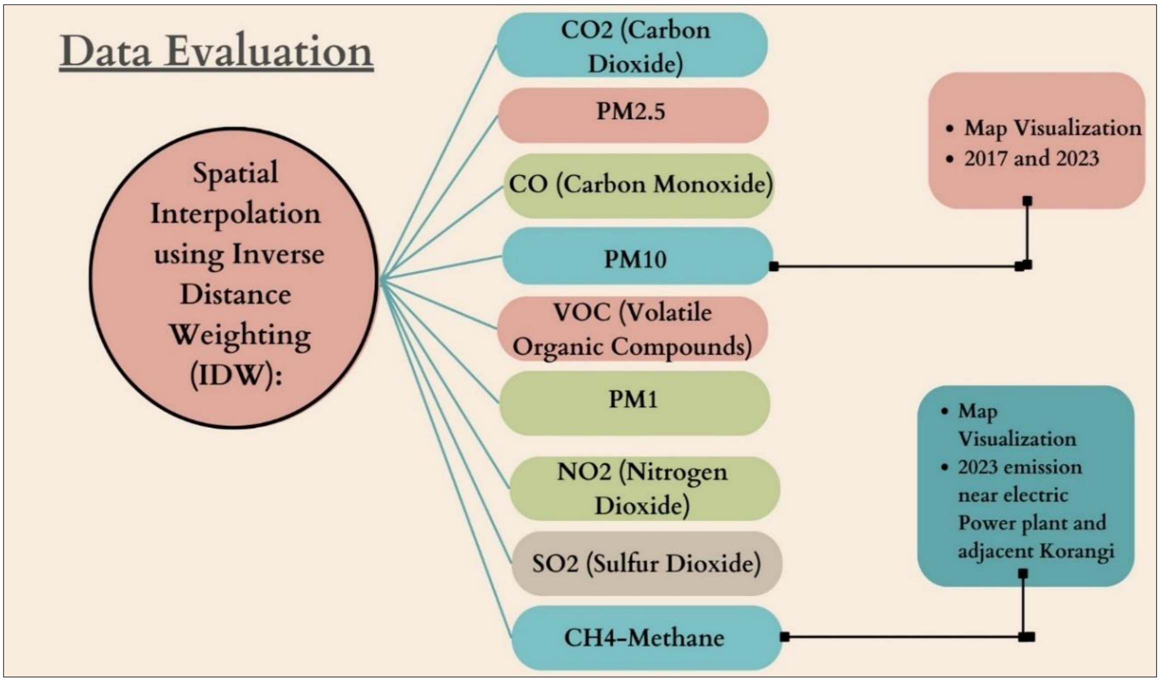
Particulate Matter	Instruments
CO2	UNI T UT338C air quality meter
	Air Quality Detector Model JSM-131 SC,
Volatile organic compounds (TVOC)	Voltage SV, Standard JJF10591-2012, JJG 1022-2016
SO2	Air quality, Forensics Detector
PM 2.5	Air Quality Humidity Detector to record fine particulate matter

GIS Analyses (Interpolation)

The data was collected from 95 sites, of which 54 are solar panel sites and the remaining 41 are commercial and residential sites. The distribution allowed us to observe and compare the levels of pollution in areas with solar panels versus typical residential and commercial areas. The Inverse Distance Weighting (IDW) interpolation method was selected. IDW method is considered efficient in assessing values at unsampled locations based on nearby measurements. It aligns with our data's spatial characteristics and validation outcomes (Kausar et al., 2022). Surfaces are generated through the IDW method by using ArcGIS for air quality data. IDW will help to analyze data and for the identification of hotspots of pollutants i.e.CO2, CO, $PM^{2.5,}$ and PM^{10}. IDW surfaces have also been generated for VOCs, NO2, SO_2, and CH4 pollutants at the power plants (Figure 3).

Figure 3

The data evaluation framework of the study area



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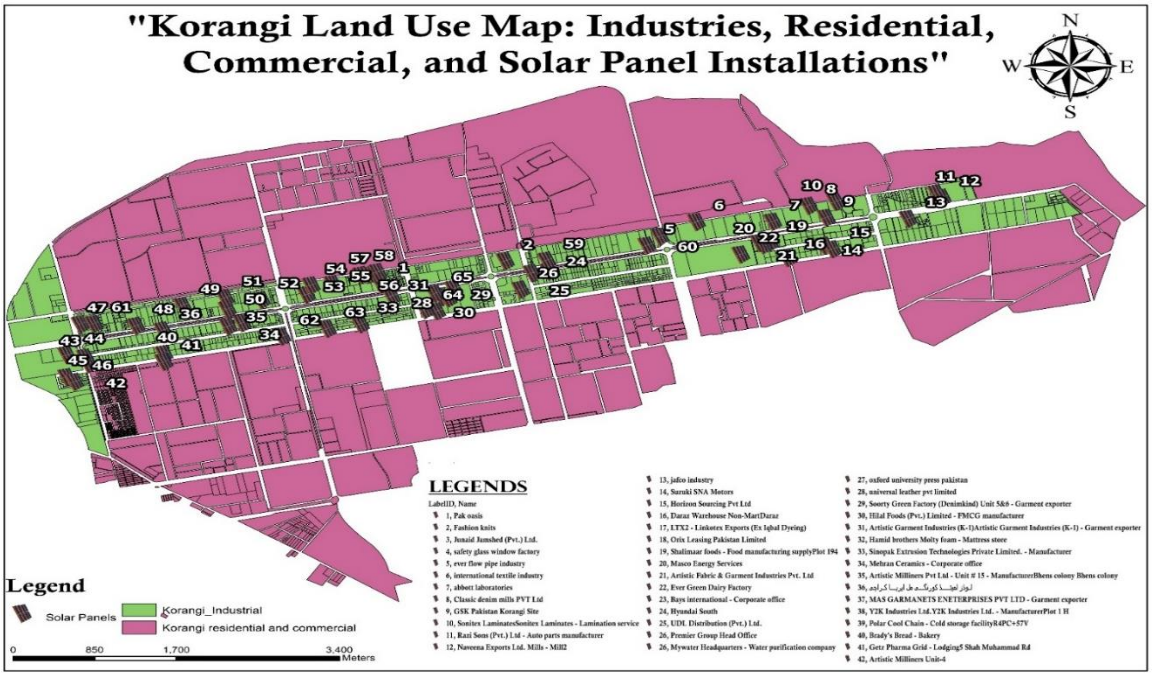
RESULTS AND DISCUSSIONS

There are 54 industries in which solar panels have been installed. The locations of solar panels that have been found through satellite imagery, in 2023, have been captured in Figure 4.

Figure 4

Solar panel integration in the industrial sector 2023



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Comparative Satellite Image Analysis for 2017 and 2023- Assessing Solar Panel Integration

Through the detailed Google Earth Pro observation, we can see that there is limited occurrence in both residential and non-industrial sectors in 2017 of solar panels in the Korangi area. Comparatibely, by 2023 there is integration of solar panels, which are more prevalent in industrial areas compared to residential areas (Figure 5(a) and 5(b)).

Figure 5 (a)

A Comparative Satellite Image Analysis for 2017 and 2023 of Sunbeam Engineers (Pvt) Ltd industry of Korangi, Karachi.

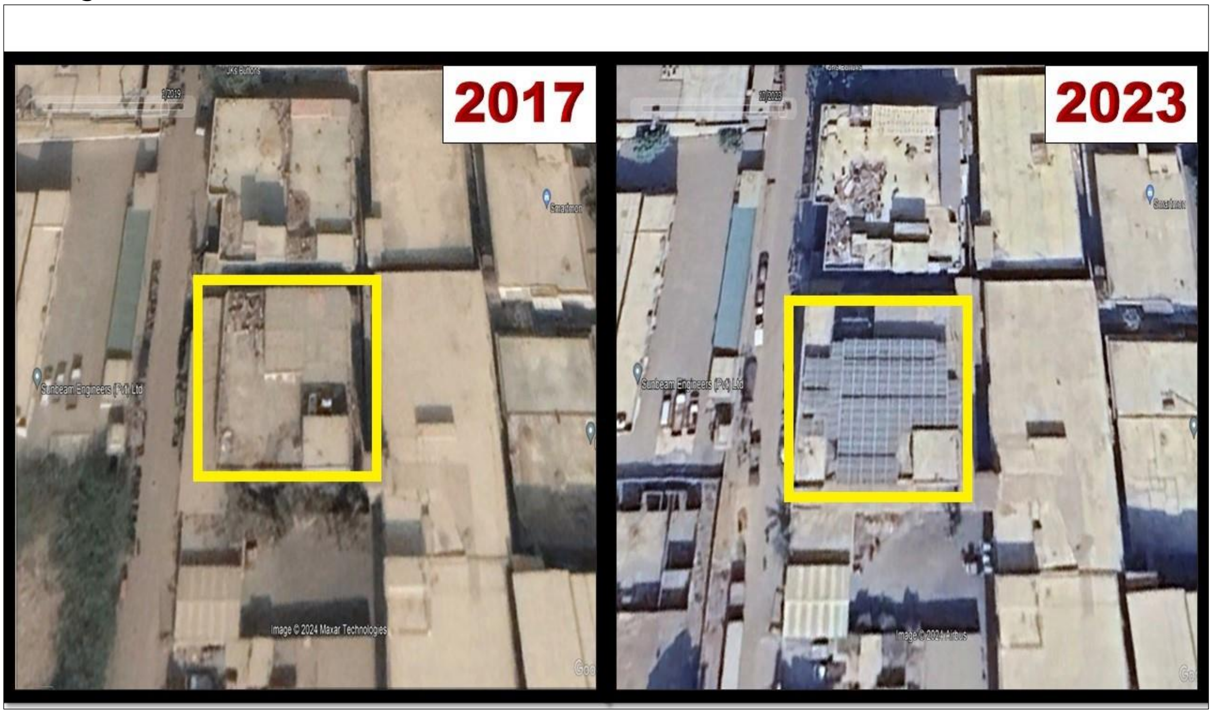

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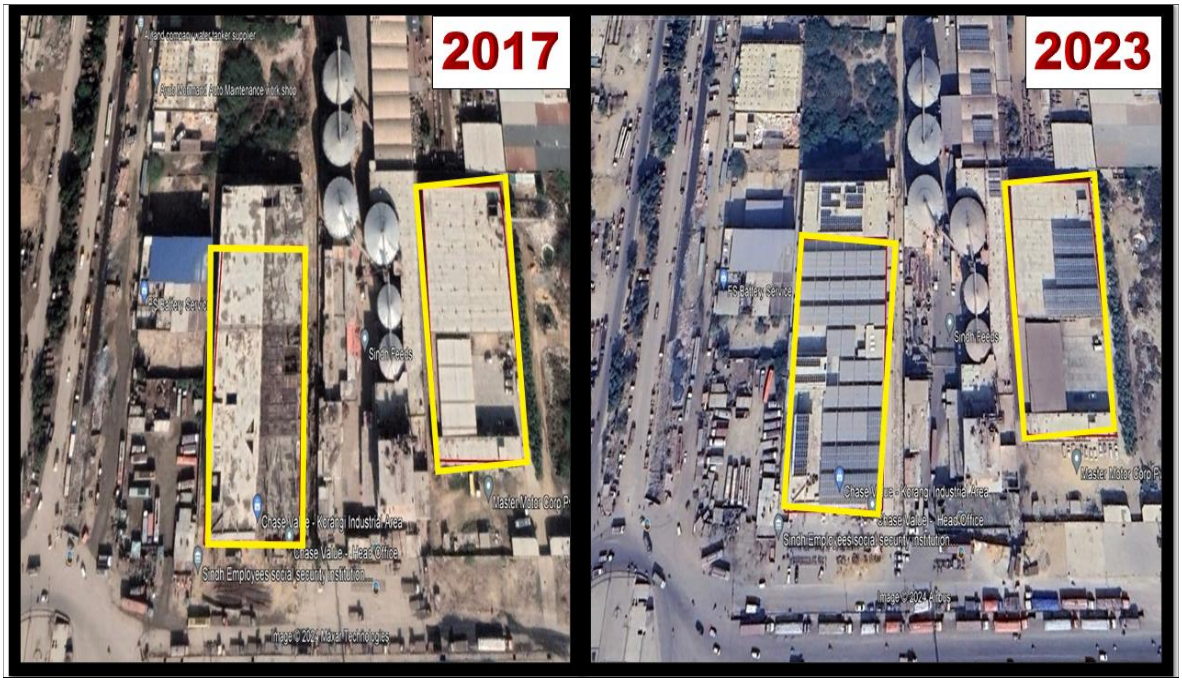
Figure 5 (b)

A Comparative Satellite Image Analysis for 2017 and 2023 of Chase value of Korangi Industrial Area, Karachi.



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Assessment of Solar Radiation Potential by Using Remote Sensing

In Korangi, the topographical variation is revealed through DEM data (Figure 6) with elevation ranging from 4 meters to 60 meters above sea level. The difference highlights (56 meters) the area's diverse landscape that influences local hydrological patterns and urban infrastructure (Figure 7). In Figure 7 the radiation shows within a day in WH/m². Generally, average daily solar radiation values in the world ranges between 4000 to 7000 WH/m²/day or 4 to 7 W/m² (National Renewable Energy Laboratory, 2024). Karachi has potential maximum solar radiation levels of 7,330 WH/m², and that thus the city has immense potential for solar generation (Tutiempo Network, 2024). Korangi is situated in the southern part of the country, approximately 24.8 degrees north of the equator at latitude. That is relatively close to the equator, contributing to the high level of solar radiation and warm climate. The major product of this area is 5000-7000 WH/m²/day, it is considered a favorable radiation for solar panels or energy production (Figure 7).

Significant variation has been quantified by zonal analysis through ArcMap in daily solar radiation values across different UCs in Korangi, Karachi. The highest recorded radiation is 15,568 WH/m², while the mean values range from 4,466 WH/m² in Morio Khan Goth to 5,467 WH/m² in Zaman Town. The (STD) values implying the alterability in daily solar radiation, range from 1,981 in Burmee Colony to 2,569 in Muslimabad. Other UCs such as Zaman Town, Awami Colony, Sherabad Colony, and Korangi 33 also portray comparatively high solar radiation values, with means around 5,400 WH/m². Most of the UCs in Korangi receive substantial solar radiation, with means generally around 5,000 WH/m²/day.

Figure 6

DEM Korangi-Karachi

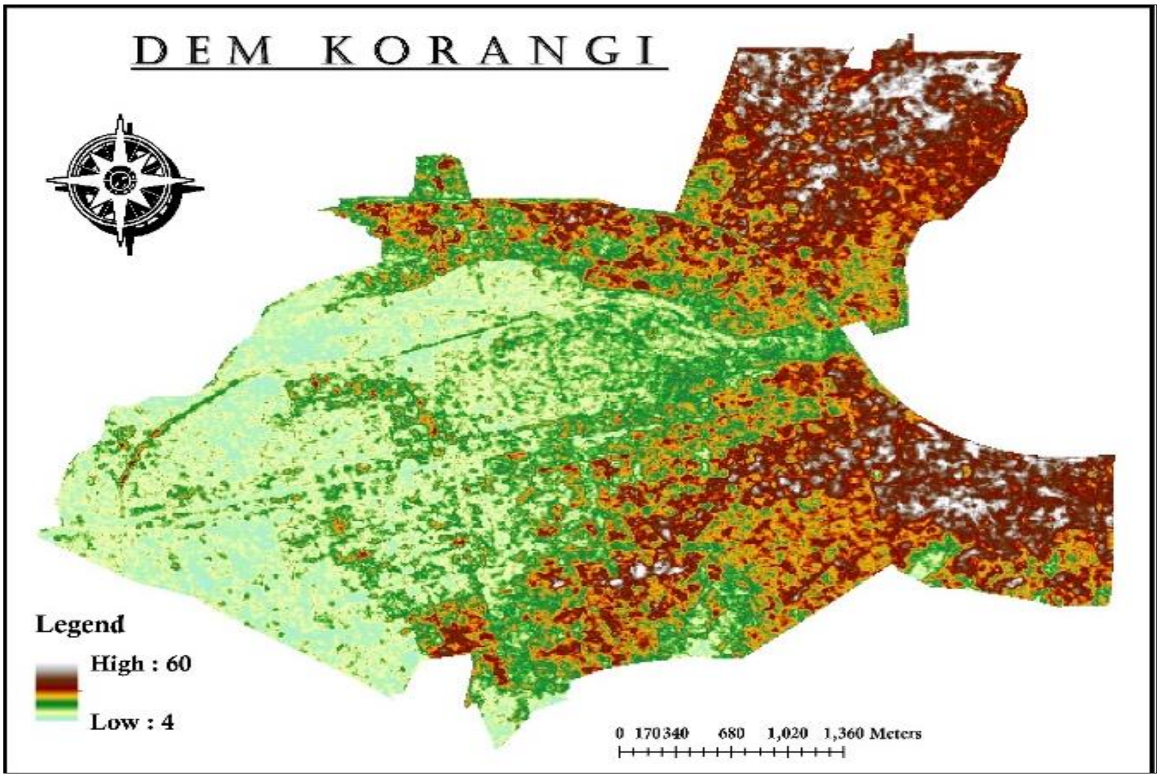

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Figure 7

Solar radiation intensity in Korangi, Karachi.

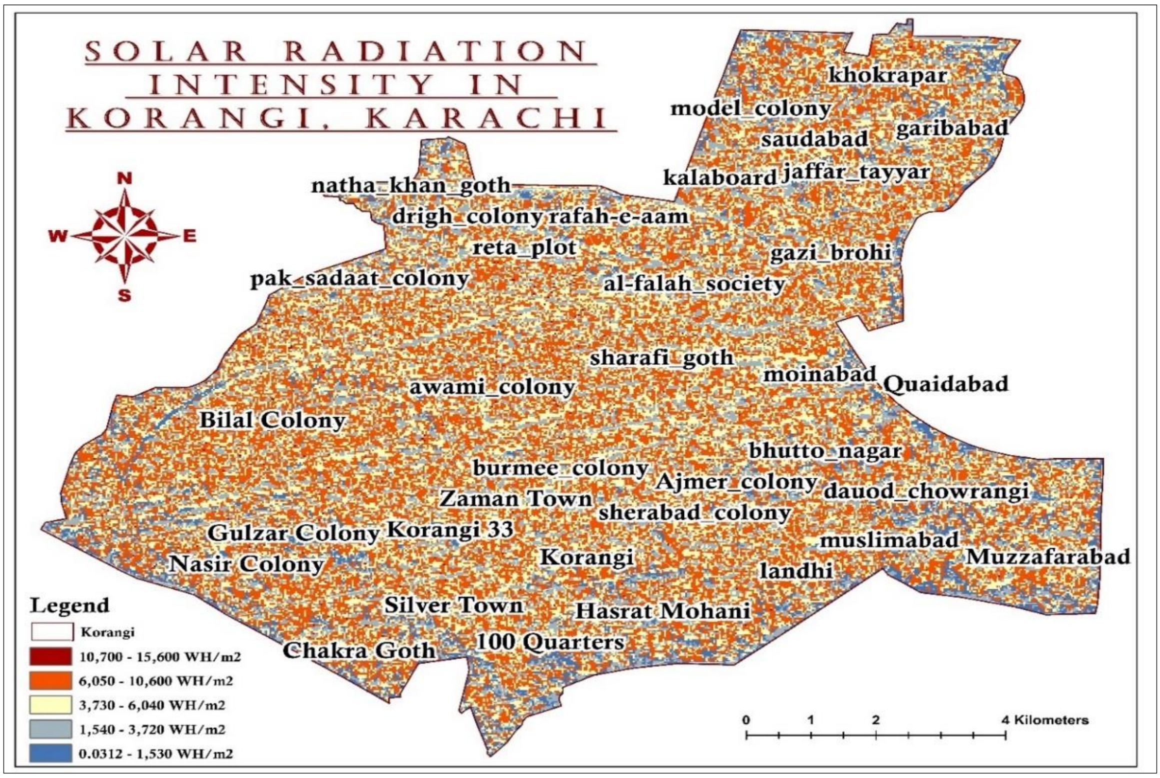

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Table 2 shows the statistical values of different commercial areas in district Korangi. Karachi. Industrial areas such as textile and clothing manufacturing, Places for Packaging Agriculture and Food Products, Timber, Furniture, Paper, and Printing industries show higher radiation, as they receive more sunlight throughout the day (Figure 8) and have taller buildings in the area (Teunissen et al., 2021). Other places like mosques and other religious places (based on observation surveys) and small commercial places nearby all have fewer receivers in value compared to industries. Industrial facilities with optimal solar gain, are often designed to maximize sunlight exposure, with fewer obstructions such as tall buildings nearby whereas mosques and smaller commercial structures may not prioritize such orientation, consequently receiving less sunlight absorption. (Soufiane et al., 2019). But still, radiation exceeds the typical average, indicating excellent conditions for solar energy production in Korangi. This suggests that solar panels in this area could generate a significant amount of electricity.

Figure 8

Korangi industrial region and its surrounding

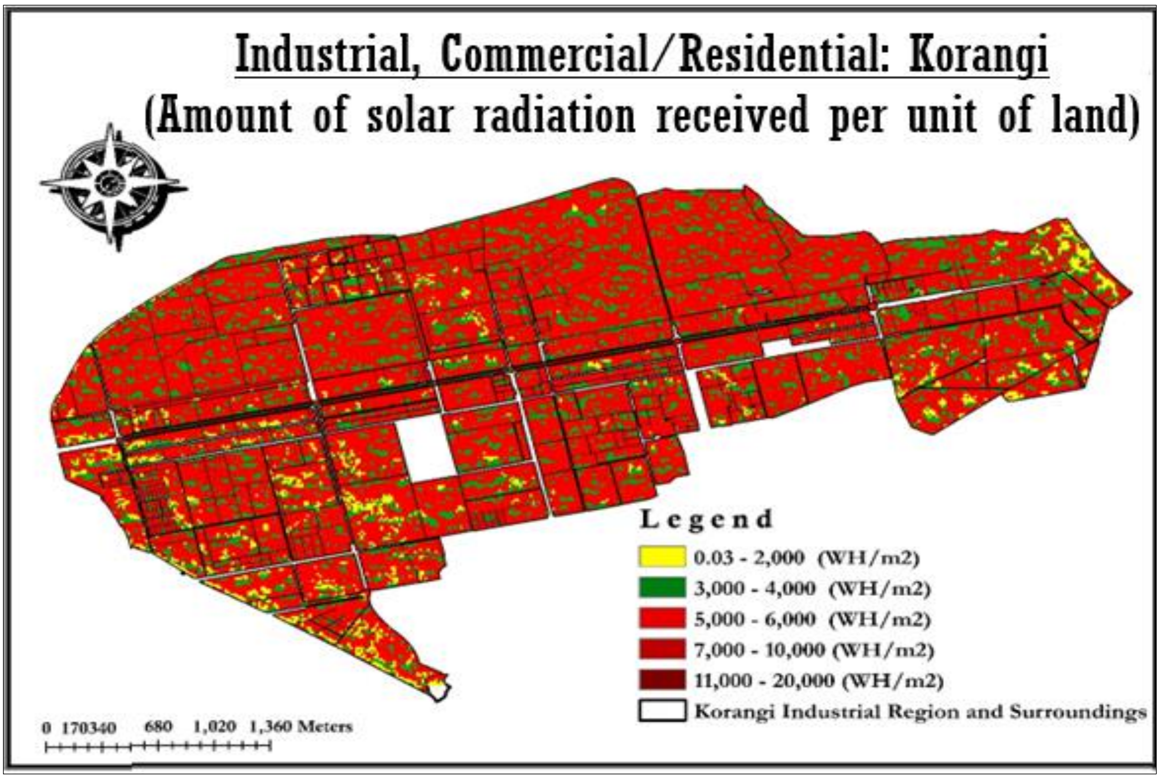

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Table 2

Commercial Area Solar Radiation (WH/m2) within a day

S.no	Commercial Areas	MAX	MEAN	STD
1	Textile and Clothing Manufacturing	7897	5340	1981
2	Manufacturing of Food, Drink and Tobacco	7891	4535	2164
3	Places for Packaging Agriculture and Food Products	15569	5443	2438
4	Medicine, Pharmaceutical	7888	5067	2077
5	Mechanical, Instrument and Electrical Engineering	15569	5597	2315
6	Banks	7802	5078	1983
7	Timber, Furniture, Paper, and Printing industries	7897	6395	1747
8	Mosques and Other Religious Places	6587	4379	1465

Korangi Pollution Assessment:

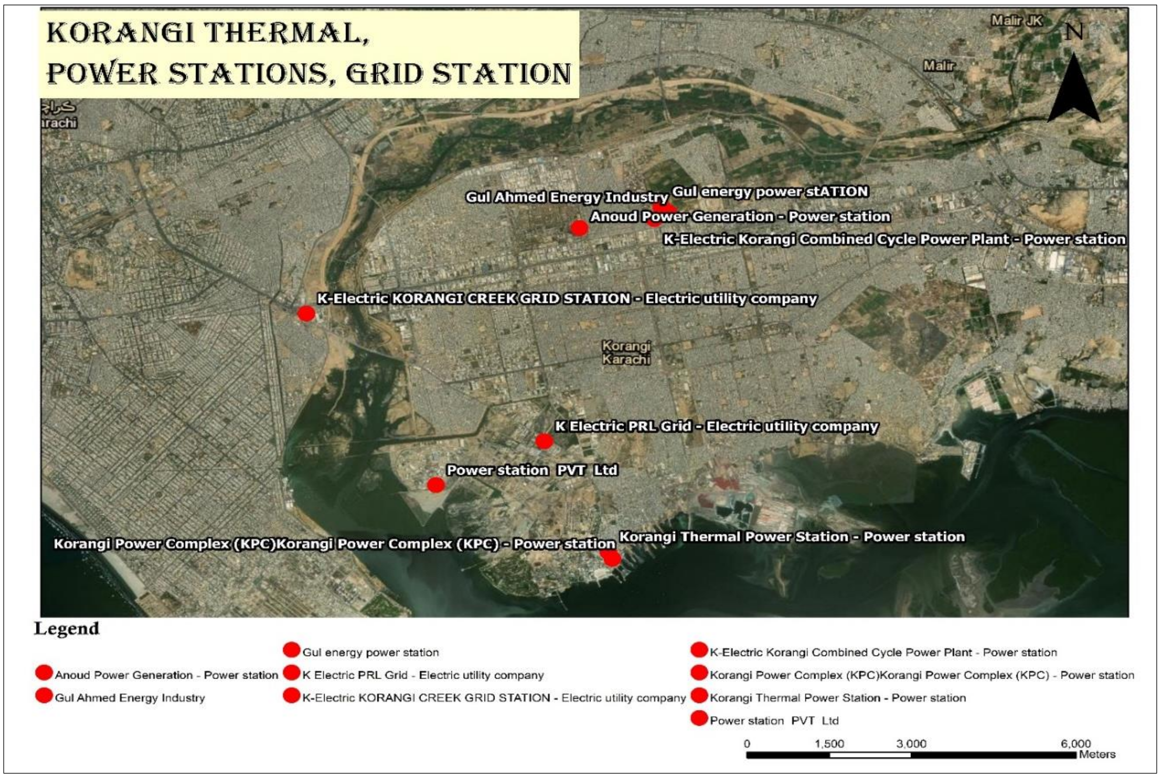
Air quality hazard zones

By assessing the 2023 data, it is observed that most of Korangi's Air Quality is restored, and the reason is the installation of solar panels and the conversion of power-generated resources.

Further study of power (electricity) generating plants has been conducted to validate this (Figure 9). Gather SO_2 ppm data of Korangi that clearly shows where electric power stations such as k Electric Korangi Creek, KPC, have higher SO2, around 88.5 µg/m³ to 96 µg/m³. In addition, nearby areas, specifically residential areas are affected. On the contrary, industrial Korangi regions have a lower ratio because Solar panels do not emit SO_2, so the use of solar panels in some areas has helped to reduce the overall levels of SO_2. A thorough study on the burden of respiratory diseases and cardiovascular to SO_2 exposure in Iran found that the highest occurrence of SO_2 causes deaths due to cardiovascular diseases was 0.080 µg/m³ (Rabiei et al., 2020). This indicates that Korangi SO2 level contributes to the increased rates of heart failure arrhythmias, and other cardiovascular problems among locals.

Figure 9

Korangi thermal power stations, grid station by satellite image of Google Earth Pro



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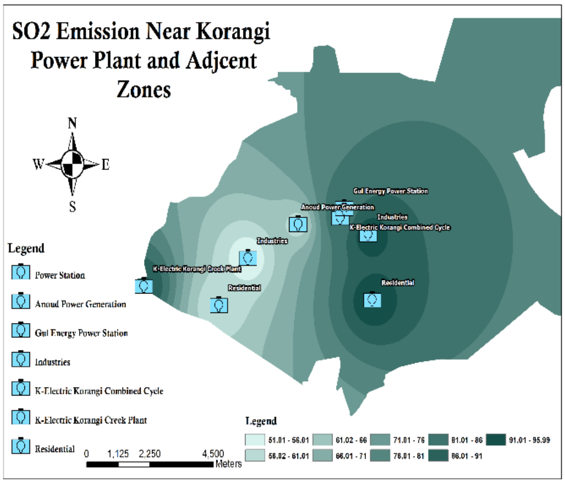
Volatile Organic Compounds (VOCs) are emitted from various sources, including power plants. To generate electricity, coal, oil, and natural gas combustion can release VOCs into the atmosphere (Figure 10). By assessing residential and industrial impact, places near industries are less polluted compared to where electric power plants and stations exist. The adjacent areas are also affected by pollution, which has a variety of harmful effects on human health. When fossil fuels such as coal, oil, gas, or diesel are burned at high temperatures, they emit nitrogen dioxide, a gashouse pollutant (Karakosta et al., 2021). Nitrogen dioxide can harm the human respiratory tract and make people more susceptible to respiratory infections and asthma. There was moderate evidence that short-term exposure to NO_2, even at mean values below 50 $\mu g/m^3$, both increased hospital admissions and mortality (Gillespie-Bennett et al., 2010).

Chronic lung disease can be caused by long-term exposure to high levels of nitrogen dioxide. Contact with pollutants such as particulate matter (PM), sulfur dioxide (SO2), and nitrogen oxides (NOx) can lead to chronic respiratory conditions, including asthma, chronic bronchitis, and reduced lung function (Hayat et al., 2023). Korangi Electric Power generation is near a residential area and in industries where employees regularly come from different places and have regular exposure. NO_2 was also found around the power station (Figure 10), and the reading reached 25.4 ppm. Though CH_4 is also found in Korangi, the source region is along the power station located in a residential area, followed by the K-Electric Creek plant and, once again, around Power station (Figure 10). The fine particulate material PM 1 is spread around the western zone. Three main power plants are in contagious condition: Residential Power Station, K-Electric Korangi Creek, and around the Power generation plant (Figure 10).

Figure 10

a) $SO2$ b) VOC, c) NO_2, d) CH_4, e) PM1e emission along power plants



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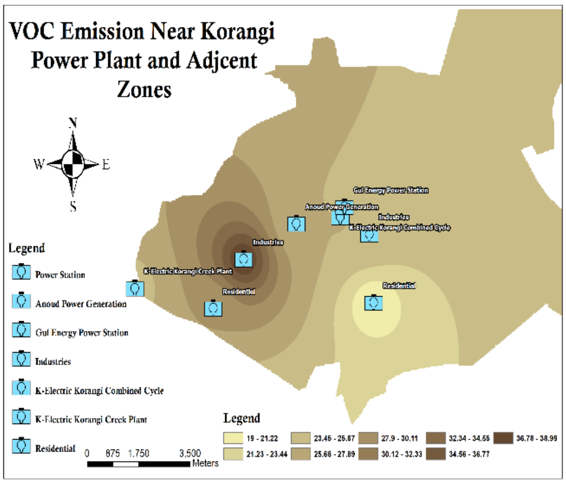

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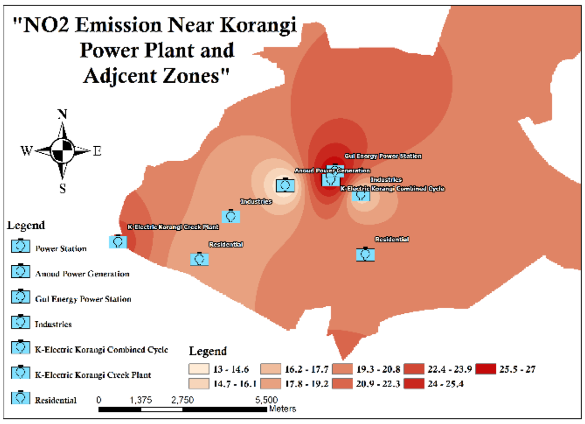

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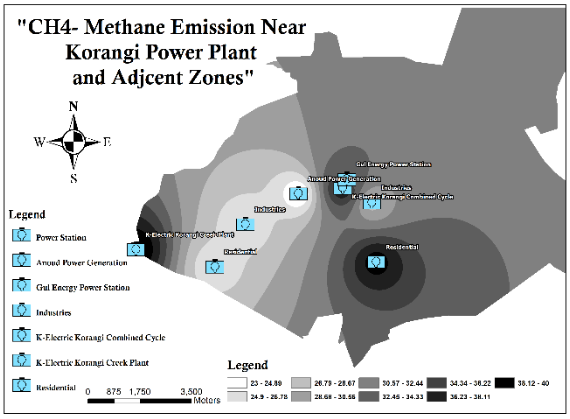

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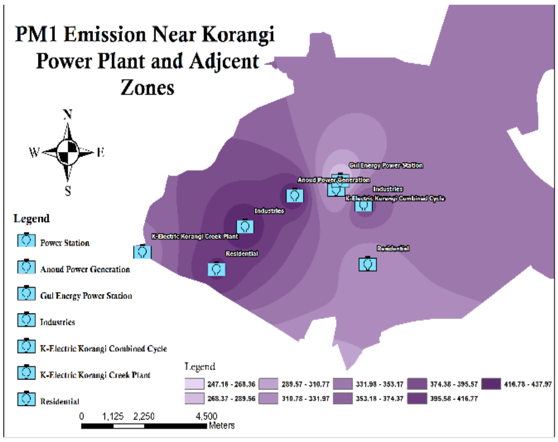

e)

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Comparative Assessment of Pollutants in Korangi-Karachi.

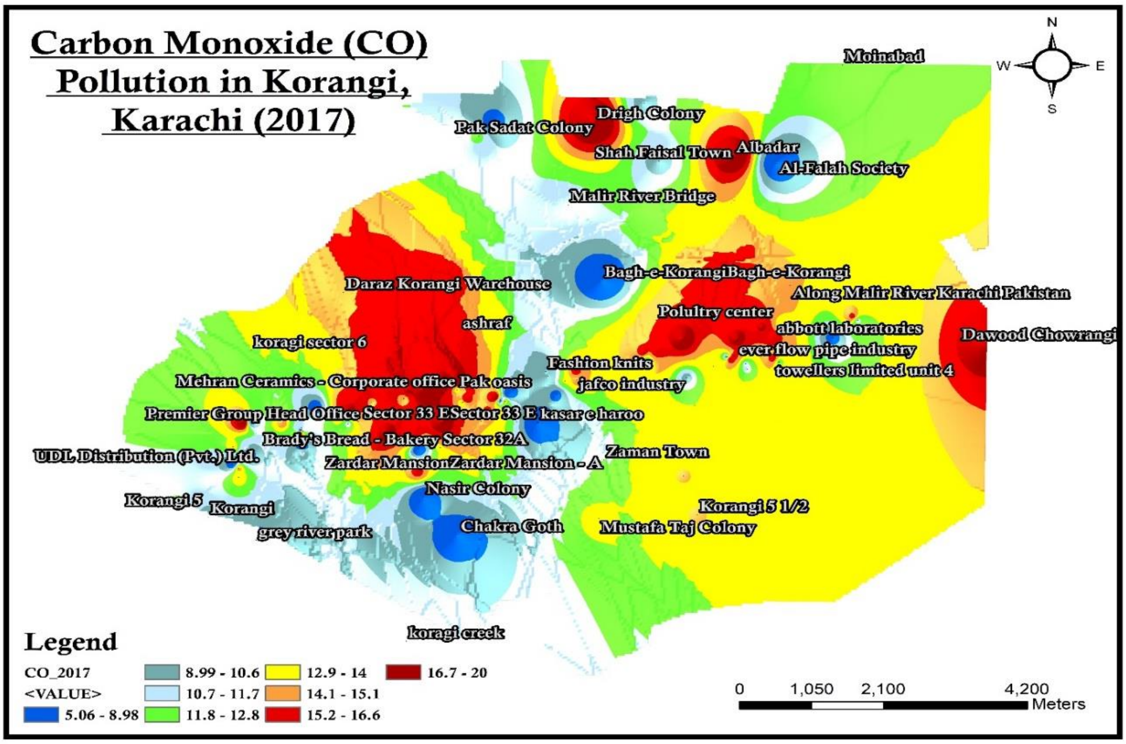
In comparison for years 2017 and 2023, it has been observed that a large region of Korangi faced a high level of contamination. The highest reading in 2017 was up to 20 ppm, while in 2023, it rose to 44.7 ppm. However, after critical examination (Figure 11) CO concentrations have arisen. At the same time, in 2023, the CO reading is much higher but concentrated only along some sources (Figure 11). Therefore, the extent becomes shortened, but the occurrence particularly becomes more concentrated. In the year 2017 (Figure 11), carbon dioxide gas emissions were recorded at Drigh Colony with the highest rate of emission i.e., 295.4, and the range extends till Bagh Korangi with the reading up to 258, Pak-Saadat Colony, again the loop of highest contamination is found in Abbott Laboratories, Toweller limited, and Jamia Dar Uloom, then along the pipeline industry and adjacent industries, while Mustafa Taj Colony and Chakra Got were also highest contamination area.

The emission of Carbon dioxide in Korangi will be reduced in 2023 (Figure 11), and the range of the CO_2-affected regions will be reduced from the areas before the study year (2017). Nevertheless, now contamination is confined along the industrial belt non-contagious but linear sources can easily be identified. Bagh e Korangi is still the hotspot like before. Also, Cui and colleagues (2019) reported that China is the major provider of global CO_2 releases; more than a quarter of the world's total CO_2 is from China due to fossil fuel combustion and cement production. Figure 12 (a) Carbon footprints in the industrial area of Korangi, Karachi. The maximum carbon was detected. Meanwhile, the CO_2 emissions from these ten industrial production developments displayed a fast rise before 2014 and varied from 2014 to 2018. The maximum emission was detected in the northern, central, and eastern parts of the Korangi district in 2023.

Figure 11

(a) Carbon Monoxide in 2017 b) Carbon Monoxide in 2023 Korangi, Karachi

(a)



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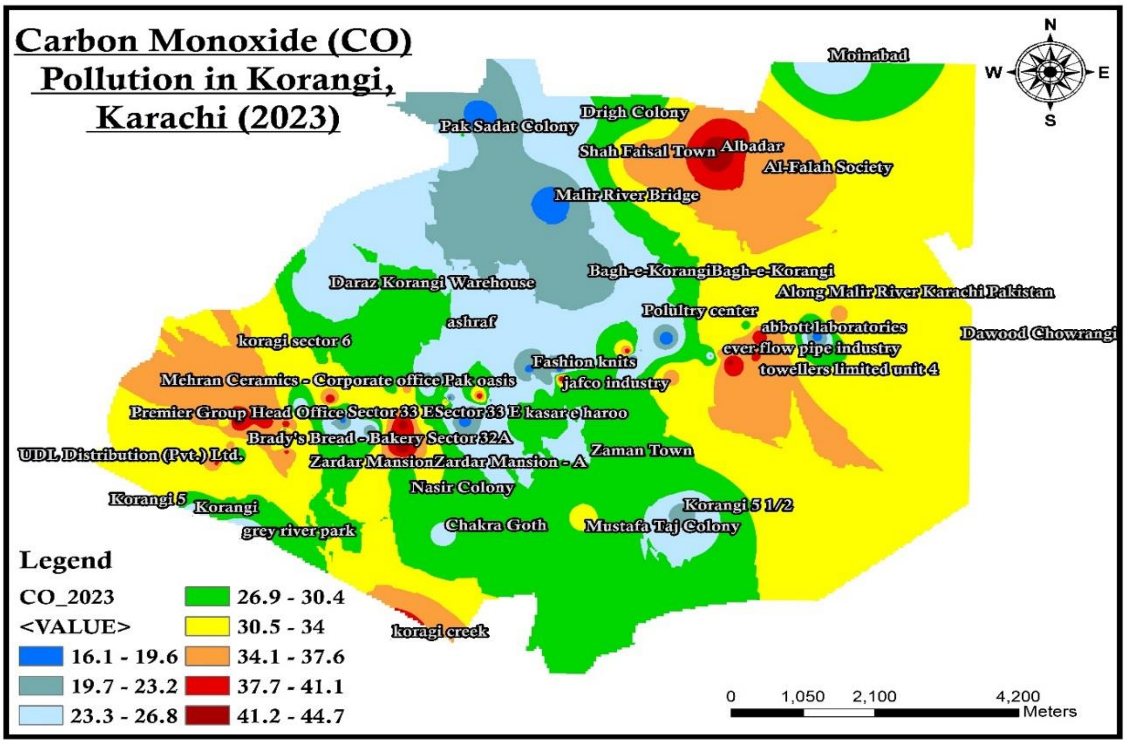

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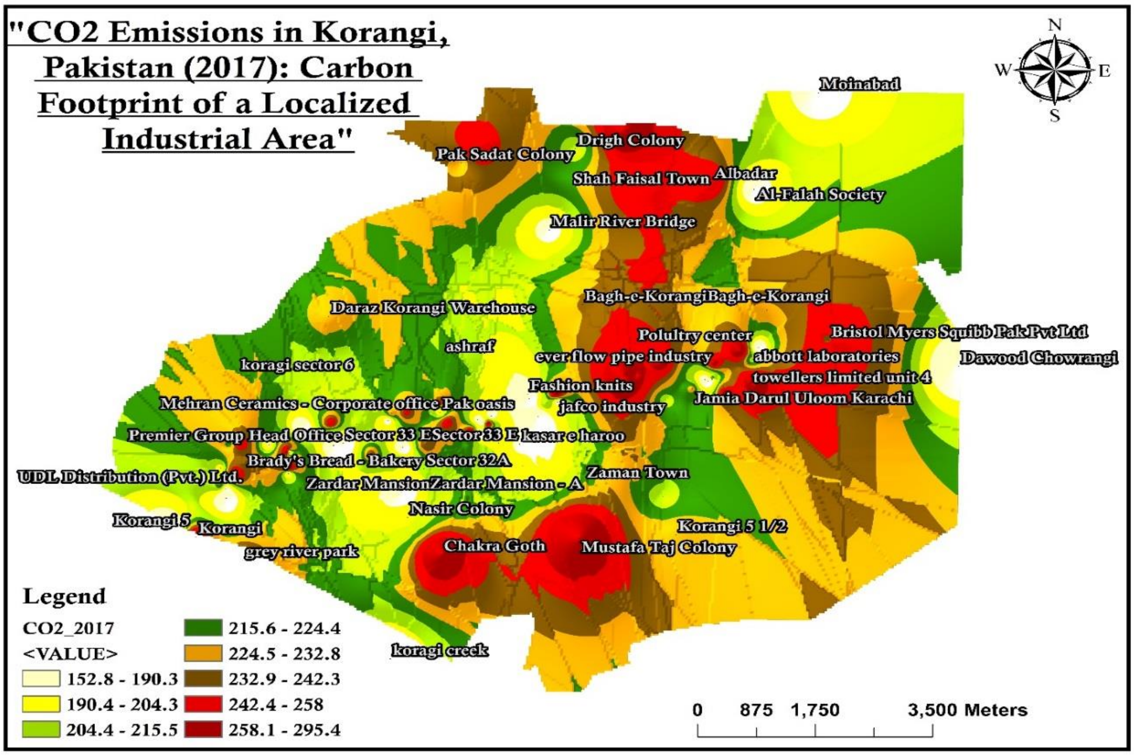
Figure 12

(a) Co2 emission in 2017 b) Co2 emission in 2023 in Korangi, Karachi

(a)



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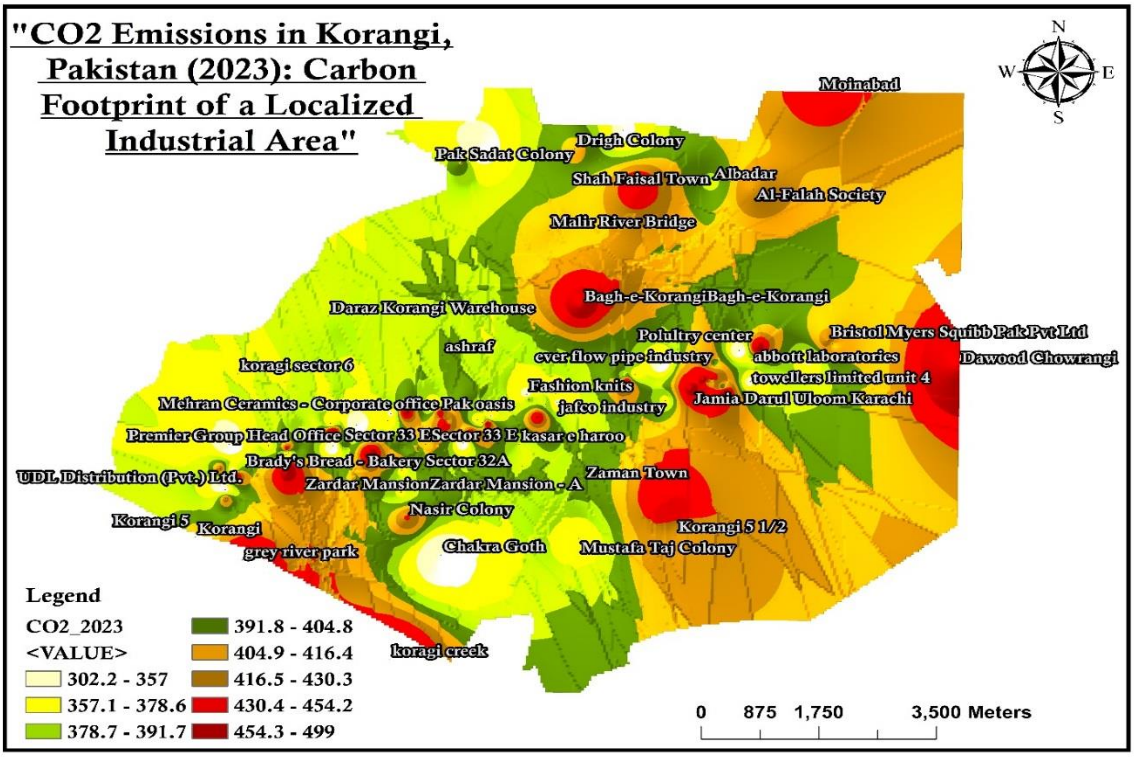

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Figure 13 (a &b) indicates the PM 2.5 concentration in Korangi Karachi. $PM^{2.5}$ are lighter-weight fine particles containing a diameter of 2.5 micrometers that are emitted from industries. A high level of $PM^{2.5}$ was observed in 2017 on the western side of Korangi. While a decline has been observed since 2017, it is not much of a great share. No substantial decrease was observed during the past five years. Therefore, the installation of solar panels does not control $PM^{2.5}$ efficiently. Korangi does not reflect major changes in pollutant declination for identification, the industrial zone has been digitized and analyzed closely.

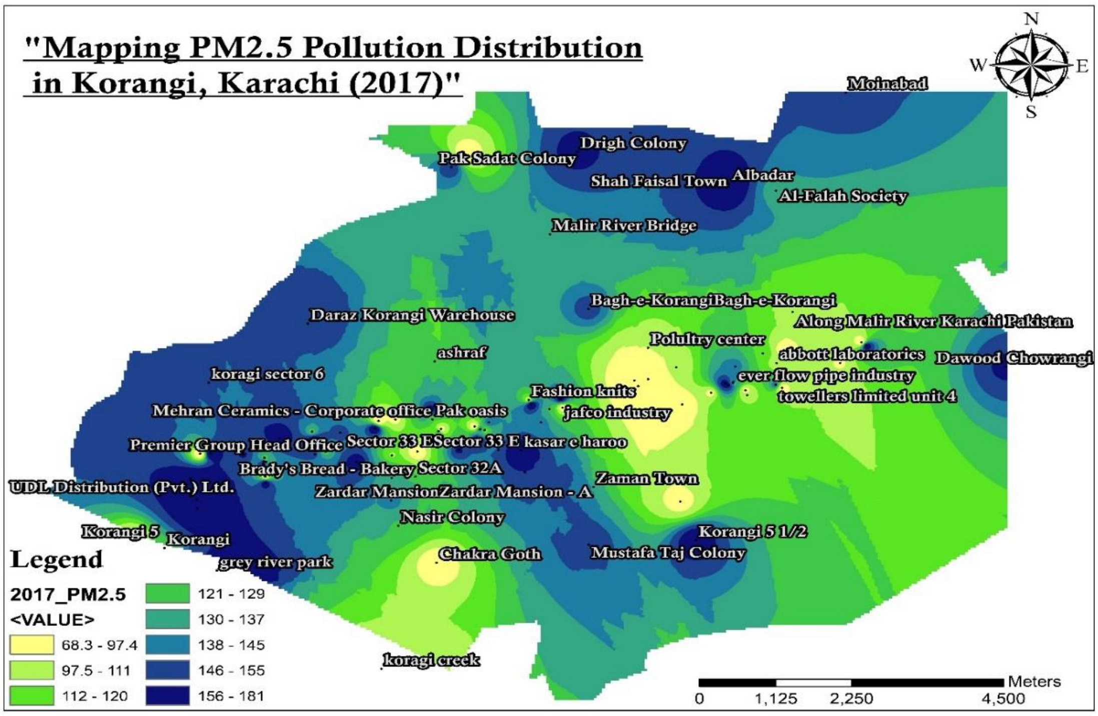
Figure 13(c) & (d) depicts the concentration of PM^{10} in the study area. In 2017, the areas of western Korangi experienced a high level of PM^{10} pollutants as compared to 2023. $PM^{2.5}$ still exists in the environment but is now concentrated along the Mustafa Taj. These locations are not found in the industrial zone i.e. Daraz Korangi warehouse, Grey River Park, Shah Faisal, Korangi Sector 5 Korangi Creek are not found in the industrial region. In 2023 the concentration of PM 10 was found more as compared to 2017. The maximum hotspot areas are in western Korangi.

Figure 14 depicts that the hotspots of $PM^{2.5}$concentration are more in industrial areas where solar panels are not installed, or fewer solar panels are in the suburbs. At these hot spots, PM $^{2.5}$ level reached up to 256 ppm. Kausar, (2023b) reported that PM2.5 level around 256 ppm is considered as very unhealthy air quality. Son and colleagues (2020) revealed that the negative influences of airborne particulate matter (PM) on solar PV power generation should be considered in policymaking on target solar power generation in Korea and in states with high PM releases.

Figure 13

a) PM2.5 in 2017 b) PM2.5 2023 & c) PM10 in 2017 d) PM10 in 2023

(a)



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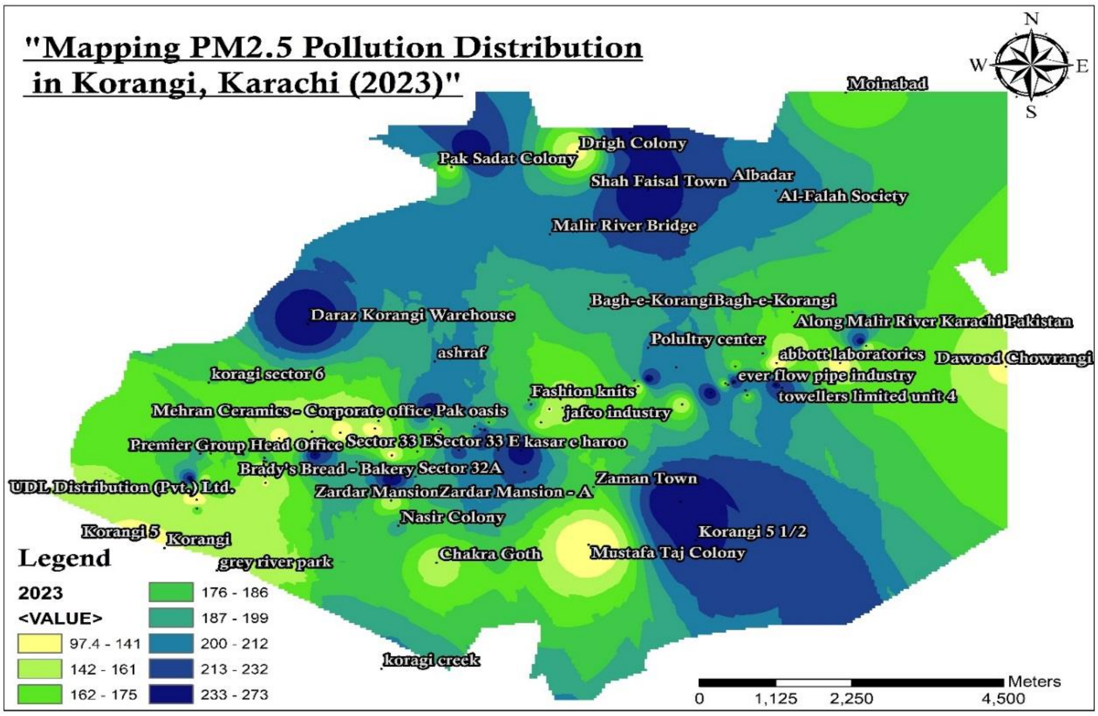

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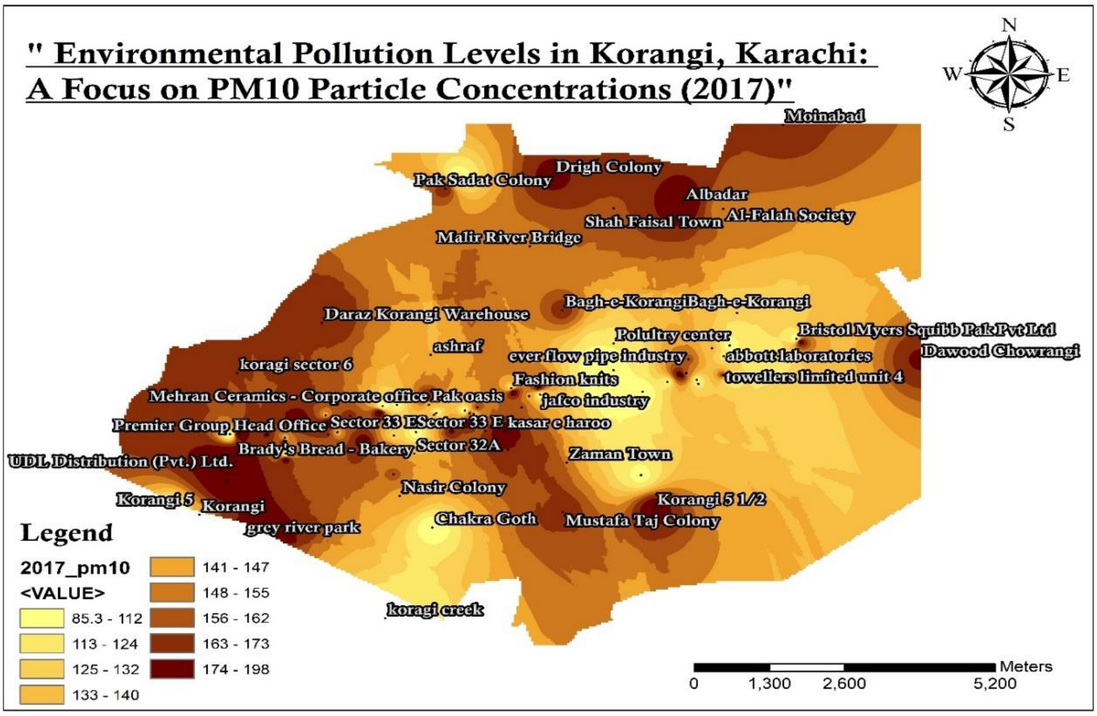

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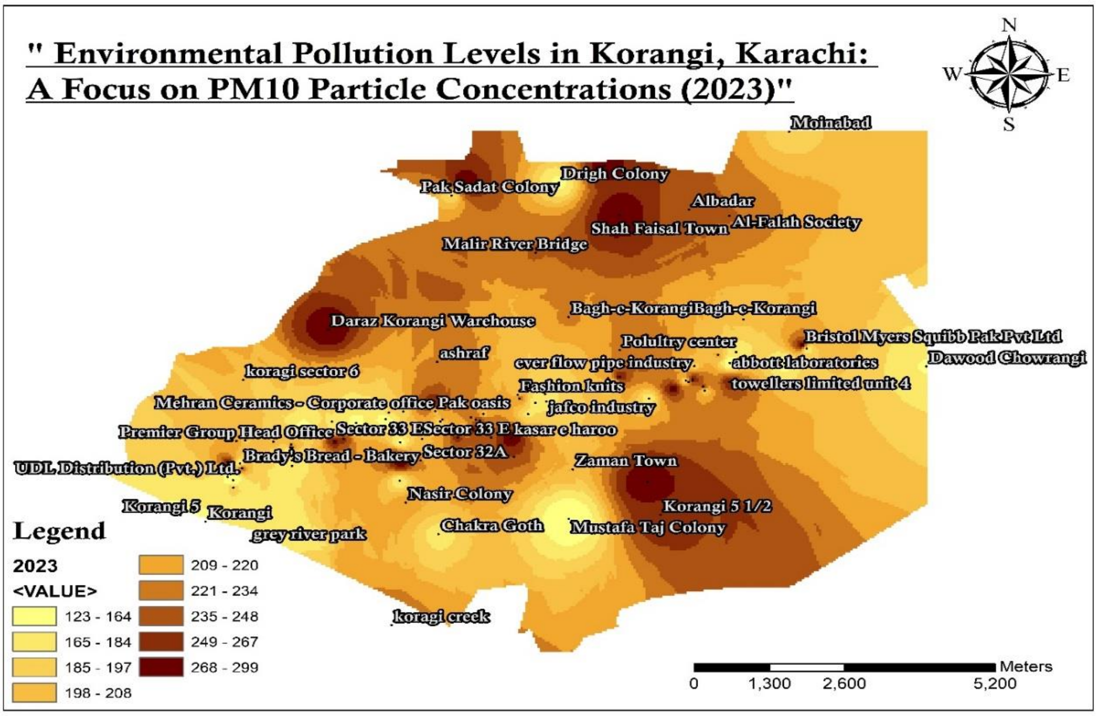

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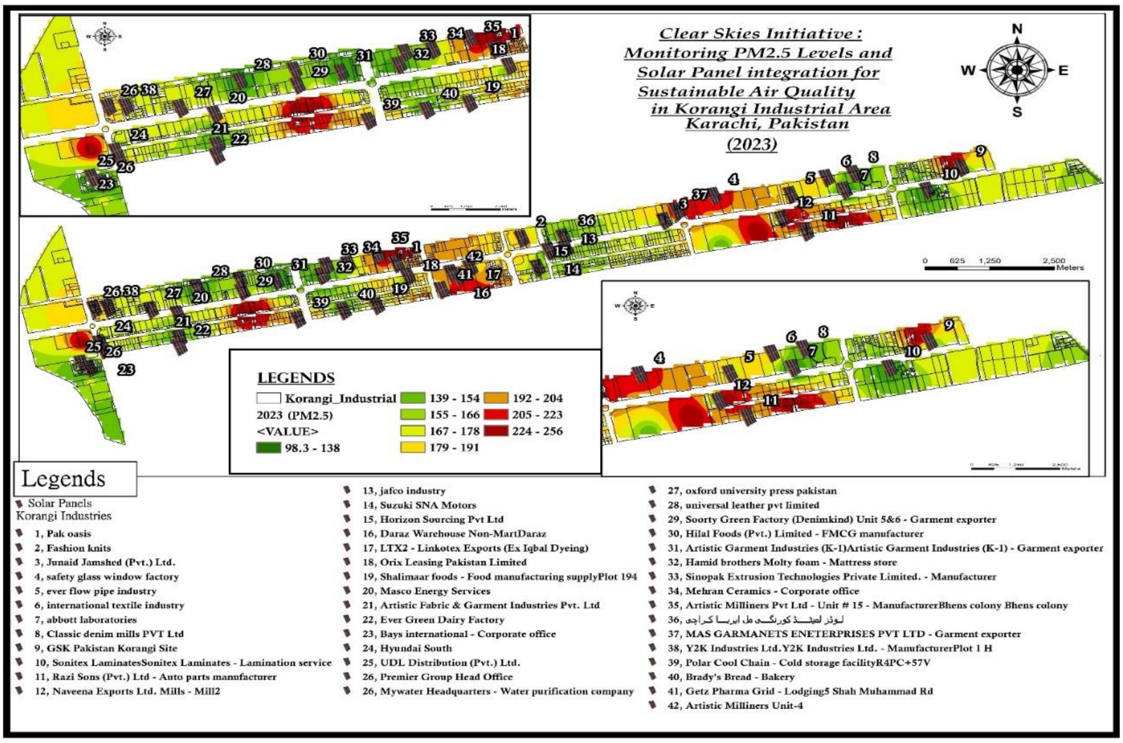
Figure 14

Monitoring PM 2.5 levels and Solar panel integration



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CONCLUDING RECOMMENDATIONS

Korangi displays significant potential for solar energy, with daily radiation values ranging from 4,466 WH/m² to 15,568 WH/m² across different urban centers. Industrial areas like textile and food packaging industries receive higher radiation due to fewer obstructions, making them ideal for solar energy installations. Overall, the region's high solar radiation levels suggest substantial opportunities for solar energy development, especially in areas with optimal sunlight exposure.

After installing solar panels, CO, PM ^{10}, and PM$^{2.5}$ have been notably reduced in the Korangi environment. There are 54 locations where solar panels are installed within five years. Though the CO concentration is much higher (44.7) in 2023 than 20 in 2017, the change has been recorded in the form of spread. Earlier, the range over the land of Korangi was higher. Concentration is high, but certain spots and ranges over the land are limited. The extent of

PM^{10} and $PM^{2.5}$ is also delimited in certain places. Concentration level is the main issue, as before. These source regions are Daraz Korangi warehouse, Grey River Park, Shah Faisal, Korangi Sector 5 Korangi Creek, and Mustafa Taj. By comparison between 2017 and 2023, the level of $PM^{2.5}$ observed in 2017 was higher in the western side of Korangi. A decline has been observed since 2017, but it is not very significant.

$PM^{2.5}$ are lighter-weight fine particles containing a diameter of 2.5 micrometers that are emitted from industries. In five years, the decline of the particulate is not much higher. Therefore, the installation of solar panels does not control $PM^{2.5}$ efficiently. In the year 2017, carbon dioxide gas emissions were recorded at Drigh Colony with the highest rate of emission, i.e., 295.4, and the range extends till Bagh Korangi with the reading up to 258. Again the loop of highest contamination is found in Abbott Laboratories, Toweller Limited and Jamia Dar Uloom, and then along the pipeline industry and adjacent industries; while Mustafa Taj Colony and Chakra Got were also found to have highest contamination. It was expected that the emission of carbon dioxide in Korangi will be reduced in 2023, and the range of the CO2-affected regions will be reduced from the areas before 2017. But now contamination is confined along the industrial belt, and non-contagious but linear sources can easily be identified. Bagh e Korangi is still the hotspot like before.

Implementing solar panels gives a way to live in a clean environment. Korangi is one of the main industrial sectors in Karachi and a source of income for many Karachiites; therefore, it is an important sector in terms of production and revenue generation, but a clean environment for a healthy lifestyle and the industry’s labor workplace is essential. Since the Industrial Revolution, human beings have been in the race to make money at every cost, which has impacted the environment adversely. Air Quality Hazard zones are found along the areas of conventional power generating plants, as can be seen in the case of Korangi, Karachi. A sustainable approach is urgently needed to generate energy with lower impact on the environment. This is possible if both the industrial and residential sectors adopt the implementation of solar panels strategy and cost-effective technology to reduce and mitigate environmental pollution as well as save electricity bills in times of rising inflation. Many people remain unaware of solar energy's potential for environmental benefits and cost savings. This research aimed to help advocate for a reduced reliance on fossil fuels and mitigate greenhouse gas emissions. Such integration of renewable energy contributes to energy security and supports global climate commitments (Kabir et al., 2018).

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APPENDIX

S.No	latitude	longitude	Name	PM 10(2017)	PM 10(2023)	PM 2.5(2017	PM 2.5(2023)	CO(2017)	CO(2023)	CO2(2017)	CO2(2023)
1	24°50'41.09"N	67° 8'36.50"E	Fashion knits	112	200	95	174	9	17	177	332
2	24°51'23.42"N	67° 6'50.61"E	Daraz Korangi Warehouse	172	293	155	267	15	24	230	391
3	24°52'13.15"N	67° 8'46.74"E	Malir River Bridge	152	234	135	208	11	18	184	412
4	24°49'44.61"N	67° 9'49.16"E	Sindh Government Hospital Korangi5	106	299	89	273	14	30	211	448
5	24°50'13.01"N	67° 8'32.92"E	kasar e haroo	198	290	181	264	5	30	188	378
6	24°49'45.22"N	67° 7'30.64"E	Zardar MansionZardar Mansion - A	157	166	140	140	16	27	163	375
7	24°50'13.36"N	67° 8'3.12"E	Muhammad Noor HouseMuhammad Noor House	178	258	161	232	14	16	216	318
8	24°49'57.76"N	67° 7'30.90"E	Sir Sardar Umair HouseSir Sardar Umair House	150	300	133	274	5	44	198	365
9	24°50'2.60"N	67° 7'27.55"	Madani Kiryana and General Store Zia Colony korangi	157	245	140	219	18	42	221	430
10	24°47'54.95"N	67° 6'27.36"E	Mehran Commercial EnterprisesMehran Commercial Enterprises	85	286	68	260	12	29	275	452
11	24°48'5.08"N	67° 6'16.33"E	Korangi Creek Industrial Park	168	227	151	201	16	30	277	384
12	24°51'31.58"N	67° 9'5.13"E	Bagh-e-KorangiBagh-e-Korangi	167	223	150	197	6	20	233	475
13	24°48'11.76"N	67° 7'26.08"E	koragi creek	106	234	89	208	11	42	185	477
14	24°49'40.78"N	67° 5'57.62"E	embroidery department AK#4embroidery department AK#4 -	197	199	180	173	14	31	150	429
15	24°49'23.16"N	67° 9'56.58"E	Korangi 5 1/2	185	263	168	237	14	22	230	426
16	24°49'23.07"N	67° 5'27.98"E	Malir River	93	150	76	124	12	34	151	389
17	24°49'18.87"N	67° 5'42.05"E	Untitled Placemark	141	154	124	128	10	23	263	417
18	24°49'6.35"N	67° 6'7.08"E	grey river park	183	178	166	152	8	22	251	481
19	24°50'51.93"N	67° 9'27.18"E	Junaid Jamshed (Pvt.) Ltd.	198	229	181	203	9	24	172	397
20	24°50'48.64"N	67° 9'28.97"E	Pak oasis	90	216	73	190	16	41	274	382
21	24°50'48.64"N	67° 9'28.97"E	Junaid Jamshed (Pvt.) Ltd.	137	201	120	175	13	31	188	446
22	24°50'59.29"N	67° 9'47.16"E	safety glass window factory	96	161	79	135	12	18	279	471
23	24°50'59.74"N	67°10'15.48"E	ever flow pipe industry	116	236	99	210	19	17	267	323
24	24°51'6.96"N	67°10'28.71"E	international textile industry	159	189	142	163	19	33	268	400
25	24°51'1.71"N	67°10'35.32"E	abbott laboratories	137	211	120	185	17	29	291	312
26	24°51'8.73"N	67°10'38.75"E	Classic denim mills PVT Ltd	120	133	103	107	16	41	213	376
27	24°51'13.19"N	67°11'15.97"E	Bristol Myers Squibb Pak Pvt Ltd	101	165	84	139	13	32	164	478
28	24°51'11.21"N	67°11'18.28"E	GSK Pakistan Korangi Site	89	283	72	257	16	35	238	430
29	24°51'1.63"N	67°11'5.73"E	Sonitex LaminatesSonitex Laminates - Lamination service	191	158	174	132	11	34	259	409
30	24°50'49.52"N	67°10'34.83"E	towellers limited unit 4	112	148	95	122	8	18	243	353
31	24°50'47.84"N	67°10'37.86"E	Cpmmodities and textile Pvt.Ltd	165	264	148	238	16	39	272	336
32	24°50'43.75"N	67°10'21.19"E	Razi Sons (Pvt.) Ltd - Auto parts manufacturer	96	258	79	232	12	34	274	375
33	24°50'50.45"N	67°10'14.41"E	Fazal Sardar Textile Mills - Textile exporter	119	184	102	158	11	39	270	498
34	24°50'49.40"N	67°10'12.17"E	Naveena Exports Ltd. Mills - Mill2	103	242	86	216	11	44	236	385
35	24°50'45.11"N	67°10'3.82"E	Jamia Darul Uloom Karachi	156	279	139	253	16	38	252	472
36	24°50'36.83"N	67° 8'52.69"E	Untitled Placemark	146	258	129	232	15	34	154	396
37	24°50'36.83"N	67° 8'52.69"E	jafco industry	184	219	167	193	19	27	153	399
38	24°50'35.90"N	67° 8'46.51"E	Suzuki SNA Motors	187	163	170	137	8	21	176	500
39	24°50'28.55"N	67° 8'42.38"E	Horizon Sourcing Pvt Ltd	106	280	89	254	13	31	229	473
40	24°50'24.84"N	67° 8'13.26"E	Daraz Warehouse Non-MartDaraz Warehouse Non-Mart - Warehouse	85	171	68	145	10	36	211	371
41	24°50'24.33"N	67° 8'15.51"E	LTX2 - Linkotex Exports (Ex Iqbal Dyeing) - ExporterPlot # 36 & 37	101	185	84	159	15	41	182	350
42	24°50'18.58"N	67° 8'11.37"E	Ali Asghar Textile Mills - Warehouse	145	162	128	136	13	20	216	390
43	24°50'24.98"N	67° 7'54.53"E	Orix Leasing Pakistan Limited	157	179	140	153	8	28	153	458
44	24°49'52.73"N	67° 9'7.48"E	Zaman Town	166	236	149	210	7	34	159	351
45	24°50'12.47"N	67° 7'43.18"E	Shalimaar foods - Food manufacturing supplyPlot 194	127	248	110	222	14	21	282	481
46	24°50'12.49"N	67° 6'59.27"E	EMD Department - Electronics store	163	196	146	170	5	24	176	349
47	24°50'10.96"N	67° 6'54.12"E	Bhanero office karachi - Lodging	200	274	183	248	14	21	153	431
48	24°50'8.87"N	67° 6'29.86"E	Masco Energy Services- Karachi - Solar energy company12/1 Main Korangi Indus	95	216	78	190	17	15	253	421
49	24°50'50.76"N	67° 6'3.17"E	koragi sector 6	148	173	131	147	12	38	247	462
50	24°51'29.91"N	67°10'42.91"E	Along Malir River Karachi Pakistan	99	197	82	171	19	30	242	406
51	24°51'2.53"N	67° 7'51.52"E	ashraf	140	255	123	229	14	18	162	403
52	24°49'58.52"N	67° 6'30.40"E	Artistic Fabric & Garment Industries Pvt. Ltd Unit-8 - Clothes and fabric manufac	163	278	146	252	11	23	159	302
53	24°49'54.96"N	67° 6'30.45"E	Ever Green Dairy Factory OutletEver Green Dairy Factory Outlet - BakeryR4J5+R	135	217	118	191	11	45	251	473
54	24°49'53.57"N	67° 6'2.46"E	Bays international - Corporate office	135	246	118	220	11	32	154	353
55	24°49'56.51"N	67° 6'1.36"E	Hyundai South - Hyundai dealerSector 23 Korangi, Karachi, Karachi City, Sindh 7	167	196	150	170	7	24	299	359
56	24°49'57.48"N	67° 5'54.42"E	Sanofi-Aventis Pakistan Limited	184	128	167	102	19	41	238	371
57	24°49'47.82"N	67° 5'54.46"E	UDL Distribution (Pvt.) Ltd.	105	166	88	140	6	26	289	497
58	24°49'45.70"N	67° 5'57.50"E	Mywater┬« Headquarters - Water purification company	188	164	171	138	11	39	182	472
59	24°50'11.16"N	67° 5'57.50"E	Premier Group Head Office	192	238	175	212	6	19	270	489
60	24°50'10.74"N	67° 6'19.91"E	oxford university press pakistan	198	162	181	136	11	38	245	338
61	24°50'19.88"N	67° 6'37.04"E	universal leather pvt limited	188	271	171	245	14	31	196	426
62	24°50'18.52"N	67° 6'53.65"E	Soorty Green Factory (Denimkind) Unit 5&6 - Garment exporter	177	158	160	132	6	39	226	320
63	24°50'23.53"N	67° 6'52.75"E	Hilal Foods (Pvt.) Limited - FMCG manufacturer	183	121	166	95	15	32	177	341
64	24°50'22.86"N	67° 7'6.25"E	Artistic Garment Industries (K-1)Artistic Garment Industries (K-1) - Garment exp	88	221	71	195	20	32	221	303
65	24°50'25.30"N	67° 7'22.89"E	Hamid brothers Molty foam - Mattress store	175	207	158	181	15	40	186	370
66	24°50'29.44"N	67° 7'24.61"E	Sinopak Extrusion Technologies Private Limited. - Manufacturer	196	142	179	116	7	23	154	376
67	24°50'30.21"N	67° 7'32.65"E	Mehran Ceramics - Corporate office	194	174	177	148	20	29	209	495
68	24°50'34.26"N	67° 7'43.18"E	Artistic Milliners Pvt Ltd - Unit # 15 - ManufacturerBhens colony Bhens colony	141	179	124	153	16	41	258	354
69	24°50'34.42"N	67° 7'45.88"E	National RefineryNational Refinery - ManufacturerR4VH+6VM	165	138	148	112	15	32	211	301
70	24°50'35.66"N	67° 7'49.12"E	Pearl Fabrics Company - Corporate officePlot 15	196	139	179	113	14	32	180	360
71	24°50'41.60"N	67° 8'51.83"E	load	87	188	70	162	17	29	232	351
72	24°50'52.68"N	67° 9'33.71"E	MAS GARMANETS ENETERPRISES PVT LTD - Garment exporter	106	188	89	162	19	36	249	469
73	24°50'11.43"N	67° 6'4.21"E	Y2K Industries Ltd.Y2K Industries Ltd. - ManufacturerPlot 1 H	130	214	113	188	20	16	244	398
74	24°50'6.68"N	67° 7'14.10"E	Polar Cool Chain - Cold storage facilityR4PC+57V	174	280	157	254	15	28	166	324
75	24°50'10.29"N	67° 7'30.91"E	Brady's Bread - Bakery	188	283	171	257	20	20	259	372
76	24°50'19.17"N	67° 8'7.07"	Getz Pharma Grid - Lodging5 Shah Muhammad Rd	184	170	167	144	16	17	283	372
77	24°50'26.41"N	67° 8'10.59"E	Artistic Milliners Unit-4	99	273	82	247	16	23	260	359
78	24°52'37.74"N	67° 9'33.65"E	Shah Faisal Town	199	194	182	168	8	45	256	358
79	24°52'57.51"N	67° 8'6.13"E	Natha Khan GothNatha Khan Goth	186	219	169	193	18	20	238	480
80	24°52'50.38"N	67° 7'59.55"E	Pak Sadat Colony	126	154	109	128	16	43	165	393
81	24°52'58.95"N	67° 8'59.84"E	Drigh Colony	139	170	122	144	16	21	282	450
82	24°53'9.51"N	67° 9'25.28"E	Moria Khan Goth	89	221	72	195	20	42	180	353
83	24°52'41.18"N	67°10'12.42"E	Albadar	161	290	144	264	10	37	252	448
84	24°52'37.32"N	67°10'35.01"E	Al-Falah Society	95	294	78	268	8	16	255	320
85	24°52'33.24"N	67° 2'53.77"E	Muslimabad	172	182	155	156	12	27	229	406
86	24°50'59.53"N	67°12'25.20"E	Dawood Chowrangi	179	158	162	132	20	26	210	408
87	24°53'31.85"N	67°11'8.49"E	Moinabad	167	279	150	253	10	27	278	349
88	24°49'31.20"N	67° 7'34.12"E	Nasir Colony	188	239	171	213	19	44	255	389
89	24°49'10.63"N	67° 7'52.33"E	Chakra Goth	149	234	132	208	7	36	179	429
90	24°49'20.63"N	67° 9'5.27"E	Mustafa Taj Colony	133	164	116	138	6	35	182	310
91	24°49'34.54"N	67° 8'0.98"E	Gulzar Colony	175	163	158	137	18	31	167	499
92	24°50'13.34"N	67° 8'21.88"E	Sector 33 ESector 33 E	168	190	151	164	12	24	181	441
93	24°50'0.86"N	67° 8'34.58"E	Sector 33 GSector 33 G	145	215	128	189	6	30	204	432
94	24°51'10.09"N	67° 9'33.70"	Polultry center	100	176	83	150	7	26	286	310
95	24°49'58.47"N	67° 7'42.30"E	Sector 32A	166	124	149	98	13	31	291	365