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The Carbon Footprint of Transport Activities of the 401 Military General Hospital of Athens

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Abstract

It is a scientifically accepted fact that climate change constitutes a major challenge for the future well-being of the whole humanity. Medical and hospital care facilities generate their own greenhouse emissions. Hospital transportation activities encompass not only the transportation of patients and medical personnel but also the operation of transportation assets associated with the logistical support of hospital operations. The present research focuses on the carbon footprint of the transportation functions and activities of the 401 Military General Hospital of Athens (401 MGHA), in order to serve as a starting point for the development of an action plan for the mitigation of greenhouse gas emissions in the hospital-based healthcare of the Hellenic (Greek) Army. Based on this, a simple and easily operated monitoring scheme of the greenhouse gas emissions of the transport activities and a portfolio of mitigation actions are proposed. The estimation of the carbon footprint of the transport activities, and of the other stationary emission sources of the hospital (energy consumption, waste treatment, etc.) of the 401 MGHA, will be the starting point for the development of an action plan for the estimation and mitigation of GHG emissions in the hospital-based healthcare of Greece.

Keywords Carbon footprint · Climate change · Greenhouse gas emissions · Road transport · Hospital-based healthcare

1 Introduction

Climate change presents a multifaceted challenge and threat to the well-being of the whole world. Climate change is altering fundamental parameters of the world's environment, e.g., melting of the polar ice caps, and affecting the global ecosystem, e.g., rising of sea levels. These changes have multiple environmental, political, economic, and social effects (e.g., persistent regional droughts with food supply failures and mass human migrations, storms of greater intensity with resulting damage to critical economic infrastructure, etc.). Estimates of the Intergovernmental Panel on Climate Change (IPCC) at a 95% certainty level identify human activities as the main cause for the generation of greenhouse gas (GHG) emissions and the resulting global warming and climate change. These gases in the Earth's atmosphere trap the sun's heat and stop it from leaking back into space. CO2 is the greenhouse gas most commonly produced by human activities, and it is responsible for 64% of man-made global warming. Since the beginning of the Industrial Revolution (around 1750), human activities have produced a 45% increase in the atmospheric concentration of carbon dioxide, from 280 ppm in 1750 to 415 ppm in 2019 [1–5]. According to NOAA's National Centers for Environmental Information, the combined land and ocean temperature has increased at an average rate of 0.07 °C per decade since 1880 and over twice that rate (+0.18 °C) since 1981 [6].

The healthcare sector with its hospital operations and facilities possesses its own carbon footprint and is a notable contributor to global warming. Thus, the healthcare sector and its hospital facilities need to undertake concrete and environmentally friendly actions in order to reduce the inimical health effects that global warming itself creates. This includes emission reductions in GHG and other pollutants [7]. Hospital healthcare facilities are energy intensive and emit considerable quantities of GHG. Within the USA, hospital buildings follow food services facilities as the second largest energy intensive commercial structures [8]. Hospitals typically occupy large buildings or campus-

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like structures (e.g., university hospitals), they operate continuously, and their energy consumption includes appropriate heating and cooling machinery, various medical devices and laboratory equipment, food preparation and distribution facilities and laundries. A major component of hospital energy consumption and corresponding GHG emissions relates to transport activities and operations. These include the vehicular movement of patients (i.e., ambulances), as well as those of hospital staff (i.e., hospital and personal vehicles).

The definition of the carbon footprint includes the total GHG emissions that are generated by a single person, an organization and a particular product. [9–11]. Various estimates indicate the major role that healthcare facilities play in national GHG emissions. Estimates by [12] indicate that healthcare facilities in the USA account for 8% of the GHC emissions. In the UK, the healthcare sector accounts for 30% of the GHG emissions from the public sector and 3.2% of the overall national CO_2 emissions. In turn, energy consumption of healthcare structures accounted for 22% of these GHG emissions, while 18% was attributable to transport activities, and 59% was caused by various logistical support activities and operations [13–16]. Other estimates indicate that healthcare-related transport activities account for 5 % of the total transportation sector emissions in the UK [17]. EU-related estimates disclose that road transportation is responsible for 20% of the CO_2 total emissions across all of the EU member states. Furthermore, transportation is a major activity sector where GHG emissions are still increasing [18].

The World Health Organization [1] has stated that the healthcare sector can play a major role in the reduction of GHG emissions and the consequent amelioration of the global warming effects. According to the WHO, participation of the healthcare sector in the effort to combat global warming will result in healthcare improvements for the world's population as well as in various socioeconomic benefits. The following elements were outlined in the relevant WHO report (Table 1):

2 Case Study

In this paper, the carbon footprint of the transport activities of the 401 Military General Hospital of Athens (401 MGHA) has been estimated for the purpose to serve as the starting point for the overall objective to develop a carbon reduction action plan for the mitigation of greenhouse gas emissions in the hospital-based healthcare of the Greek Army. The estimation of the carbon footprint of hospital health units is directly related to the successful implementation of the Corporate Social Responsibility (CSR) strategy of hospitals. The CSR of hospitals, which are either public or private organizations, as well as enterprises, aims at contributing to address environmental and social issues, given that hospitals are particularly important organizations, which are closely connected with the community.

Based on the estimated carbon footprint, a simple easily operated monitoring scheme for the continuous quantification of the GHG emissions of the transport activities of the hospital is proposed, along with a portfolio of mitigation actions for the reduction of these emissions [10].

2.1 The 401 Military General Hospital of Athens (401 MGHA)

The 401 Military General Hospital of Athens (401 MGHA, http://401.army.gr) was founded in 1904, and it is the largest military hospital of Greece. It is located at 138 Mesogeion Avenue & Katehaki Avenue in Athens since 1971. The current staff personnel of Ministry of Defence (MoD), the Hellenic Police, the Hellenic Fire Service and the members of their families are entitled to hospitalization. Any other civilian person under specific circumstances can also be hospitalized.

In 2018, the outpatient clinic of the 401 MGHA was visited for daily medical examination by approximately 166,000 patients. Moreover, 14,400 patients were hospitalized for

Table 1 Seven elements of a climate-friendly hospital

Element	Description
Energy efficiency	Reduce hospital energy consumption and costs through efficiency and conservation measures
Green building design	Build hospitals that are responsive to local climate conditions and optimized for reduced energy and resource demands
Alternative energy generation	Produce and/or consume clean, renewable energy onsite to ensure reliable and resilient operation
Transportation	Use alternative fuels for hospital vehicle fleets; encourage walking and cycling to the facility; promote staff, patient and community use of public transport; site healthcare buildings to minimize the need for staff and patient transportation
Food	Provide sustainably grown local food for staff and patients
Waste	Reduce, re-use, recycle, compost; employ alternatives to waste incineration
Water	Conserve water; avoid bottled water when safe alternatives exist

112,608 days during 2018, with an average of 7.82 days of hospitalization. Therefore, the number of patients that visited the hospital exceeds 180,000 patients, which is more than 490 visits per day, on average.

In the context of quantifying the carbon footprint of 401 MGHA from all transport activities for the year 2018, the distance travelled by each one of the hospital vehicles, delivery vehicles, staff and patient travel was recorded, and the associated GHG emissions were calculated based on the fuel consumption characteristic of each vehicle type.

2.2 Carbon Footprint Calculations

The carbon footprint of transport activities of 401 MGHA is estimated based on data of year 2018. It includes the emissions of the following greenhouse gases that are emitted during transport activities: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). The carbon footprint is estimated in "carbon dioxide equivalent" or "CO2eq" units, which is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO2eq signifies the amount of CO2 that would have the same global warming potential (GWP). In this analysis, the GWPs from the Fourth Assessment Report of Contribution of Working Group I to the Intergovernmental Panel on Climate Change were used, based on the effects of greenhouse gases over a 100-year time horizon, which are 25 and 298 for CH4 and N2O, respectively [19].

2.2.1 Patients

The method of spot recording at the entrance of the hospital was used to take a sample of 1000 patients, during the period from 24 March to 30 June 2018, in different days and hours. The questionnaire recipients were asked about:

a. The mode of transport that they used to reach 401 MGHA
b. How many times they visited the hospital last year
c. An estimate of the distance they travelled to reach the hospital
d. If they use their private car, whether they come alone or with other colleagues to the hospital (carpooling/car sharing)

Regarding the means of transport, by analysing the sample, it was concluded that:

a. 58.10% (581 persons) used private cars. The use of taxi was included under the category of private cars.
b. 11.90% (119 persons) used public buses.
c. 23.00% (230 persons) used metro (the subway).
d. 7.00% (70 persons) used motorbikes.

Following the *Central Limit Theorem* and taking advantage of the fact that the binomial distribution approximates the normal distribution for large samples, it can be assumed that the sampling percentages follow normal distribution with mean $\mu = p$ and standard deviation $\sigma = [p(1\text{-}p)/n]^{1/2}$. The properties of the normal distribution enable the construction of a confidence interval *95%* around the actual population mean, according to the formula:

$$P\left(p-1.96\sqrt{p(1-p)/n} < X < p+1.96\sqrt{p(1-p)/n}\right) = 0.95 \quad .$$

Recall that for $z \cong 1.96$, we get:

$$P\left((X-p)\Big/\sqrt{p(1-p)/n} < z\right) = 0.975 \quad where \quad (X-p)\Big/\sqrt{p(1-p)/n} \cong N(0,1).$$

Using the above formulas, Table 2 is constructed as follows:

Therefore, the 180,000 patients that visited the hospital in 2018 are categorized as follows, regarding the mode of transport they used to reach the hospital:

a. 104,580 used private cars;
b. 21,420 used public buses;
c. 41,400 used the metro; and
d. 12,600 used motorbike.

By the analysis of the sample, it was also estimated that 25.64% (26,820 out of 104,580) of private cars, which was used by patients, were equipped with diesel engine.

It was also estimated that the distance travelled *by the sampled 1000 patients* of 401 MGHA were 40,078 km (kilometres) to arrive to and return from the hospital. The distance travelled is distributed to the respective means of transport as follows:

a. 73.23% (29,350 km) by private cars
b. 7.78% (3120 km) by buses
c. 12.55% (5030 km) by the metro
d. 6.43% (2578 km) by motorbike

The distance travelled by the 180,000 patients that visited the hospital in 2018 corresponds to 7,214,040 km (i.e., 180,000 patients multiplied by 40,078 km per 1000 patients). This distance is categorized per mode of transport in Table 3, using the above formulas of the *Central Limit Theorem*, as follows:

Table 2 Mode of transport of patients

Mode of transport	Sample	Standard deviation	95% confidence interval for the population average		Scaling to 180,000 people		
			lower limit	upper limit	lower limit	upper limit	average
Private car	58.10%	1.56%	55.04%	61.16%	99,076	110,084	104,580
Metro	23.00%	1.33%	20.39%	25.61%	36,705	46,095	41,400
Bus	11.90%	1.02%	9.89%	13.91%	17,808	25,032	21,420
Motorcycle	7.00%	0.81%	5.42%	8.58%	9754	15,446	12,600

According to Table 3, the distance travelled in 2018 is distributed to the respective means of transport as follows:

a. 5,283,000 km by private cars; it was assumed that 25.64% of distance or 1,354,561.20 km was driven by diesel engines;
b. 561,599 km by public bus; it was considered that 80% of buses consume diesel (military buses) and the other 20% natural gas (public buses);
c. 905,398 km by the metro; and
d. 464,043 km by motorbike.

The GHG emissions are calculated by the multiplication of the distance travelled by the GHG conversion factor per mode of transport. The GHG emissions are calculated in tones CO2eq; the distance travelled is given in Table 3 in km; and the GHG conversion factor are the emissions factors to estimate the combined GHG impact (CO2, CH4 and N2O) per passenger-km from travelled distance. The GHG conversion factors used in this study and their source are presented in Table 4. The GHG conversion factor of metro was based on electricity consumption data provided by Urban Rail Transport S.A. and the 2014 grid electricity CO2 emission factor, 833.8gCO2eq/kWh [20]. The GHG emissions per mode of transport generated by the transport activities of daily patients are presented in Table 5.

The use of private car prevails compared to other mode of transport, being responsible for the 93.76% of GHG emissions made by the movement to and from the hospital of patients (Table 5).

2.2.2 Staff

The hospital staffs are about 1000 employees, working in three shifts, 8 h per day. To calculate the kilometres travelled per mode of transport, all employees have responded to the same questionnaire as in the case of patients. It was found that:

a. 58.10% (581 persons) use private cars.
b. 11.90% (119 persons) use buses.
c. 23.00% (230 persons) use the metro.
d. 7.00% (70 persons) use motorbikes.

It was also found that 25.60% (149 out of 581) of private cars, which was used by hospital staff, were equipped with diesel engine. The distance travelled in 2018 is distributed to the respective mode of transport as follows:

a. 73.23% (29,350 km) by private cars
b. 7.79% (3120 km) by bus
c. 12.55% (5.030 km) by metro
d. 6.43% (2.578 km) by motorbike

As in the case of daily patients, the use of private cars prevails compared to the other modes of transport, being responsible for the 93.71% of GHG emissions generated by the daily movements of the hospital staff (Table 6).

Table 3 Distance travelled per mode of transport by patients

Mode of transport	Sample	Standard deviation	95% confidence interval for the population average		Scaling to 7,214,040 km		
			lower limit	upper limit	lower limit	upper limit	average
Private car	73.23%	1.40%	70.49%	75.98%	5,085,037	5,480,963	5,283,000
Metro	12.55%	1.05%	10.50%	14.60%	757,271	1,053,526	905,398
Bus	7.78%	0.85%	6.12%	9.45%	441,800	681,397	561,599
Motorcycle	6.43%	0.78%	4.91%	7.95%	354,350	573,736	464,043

Table 4 GHG conversion factors in kg CO2eq per passenger-km (pkm) per mode of transport

Mode of transport	Private car	Private car	Motorcycle	Bus	Bus	Truck (< 7.5 t)	Metro	Source
Fuel	Gasoline	Diesel	Gasoline	Diesel	NG	Diesel	Electricity	
EF CO2 (t/TJ)	73.26	73.23	73.26	73.23	55.67	73.23	–	[20]
EF CH4 (kg/TJ)	11.95	0.27	112.64	5.38	92.00	5.38	–	[20]
EF N2O (kg/TJ)	1.64	3.44	1.63	1.43	3.00	1.43	–	[20]
NCV (TJ/kt)	42.79	42.75	42.79	42.75	49.06	42.75	–	[20]
Fuel consumption (g/km)	70.00	60.00	35.00	240.00	301.00	110.00	–	[21]
EF CO2 (kgCO2/km)	0.219	0.188	0.110	0.751	0.822	0.344364	–	–
EF CH4 (kgCH4/km)	3.58E-05	6.98E-07	1.69E-04	5.52E-05	1.36E-03	2.53E-05	–	–
EF N2O (kgN2O/km)	4.92E-06	8.83E-06	2.44E-06	1.47E-05	4.43E-05	6.72E-06	–	–
EF GHG (kgCO2eq/pkm)	0.222	0.190	0.115	0.019*	0.022*	0.347	0.012	–

Abbreviations: PC = personal car or taxi, NG = natural gas, EF = emission factor, NCV = net calorific value, TJ = tera joule, kt = thousand tonnes, kg = kilogramme, g = gram, km = kilometre, GHG = greenhouse gas

*it is assumed that in each bus are 40 passengers

2.2.3 Hospital Vehicles

In 2018, hospital vehicles, including ambulance services, of the 401 Military General Hospital of Athens consumed 33,878 lt of diesel and 7290 lt of gasoline. By using Table 4, the fuel consumption is converted to GHG emissions, which are estimated to be 105.370 tCO2eq.

2.2.4 Suppliers

In 2018, the supply of the hospital with food, fuels, medical and other material was performed by 12 vendors. The total mileage travelled by the trucks of suppliers was 98,192 km in 2018. By using the GHG conversion factors from Table 4, the GHG emissions from the suppliers of 401 MGHA are estimated to be 34.073 tCO2eq.

2.2.5 Waste Disposal

In 2018, the total mileage of the vehicles engaged to the disposal of hospital waste in 2018 was recorded (4580 km). By using Table 4, the mileage is converted to GHG emissions, which are estimated to be 1.590 tCO2eq. Similarly, the total mileage of the vehicles engaged in the disposal of clinical waste in 2018 was recorded (143,000 km). By using Table 4, the mileage is converted to GHG emissions, which are estimated to be 49.621 tCO2eq. Therefore, the total GHG emissions of the vehicles engaged in the disposal of hospital waste in 2018 are estimated to be 51.211 tCO2eq.

3 Results and Discussion

The total GHG emissions or the carbon footprint of the transport activities of the 401 Military General Hospital of Athens (401 MGHA – Hellas) is presented in Table 7. The movement of patients to and from the hospital is the category with the highest contribution (85.92%) to the hospital's carbon footprint of transport activities, followed by the ambulance services with 7.52%. Waste disposal and procurement contribute 3.65% and 2.43%, respectively, while the share of staff's movement is limited to 0.48%.

In line with the emission reduction target of the transport sector, the objective of this study was to estimate the carbon footprint of transport activities of the 401 Military General Hospital of Athens, as the starting point for the development

Table 5 GHG emissions per mode of transport by patients

Mode of transport	Distance travelled (km)	GHG conversion (kg CO2eq / pkm)	GHG emissions (tCO2eq)	Share (%)
Private car (gasoline)	3,928,438.80	0.222	872.113	72.40
Private car (diesel)	1,354,561.20	0.190	257.368	21.36
Metro	905,398.00	0.012	10.865	0.90
Motorbike	464,043.00	0.115	53.365	4.43
Military bus (diesel)	449,279.20	0.019	8.503	0.71
Public bus (NG)	112.319.80	0.022	2.440	0.20
Total	7,214,040.00	–	1204.654	100

Table 6 GHG emissions per mode of transport by 401 MGHA staff

Mode of transport	Distance travelled (km)	GHG conversion (kg CO2eq/pkm)	GHG emissions (tCO2eq)	Share (%)
Private car (gasoline)	21,836.40	0.222	4.848	72.39
Private car (diesel)	7513.60	0.190	1.428	21.32
Metro	5030.00	0.012	0.064	0.96
Motorbike	2578.00	0.115	0.296	4.42
Military bus (diesel)	2496.00	0.019	0.047	0.70
Public bus (NG)	624.00	0.022	0.014	0.21
Total	40,078.00	–	6.697	100

of an action plan for the mitigation of greenhouse gas emissions in the hospital-based healthcare of the Greek Army. Based on the estimated carbon footprint, a simple and easily-operated monitoring scheme of the GHG emissions of the transport activities of the hospital is proposed. Furthermore, a portfolio of a number of mitigation actions is proposed, which are expected to have a significant effect on the GHG emissions of transport activities of the 401 MGHA.

3.1 Goal Setting

People perform better when they are committed to achieving certain goals [22]. This improvement in individual performance because of goal setting is used often by organizations to improve their employees' efficiency [23]. Goal setting involves the development of an action plan intended to provide the individual with sufficient motivation and guidance in accomplishing a certain goal. In order to set a goal, there is a need for a monitoring and evaluation scheme in order to define the baseline or the starting point and for the individual to consider its strengths and weaknesses. Additionally, by monitoring progress in goal implementation, it is possible to appropriately adjust the goal and apply the necessary changes for its successful application.

The carbon footprint presented in this work can serve as the baseline of the GHG emissions of 401 MGHA transport activities. A simple monitoring scheme can be developed by using Tables 2 and 5 and calculate the GHG emissions per patient per mode of transport (kgCO2eq/patient), as it is presented in Table 8.

The type of transport used by each patient could be recorded at the entrance of the hospital as to estimate the daily GHG emissions. In this way, the hospital administration can aim in reducing this indicator, i.e., the carbon footprint of transport activities, and monitor this reduction target per month and each year. By monitoring the implementation of reduction target, the hospital administration can assess the successful application of mitigation actions; determine what changes should be made in order for emissions to be lessened; and plan and apply new mitigation actions. A portfolio of mitigation actions is presented below.

3.2 Mitigation Actions

The analysis of the 401 MGHA's carbon footprint of transport usage demonstrates that around 86% of GHG emissions derive from patients' visits to the hospital. The majority of these emissions (around 94%) are produced due to private car use, although the hospital is placed in an easy-to-access area of Athens, near a Metro station and other public means of transport. On the other hand, the lack of sufficient parking lot poses the necessity of replacing the use of private cars with other means of transport.

Therefore, the use of private cars for patients' visits could be significantly reduced, if the free parking for patients inside the hospital premises is strictly forbidden by the hospital administration. Free parking should be allowed only for emergencies and for older people with restrained mobility. Additionally, the hospital's bus line for the staff transportation could be employed to also serve patients. Patients could also be encouraged to use public means of transport instead of private cars, by taking precedence in light routine medical cases and simple diagnostic

Table 7 The total carbon footprint of the transport activities of the 401 Military General Hospital of Athens

Transport activities	GHG emissions (tCO2eq)	Share (%)
Movement of patients to and from the hospital	1204.650	85.92
Staff's movement	6.700	0.48
Ambulance services	105.370	7.52
Suppliers	34.073	2.43
Waste disposal	51.211	3.65
Total	1402.004	100

Table 8 GHG emissions per mode of transport per patient

Mode of transport	kgCO2eq/patient
Private car	10.800
Metro	0.262
Motorbike	4.235
Military bus (diesel)	0.496
Public bus (NG)	0.570

tests. These simple and costless mitigation actions may reduce the carbon footprint yielded by transport activities around the hospital area from 30% up to more than 40%.

Information and communication technology (ICT) has been suggested as another solution for reducing the carbon footprint in many cases, including the healthcare sector [24]. Telemedicine, which is defined as the use of ICT to provide health services from distance, regardless of time or other constraints, has been suggested to be a dynamic tool in reducing emissions from transportation. According to the UK National Health Services (NHS), telemedicine can reduce the total carbon emission in the UK's health sector by 18% [15]. Telemedicine covers a broad technological applications and methods that have been applied to many different clinical domains, such as radiology, pathology, dermatology, rehabilitation and chronic disease management [25]. The implementation of telemedicine services based on videoconferencing technology, in order to reduce the need for travelling and thus GHG emissions, could have a significant impact. According to Holmner et al. [7], by replacing in vivo visits with telemedicine appointments, GHG emissions could be significantly decreased by 40–70 times during rehabilitation of hand movements and in plastic surgery section. Previous studies have also demonstrated that videoconferencing reduces the required travelling distance and leads to substantial reduction in vehicle emissions [26–29]. Telemedicine initially has been developed to serve the needs of those incapable of accessing healthcare services due to location or other constraints. However, it could be of essence as a mitigation action, if it becomes one of primary healthcare services.

According to the analysis of 401 MGHA's carbon footprint caused by the use of patients' transportation, the second most important source of GHG emissions is the ambulance operation. In this case, the hospital's carbon footprint could be reduced by upgrading the ambulances to use 100% renewable fuels (e.g., biodiesel) and the training of the drivers in eco-driving. Training in eco-driving will improve their awareness of their driving behaviour and thus improving their driving style. As a result of their improved driving style, fuel consumption, emission levels and accident rates could be reduced.

Health and social care organizations can influence other public sectors and private companies, in embracing a more environmentally sustainable to operate. Adopting a policy of purchasing food and other products from local suppliers reduces the carbon footprint associated with their transportation. Additionally, as part of the hospital's environment-friendly strategy an evaluation of potential suppliers' compliance to hospital's practices and implementation of green procurement practices could result in major advancements in the procurement process [30].

Furthermore, the carbon footprint of transportation associated with waste disposal could be reduced through the reduction of the travelled distance of the vehicles engaged in the disposal of hospital waste, either by optimizing their routes or lowering the waste production. In any case, hospital administration should find ways to reduce, re-use, recycle and compost.

Staff travel also contributes to the carbon footprint occurred at the hospital. The hospital administration should encourage "active" means of transport (walking or cycling) by collaborating with local authorities on constructing suitable routes and by providing secure cycle storage and shower/changing facilities [31]. The hospital administration should also encourage the use of public transport; use of official military bus for arrival and departure from the hospital; and carpooling-car sharing. For the staff for which car transport remains necessary, reimbursement and parking provision should incentivize use of low-carbon options such as electric or hybrid cars. Whenever possible, travelling should be avoided, by use of virtual meetings via teleconference, videoconference and web-enabled meeting facilities [13].

4 Conclusions

By 2050, the EU should scale down greenhouse gas emissions to 80% lower than 1990 level through domestic reductions alone. Emissions from transport is planned to be reduced to more than 60% below 1990 levels by 2050 [32]. All EU countries and responsible sectors need to contribute towards this goal. In line with the EU low carbon roadmap, Greece needs to reduce emissions from all sectors that are not included in the EU Emissions Trading System (EU ETS), such as transport, buildings, agriculture and waste, to 4% by 2020 compared to 2005 levels. Moreover, the legislative proposal and an aim set for Greece by the European Commission for the 2030 is a 16% reduction of GHG emissions of the non EU ETS sectors compared to 2005 levels. Given that the highest rates of non EU ETS GHG emissions in Greece originate from road transportation (32% in 2017), there is a clear need to design and implement measures for the mitigation of GHG emissions caused by this means of transportation.

The estimation of the carbon footprint, firstly, of the transport activities and secondly, of the internal energy use processes (hospital's energy consumption, building energy use, waste treatment, etc.) of the 401 Military General Hospital of Athens, will be the starting point for the development of an action plan for the mitigation of GHG emissions in the hospital based healthcare of Greece.

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