Impact of Internal Combustion Engine on Energy Supplyand its Emission Reduction via Sustainable Fuel Source

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Impact of Internal Combustion Engine on Energy Supply and its Emission Reduction via Sustainable Fuel Source

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Abstract: The study intends to assess long-term mitigation strategies for reducing CO_2 emissions from internal combustion. The research makes use of well-known academic literature with relevant information, covers arguments, comprehension, findings, conclusions, and suggestions from literature. Concepts of combustion, internal combustion engines (ICEs), benefits of internal combustion, CO_2 emission, consequences of CO_2 emission on the environment, and CO_2 emission mitigating measures were taken into consideration for the evidence gathered in this study. The established, reviewed literature served as the basis, pointing petroleum as the primary source of energy for both industrial and home uses is the ICEs. However, it is also account for greenhouse gas emissions like CO_2 and others, which have a direct impact on the world climate, thus strongly urges the advancement of environmental sustainability through the dissemination of fresh scientific findings that will aid in reducing CO_2 and other greenhouse gases. The use of electric vehicles and biofuel applications were discussed as alternative to the fossil products. The research finding revealed that the use of internal engine a gasoline (GE) car produces 167g of CO_2 gas per kilometer, a diesel vehicle (DE) emits 134g, a hybrid (HEV) emits 145g and an electric vehicle (BEV) emits 114g, according to the life cycle assessment. The use of Coconut B5, B15 fuel gives CO_2 raise of 2.54 % B20%,4.64 B100%. While when of Camelina fuel lower 13.8 % of B100 than B20%, thus revealed that biofuel can increase or decrease in emission generation. However, biofuel is considered as an alternative energy source that is currently being researched and applied as fuel in motorized vehicles.

Keywords: Sustainability, Internal Combustion, CO_2 Emission, Mitigations, and Climate Change

1. Introduction

The worrisome impacts of climate change, future energy sources, fuel, and studies that helped analyse engine emissions, zero emissions, internal combustion engines, and electrification have all been discussed by various researchers [1)] and Reitz et al. [2)]. According to Olivier and Peters [3)], trends in global emissions, Covid-19 global trends and future effects, global movement in the amount of greenhouse and CO_2 emissions [3) 4)], the body of established literature within the context of energy policies, the examination of the power concentration and together with its factors regional economies in China were all taken into account in the study. The analysis focuses on the regional energy constructed for the project with the aid of its comprehensive database [4)]. The study correlates between chemical and physical processes concerning greenhouse effects, also addressed how atmospheric gases absorb solar energy [5)]. Since energy efficiency leads in less energy use and less greenhouse gases discharged into the atmosphere, promoting environmental sustainability. As a result, several governments, led by advance nations, are attempting to adopt strategies to improve power performance without affecting the environment [6)]. The study evaluates the functions of technological innovation with trade openness about energy price and its intensity in OPEC countries with the aid of panel Autoregressive Distributed Lags (ARDL) techniques between 1990 – 2016 [6)] . It emphasized its dynamic heterogeneous panel configuration to assessed the data throughout the duration stated above. Huayi [7)], indicates that the study dwells on the disparities in energy intensity of regional energy demand and supply. It, therefore, correlates the provincial energy intensity within the provinces of China with the aid of spatial panel data models. Markus et al[8)], uncovered 37.6 wt% piperazine (7 molal) was evaluated in the PCC-test facility with reference to the power generator in Durnrohr, Austria. The stipulated energy consumption for the regeneration of solvent could be reduced to precisely

3.17 GJ/t_{CO2}, this with no absorber intercooler and multi-stage flash. This consequently results in power saving of 14% when it is carefully compared with 30wt% MEA [8]. The primary parameters utilized to simulate the fuel reactors [9] , are detailed in Table 1. Furthermore, biofuel with the potential to address the drawbacks of existing fuels by serving as a clean, efficient, and ecologically friendly renewable alternative fuel were suggested [10]. Internal combustion engines (ICE), which are the primary means of propulsion for cars today, play a significant role in mobility. ICEs currently power 99.8% of all vehicles on the planet, while oil-based liquid fuels account for 95% of all energy transportation[11]. The three primary substitutes are fuel cell electric vehicles, battery electric vehicles, and hybrid electric automobiles (FCEVs). There are still several obstacles preventing the widespread use of these powertrain systems. The primary restrictions are supply and recharge, battery charging time, vehicle range [12,13], high vehicle expenses [14,15].

However, internal combustion engine vehicles (ICEVs) will continue to play a prominent role in society for the foreseeable future. To do this, ICEVs must see constant advancement for at least the next 20 to 30 years remaining in cars [11,16]. Nevertheless, there is an increasing need to enhance this propulsion source in order to decrease CO_2 emissions and harmful exhaust components, utilize renewable energy sources, and improve performance and efficiency [11]. Therefore, in order to enhance sustainability, this work aim in discussing on replacing fuel sources with high emissions with eco-friendly fuel sources and to analyze the full process of CO_2 given off by petrol and diesel internal engine vehicle (ICV), gasoline engine and diesel engine vehicle (GE, DE), and battery electric vehicle (BEV). All industries that require its services should be able to use sustainable fuel without negatively affecting the environment. Internal combustion engine waste heat recovery is a legal approach to produce energy that can be used to achieve sustainability, environmental, and fuel efficiency goals [17]. Although EVs (electric cars) are known with capacity to reduce greenhouse gas emissions, but the use is yet relatively minimal [12]. Internal combustion engines (ICEs) that burn liquid fuels derived from petroleum are used almost exclusively in transportation, and there is a significant and rising global need for transportation energy [16].

Table 1. The basic factors utilized in = a fuel reactor experiment [9].

Name	Parameter	Value	Unit
Amount in fuel bubbling bed	V_{total}	133	M^3
Gas amount in a bubble phase	E_b	0.9	-
Gas amount in the emulsion phase	E_m	0.5	-
Temperature of operating	T_{FR}	1350	^oC
Pressure of operating	P_{FR}	10	Atm
Entrance solid mass flow rate	F_s	25	Kg/s
Entrance surface gas velocity	U_o	0.36	m/s

2. Combustion

Why IC Engine? Reposed to this brilliant question is in the work of Reitz et al. [2], the modern society rely solely on the transportation of goods and services. With the use of liquid fuels, internal combustion engines play important functions that lead to comfort and affordability. Additionally, stationary ICEs, like generators, are off-road applications for generating power for industry and households, promoting human well-being in all its forms [18,19]. ICEs are frequently used as commercial power sources. Also, ICEs can also be used to power hybrid propulsion systems[20]. Internal combustion engines have also shown to be successful in using hydrogen as a sustainable energy source. Almost every automobile manufacturer, including BMW, Ford, and Mazda, has produced hydrogen-fuelled vehicles [21]. More so, ICEs with free-piston have a number of potential benefits, including a simple structure, high conversion efficiency, multi-fuel capabilities, and a variety of power output types [22]. ICEs have been successfully observed as a clean, effective, and ecologically friendly renewable power source using ethanol and butanol categorized as renewable product which can alleviate the drawbacks of current fuel[23,10]. In addition, ICEs that are lighter, cheaper, better, and more efficient are becoming increasingly important nowadays. This is based on the implementation of new laws, such as EURO 7, which further restrict emissions [24]. Also, heat recovery from exhaust gas of ICE is a viable energy production method that meets the needs of sustainability, environmental preservation, and reduced fossil fuel use[17]. Masoud et al, [25] contemporary machine learning techniques were being used to optimize and manage internal combustion engines. In addition, internal combustion engines have been successful in using technical equipment and procedures to limit sound emission[26]. Ander et al [27], suggested that internal combustion engines with good configurations yielded significant advantages in in reducing flared gas. The sector is rapidly growing with technological improvements for transportation, industrial and domestic energy demand and supply. Scholars covered that there are closely 1.2 billion LDVS (light-duty vehicles), closely 380 million heavy-duty vehicles with fuel demand of greater than 11 billion liters [2]. There is progressive CO_2 post-combustion capture system through the application of reactive solvents as part of the IPCC 2005 report [28]. This solely covers fundamental knowledge, practical and technological experience in pilot and demonstration of commercial plants. Demonstration of commercial carbon capture plants is also covered by Raphael et al [29]. Rohan, Terry et al [30] contributed that oxyfuel combustion is among the most effective technologies employed for power plant CO_2 capturing. It handles the processes of burning the fuel in the absence of air but the presence of pure oxygen. The processes involve the regulation of flame temperature by reusing a portion of flue gas in the boiler/furnace. Figure 1 shows the framework developed for data processing purposes [31], while Figure 2 gives details of the pre-combustion capture for energy production for domestic/industrial uses. Accurate and time-saving, the grid independent test in simulations through converting the node enumeration to a minimal mesh.

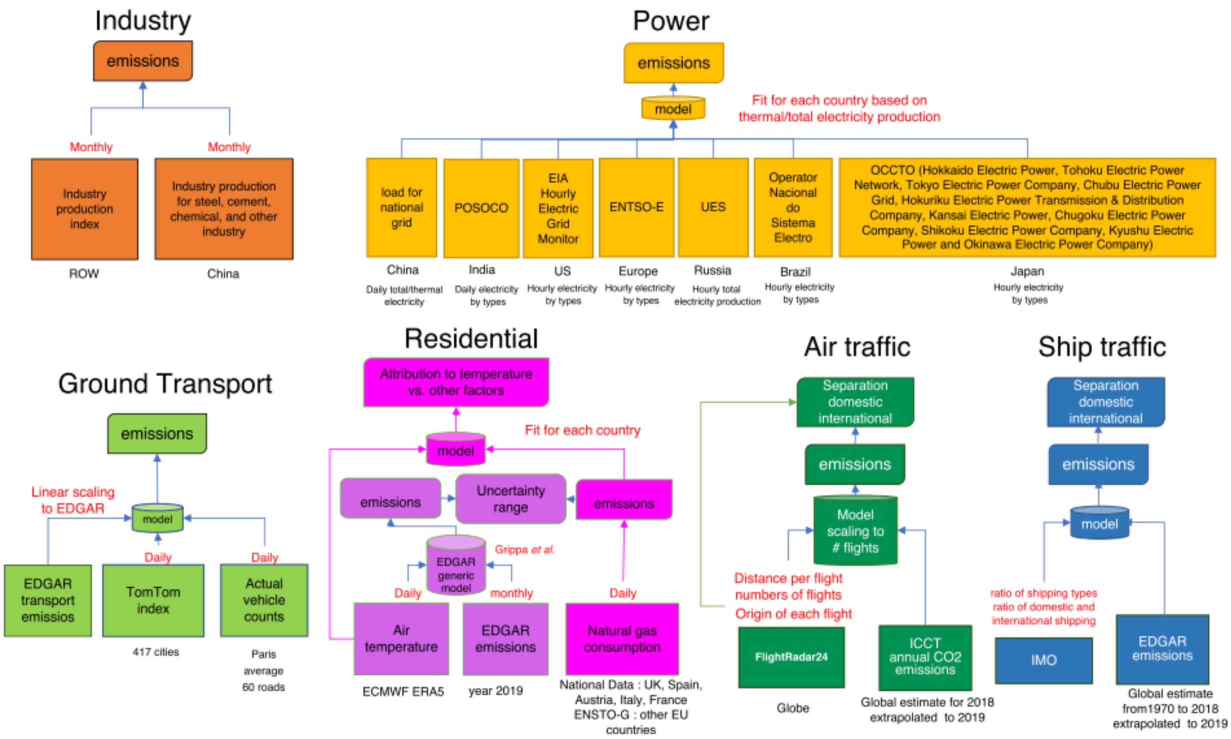

Fig. 1: Framework for data processing [31].

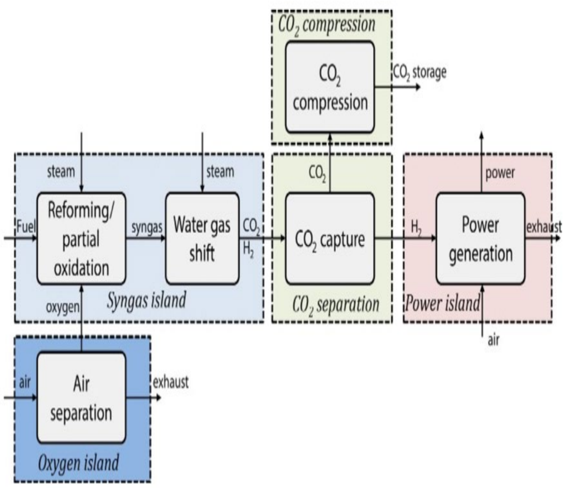

Fig. 2: Details of Pre-combustion Capture of Energy Production [32].

2.1 Internal Combustion

In ICEs operations, multiple technologies are needed to improve thermal efficiency and long-term decarbonization methods (such CO_2 capture and recycling technologies), which led to a large cost increase. [33,34]. One of main approaches to reduce CO_2 emissions is increase the compression ratio. With this, the overall efficiency of the engine improves. A higher compression ratio, less fuel consumption, results in less CO_2 emissions into the atmosphere [35]. Carbon catch and store (CCS) is a significant approach for reducing GHG emissions. Pre-combustion capture, oxy-fuel process, and post-combustion catch are the three approaches for CCS. The most important of these is post-combustion capture, which provides pliability and may be simply integrated into running stages[36]. The utilize of dimethyl ether as a fuel in a vehicle ignition engine reduces CO_2 emissions [37]. It is evaluated that using synthetic fuels in the ICEs will be more environmentally friendly than using electric automobiles [37]. According to the life cycle assessment, a gasoline car produces 167g of CO_2 gas per kilometre, a diesel vehicle emits 134g, a hybrid emits 145g and an electric vehicle emits 114g[38]. However, internal burning engines can achieve them potential through the help of electrification as shown in Figure 3. The ICEs will be much simplified as a result of this, and the cost will be significantly decreased in order to save energy and reduce carbon emissions [34]. In the future, a powertrain will combine the operations of an ICEs and an electric motor. The ICE, battery, and motor are connected, allowing for the use of battery charging and discharging to accommodate various operating conditions[34]. Some researchers have promoted electric vehicles as the only and best solution for a sustainable future of mobility, to the disadvantage of the ICEs [18,39]. In line of this, Government of the Republic of Indonesia has issued a Presidential Regulation to accelerate vehicle electrification for minimise pollution [40]. Furthermore, the scarcity of fossil fuels and the growing demand for them drive the development of renewable energy resources such as bioethanol and ethanol, which are used as an alternative fuel in motorised vehicles [41,42,43]. However, with biofuels, ICEs research is still required and will continue for greener mobility [19,44,45]. Moreover, a research into the true source of global emissions revealed that power generation, not automobiles, is the primary source of pollution [18]. Advances in technology related to the use of renewable fuels are critical to environmental and economic sustainability [44,46,16,47]. Renewable and non-conventional energy have already established themselves as major possibilities for countries' energy security and sustainability, such as Japan[48,49].

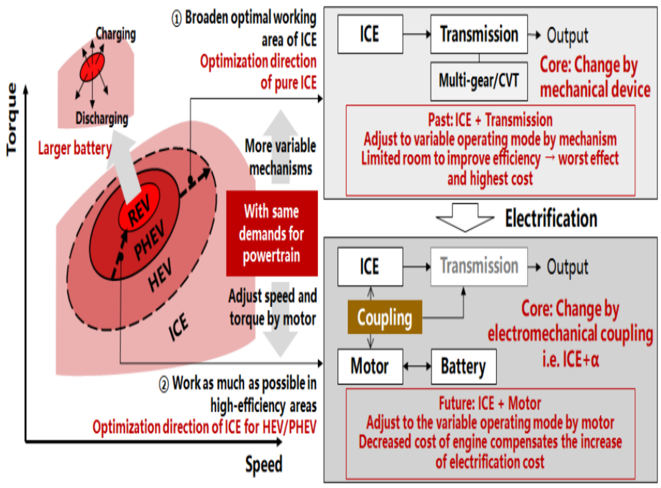

Fig. 3: Electrification of Internal Combustion Engine [34].

Challenges of internal combustion are captured in the work of Fuguan et al [34], which include (a) combustion engines increase the stringent fuel regulations of consumption, (b) It increases the upgraded environmental standards, (c) it is challenging developed from the new technologies. Table 2 indicates the proportion share of worldwide transportation energy order in 2018 for various of transportation section [46], showing 13, 000 million tons of oil equivalent per annum.

Table 2 shows the proportion share of global transportation energy demand by variation transport sectors in 2018 [46].

Passenger Sector	(%)
buses, Rail and 2-3 wheelers	7 %
Light-vehicles (LDV)	44 %
Aircraft	10%
Freight transport	26 %
Marine	8 %
Rail and Pipeline	5 %

Engine scholars and manufacturers target mitigating and cutting down fuel consumption and carbon emission [46]. The transportation section, particularly rider transport, is the fastest-growing source of GHG emissions [50]. Despite the fact that CO_2 organizing is becoming increasingly important in the transportation sector. This considers the CO_2 emissions from the operation phase as well as emissions from power generation [51]. Differing distances and CO_2 emissions of the battery manufacture were also assessed in terms of process of CO_2 shown in Table 3. The researchers thoroughly discussed the various types of biodiesel and their manufacturing procedures [52].Table4 shows the emissions of biodiesel based on the components used to make biodiesel and the engines that use it. In addition, Biofuel is one of several alternative energy sources that has attracted more attention in globally because it is thought to be the most environmentally friendly and sustainable energy source. Biofuel is an alternative energy that is currently being researched and used as an alternative fuel in motorised vehicles.

Table 3. Past life-cycle assessment (LCA) assessed on internal combustion motor automobiles and advanced powertrain automobiles

Ref	Vehicles	CO_2 Emission [kg-CO_2/kWh]	Research area	Results
51)	(ICV *1 and BEV *2) 180,000 km	0.521	Europe	The CO_2 emissions in case (BEV) lower than (ICV) when was powered by renewable energy.
53)	ICV (GE *5, HEV *6, plug-in HEV) and BEV 320,000 km	0.8515	US	(HEV) emitted less CO_2 than (BEV) and plug-in (HEV).
54)	ICV (GE, HEV) and BEV 150,000 Km	1.04	Australia	(BEV) emit fewer greenhouse gases than (GE) but more than (HEV) in larger cars.
55)	ICV (GE, DE) and BEV 240,000 km	0.485	China	When compared to GE, BEV reduces greenhouse gas emissions by 36–47 percent.
56)	ICV, BEV 200,000 km	0.30	European average	In most European countries, BEV produced far less CO_2 than ICV.

Table 4. Biodiesel emission of internal engine

Ref	Kind of fuel	Engine condition	NOx	CO	CO_2
57)	Sunflower B100	4 Stroke, 1-cylinder , inconstant load, stable velocity 1500 rpm	higher 1.27 %	lower 4.21 %	-
58)	Coconut CB5, CB15	4 Stroke, 1-cylinder stable velocity 2200 rpm	raise all B5 1.42% B15 3.18%	lower all B5 13.4% B15 21.52%	raise all B5 2.54% B15 4.64%
59)	Camelina B20, B100	4 Stroke, 4-cylinder DI Varying velocity 1200 to 2600 rpm, fixed load	raise 9.6 % B100 B20> B100	lower 15.4 % B20> B100	lower 13.8 % B100 B20> B100
60)	Cotton B20	4 Stroke, 1-cylinder inconstant load, stable velocity 1500 rpm DI diesel engine	raise 8%	Lower 18.4%	raise 14%
61)	Soy B20, B40, B100	1-cylinder , inconstant load, stable velocity 1500 rpm, DI diesel engine	Raise 7.5 % B20% B100% higher than B20 % and B4 0%	lower all B20% 11.36 B40% 29% B100% 41.7%	-
62)	waste cuisine oil B20	4 Stroke, 1-cylinder Unstable load, stable velocity 1500 rpm	lower 29.07%	raise 3.19%	Increase 5.33%
63)	Canola B10%	1-cylinder. Unstable load, stable velocity 2200 rpm, Compression ratio 18:1	higher	lower	higher
64)	Mustard B20%, B10	4-cylinder. Unstable load, stable maximum velocity 4000 rpm, Compression ratio 18:1	raise all B10 9% B20 12%	B20% lower than B10%	-

2.2 Internal Combustion Engines and Future Benefits

The advantages of internal combustion engines and future opportunities are handled by many researches [65,66]. Firstly, electric vehicles have battery costs and their driving range, the battery cost is a great challenge that could not be reduced in the short term[65,66]. In addition, their manufacturing process, (ii) their use throughout their lives, and (iii) their disposal and recycling procedure[67]. Secondly, an Internal combustion engine has fewer limitations compared with electric vehicles. Electric vehicles limitations are within the context of determination of the battery properties with a very high level of difficulties in solving it[68)67)]. Finally, it was developed over a century, this made it very possible for the internal combustion technologies to have full industrial connection, an apparent class of skills, labour in and in-depth skills for its manipulation manipulations[2)]. This is unlike the electric vehicle that was developed recently by Fuguan et al [34)]. Figure 4 below demonstrates the presence of the principal laboratory equipment scheme of internal combustion engine.

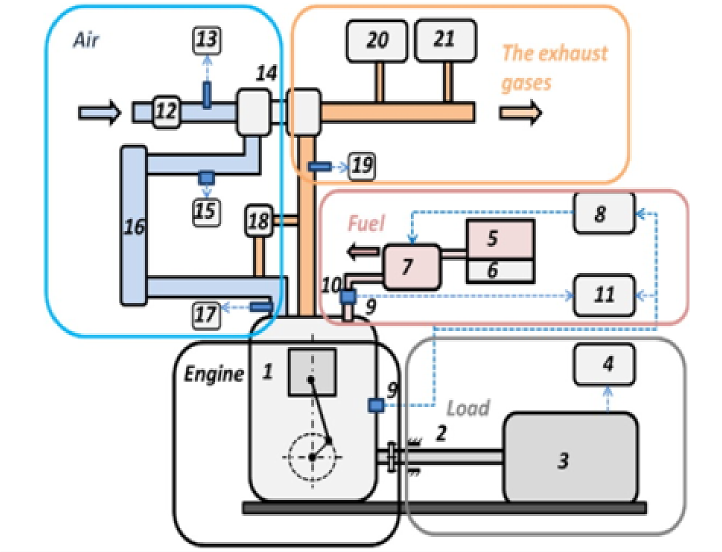

Fig. 4: Presentation of the Principal Laboratory Equipment Scheme of Internal Combustion Engine[69)].

Internal combustion engine laboratory test was carried out as illustrated in Figure 4. The equipment in the laboratory covers compression ignition (CI) engine, engine load apparatus, air and fuel supply technology, and exhaust framework [69)]. Edmundas et al [69)], the testing types of equipment of the scheme engine are the following representation of numerals to alphabetical quotations as (a) compression ignition engine, (b) shaft, (c) engine load stand (d) Engine brake torque and speed taking apparatus, (e) fuel tank, (f) fuel scales, (g) high-pressure fuel pump, (h) fuel injection regulating apparatus, (i) crankshaft location sensor, (k) beginning of fuel injection sensor (l) beginning of fuel injection recording apparatus, (m) air mass meter, (n) intake air temperature meter, (o) turbocharger, (p) turbocharger pressure meter, (q) 16 air cooler, (r) intake gas temperature meter; 18 exhaust gas recirculation (EGR) valve, (s) exhaust gas temperature meter, (t) exhaust gas concentrations examiner, and (u) smokiness meter [69)]. Advantages of internal combustion engines are treated in Mehdiet et al [70)], when optimally configurated with aim to cut down on emissions and enhance power output. According to Felix et al [46)], the advantages of ICEs is seen through, presently 99.8% of global transportation sector rely on ICES power supply, 95% of its power are directly from liquid fuels like petroleum products. Although there are alternative considerations of biofuels and hydrogen. Figure 5 reveals a basic detail of temperature swing adsorption (TSA) process involving the stated four Steps. Q, heat provided or removal; T_{ads} absorption temperature; T_{des} Desorption temperature.

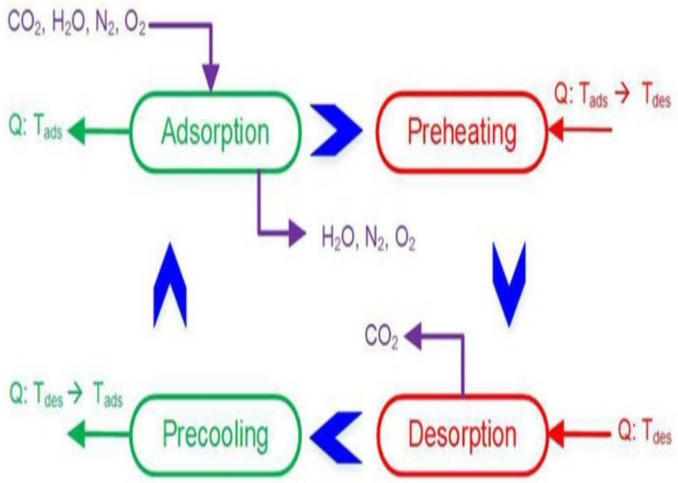

Fig. 5: Basic diagram of TSA Cycle with Four Processes. Q, Heat Supplied or Removal; T_{ads} Absorption Temperature; T_{des} Desorption Temperature (2019)[71)].

3.Energy Demand and Internal Combustion

For example, Malaysia's energy demand has been steadily increasing as the country's industrial, transportation, and agricultural sectors have expanded. Figure 6 depicts the industrial sector's energy consumption structure, which is dominated by the cement industry (48%) and steel & iron industry (19%)[72,73)]. From 2007 to 2017, the transportation sector saw a significant increase in energy consumption, rising from 0.05 percent to 0.3 % of total country demand. The focuses on the green house global (GHG) emissions from the electrical sector, which is considered as the largest source of world CO_2 emissions[72)]. GHG discharges are approximately beyond 50 billion tonnes each year globally. Figure 7 shows the power section accounts of approximately three-quarters of global CO_2 discharge.

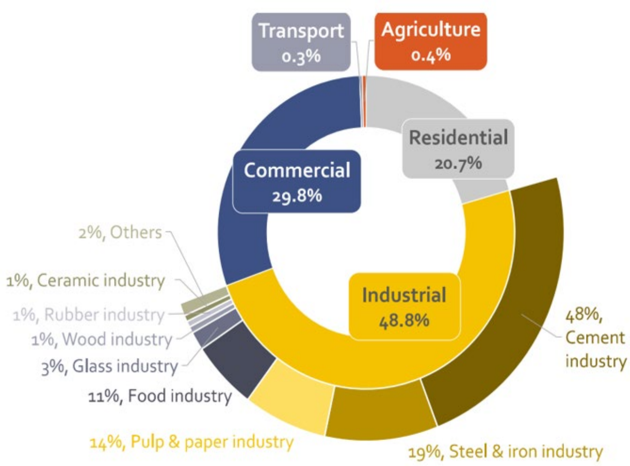

Fig. 6: Energy Demand in Malaysia [73)].

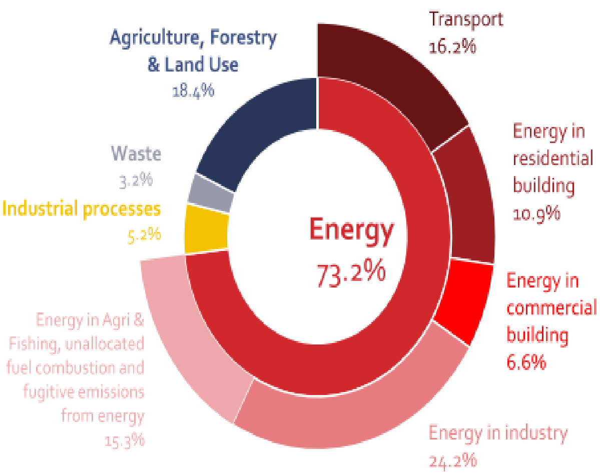

Fig. 7: shows the global sources of total CO_2 [73]

3.1 CO_2 Emission

Global CO_2 eradication is essential, especially with regard to emissions from the transportation sector. Though several nations globally had set aside policies banning the use of combustion engines in the next 20 years. Efforts of replacing internal combustion-powered engine vehicles is at rapid growth for the passengers' vehicles [74]. Zhu et al [75], stated that pandemic of Covid-19 lockdown has significant impacts on human activities viz-a-viz to the environment due to challenges faced by the society on researching deep in renewable fuel. The study uncovered carbon emission sharply reduced by 8.8% on worldwide CO_2 emission (1551 Mt CO_2) within the beginning six months of 2020, when analyzed against emissions in 2019. Zhiwu et al [76] indicated that at present, post-combustion carbon capture (PCC) is the sole commercial scale CO_2 absorbing system in the TMC Mongstad in Norway with precisely 300,000 tonnes of CO_2 absorbed together with 1 million tonnes of CO_2 absorbed in BD3 SaskPower each year. The study evaluates the performance of CO_2 capturing in IGCC energy generators with the aid of air-blown gasification.

The entire process is carefully modelled and practiced ranging from coal gasification to its syngas cooling together with the cleaning[77]. Edward S. R. et al [78] stated that the work is to assess present CO_2 capture and storage (CCS) expenses for the recent crude oil energy generator. The study also is to analyzed those data against the expenses established and recorded 10 years back in the IPCC special report on carbon dioxide capture and storage (SRCCS)[78]. Tim, et al [28] indicated that the 2005 IPCC Special Report on carbon dioxide capture and storage (IPCC, 2005) was issued. It resulted in rapid developments at international, regional, and national levels with regards to laws and regulations established with CCS. Saffet et al [6], said energy efficiency helps to reduce energy use and the amount of greenhouse gases discharged into the environment, promoting environmental sustainability. On this, many nations following the footsteps to create regulations that promote energy efficiency. To reduce CO_2 emissions in the transport sector, vehicles can be powered by electricity, converted to biofuels, or CO_2 can be captured and stored on board [71].

The degree to which the carbon intensity of the power used to make, run, and recycle these cars can be decreased will determine how well this strategy works to cut carbon emissions [74]. Peta et al [79] uncovered that the IPCC SRCCS report after a decade of its release generate great scientific contributions from scholars within the public domain. Table 5 uncovers internal combustion motor processing factors featuring minimizing and maximizing standards.

Table 5. Internal Combustion Engine Working Factors with Minimizing and Maximizing Criteria[69].

Criteria	Min/Max	Parameters	Titles
x_1	Min	CO, %	Carbon monoxide
x_2	Max	CO_2, %	Carbon dioxide
x_3	Max	O_2, %	Oxygen
x_4	Min	HC, ppm	Hydrocarbons
x_5	Min	NOx, ppm	Nitrogen oxides
x_6	Min	Smoke., %	Smokiness
x_7	Min	BSFC, g/(kWh)n	Brake-specific fuel consumption
x_8	Max	η	Effective energy efficiency coefficient

The motor's energy efficiency was evaluated based on the factors of brake specific fuel consumption (BSFC), while the eco-efficiency factors employed; NOx, HC, CO, and CO_2 (amount in emitted smoke) during carried out experimental studies (Edmundas, Audrius et al) [69]. Table 6 shows an average global everyday requirement for vehicle fuels and the third quarter of 2018.

Table 6. A Standard Everyday Requirement for Vehicle Fuels Worldwide, and Third Quarter of 2018[46].

Assuming 32.5 MJ/l for gasoline, 36 MJ/l for diesel and jet fuel, 40 MJ/l for RFO. 1 exa joule = 163.4 million barrels of oil equivalent (BOE)		
Million barrels of oil equivalent (BOE)	Energy, exajoules	Fuel Volume, billion liters
26.4	0.162	4.985
28.1	0.172	4.778

8.0	0.049	1.361
7.0	0.043	1.075

Amaya et al [80] added sources of Hydrocarbons emissions as oxides of nitrogen (NOx), nonstoichiometric air-fuel ratio, incomplete combustion, oils on combustion chamber walls, crevice volumes, deposits on combustion chamber walls, and Carbon monoxide emissions. Ting et al [81] scientifically uncovered GHG Emission inventories of selected eight urban sectors which include; residential land-use, commercial and uses, institutional land uses, industrial land uses (energy usage), industrial emission from the fugitive, transportation land use from vehicles, rail-way, from waterways, agricultural land uses and related waste disposal together with treatment land-fills are in the inventory. Quéré et al [82] stated the statistical reduction of daily CO_2 during Covid-19 lockdown. The CO_2 emission cuts down by -17% (-11 to -25% for +/- 1) in the early April 2020 of the pandemic. This is academically compared with the year 2019 CO_2 emissions. Table 7 shows the scaling factors for emission growth in 2019 against 2018 in selected developed countries [31].

Table 7. Reveals scaling factors for emission growth in 2019 analysed against 2018 in selected developed countries [31].

Countries/Regions	Scaling Factor (%)	Source
China	2.8	Calculated in this paper
India	1.8	Global Carbon Budget 2019
US	2.4	Carbon Brief, 2020
EU27 & UK	-3.9	Carbon Brief, 2020
Russia	0.5	=ROW
Japan	0.5	=ROW
Brazil	0.5	=ROW
ROW	0.5	Global Carbon Budget 2019

3.2 Effects of CO_2 on the Environment

Andres, Adalberto et al [80] and Lestari et al [83] academically stated that fuel combustion results in environmental pollution which has direct effects on climate change through acid rain, global warming, smog, odors, and all related to respiratory tract infection together with diseases. Scientifically indicates major causes of emission to include dissociation of nitrogen, non-stoichiometric combustion related conditions, impurities present in the fuel and air together with other motor processing factors. Hydrocarbons (HC), carbon monoxide CO, nitrogen oxides (NOx), sulfur, and solid carbon entities are major concerns because of their adverse influence on both an individual's wellbeing and the environment (Amaya et al) [80] .Bright, Festus et al. [84] covered the global warming issues as the major predicament to most economies particularly that of Emerging 7 (E7) economies. The E7 nations set-asides CO_2 emission mitigating policies through cutting down the CO_2 emission with the trajectory of the economies. The study did focus only on the states of recycling of waste materials within the vehicle productions state or phase. It did not also handle parts of vehicle recycling within the maintenance phase or stage nor on its disassembling components from automobiles in the EOL stage (Kawamoto et al) [85]. Olumide and Felix [38] uncovered green gases result in global warming, and consequently to climate change is generating consciousness and efforts in its mitigation. CO_2 emission covered 76% of the total greenhouses emitted in the year 2010. Intergovernmental Panel on Climate Change (IPCC) (2021) discussed in detail the academic History of global temperature change and its major causes with reference to the recent Warming in the following headings. The panel (a) treated changes that are directly on global surface temperature reconstructed from paleoclimate archives. Panel (b) on the other hand handled changes on worldwide surface temperature using the previous 170 years as the benchmark. Oyetola and Noor [86] air pollution from the combustion of fossil fuels results in lung disease, heart diseases, and cancer. Biodiesel could help greatly in mitigating emi8ssion generated from fossil fuel emissions. This could therefore mitigate the emission effects on the environment and human health.

Saffet and Hakan [6] academically stated that low and less energy consumption consequently leads to rapid reduction in the greenhouse numerous gases nature release. This leads to environmental sustainability promotion. The attracts many nations globally to set aside energy efficiency policies. Frederica [87] revealed that fossil-fuel combustion results in children's health globally, it is, therefore, a great threat and the prime contributor to environmental equality and injustice. The pollutants of CO_2 as the key players in climate greenhouse damages. Habibie et al[40], investigated the sustainability of converting an internal combustion engine motorcycle to an electric motorcycle in order to reduce carbon emissions. One of the most major climate alterations is global warming, which is defined as a gradual increase in global rate temperature caused mostly by greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), ozone (O_3), and chlorofluorocarbons (CFC) [88]. Another issue that has an impact is pollution in the environment [89]. Muhamad et al [90], discuss how the number of people, population, civilization, and manufacturing have all had a substantial impact on ecological conditions human live. Forest blaze create CH_4 gas, which is 21 times more poisonous than (CO_2) emission, but peat fires can emit ten times as much CH_4 as burns on other types of ground. CH_4 gas has a higher possibility for global warming, therefore it will have a greater impact on ecological harm [91].

3.3 CO_2 Emission Mitigation

Municipal waste management has new technology known as thermochemical used solely in burning solid waste. This burning results in air pollutions through heating, and gases emission. This involves a very high cost of management. and it, therefore, required new mitigation emission through intensive studies for technological applications [92,93]. Increased output of solid municipal garbage is a result of urbanisation, 2030 regarding CO_2 emission stated targets with the aid of rapid economic expansion, rising community living standards, and urban population lifestyle changes[94]. Figure 8 shows a recycling system and municipal trash collection, the most cost-effective ways to minimise greenhouse gas emissions. On a worldwide scale, Significant consumption of electrical and electronic equipment (EEE) is driving up the volume of e-waste. So, Energy recovery is important to the economic potential of waste management systems as it provides an important source of energy to address this issue and helps improve the cost-effectiveness of waste management [95]. Alternate energy sources are an exporter with the possible to improve energy production on a national scale while meeting the appropriate requirements for pollution control in the air and natural environment and creating new jobs [96]. Climate change is unavoidable, and it must be tackled in a sustainable and suitable manner [97].

Peter et al [98] stated the Paris agreement set aside comprehensive policies scenarios toward addressing and mitigating against the global warming of climate emergency. This could be achieved by cutting down greenhouse gas emissions, which subsequently reduce the global temperature by 1.5ºC. Battery electric vehicle (BEVS) is an effort towards achieving the set-aside policies. Arman et al [93] the following factors to be considered for thermochemical plant selections. They are the technical, environmental, and economic factors. The technical factor covers system level, apparatus accessibility, simple system, and workplace safety. The environmental factor covers slag, land utilization, and emissions. The economic factor on the other hand covers employment rate, equipment sector growth and overhead expenses. Johannes et al [99] internal combustion banning sales of passenger cars are getting popularity within the context of climate change and its policies. The study, was on carbon effects of vehicles traveling banning in Sweden with the aid of a new automobile turnover design together with potential lifecycle examination considering the decarbonization of distributors [99,100]. Ryuji et al [85],focused on vehicle life with 1 to 5 stages and on each which stage CO_2 was analyzed. The stages are (a) Phase 1 Vehicle production processes, this covers drawing of natural resource, material and automobile parts manufacture, and the assembly processes. (b) Phase 2 Fuel creation/electric energy creation processes and handles its creation of fuel for ICVs, and its generation of electric power for BEVs. (c) Phase 3 automobile utilization on the other hand, assesses fuel combustion in driving ICVs, (d) Phase 4 maintenance stages and solely deals with the manufacturing of replacement components, (e) Phase 5 on the other hand, is the end-of-life (EOL) which is concerned with the removal of automobiles when its useful life ends [85]. Do and Clemens [101] stated that their work is within power planning for Vietnam from 2018 to an energy model for its expansion. Their results indicate 42.6% coal-fired implemented capacity, while as projected by the year 2030 the Vietnam share power will be within 29% with a precisely 8% reduction in the CO_2 emission scenario. It is projected also 19% will result in CO_2 cut down by 25% scenario. Hydro, wind, and solar power are expected to be the primary venture in the coming years [101]. Peter [102] academically commented that CO_2 Sequestration as a technique of decarbonization of fossil fuel and to eliminate CO_2 emission into the atmosphere will pave ways for sustainability through the renewable and carbonless community. Ting et al [81] contributed to the Carbon Reduction Target Analysis employed by the 167 cities. the studies emphasize the cities geographical location and boundaries, its types of targets set aside, its populations present and projected. The study further itemized and evaluated the climatic condition of each of the study cities with reference to its carbon mitigation strategies, its components, and scenario baseline that could be linked to the global perspectives Ting et al [81]. Zhu, Stanislaw et al [103] reported that, the mitigation of greenhouses gases emission is to be best achieved through cutting down usage of fossil fuel. Economically fossil fuel is very expensive. It has been scientifically proven that the intensity of photosynthesis could significantly reduce anthropological carbon emission sources. Nicholas and Daniel [104], evaluated energy consumption and its emissions stipulated regulations concerning very old powered petroleum vehicles and those with new plug-in electric vehicles. Although, globally, vehicles regulations with regards to energy consumptions and carbon emission are ignored. Figure 9 indicates measures for the carbon dioxides (CO_2) emission lowering strategies. In addition, Renewable hydrogen is a long-term strategy for decarbonizing the energy system, lowering pollution emissions, and mitigating climate change [21]. Furthermore, butanol is an alcohol-based biofuel with the potential to address the drawbacks of existing fuels by serving as a clean, efficient, and ecologically friendly renewable alternative fuel[10]. Wei et al[105],stated that the exhaust gas recirculation (EGR), thermal and chemical effects on combustion and emission of diesel engine. The thermal and chemical effects of CO_2 and H_2O were responsible for 65.3 % and 36.7 %, respectively, at the 50 % EGR rate.

Fig. 8 shows a recycling system and municipal trash disposal[92)]

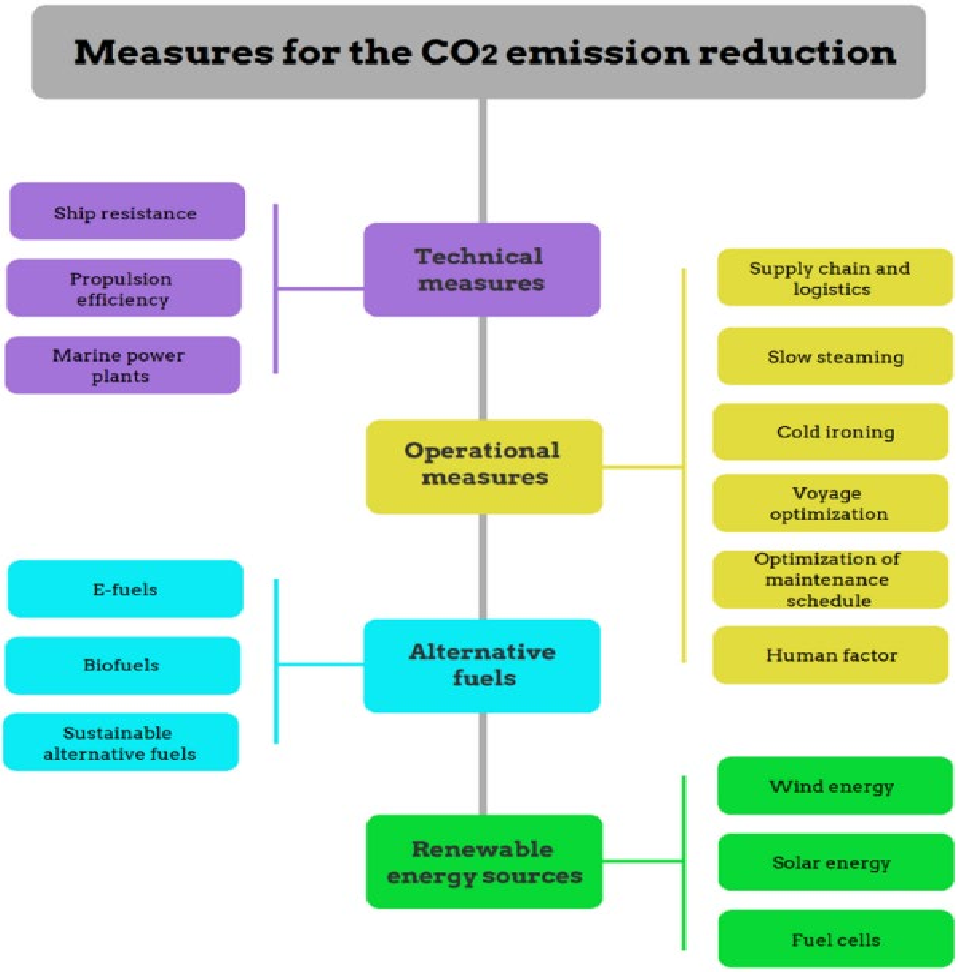

Fig. 9: Measure for the CO_2 Emission Reduction [106)].

4. Conclusions

This research reviewed the possible approach on mitigating CO_2 emissions from various combustion sources as prevent environmental issues. In account of the difficulties, various environmentally friendly sources were investigated. Despite various scientific efforts to replace internal combustion engines, which have been used for more than a century, with electric vehicles, this has not yet fully accomplished. The reviewed literatures revealed that there are numerous efforts being made to modify internal combustion engines in order to reduce their fuel consumption, CO_2 emissions, range, durability, and lifespan, as well as their comfort and flexibility in use. However, there are drawbacks in using internal combustion, including difficulties with human health relating to heart and lung ailments, CO_2 emissions, greenhouse gas emissions, climate change consequences, and environmental damage. Yet, internal combustion continues to be a crucial component of the world's energy supply, helping to meet demand across all industries. The study observed that approach of capturing CO_2, EGR stands as a positive means of solving the emissions in the environment. Furthermore, suggested that, biofuel is one of promising alternative energy sources that has attracted more attention globally because it is the most environmentally friendly and sustainable energy source. Biofuel is an alternative energy that is currently being researched and used as an alternative fuel in motorised vehicles.

5. Recommendations

The study mandates the advancement of environmental sustainability through the dissemination of fresh scientific findings that will aid in reducing CO_2 and other greenhouse gases. The creation and use of policies could help with this. Promotions of zoning regulations, the separation of worldwide combustion-related industrial land use from residential land use, the use of greenways between industrial and residential areas, and the separation of other non-conforming or incompatible land uses are all important. Biofuel technology and other related technologies that could help in reducing the consumption of fossil fuels and its CO_2 emission should be encouraged among scholars through the government's provision of research grand at all levels. Researchers and academicians at the postgraduate and postdoctoral level are to enjoy scholarship and research grand to enable further new academic researches to be conducted in the trajectory of internal combustion engines.

Nomenclature

ICV	Internal combustion engine vehicle
BEV	Battery electric vehicle
HEV	Hybrid electric vehicle
DE	Diesel engine vehicle
GE	Gasoline engine vehicle

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