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Sustainable Living: Carbon Footprint Over A Spectrum Of Regions

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ABSTRACT

This literature review is aimed at understanding "Sustainable Living", and factors which impact Sustainable living, Carbon footprint being the major one. It will help us to understand how carbon emissions affect a wide array of regions ranging from food to transport and construction among others. The reduction of carbon emissions should be discussed more often since major industries take irresponsible actions regarding their carbon footprint hence causing damage to sustainability. This study includes reviews of articles about carbon footprints over different carbon emitting sources.

Keywords: Green House Gas (GHG), Carbon Footprint (CF), Emission, Sustainable, Environment.

INTRODUCTION

Sustainable living describes a lifestyle that attempts to reduce the use of Earth's natural resources by an individual or society. Following a sustainable lifestyle ensures that we humans exert less pressure on our biosphere. Researches into sustainability have shown that it is no longer just bound to the environment, it has grown over time, because of the term being so generalized and there not being a proper unit/way to measure or keep a track on it, we as people are unable to create a sustainable environment. Sustainability is often assumed to be uneconomical and hence is practiced seldomly. Having just about enough knowledge about sustainability is important. Knowing too much about it can affect one negatively as they might feel they are not doing enough for the ecosystem. For knowledge in sustainable living is more about familiarity in doing things the ecological way. It is difficult to live sustainably in today's era where more consumption is equated to more happiness. If this continues, we'll be looking at an environmental crash very soon and hence a transition towards a simpler lifestyle is necessary. One part of living a sustainable lifestyle is reducing one's Carbon Footprint. Reduction in carbon footprint is directly proportional to living a more sustainable lifestyle. The term 'carbon footprint' has become tremendously popular over the last few years and is now in widespread use across the world. But what exactly is a 'carbon footprint'? In Layman's terms, carbon footprint stands for a certain number of gaseous emissions that are relevant to climate change and associated with human production or consumption activities. The more precise definition as given by the WHO is the measure of the impact your activities have on the amount of carbon dioxide (CO_2) produced through the burning of fossil fuels and is expressed as a weight of CO_2 emissions produced in tonnes. Rather than the greenhouse gas emissions associated with production, carbon footprints focus on the greenhouse gas emissions associated with consumption. The concept and name of the carbon footprint was derived from the ecological footprint concept, which was developed by William E. Rees and Mathis Wackernagel in the 1990s at the University of British Columbia. While carbon footprints are usually reported in tons of emissions (CO2-equivalent) per year, ecological footprints are usually reported in comparison to what the planet can renew. This assesses the number of earths' that would be required if everyone on the planet consumed resources at the same level as the person calculating their ecological footprint. The carbon footprint is one part of the ecological footprint. Carbon footprints are more focused than ecological footprints since they merely measure emissions of gases that cause climate change into the atmosphere.

SUSTAINIBILTY

SUSTAINIBILITY IN RECYCLING W.R.T. CARBON FOOTPRINTS:

A key challenge for the waste management sector is to maximise resource efficiency while simultaneously reducing its gas (GHG) emissions. For stakeholders to understand the GHG impacts of their waste management activities and identify emissions reduction opportunities, they have to be ready to quantify the GHG impacts. While previous studies are undertaken to develop GHG emission factors (EF) for materials recycling, they're generally insufficient to support decision-making thanks to a scarcity of transparency or comprehensiveness within the range of materials considered. During this study, a comprehensive, scientifically robust, fully transparent, and clearly documented series of GHG EFs for the recycling of a large range of source-segregated materials. EFs were derived from a series of partial life cycle assessments (LCA) performed as far as possible in accordance with the ISO14040 standard. With the exceptions of soil, plasterboard, and paint, the recycling of source-segregated materials resulted in net GHG savings. The bulk of calculated GHG EFs were within the range of information presented within the reference literature. Overall, the results highlight the important contribution that effective source-segregated materials recycling can have in reducing the GHG impacts of waste management. Solid waste management contributes about 5% to global gas (GHG) emissions. In response to growing concerns about the threat of temperature change, international action geared toward reducing gas (GHG)emissions is accelerating and therefore the solid waste management sector is expected to contribute.

CARBON FOOTPRINT CALCULATION

Carbon footprint is the measurement of a company's greenhouse gas emission in units of tons. This review provides 4 main steps for calculating carbon footprint:

1st Step: To identify business operations:

Business operations like heating, transportation, etc. Metrics such as litres or gallons can be used to calculate your fuel consumption. Electricity consumption can be measured by kilowatt hours, etc.

2nd Step: Collect data:

All companies release greenhouse gases through direct and indirect activities. That is why collecting data can be challenging. Collecting all data regarding company's greenhouse gas emission can help getting more accurate carbon footprint.

3rd Step: Find operation-specific emission factors:

To calculate your carbon footprint, you need to know how much GHG emissions are generated per kilowatt-hour of electricity used, per gallon of gasoline consumed, and so on.

4th Step: Calculate and interpret:

For interpreting your carbon footprint, using cloud-based tools (such as Vedantrix) can be helpful, as they illustrate how your company is performing on specific business operations.

For example:

Let's take an example of Falcon Communications it's an oil and natural gas company based in Thane, Maharashtra. As per steps given above, we identified its business operation; it is heating. After collecting data, we got both direct and indirect greenhouse gas emissions. Operation specific emission factor would be miles per gallon. A fuel gas company produces 1.22 million metric tons of carbon emission.

CARBON FOOTPRINTS OF CONSTRUCTIONS:

CIVIL WORK:

The high energy ingesting and carbon emissions of the construction industry are triggering environmental problems. Therefore, it is imperative to study approaches and strategies to reduce emissions during construction for a healthy, safe and workable environment. Using a life cycle valuation approach, this study aims to analyze the results of construction projects and their carbon footprint during the construction conveyance period. The results show that overall engineering projects generate more carbon emissions than cosmetic engineering. In accumulation, the average ratio of cement carbon emissions to total carbon emissions is the highest at 30.26%. Results also show a durable linear relationship between total carbon emissions, eave height, labor costs, and building area during construction. The results of this article support the renovation of buildings from high energy consumption to carbon reduction. The notion of this research contributes to the existing knowledge by proposing a method for calculating the carbon footprint and creating the structure of the carbon emission of buildings. In addition, the results of this research encourage the industry to regulate the extent of its industry constructed on its technology level and obtain carbon emission calculation results close to the real carbon emissions of construction projects, which can provide an orientation for improvement or implementing emission reduction measures during the delivery period of the building.

GEOPOLYMER CONCRETE:

Carbon footprint scrutiny of geopolymer materials can be used to regulate its advantages over Portland cement. However, the impact of the distribution concept has been unkempt in previous geopolymer life cycle research studies. The difference in this research is observed here through the analysis of the effect of the boundary situations on the evaluation of the self-healing geopolymer made from fly ash and granulated ground blast slag feedstocks. In addition, "grey box" model was added to the lifecycle analysis to permit different combinations to match product property stipulations. The outcomes are strongly influenced by the perception of mass, with a carbon footprint of 208.72 kg eq. CO_2 and 395.72 kg eq. CO_2 per cubic meter of concrete.

RECYCLED CONCRETE:

The construction industry constitutes a considerable development factor for the so-called emerging economies, but at the same time, it's one of the biggest sources of waste generation, since in its processes many materials related to other industrial sectors are used, like cement, steel, stone, cardboard, glass, wood, aluminum, plastics, and ceramics, among others. Building materials, like concrete, are increasingly being questioned for their environmental impact; because construction and demolition waste could be a major component of all the waste generated by the development industry, and to cut back the pressure on the exploitation natural resources, industry has focused on finding greener ways to provide concrete, encouraging the utilization of recycled materials to switch virgin materials. Within the last decades, a discount of natural resources consumption within the production of aggregates through concrete debris recycling has been sought, so new aggregates is obtained which replace the standard aggregates coming from the crushing of virgin limestone, which even offers economic advantages, because when comparing costs of recycled aggregates with normal aggregates, savings of virtually 4 USD(26%)per m3 of aggregate and almost 6 USD (9%) per m3 of concrete are often obtained. However, in sight of the variety and variability of the recycled aggregates' properties, there's an absence of consensus regarding the concrete's behaviors when this sort of aggregates is employed, so it's necessary to judge the feasibility of using them from an environmental perspective, which may be achieved through the applying of a life cycle assessment (LCA) methodological approach. LCA in concrete fabrication has been utilized by some researchers to assess the environmental impact generated within the cement production process and within the extraction of stone material to get aggregates. It is has resulted in the exploration for alternate materials like ash, slag, and aggregates recovered from construction and demolition waste (CDW), which has given rise to the Green Concrete notion. This work examines the environmental and geochemical impact of recycled aggregate concrete production with properties representative for structural applications. The environmental influence of cement content, aggregate production, transportation, and waste landfilling is analyzed by undertaking a life cycle assessment and considering a life cycle inventory largely specific for the region. To get a close insight into the optimum life cycle parameters, a sensitivity study is applied within which supplementary cement materials, different values of natural-to-recycled aggregate content ratio and case-specific transportation distances were considered. The results show that carbon emissions were between 323 and 332 kgCO2e per cubic meter of cement only natural aggregate concrete. These values are often reduced by up to 17% by replacing 25% of the cement with ash. In contrast, carbon emissions can increase when natural coarse aggregates are replaced by recycled aggregates in proportions of fifty and 100%, and transportation isn't included in analysis. However, the concrete with 50% recycled aggregate presented a lower increase, only 0.3% and 3.4% for normal and high strength concrete, respectively. In some cases, the relative contribution of transportation to the entire carbon emissions increased when cement was replaced by ash in proportions of 25%, and case-specific transportation distances were considered. In absolute values, the concrete mixes with 100% recycled aggregates and 25% ash had lower carbon emissions than concrete with cement and natural aggregates only. Higher environmental benefits are obtained when the transportation distances of ash are relatively short (15–25 km) and also the cement replacement by ash is equal or beyond 25%, considering that the mechanical properties are adequate for usage. The observations from the paper show that recycled aggregate concrete with strength characteristics representative for structural members can have lower carbon emissions than conventional concrete, recommending them as an alternative to achieving global sustainability standards in construction.

ROADS:

This article scrutinizes the concept of carbon footprint and analyses carbon dioxide emissions and energy consumption for road pavement production through prose review. In any case, research evidently shows that bitumen has a lower carbon footprint. This means that bitumen pavement is the most sustainable option. The reduction of carbon emissions is possible by creating a special product for different types of vehicles and the documentation of fuel ingesting at different levels by fuel type and type of vehicle. For unyielding cement pavement systems, higher productivity values are detected than for flexible pavements because the cement production itself produces a much higher-level productivity. In addition, the movement and operation of firm pavement systems harvests lower emissions than flexible pavements, which is primarily due to the high energy required when fraternization and tamping bitumen. In general, it was found that the yield of the stiff pavement was complex than that of the flexible bitumen pavement structure (about 25% difference between the two pavement systems).

COMMUTING:

This paper has found some stimulating and eloquent results, based on the analysis of commuting co2 emissions from 1393 respondents in two peri-urban areas in Shanghai. Lowering emissions factors of travel mode and shortening travel distance can perceptibly reduce emissions. Also, encouraging carpooling is an effective way to grow the number of passengers in cars and can significantly reduce emissions. On the other hand, shortening your travel is an effective way to reduce emissions. The distribution of co2 emissions from transport among people is very uneven.

TOURISM:

This study estimates the carbon footprint of tourism in Heilongjiang Province from 2009 to 2018 using the carbon footprint model and the tourism carbon capacity model. The results of this study can be summarized with the following conclusions: The carbon footprint of tourism comes from the contribution of the carbon footprint of domestic tourism. As above, the carbon footprint of tourism shows a constant growth trend, and there is no indication that it will stabilize or decline. The growth in the carbon footprint of tourism shows that the environmental problems of tourism are still well-known. Based on the results of this study, the following recommendations can be made: It is important to increase the preferment of low-carbon tourism and establish a multistakeholder cooperation system. The government and related companies in Heilongjiang Province should actively participate in promoting low-carbon tourism to the people. The Heilongjiang provincial government should learn from the successful experiences of other provinces, such as creating and improving appropriate standards, supporting public participation, and promoting the development of low-cost tourism.

CARBON FOOTPRINT OF HOUSEHOLD ITEMS:

HOUSEHOLD:

Residential energy consumption is about 20% of greenhouse gas (GHG) emissions in the United States. Using data from 93 million individual residents, the researchers estimated these GHG emissions across the United States and described the effects of climate, economy, energy resources, urban types, and housing characteristics. A state-level analysis reveals that GHG emissions (per land area) are lowest in western US states and highest in central states. Wealthy Americans have a per capita footprint 25% larger than those with lower incomes, largely due to larger homes. In prosperous urban areas, these stats can be 15 times higher than in neighbouring areas. If the electricity grid is decarbonized, the residential sector can meet the 28% reduction target for 2025 under the Paris Agreement. However, grid decarbonization will not be sufficient to meet the 80% reduction target for 2050 due to growing housing stock and the constant use of fossil fuels (natural gas, propane and fuel oil) at home. Achieving this goal will also require a deep energy recovery and transition to low carbon emission sources, as well as reducing land space per capita and zoning for critical maintenance measures.

SOLID WASTE:

Every day, Bangalore generates approximately 3,000–4,000 tons of waste. A major fraction (72 %) of total waste is organic or wet waste, which is degradable in the natural environment. This study was focused on the carbon footprint of the household waste generated by Bengaluru City. Studies revealed an emission of 0.013 g CH_4/kg of organic fraction of municipal solid waste. From the elemental composition and general theoretical chemical equation of aerobic and anaerobic degradation of waste amounts, total methane and carbon dioxide were estimated to be 670,950 and 1,870 tons per day by the mass balance approach, which are considerably higher than the 87.32 tons per day of methane emission determined using the default methodology. These values are still higher than the experimental estimated values of methane and carbon dioxide. This study indicated that the theoretical estimation of emissions from solid waste is much higher than the experimentally determined Carbon Footprint of Solid Waste. Total emissions from local waste of the city are 19.13 and 242.83 kg/day of methane and carbon dioxide, respectively. Reduction of waste generation is possible through reduced waste generation, segregation at source level, reuse, and recovery of waste. Composting and anaerobic digestion are treatment options for organic waste (which constitute 70– 75 % of the total), whereas recycling is used for inorganic materials (15–18 %). Waste that cannot be treated or recycled is then eventually disposed at landfills. Hence it should be noted that segregation at the very start and respective treatment at local levels plays a prominent role in minimising organic waste going into landfills. GHG emission factors vary with methodology.

WASTE SORTING:

This study based in Xiao'er Township in Gong County, Sichuan Province, China as a case study to analyse and estimate the carbon emission reduction effects of the township's pilot waste sorting program. By using a specific technique known as the five - point sampling method wastes are collected, evaluated, and measured for their major components and other key indications. Other than this, questionnaires surveys and interviews were conducted in that township, along with examination of existing records and other such relevant information. To study this data of the township, the solid waste management-greenhouse gas calculator was used. The results showed that proper waste sorting methods could potentially play a major role in the reduction of carbon emission. Specifically, after implementing waste sorting in Xiao'er, annual carbon emissions were reduced by 2081 tons—equivalent to the electricity consumption of a family of three people for 1718 years. If such measures were followed optimally that is increasing the recycling of wet waste and recyclable waste further, the level of carbon emission in Xiao'er could be reduced up to 4482 tons per year. If these waste management methods were followed across villages and townships throughout China, then the carbon emissions reduced in a year would be equal to the carbon dioxide emissions from electricity generation in Beijing for over a year. Based on the results of this study, the researchers provided three policy recommendations for effective carbon emission reduction:

1. increasing residents' awareness about environmental protection over the long term
2. boosting funding support and spreading knowledge about waste sorting and treatment.

FOOD:

Carbon emissions occur at different stages of the life cycle of food products. GNG emissions from 24 Indian food sources show that food from animals and rice farming are the main funders to methane emissions, while food from crops contributes to nitrous oxide emissions. GNG emissions over the life cycle of cooked rice are 28 times greater than lifetime GHG emissions.

MILK:

Many studies have shown that food additives such as 3-nitrooxypropanol (3-NOP) and nitrate have great latent to reduce plant growth. The purpose of this study is to determine the net effect of 3-NOP and nitrate on the carbon footprint of milk on farms in different provinces of the United States and to determine the evolution of the carbon footprint. This study states that use of 3-NOP could reduce the gas air from the milk. This study suggests that future research should focus on evaluating other potential food additives and vindication strategies to determine their impact on the net reduction of greenhouse gas emissions from the dairy production process.

CANOLA AND MUSTARD:

The objective of this study is to provide an assessment of the carbon footprint of selected oilseeds grown in the Great Plains (Canada) with low rainfall and to determine the effect of nitrogen fertilization on the environment. They hypothesized that the C footprint of oilseeds is basically dependent on the rate of N fertilization applied to the crop, while the extent of variation in the value of the carbon footprint is influenced by the environmental conditions in which the oilseed is produced. Therefore, the objectives of this study were to (a) characterize the C footprint of selected oilseeds grown in semi-arid environments and (b) determine the effect of rates of N fertilization on the C footprint of oilseeds. Field trials were conducted at eight sites: Melfort in 2003, 2004, and 2005; Scott in 2004 and 2005; and Swift Now in 2003, 2004, and 2005, all in Saskatchewan, Canada. Five oilseed cultivars were analysed: yellow mustard S. alba (cv. Baser), B. Juncea Canola (CV. Amulet), condiment mustard B. juncea (cv. Cutlass), canola B. rapa (cv. Hysyn 110) and the canola hybrid B. napus (cv. InVigor 2663). For each crop, its proficiency was calculated, defined as the yield produced per unit of available N, the total available N being the sum of residual soil mineral N plus applied fertilizer N. The amount of direct and indirect carbon emissions is associated to the amount of nitrogen applied and environmental conditions. The agriculture sector is responsible for about 8% of Canada's total GHG emissions, apart from all emissions from agricultural energy use. The study showed that the C score of oilseeds (especially canola and mustard) is a function of the rate of nitrogen fertilizer applied to the crop. When the rate of nitrogen fertilization went from 0 to 50 kg N ha-r, the carbon footprint of oilseeds increased slightly, but once the amount of nitrogen fertilizer exceeded 50 kg N ha-l, a significant increase in the carbon footprint occurred. A similar relationship exists between the C footprint and the N ratio for the five types of oilseeds analysed. The change in the environment contributed 10% to the change in the C-footprint of the fuel. Plummeting the carbon footprint of oilseeds entails adopting strategies and best practices to reduce the use of nitrogen fertilizers and improve the efficiency of nitrogen use in oilseed production.

WATER PUMPING:

India has a complex relationship between irrigation, energy and climate. Subsidized electricity has led to unrestrained groundwater flow, causing groundwater levels to drip and carbon emissions to gush. This intricate relationship requires consideration of carbon discharge from groundwater irrigation. Estimates display that groundwater irrigation emits 45.3-62.3 MMT of carbon yearly, contributing 8-11% of India's 30 overall carbon emissions. This analysis shows that deep wells have a vast carbon footprint and their increasing population is an environmental trouble. Geospatial investigation reveals that India's western and subcontinental areas, which contribute 85% of the country's over-utilize groundwater reserves, largely promotes to the carbon emissions. Additionally, the region is home to 27 hydro-energy-climate hotspots, co jointly accounting for 34% of carbon emissions from groundwater. A comparison of prior estimates discloses that carbon emissions from groundwater almost doubled between 2000 and 2013. The findings of this study are censorious to the subject of environmental costs. The uninterrupted practice of unhygienic water pumping acts as a double threat to the environment: it depletes the groundwater, which reduces the energy needed to use turn on the same volume of water, leading to carbon dioxide. Carbon emissions are very sensitive to pump performance. The potential and high environmental costs of groundwater extraction in India are rooted in its reliance on agricultural electricity.

MARITIME:

Current greenhouse gas (GHG) emissions from shipping represent approximately 3% of global GHG emissions and will need to be halved by 2050 to meet the Paris Agreement targets. Many see liquefied natural gas (LNG) as a replacement fuel that could be used for shipping. Better hydrogen/carbon efficiency compared to diesel (liquid gas fuel, MGO) or heavy fuel oil (heavy fuel oil, HFO) translates directly into lower carbon emissions per kilowatt produced. This study examines the conditions under which LNG can work as a replacement fuel in the decarbonization of shipping, while ensuring that the other lowest possible impacts on global warming. The transition refers to the process of moving away from fossil fuels to low carbon fuels and engine technologies. The results showed: 1. Importance of applying appropriate engine technology to maximize GHG reduction. 2.Application of the best engine technology is profitable.

SOLAR PHOTOVOLTAIC CELLS:

Area: West Bengal, India

Most of the Energy used in India is coal-based energy, which leads to a huge amount of formation of CO2 gas. The solar energy is accepted as an important alternative source of energy as it is green energy. But the single crystal silicon cell, which is the starting material for solar cells produces huge amount of greenhouse gases. This article highlights an estimation of solar energy production and carbon credit (CC) created by the photovoltaic cells of mono-crystalline silicon, largely used in West Bengal, India. In addition, the number of silicon cells required for the preparation of this module as well as its equivalent amount of carbon dioxide generation during the extraction from quartzite sand by the Czocharlski' technique has been calculated. This analysis is based on the experimental and theoretical performance of the system. The study shows that, on considering average light intensity (4.5 kWh) for 10h/day, the power output of this solar module is 0.60 kWh/m2 /day. CC earned is computed as 0.33 tonnes/MWh/year, under West Bengal climatic condition as per the norms of the Kyoto protocol. For obtaining 11.86 kg of silicon, which is the raw material of solar cell used in this study, the amount of CO2 production is calculated as 8.70 kg/MWh/year. Considering 35 kg CO2/MWh as reference, this amount of CO2 production corresponds to 25% of the total carbon footprint. This review highlights a comprehensive method of calculation for assessing the amount of Carbon dioxide generation during preparation of silicon wafers used as Photo Voltaic cells. From this review, it is clear that during large-scale solar power generation, there will be significant impact on the environment. The amount of CO2 generation has been calculated here is direct generation, but there is also some indirect CO2 generation, and this leads to further scope of work in terms of indirect CFP generation involved in this process which is not considered in this review.

CARBON FOOTPRINT OF SUPPLY CHAINS:

This study aims to review the literature in reducing carbon emission from the supply chain system for the past few years and presenting drivers, barriers, performance indicators, and practice. The problem of reducing carbon emission becomes frequently discussed since unplanned and irresponsible actions by industries are potential threats to sustainability. Companies are now trying to attenuate environmental impacts by integrating environmental concerns into their supply chain operations. Within the aim of reducing carbon emissions, the industry is faced with different drivers, barriers, and performance indicators. With a range of problems faced, the practices taken to scale back carbon emissions are very diverse. Thirty papers were collected from previous studies and linked to discussion points. The result showed that good coordination with various media within the supply chain system would be able to achieve common goals in reducing gas emissions. Supply chain management is strategically positioned for sustainability, performance, and organizational sustainability. Furthermore, the provision chain is a necessary branch of operations management, and it's an important impact on the environment, including emissions, pollution, and therefore the risk of the community. However, unconsciously, inefficient supply chain management activities from upstream to downstream can cause excessive carbon gas emissions. The rise of worldwide warming and changing biodiversity has brought the world's sustainability towards immediate danger. People from different areas, including researchers, academicians, practitioners, and scientists got all at once to suggest ways to keep up the environmental sustainability. Reducing carbon emission has recently become a corporation goal. The emergence of concern about carbon emissions can come from internal and external companies. Many companies are directly responsive to the attention of reducing carbon emissions. However, it's not uncommon for companies that really don't have awareness but must do so thanks to government policies associated with carbon emissions.

METHODS TO REDUCE CARBON FOOTPRINT IN VARIOUS AREAS:

Methods to reduce carbon emissions effectively carbon footprints:

- <u>Carbon emission reduction potentials in diverse industrial sectors:</u>

➢ **Iron and steel industry**:

1)Three of the most operative symbiotic procedures for CO_2 reduction were blast furnace gas recycled on site as fuel and/or sold off-site, coke oven gas recycled on site as fuel and/or sold off-site, and blast furnace slag sold to cement manufacturing companies.

2) Consumption of gaseous and solid waste/by products far outweighed the usage of sensible heat in terms of their contributions to CO_2 reduction, which indicated the abundant potentials in sensible heat recovery.

3) Cleaner production inside an ISM subsidized more to CO_2 reduction than symbiotic actions with other enterprises did.

➢ **Cement Industry**:

The various CO_2 discharges reduction approaches, including energy efficiency enhancements, waste heat recovery, the replacement of fossil fuel with renewable energy sources, the manufacturing of low carbon cement and CCS. In addition, the use of accompanying cementitious materials, such as fly ash, silica fume, copper slag, sewage sludge, ground-granulated blast furnace slag, are often promoted as ways to reduce carbon emissions. Based on data from cement plants showed that substituting carbonate containing resources with non-carbonate resources and by changing the clinker ratio were the main ways to reduce CO_2 content in raw meal and procedure emissions.

➢ **Aluminum Industry:**

The aluminum industry will be challenged with limitations on the high quality bauxite import and deprivation of domestic bauxite quality. It is anticipated that wide adoption of the Sinter-Bayer Series Process and 35 improved Bayer Processes as well as further removal of the lime-soda sinter process and the sinter-Bayer combination process, have the reduction potential of 6%, which is almost corresponding to the reduction effect of the standard Bayer process relying on external resources. For further CO2 emission reductions, industry should update existing smelters and eradicate smaller and outdated smelters. Moreover, it is necessary to hasten technology development, such as lower electrolyte temperature, wettable cathodes and inert anodes.

➢ **Paper Industry**:

Conventional manufacturing of paper consists of dispensation wood fibre streams into planar structures (mixed raw material). With the growth of future manufacturing concepts, the final paper product has a tailormade layered structure: fibres and other resources are placed in the ideal position dependent on the essential properties and functionality. This kind of optimal aligning allows papermaking firms to manufacture paper products with equal or improved assets while using less wood-fibre raw material and energy. quantified carbon discharges reduction potentials in super- calendared paper manufacture and lightweight coated paper production through the application of these advanced manufacturing strategies using progressive sheet structure design and fibre changes.

➢ **Hydraulic Presses:**

Hydraulic presses are engine tools using a hydraulic cylinder to generate compressive forces, which are normally used for forging, molding, blanking, punching, deep drawing, and metal forming operations in many manufacturing fields. Therefore, based on the features of each component's energy conversion, divided hydraulic press systems into six parts: “electrical-mechanical energy” conversion units, “mechanical-hydraulic energy” conversion units, “hydraulic - hydraulic energy” conversion units, “hydraulic-mechanical energy” conversion units, “mechanical to deformation energy” conversion units and “thermal to thermal energy” conversion units. Using this classification, proposed an analytical approach for calculating energy flows in large and 36 medium-sized hydraulic press systems and indicated that the main cause of low energy proficiency is that load characteristic is not properly harmonized with the drive mode, and the secondary is the lack of an energy storage unit in the hydraulic system, therefore energy storage and recycling units should be included in hydraulic presses.

- <u>Carbon emission reduction potentials in the agricultural sector</u>

➢ **Mushroom production sector:**

For the production of button mushroom the compost, diesel fuel and electricity were the most energy consuming inputs. The carbon productions of mushroom production were compact in efficient units compared with inefficient units. Managing of diesel fuel and electricity consumption in all mushroom production services helped the more well-organized systems to achieve such drops.

➢ **Lucerne production sector:**

The novel integrated assessment outline, based on carbon and water accounting, which enabled to analyze the probable trade-offs among water savings, energy consumption, carbon emissions and economic benefits associated with the adoption of new water efficient irrigation technologies. Outcomes exposed that efficient sprinkler expertise not only saved water but also reduced energy use and carbon emissions. Water-inefficient and energy intensive sprinkler irrigation systems such as roll-line systems to center pivot sprinkler irrigation systems will help to make lucerne manufacturing more effective and efficient.

➢ **Livestock production sector:**

The intensification of pig manufacture has led to build-up of increased number of livestock wastes in small and localized areas, where the use of manure as an organic manure has flashed a rise in nutrient concentration in soils, groundwater, and surface water. The predictable carbon emissions reduction 37 of a swine manure treatment plant compared with conventional storage in anaerobic tanks, applying the manure treatment plant could lead to a total yearly carbon emission reduction of 62%, counting CO2 emission reduction 72%, CH4 release reduction by 69%, and no change of N2O release.

<u>Assessment of carbon emissions reduction potentials is different societal scales:</u>

➢ **Household level:**

The following measures are taken: -

1. Domestic income is the most significant contributor to the change of household carbon emissions, and its constructive effect increases as household carbon releases rises.
2. Domestic house ownership and deposits subsidize little to household carbon emissions, while household car ownership contributes extra.
3. Young society and progenies will emit extra household carbon emissions than grown-ups, and the working emit more than persons who are unwaged or retired.
4. Education rises household carbon releases total but mainly at the low quintiles. In order to cut carbon discharges, people should transform from deluxe to more thrifty consumption activities, such as less use of air conditioning, reusing and recycling clothes and furnishings, purchasing low gasoline ingesting and emission cars, and using more energy conserving and ecologically friendly home applications.

<u>Schemes:</u>

➢ **Geoengineering schemes:**

In addition to CCUS, some scientists have projected to use geoengineering (or climate engineering) to theatrically cool the Earth. Geoengineering, which is the planned large-scale manipulation of the environment, has been recommended as an operative means of justifying global warming from anthropogenic carbon releases. Most geoengineering schemes proposed to be achieved on land or in the ocean are to use physical, chemical or biological tactics to remove atmospheric CO2. These schemes 38 have relatively low costs and short lead times for technical implementation, and can act rapidly to reduce temperature irregularities caused by anthropogenic carbon releases.

➢ **Carbon taxation/trading schemes:**

Carbon emission trading schemes and carbon taxation schemes are the main methods adopted by nations and counties to seek to accomplish their emission decrease goals. Both schemes may potentially outcome in similar release reductions, and neither scheme seems to lead to lower emissions than the other. Advanced countries have high carbon emission reduction costs compared with large emerging nations. Higher carbon valuing levels can reduce the financial benefit for high carbon emitters.

CONCLUSION:

Through the above research we can conclude that the continuous rise in carbon footprints in respective fields is concerning and needs a fast check. We do not generally understand how much of emissions occur through day-to-day activities and hence reading through such researches as a whole gives a fact check as to where we are headed. To achieve a target of reducing emissions by around 70% which is necessary, it is estimated that global greenhouse gas emissions need to decrease by 50-60% from 2000 to 2050, and by almost

100% by 2100. Serious measures need to be implemented in order to ensure a safe and habitable earth for the future.

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