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# Towards sustainable health facilities: Developing green, safe, and climate-resilient design principles and practices for DOH hospitals in the Philippines

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**Abstract:** Climate change disrupts the delivery of health care services. Health care facilities are also leading consumers of energy, with a large environmental footprint that contributes to carbon emissions. Such emissions can be mitigated by using renewable, sustainable and clean energy. This can also be achieved by using materials that reduce energy consumption. Pursuant to the Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 11285 "Energy Efficiency and Conservation Act," Section 33 states that all energy users shall use every available energy resource efficiently and promote the development and utilization of new and alternative energy-efficient technologies and systems, including renewable energy technologies. The Department of Health (DOH), as the nation's leader in health, has developed the Green and Safe Healthcare Facility Standards and Guidelines, which serve as a guide for health facilities in taking appropriate measures to reduce their environmental footprint. This study aims to describe the process related to the development of standards for a climate-smart health facility and to document the present practices of DOH hospitals. The principles of the standards are aligned with existing national policies and international standards. Some of the DOH hospitals implement green measures such as reduction of energy consumption, rainwater harvesting, energy audits, the use of sustainable materials, handwashing facilities, food safety, green procurement, the use of renewable and clean energies, biophilic design, and healing gardens. The study recommends that more action be taken by the DOH hospitals to develop green and safe (climate-smart) health facilities and that they should also include funding for proper implementation.

**Keywords:** Climate Change; Climate-Smart Health Facilities; Sustainability, Philippines.

## 1. Introduction

Our Environment according to the UN Sustainable Development Goals (SDGs) provides paradigm shifts in the Philippine context. The country has employed a whole-of-government and whole-of-society's approach to SDG implementation with national actions grounded in laws to ensure robustness. The Partnership Framework for Sustainable Development (PFSD) supports the national long-term vision and maps directly and indirectly into the Philippines Development Plan (PDP) priorities, organizing its strategic contributions through the 2030 Agenda lens into three pillars: "People", "Prosperity and Planet", and "Peace."

Climate change interrupts health service delivery. Natural calamities are getting more severe each year, pushing health facilities to the limit of their structural soundness. Floods damage hospital mechanical equipment. Prolonged high winds during storms damage rooftop equipment, building structures, electric transmission lines and other public infrastructures. The global challenge of our time is climate change, which disrupts the delivery of health care services. The increased intensity of natural disasters challenges the structural integrity of health care facilities as well as the infrastructure, support systems and supply chains that these facilities and their communities depend on.

Health care facilities are also leading consumers of energy, with a large carbon footprint that contributes to carbon emissions. Such emissions can be mitigated by using renewable, sustainable and clean energy. This can also be achieved by using materials that reduce energy consumption. Pursuant to the Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 11285 "Energy Efficiency and Conservation Act," Section 33 states that all energy users shall use every available energy resource efficiently and promote the development and utilization of new and alternative energy-efficient technologies and systems, including renewable energy technologies and systems pursuant to RA 9513, otherwise known as the "Renewable Energy Act of 2008," across all sectors.

In 2020, according to the Global Climate Risk Index, the Philippines was ranked as the 2nd most affected by climate change in 2018 (a significant increase from 20th place in 2017) and 4th most affected for the long-term index from 1999-2018 (a notch higher than the previous long-term index) [1]. The UN-IPCC also projects that risks from some vector-borne diseases, such as malaria and dengue fever, will increase with warming from 1.5°C to 2°C [2].

Based on a study by the Asian Development Bank on the economics of climate change, the country stands to lose 6% of its GDP annually by 2100 if it disregards climate change risks [3]. This same study found that if the Philippines invests 0.5% of its GDP by 2020 in climate change adaptation, it can avert losses of up to 4% of its GDP by 2100—clearly a short-term investment with a long-term eight-fold gain based on the Philippine Climate Change Commission.

In the past 65 years, from 1951 to 2015, there has been an increasing trend in the annual mean temperature, with an increase of 0.68°C. Compared to the more rapid increase in the annual minimum temperature (0.15°C/decade), the annual maximum temperature has increased at a slower rate (0.05°C/decade). The Philippines also experiences more hot days and fewer cooler nights [4].

It's also concerning that the Philippines ranks high on the "lack of adaptive capacities index," which is a long-term process that includes structural changes and takes measures to

deal with the future negative effects of climate change. The country has been identified as a natural disaster hot-spot with approximately 50.3% of its total area and 81.3% of its population vulnerable to natural disasters [5]. The changing climate is expected to exacerbate these adverse impacts due to increasing severity and frequency of hydro-meteorological hazards. The observed increase in temperature would also bring warmer sea surface temperature, which is linked to the formation of intense TCs.

The National Disaster Risk Reduction and Management Council reported that Super Typhoon Yolanda (International Code Name: "Haiyan") in 2013 brought more than 89 billion pesos of damage to the Philippines [6]. Damages to infrastructure included national and provincial roads and bridges, seaports, airports, water supply system, power supply, drainage system, telecommunications, school buildings, government buildings, and health facilities. In Tacloban City, the Eastern Visayas Regional Medical Center remained operational with the manning of teams from Metro Manila hospitals. In Ormoc City, two hospitals and around 40 rural health facilities were damaged and nonfunctional.

As the health sector is significantly affected by the circumstances brought about by climate change, the Department of Health as the nation's leader in health is challenged to respond to this grave phenomenon by minimizing the carbon footprint of health facilities while delivering quality public health care. This remains to be the rationale for the development of green and safe (or climate smart) standards for all hospitals and other health facilities.

In reference to the Climate Change and Human Health—Risk Responses (CCHH-RR) study, the impacts of climate change in the Western Pacific Region were estimated at 111.4 DALY per million population, where the health outcomes considered in this analysis were food- and water-borne disease, natural disasters, and the risk of malnutrition [7]. Using the Philippine Statistical Authority (PSA) population of 100.98 million in 2015 to calculate DALYs in the Philippines due to climate change, we can multiply DALY and PSA data to get 11,249.17 years of loss/year in relation to the CCHH-RR health outcomes. With an estimated 70% going to work and a total of 2.87 million days lost, and a minimum average daily wage of Php 500.00, a total of Php 1.45 billion is lost from the economy due to climate change in health.

This study aims to describe the process of finalizing the performance standards for green, safe and resilient design principles, and to determine the feasibility of the green viability assessment tool for health facilities. This paper will document the current practices of the Philippines Department of Health hospitals in terms of (a) energy efficiency (b) water conservation and efficiency (c) environmentally resilient health facilities (d) health care waste management as part of the Green and Safe Health Facility Program's climate smart initiatives.

## 2. Methodology

The methodology of this study is a cross-sectional study designed through an online medium and maximised to get the desired output and baseline data. Greening hospital initiatives were documented in collaboration with government and non-government organizations.

The data used in this study are based on the issuances and surveys released by the Health Facility Development Bureau of the DOH from January 2019 to June 2021. This issuance includes Department Memorandum (DM) No. 2020-0240, entitled Submission of Hospital Energy Consumption and Generated Health Care Waste, and DM 2021-0271, entitled Submission of Accomplished Health Care Waste Management Manual of Standards Self-Assessment Tools.

## 3. Results and Discussion

### 3.1 Development of technical guidelines for green and safe health facilities

The Department of Health Initiatives began the development of green and safe health facilities in response to the dissemination of the Philippines Green Building Code (GB Code), the National Building Code's referral code. In 2017, the Health Facility Development Bureau facilitated a stakeholder summit and initial engagement of expert advocates (HFDB).

The World Health Organization (WHO) has designated the development of the Green and Safe Health Facilities Manual as one of its technical assistance providers [8]. The main purpose of the project is to develop a manual of standards and guidelines for green and safe health facilities. In 2019, the Department of Health issued Department Circular No. 2019-0059 to encourage the use of a green building rating system for health care facility projects.

The primary considerations of the GB Code are to provide protection to people from the harmful effects of climate change and improve the efficiency of building performance through a framework of standards that will enhance sound environmental and resource management to counter harmful gases, throughout the building's life cycle, including efficient use of materials, site selection, planning, design, construction, use, occupancy, operation and maintenance, without significant increase in cost.

The hospital and other health facilities administrators and operators have the opportunity to help address the adverse effects of climate change together with the assistance from the technical professionals, developers, contractors, property managers and building owners involved in the planning, design, construction and management of buildings by ensuring that buildings are planned, designed, constructed, operated and maintained to the required efficiency levels.

Through the Health Facility Development Bureau, the Department of Health is mandated to be stewards of green and safe design principle and practices in health care facility development. As a contribution to the National Climate Change Action Plan, the DOH implements the Hospitals Safe from Disasters policy and program that assures the health system's adaptive capacity and responsiveness to extreme weather events and other natural disasters. The development of green standards and guidelines completes the equation towards a climate-smart health care delivery system.

The HFDB was facilitating a staging on multiple fronts when the public health emergency due to the coronavirus 2019 (COVID-19) pandemic went down. These multiple fronts there included the conduct of energy audits to be led by the Department of Energy; piloting of health care waste audits in partnership with Health Care Without Harm; pilot implementation of Water, Sanitation and Hygiene (WASH) in Health Facilities with the Disease Prevention and Control Bureau and development partners; and alignment of HFDB's work program with initiatives from the Climate Change Commission (CCC's) climate smart hospitals initiative and Nationally Determined Contributions (NDC) support project.

The HFDB was able to facilitate the completion of compliance of DOH facilities with Republic Act (RA) No. 11285's provision on the appointment of Energy Efficiency and Conservation Officers. The update of the Health Care Waste Management Manual [9] was also released, in time with the DOH's series of issuances on infection prevention and control measures (including waste management) among facilities that are designated COVID-19 referral and accepting hospitals, and temporary treatment and monitoring facilities (TTMF).

With all the interventions, the Green and Safe Health Facility Program of the HFDB of the DOH released the Green

 

and Safe Health Facilities Manual, First Edition or referred to as the Green Manual. Through DOH Department Circular 2021-0437, with the technical assistance of the World Health Organization, this first edition release includes the Green Viability Assessment Tool that will serve as the users' aid in the application of the manual.

### 3.2 Green, safe, and resilient (climate smart) health facilities performance standards

The development of the Green and Safe Health Facilities Manual aims to respond to the global call for minimizing the carbon footprint of the health sector while continuing to provide quality health and safety to the people, thereby setting the minimum green and safe standards for all hospitals and other health facilities (HFs). This manual is a reference for planning a safe, sustainable, climate-resilient health infrastructure concomitant to the country's goal of meeting the health demand of the population, and closing the supply gaps in health care facilities and services.

With the finalization of the green manual, performance standards are focused on promoting the greening of hospitals and health facilities, including the improvement of energy and water efficiency and conservation, sustainable cooling systems, and sustainable healthcare waste management in hospitals. Thus, the following items are focused on for the green performance standards: governance; energy efficiency; water efficiency; sanitation and hygiene; health care waste management; environmentally resilient health facilities; site sustainability; material sustainability; and indoor environmental quality.

The Green and Safe Health Facility initiative represents a climate smart paradigm shift, away from traditional disaster response to one that proactively seeks to minimize the health impact of disasters and emergencies through climate adaptation and mitigation measures (including climate-proofing and reduction of the environmental footprint), and preparedness. Consequently, it is essential that the green manual is incorporated into the hospital and HF development agenda that are backed with earmarked resources in the national budget, and that has governance and support from the highest levels of government.

All national government agencies, local government units (LGUs), and government-owned and controlled corporations (GOCCs) shall implement energy efficiency measures. Hospitals operate 24/7 and consume a large amount of electricity to provide service and deploy critical machines that require reliable electricity. In addition, water is a core element of life. Based on existing laws and regulations, compliance with this green manual is required to reduce the carbon footprint of health facilities, make them more resilient to the effects of climate change, and promote infection prevention and control.

Health care waste management is important to ensure the protection of public health and the environment, utilizing environmentally sound methods and adopting the best environmental practices. In addition, sustainability can be achieved through green materials. Indoor Environmental Quality (IEQ) refers to the conditions inside a building, such as air quality, lighting, thermal conditions, and ergonomics, and how they affect occupants.

### 3.3 Present practices of the DOH hospitals towards climate smart health facilities

Section 16 of RA 4226, also known as the Hospital Licensure Act, and its Implementing Rules and Regulations are promulgated to protect and promote the public's health by ensuring a minimum quality of service rendered by hospitals and other regulated health facilities, as well as to ensure the safety of patients and personnel.

In March 2020, President Duterte formally declared a state of public emergency in the Philippines. In this study, the effects of the COVID-19 pandemic on hospitals were investigated. The Department of Health issued the Department Memorandum 2020-0240 that aims to determine the baseline data on energy and water consumption, and health care waste generated for the development of evidence-based green initiatives towards making resilient and energy-efficient health facilities. In relation to this, data were collected over the period March, April, and May of the year 2019 and 2020 (early surge period of COVID-19 cases) for comparison purposes.

For the energy consumption of DOH hospitals, an increase of 5.34% or 1.5 MWh in electric consumption was observed for the 51 hospitals surveyed between 2019 and 2020 (as shown in Table 1). This means that there was an increase in consumption due to the pandemic at that early stage.

**Table 1.** Electrical Consumption of DOH hospitals.

| Month | Electrical consumption (KWh) | | % change |
|---|---|---|---|
| | 2019 | 2020 | |
| March | 9,186,613 | 10,803,877.78 | +17.60 |
| April | 10,151,844.29 | 10,579,532.63 | +4.21 |
| May | 10,687,684.00 | 10,066,544.83 | -5.81 |
| **Average percentage change** | | | **+5.34** |

In collaboration with the Department of Energy, which had conducted a virtual energy audit in DOH hospitals, the Building Energy Efficiency Index (BEEI) revealed that each of the hospitals was efficient. The BEEI is considered efficient if it is equal to or less than 288 KWh/year/m2. In general, hospitals were found to comply with this threshold value.

In terms of water conservation and efficiency, it was found that water consumption in the 51 DOH hospitals investigated had increased by 2.76%, or 51,000 $m^3$, on average between 2019 and 2020 over the period March-May due to the surge in COVID-19 cases.

**Table 2.** Water Consumption in DOH hospitals.

| Month | Water consumption ($m^3$) | | % change |
|---|---|---|---|
| | 2019 | 2020 | |
| March | 609,396.52 | 636,124.00 | 4.39% |
| April | 603,813.30 | 629,067.67 | 4.18% |
| May | 650,023.52 | 648,229.37 | -0.28% |
| **Average percentage change** | | | **+2.76%** |

For the health care waste, as shown table 3, a decrease of 12.86% or almost 271 tonnes of general waste was observed in the DOH hospitals investigated. In the Philippines, incineration is not allowed. In accordance with the Philippine Clean Air Act, most of the generated waste is being collected by the City and LGU General Services (Solid waste Management); some are being transported by a 3rd party collector. The final disposal of the health care waste is in sanitary landfill.

**Table 3.** Waste Production by DOH hospitals.

| Month | Waste production (kg) | | % change |
|---|---|---|---|
| | 2019 | 2020 | |
| March | 667,100.45 | 565,957.15 | -15.16 |
| April | 593,471.98 | 526,475.55 | -11.29 |
| May | 637,101.87 | 559,763.98 | -12.14 |
| **Average percentage change** | | | **-12.86** |

Based on table 4, it is observed that the amount of infectious waste had increased by 25% or almost 341 tonnes between 2019 and 2020 over the period March-May. The main reason for the increase in the amount of infectious waste relates to the increased use in protective clothing and equipment by healthcare workers and patients during the COVID-19 pandemic and the situation that once an area is designated a COVID-19

 

ward or site, all of the waste generated is considered as infectious waste.

**Table 4.** Infectious Waste Production by DOH hospitals.

| Month | Infectious waste (kg) | | % change |
|---|---|---|---|
| | 2019 | 2020 | |
| March | 504,574.42 | 526,244.03 | 4.29% |
| April | 405,577.34 | 494,428.79 | 21.91% |
| May | 418,962.48 | 526,389.24 | 25.64% |
| **Average percentage change** | | | **+17.28** |

A survey was conducted to determine baseline data for DOH hospital compliance and to verify overall health care waste management in relation to the performance standard. The analysis showed that 87%, or 56 out of 66 hospitals, were rated satisfactory with adequate compliance based on the developed health care waste management self-assessment tool accompanying the health care waste management manual.

In terms of environmentally resilient health facilities, more than 50% of the 51 DOH hospitals that contributed to the survey were found to meet soil and structural testing requirements. Furthermore, all DOH hospitals in the study had assessed their vulnerability to climate emergencies and disasters using the hospital safety index.

## 4. Conclusions

The Department of Health, through the Health Facility Development Bureau, has developed technical guidelines and standards for green, safe, and climate-resilient health facilities that are effective in responding to the global call for minimising the carbon footprint of the health sector while still continuing to provide quality health care to the people, thereby setting the minimum green and safe standards for all hospitals and other health facilities. Obtaining baseline data will assist the health sector in improving its capacity to provide safe and high-quality health services.

The development of the standards requires strong collaboration, expert engagement, thorough evidence-based review (nationally and internationally), and high-level support from leadership. Meanwhile, the green viability assessment tool for health facilities is highly valid for the use of hospitals and health facilities.

DOH hospitals show good practices in governance, water, sanitation, and environmentally resilient health facility performance standards; however, improvements should focus on other performance standards, specifically energy efficiency and health care waste management measures.

To ensure sustainable development and human survival through its initiatives on green and safe health facility development, some of the considerations include, but are not limited to, the following: sustainable energy efficiency, water efficiency, and health care waste management; advancements for renewable energy; green spaces; indoor environment quality; water, sanitation, and hygiene (WASH); and maintained site sustainability, material sustainability, and hospital safety for zero outage status in the provision of health care during calamities and disasters.

A green and safe (also known as climate-smart) health care facility, which contributes to the mitigation of climate change shall (a) protect the lives of patients and health workers; (b) reduce damage to the hospital infrastructure and equipment, as well as the surrounding environment; (c) continue to function as part of the health network, providing services under emergency conditions to those affected by a disaster; (d) use scarce resources more efficiently, thereby generating cost savings; and, (e) improve its strategies to adjust to and cope better with future hazards.

In order to be considered a climate-smart health care facility, one must make both buildings and operations more resilient, mitigate the impacts on the environment and reduce pollution. These interventions shall save costs, reduce greenhouse gas emissions, and achieve adaptation, risk reduction and developmental benefits. As the country aspires to reduce the supply gaps in health facilities, there should be a concomitant goal for the development of safe, sustainable and resilient health infrastructure.

Further improvements include forging partnerships with organizations, associations, and other public-private institutions; incorporating the principles and strategies for green, safe, and resilient health facilities in the clinical and operational guidelines; encouraging and supporting the certification of health professionals as green practitioners, exploring mechanisms to effectively implement certification as green health facilities, strengthening green and safe health initiatives and interventions in health facilities through regulation and policy formulation; and improving the availability of high-quality data on the impact of climate change on health, particularly in less resilient locations. Also, raising awareness among stakeholders and policy-makers regarding the consequences of climate change on health, and the continuous improvement and implementation of safe, sustainable and resilient health infrastructure is necessary.

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