ITRI
Industrial Technology Research Institute

Analysis of hospital carbon emission management - case study from Taiwan

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Background

Health Care Consumes Resources and Generates CO_2 Emissions

Energy

Waste

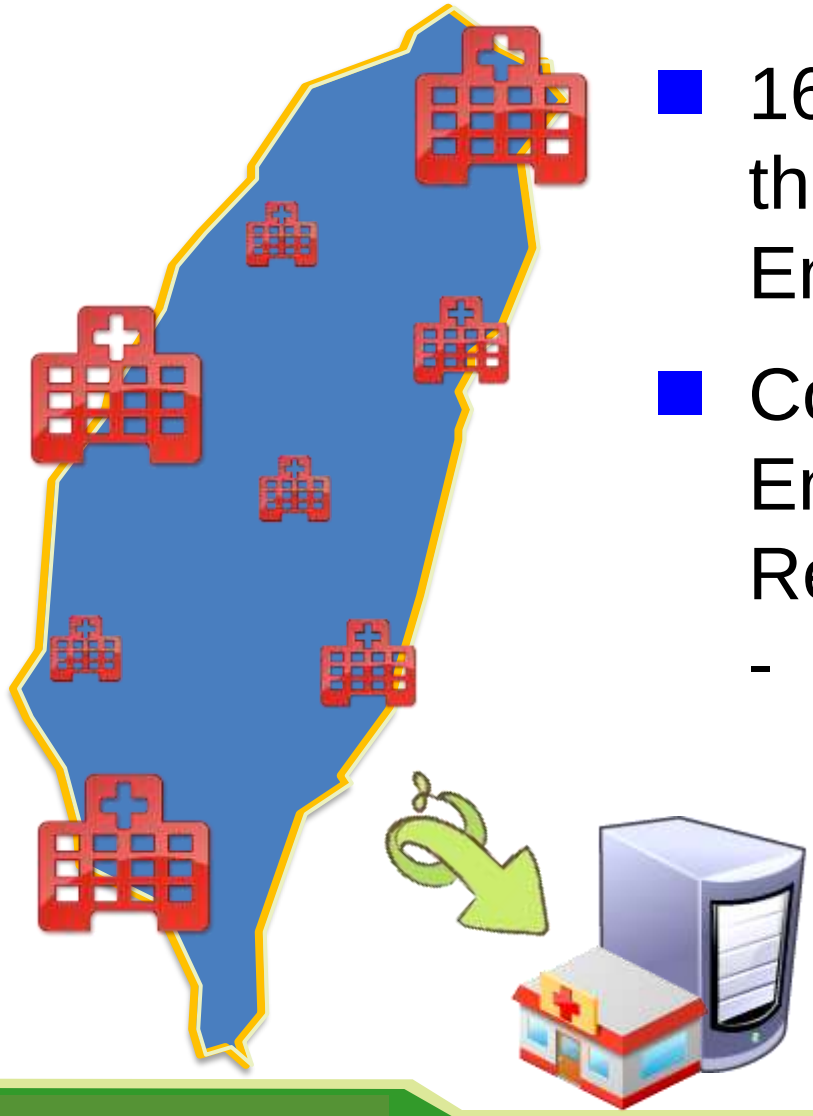
Water

Transportation

Background

- **The Health Promotion Administration (Taiwan) has advocated a campaign in October 2010 for medical sectors to pioneer in carbon reduction; a total of 128 hospitals have pledged to cut their carbon emissions by 13% reduction in the year 2020**
- **In 2013, the HPA carried out the Health Promoting Hospital and Environment-Friendly program which recruited experts from Industrial Technology Research Institute of Taiwan to give advice to hospitals. Guidance from this program included investigating energy consumptions of hospitals, planning energy conservation measures, providing suggestions of improvements, organizing workshops for low carbon emission hospitals, providing experience exchange platforms, and publishing a guidebook on health promoting and environment-friendly hospital.**

Background



- 169 Hospitals in Taiwan joined the Task Force on HPH Environment in 2014
- Completed an online system in Energy Saving and Carbon Reduction in 169 Hospitals - 2007-2013

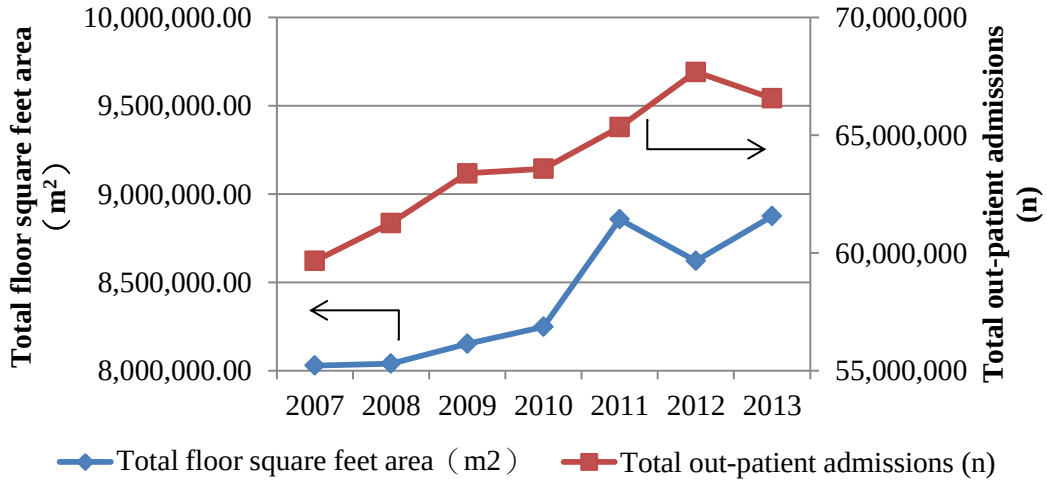
Results of Energy Saving and Carbon Reduction

Data analysis

- Source: energy consumption data collected by HPA (electricity, water, fuel, natural gas, waste, floor area and total beds)
- Sample: 159 returned sample from 169 pledged hospitals
- Reduction performance (%) = (Comparison year energy consumption – base year energy consumption)/ base year energy consumption
- Correction factor: total beds, floor area
- Carbon reduction (Calculated by the CO_2 emission coefficient promulgated by the Taiwan Bureau of Energy, Ministry of Economic Affairs)

Correction factor

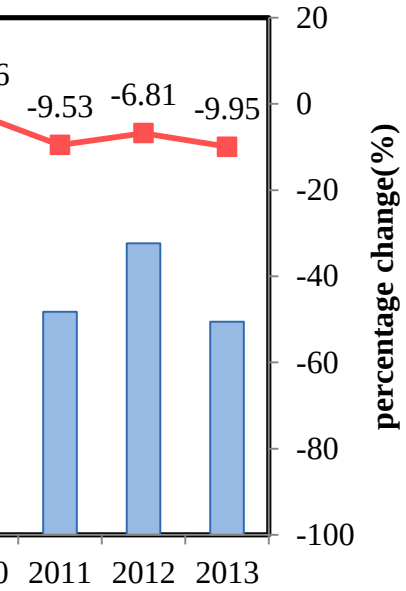
Year / Categories	2007	2008	2009	2010	2011	2012	2013
Total hospital beds (n)	84,716	85,087	86,806	87,674	87,869	86,077	87,223
Total floor square feet area（m^2）	8,028,793.50	8,040,254.50	8,152,808.61	8,248,827.04	8,857,956.65	8,622,033.15	8,876,059.91
Total out-patient admissions (n)	59,661,449	61,273,966	63,384,045	63,580,583	65,345,888	67,692,571	66,572,942
Total emergency room visits (n)	4,865,772	4,662,348	5,115,763	5,091,027	5,254,263	5,256,049	4,913,825
Total hospital admissions (n)	19,226,938	20,465,308	19,632,005	20,354,772	20,112,179	19,893,137	19,860,579



- Growing trend in total numbers of hospital beds, building floor square feet, out-patient admissions, emergency room visits and hospital admissions compared to baseline values in 2007

ENERGY

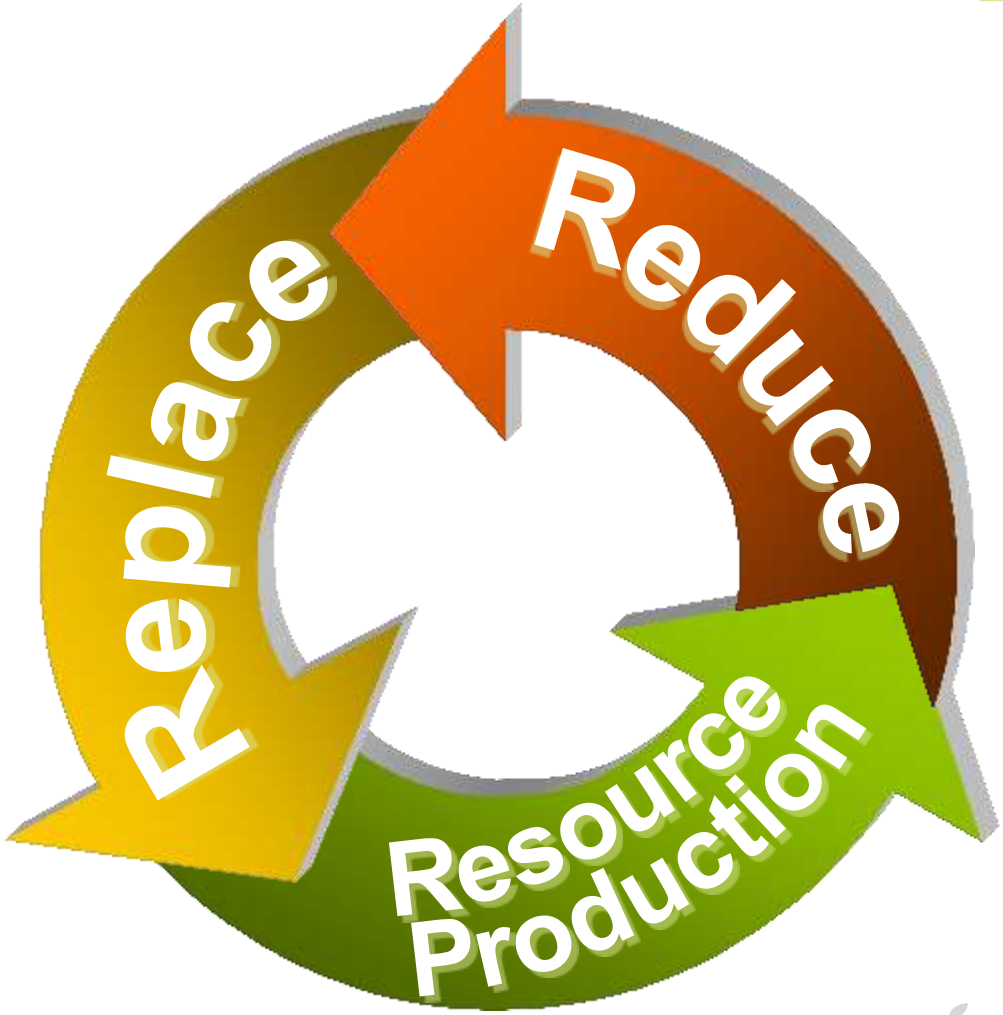
Energy



- Electricity consumption comprised 80% of the overall energy usage. (major source of carbon emission)
- 9.95% conservation on electricity consumption in 2013 compared to 2007.
- According to the target of 1% carbon reduction is expected per year, So far the hospitals have exceeded expected progress by 3.95%.

Item \ Year	2007	2008	2009	2010	2011	2012	2013
Medical center EUI (kWh/ m²/year)	252.05	251.33	244.10	245.82	244.93	241.96	233.70
Regional hospital EUI (kWh/ m²/year)	219.77	219.52	217.18	215.04	181.27	196.39	191.43
District hospital EUI (kWh/ m²/year)	180.11	179.26	176.05	177.37	176.13	172.80	167.90

Energy



Energy

Replace

1.Heat pump equipment

1) Conventional boilers need to diesel to combust, in addition to potential explosion hazards, there are also issues of carbon dioxide emission and heat consumption.
2) Heat pump can absorbs ambient heat to generate hot water, carbon dioxide emission is also reduced, nearly a quarter of the energy can be saved.

2.Lighting

1) Street lighting: change control device from light sensitive to time controlled, to be adjusted according the seasons.
2) Frosted light bulbs: replace original 220V with 240V bulbs, to increase bulb service life.
3) Toilet light bulbs: switch to infrared sensor switches that automatically switch the lights off when there is nobody.
4) Replacing old-style lamps on its own with T5, LED and other energy-saving lamps.

3.Other

1) Change the air-conditioning of operating rooms from air-cooled to water-cooled.
2) Install thermal insulation in order to avoid direct sunlight exposure and achieve thermal insulation effects.
3) Select inverter-type elevator that are in line with energy efficiency criteria

Energy

Reduce

1. Increase ventilation and reduce the use of air-conditioning
2. Adjust illuminance in accordance with prescribed illumination standards according to the different intended use of each site, replace traditional lighting with more luminously efficient T5 lighting, and adjust lighting numbers in order to meet the requirements.
3. Switch the lights off in turn for different sections and install photoelectric automatic switches for lighting to reduce unnecessary lighting losses.
4. Temperatures are set between 26-28℃.

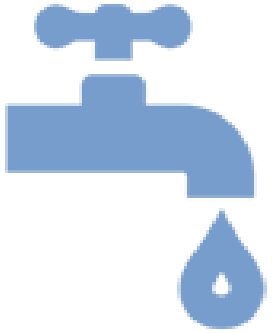
Energy

Other energy saving strategies

1.Solar power generation equipment

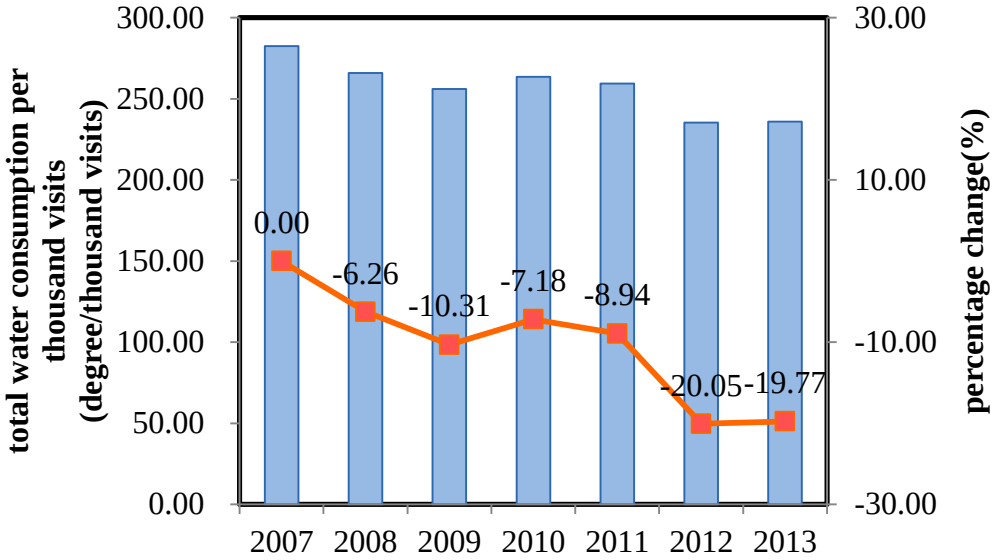
Set outdoors in the open-air solar power equipment; the solar power systems operate in parallel with Taipower to provide clean energy and to inhibit the peak hours' energy demand.

2.Control floor stops and operation time



WATER

Water



Percentage of consumption changes by year from 2007 to 2013 showed a pronounced decreasing trend, however the decrement was less significant in the year 2010, 2011 and 2012, 2013.

Water conservation equipment were unlikely to deteriorate fast and be replaced on a yearly basis, thus once the more effective water conservation measures have been installed, it is unlikely to be replaced with conventional means the fact that a flat trend in water conservation was thus observed.

Water

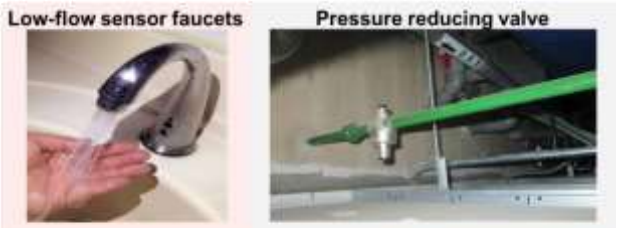
Water

Reuse

- Reuse recyclable wastewater for toilet flushing
- Collected the rainwater was to used to irrigate gardens

Replace

- Replace with water-control equipment and water-saving devices in public toilets and bathrooms in wards



Recycle

- Recycling water from waste water treatment plant
- Recycling of discarded water from RO water preparation

FOOD

Food

- Adopted reusable tableware for patient meals
- Adopted reusable tableware for dining area
- Provide only reusable green cups at meeting rooms without paper cups
- Use only environmental-friendly chopsticks in cafeteria, no longer supply disposable chopsticks
- Avoid using plastic bag for lunch transportation by use of large environmental-friendly food cart

WASTE

Waste

- Refrain from using disposable items such as paper/ plastic plates, cups, bowls & chopsticks
- Mandate the use of reusable items whenever feasible.
- Color-based classification of waste products
- Digital imaging to replace traditional radiographs
- Audit of compliance with waste classification for all units
- Each unit responsible for its cost of waste management to achieve self-surveillance
- Install “Unused drug recycle bin” next to the hospital’s drug information desk

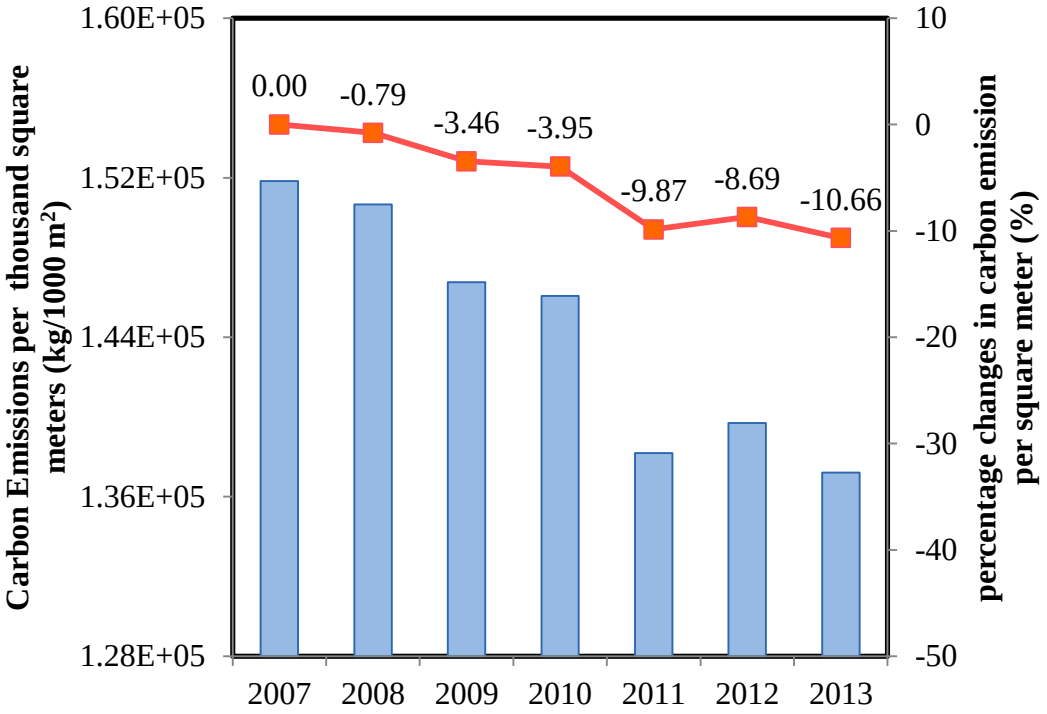
TRANSPORTATION

Transportation

- Provide shuttle buses to decrease the chance to drive by individuals
- Promote biking and stair climbing for carbon reduction

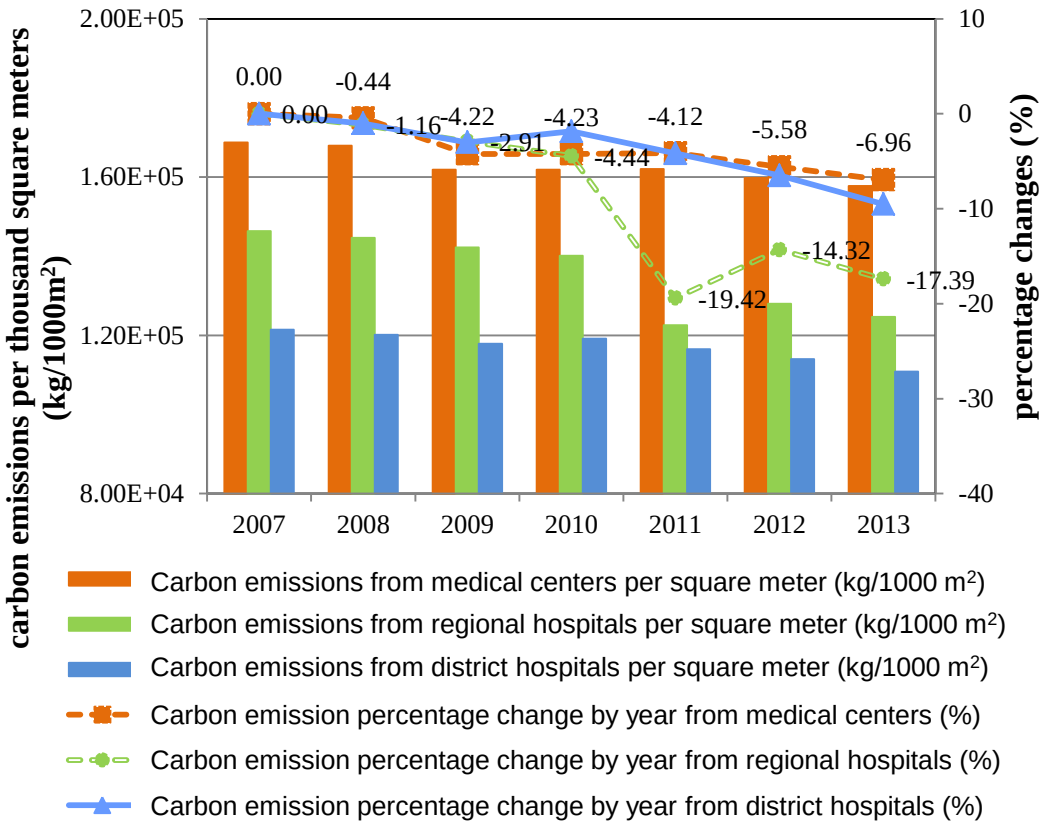
CARBON EMISSIONS

Carbon Emissions



- To calculate total carbon emissions for all hospitals from all sources - electricity, water, fuel, gas, general waste and hazardous waste from all hospitals from 2007 to 2013.
- A positive improvement in carbon conservation has been found; there was a gradual decreasing trend in CO_2 emissions over the year.
- 1,217,872.5 tons of CO_2 was emitted in 2013 and this was a 10.66% reduction.

Carbon Emissions



- Due to growing demand in medical services in recent years and the habits of Taiwan's population in favoring large scale hospitals for all medical needs. The hospital fulfill the increasing demands on hospital services, the result of these expansion was increased carbon emissions.
- After adjusting the data by dividing floor square feet (m^2) of the facility, a decreasing trend of carbon emission rate was observed over the years for all hospital types.

International Environment-Friendly Hospital Team Work Best Practice Award

- To enhance the effectiveness in reducing carbon and facilitate idea sharing among HPH members, in 2013 and 2014 the HPA organized the 1st and 2nd “International Environment-Friendly Hospital Team Work Best Practice Award”. After two rounds of review, 11 hospitals totally – both local and abroad – were selected by.
- Eligibility Criteria：
  a. Members of the International HPH Network
  b. General members of the Task Force on HPH and Environment
- Review Criteria：
  Describe the 5R’s—Replace, Reduce, Reuse, Recycle, and Resource production—are implemented in hospital to create an environment conducive to achieve it set goals for reducing energy use and carbon emissions.

International Environment-Friendly Hospital Team Work Best Practice Award

Scoring ：

1. Management policy: 15%, (describe the organization which is responsible for promoting energy efficiency and reducing carbon emissions in hospital.)。
2. Needs Assessment: 15%, (evaluate the hospital's current status and issues encountered.)
3. Action: 25%, (5R's)
4. Result: 35%，(Include quantifiable data)
5. Special and extraordinary contribution: 10%

To encourage more healthcare institutions to join the effort of promoting environment-friendly healthcare practices, HPA will continue to recognize outstanding institutions with this year's Best Practice Award.

Thank you for your attention