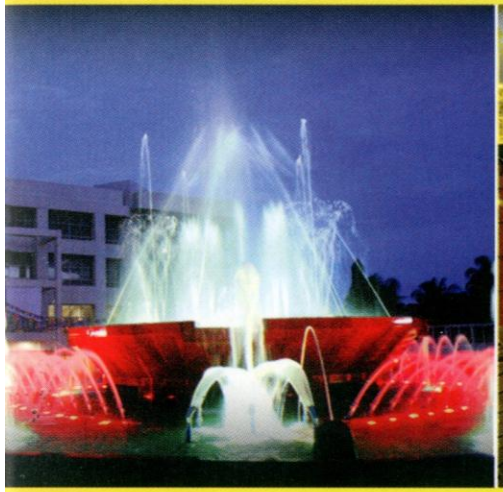
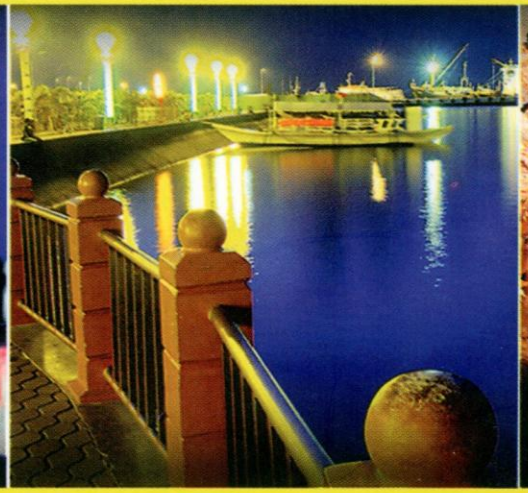
PUERTO PRINCESA

A Carbon-Neutral City





Summary of the City's Greenhouse Gas (GHG) Inventory

MESSAGE

Republic of the Philippines
OFFICE OF THE CITY MAYOR
City of Puerto Princesa

June 6, 2011

WARM greetings to my countrymen and to all citizens of the world who care for our environment!

We are proud to invite you to our City in the Forest, now holding the distinction of being the "Cleanest and Greenest City in the Philippines." Come visit and witness what committed citizens have achieved by working together towards a common goal!

When we assumed office in 1992, Puerto Princesa was an undiscovered paradise suffering from years of neglect and abuse by both local and national government officials. The City budget for the year was almost depleted despite being midway into the year, the environment was taken for granted, forest cover was rapidly declining due to illegal logging, our biodiversity both on land and in the oceans was threatened by illegal fishing and uncontrolled hunting, tourists numbered only 12,000 a year, streets were dirty with litter and uncollected garbage was all over.

Above all, many citizens were uninvolved, uncommitted and uncaring for the environment because they were not inspired to follow their elected leaders who showed little care to protect the environment for the generations to follow.

This was the challenge we faced that made us commit with unrelenting passion to immediately stop the bleeding of the wounds inflicted on the environment. This was the opportunity that we felt would make a difference even before the world realized that, unless it acted as one, our very lives on earth will be threatened by climate change, traceable to excessive greenhouse gas (GHG) emissions.

Today, we are proud of our City, we are proud of our local officials and, above all, we are proud of our citizens. Even before the Kyoto Protocol was agreed upon by the nations of the world, in an effort to reverse the possible adverse effects of greenhouse gas (GHG) emissions, we were determined to lay the foundations for sustainable development.

Today, we are projecting to break the 1million tourist mark within the next 5 years, with rapidly increasing development in the hotel and restaurant industry, continuous road development to cover the major tourist destinations, increased energy resources combining both traditional and renewable energy and a well-managed transportation system employing new e-vehicles and e-trikes to lessen anticipated emissions.

Today, we officially release our first Greenhouse Gas (GHG) Inventory following the internationally recognized guidelines from the Intergovernmental Panel on Climate Change (IPCC) with quality assurance by an independent third party, the Manila Observatory. This certifies that the City is indeed carbon-neutral!

With yearly updates of this Inventory, we can determine to what extent any major development effort will have on our existing carbon-neutral (technically carbon-negative) status now contributing a net negative emission of -1,456 kt CO_2-equivalents to our environment.

We will continue with our efforts to protect and further increase our forest cover as we open our doors to controlled and managed socio-economic development. This will be our contribution to Mother Earth and to the succeeding generations of residents in our City that now opens its doors to the world!

Mabuhay!

CLEANEST
AND
GREENEST
COMPONENT CITY
Hall of Fame Award

Mayor EDWARD S. HAGEDORN
Puerto Princesa
A Carbon-Neutral City

PUERTO PRINCESA

A Carbon-Neutral City

Summary of the City's Greenhouse Gas (GHG) Inventory

ACKNOWLEDGEMENTS

WE ACKNOWLEDGE Mayor Edward S. Hagedorn whose vision for Puerto Princesa City and commitment to the environment inspired the creation of the first Greenhouse Gas Inventory for a Philippine city.

We also would not have been able to pursue this undertaking without the support of Ateneo de Manila University President and Intergovernmental Panel on Climate Change (IPCC) scientist Fr. Jose Ramon Villarin, S.J. as well as Manila Observatory's Executive Director Antonia Loyzaga and Klima Head Deanna Olaguer, whose experience in the creation of the past two national inventories proved valuable in this pioneering effort. Fr. Villarin personally led the review of the inventory results, supported by his able staff, Mr. Andy Gutierrez and Ms. Sandee Recabar.

Dr. Rodel Lasco (Professor, College of Forestry and Natural Resources, University of the Philippines-Los Baños), Prof. Rowaldo del Mundo (Professor, College of Engineering, University of the Philippines-Diliman), Dr. Ely Ouano (former DENR-Environmental Management Bureau Director) also patiently and unselfishly guided us in understanding and addressing the technical issues covering the forestry, energy and waste sectors.

On data collection, we especially thank the City Planning Office headed by Engr. Jovenee Sagun and Mr. George Vasquez, together with their staff: Ms. Elizabeth Alzaga, Mr. Daniel Tejada, and Ms. Jo Macasaet for their cooperation and wholehearted support in sharing data collated by the City. City Agriculturist Melissa Macasaet, City ENRO Roger Daquer, and City SWMO Head Earl Buenviaje also generously shared their available data as well as their precious time and experience.

Our special thanks to Mr. Rod Saucelo for helping the Mayor during the initiation stage and providing the enthusiasm, energy and directions to give life to this project. Assistant City Administrator / City Tourism Officer Rebecca Labit was also very supportive with our logistical requirements and varied little requests, while City Information Officer Al Goh kindly provided us stock photos of the City that made this particular report come alive.

We also cannot thank enough the various offices – both private and public – who willingly cooperated in the creation of this inventory. Without their official data, it would have been impossible to arrive at these final and technically-sound GHG emission estimates.

The researchers and staff involved with SEED or the Socially-acceptable, Economically-viable, Environmentally-sustainable Development Group have to be recognized for their industry and dedication in researching activity data, calculating emissions, ensuring integrity of results, and presenting these in a reader-friendly format. These are Ms. Rochelle Diswe (senior researcher), Ms. Erlyn Ricafrente (staff assistant) and Mr. Elmer Alitagtag (graphics designer). A special acknowledgement goes to Ms. Hershey Tapia of the Department of Energy who provided priceless inputs as well as insights on the energy sector from the national perspective.

Finally, we must recognize our Creator, God Almighty, who provided this world with its breathtaking beauty and bountiful blessings, allowing humans to live with one another in tandem with nature that provides life's sustenance.

THIS is a summary of Puerto Princesa City's Greenhouse Gas (GHG) Inventory in year 2009 – researched, written and published by consultants and supporters of Mayor Edward S. Hagedorn who envisioned and initiated this project. The Inventory's methodology, computations, and final results were reviewed by the Manila Observatory under the leadership of Fr. Jose Ramon "Jett" T. Villarin, S.J. This was summarized, analyzed, and written by F. Veronica Victorio, BS ME, MSc IndEcol.

NOWADAYS, climate change has become the strongest battle cry of the environmental movement. It is such an encompassing concern that it is discussed not only by the scientific elite, but also by the farmers and fisherfolk, whose lives and livelihoods are inextricably linked to their environment. While levels of understanding and appreciation of climate change may vary among these groups, there is a general feeling of being overwhelmed at the vastness and complexity of the issue.

The Intergovernmental Panel on Climate Change (IPCC) has declared that the "warming of the climate system is unequivocal." Much evidence exists to prove that climate change is indeed happening now with far reaching implications. Despite prevailing uncertainties on its occurrence and degree of impact, one thing is clear: every country, every city and every citizen can no longer afford to ignore the issue because the risks of doing so are simply too daunting.

Addressing climate change would have probably been easier if the problem was not driven by the same core engines of economic growth: the use of fossil fuel based energy and a predominant consumer culture. It would also have been simpler if the solution was not dependent on international cooperation, where developed countries find themselves holding a historic responsibility for the current state of emissions while developing countries find themselves being most vulnerable to the impacts of these emissions.

Indeed, climate change poses a challenge to every human being today. It questions our very mode of living, makes us rethink our values and dares us to accept accountability for our actions and commit to a more sustainable pathway.

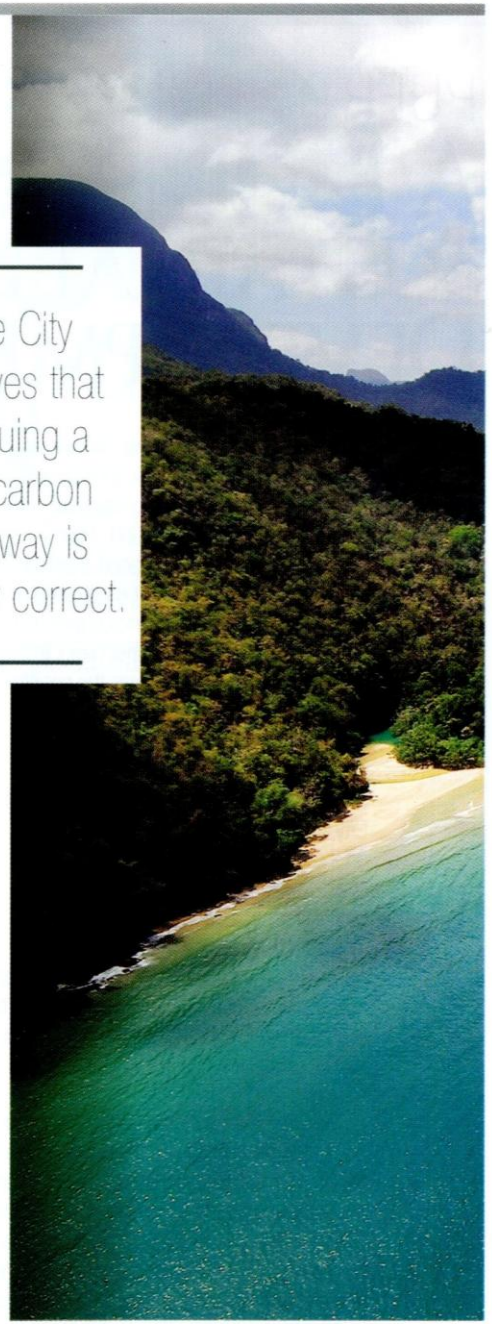
Puerto Princesa City (PPC) has long committed itself to become a model city for sustainable development within the Philippines and within the ASEAN region. This naturally entailed pursuing a low carbon pathway while it fortified the socio-economic development of the City as well as its overall environmental protection – consistent with the three legs of sustainable development (social, economic, and environmental concerns).

This Greenhouse Gas (GHG) Inventory is thus a necessary first step in understanding the contribution of each economic and/or social activity together with their components and alternatives on the total carbon emissions of the City. With its detailed and comprehensive coverage, the Inventory will allow easy determination of the impacts that any effort will have on the City's GHG emissions. Increased energy consumption, increased agriculture activity, rapid tourism development and other emission-sensitive activities can be easily computed and compared against this Inventory on an on-going basis, allowing for trade-offs, if necessary, to maintain its carbon-neutral status.

Understandably there may be questions why Puerto Princesa City is pursuing mitigation when the Philippines, as a whole, should be more concerned with adaptation, considering that the country barely contributes to total world emissions but finds itself highly vulnerable to the impacts of climate change.

The City believes that pursuing a low carbon pathway is morally correct. Even if it may be considered a relatively insignificant contributor to total greenhouse gas emissions, the City hopes to make a stand against the tendency to wait for others to act before doing one's share, because it is precisely this attitude that has led the world to its current quandary.

The City believes that pursuing a low carbon pathway is morally correct.



PUERTO PRINCESA: A MODEL IN SUSTAINABLE DEVELOPMENT

AS THE capital city of Palawan, known as the country's "Last Ecological Frontier" and declared a "Biospheric Reserve" by the United Nations in 1991, Puerto Princesa City has always faced a unique challenge. On one hand, it is committed to the preservation of its unique and rich environment but, on the other hand, it has to recognize and address the socio-economic needs of its residents.

Maintaining a balance between these twin aspirations has not been easy for the City, in light of its citizens' dependency on the environment as their source of income. From the point of view of both the small fisherfolk and farmers, including businessmen who seek quick returns on their investments, it is simply easier to cut fully grown trees or harvest fish from the bountiful seas to immediately turn these into cash without any regard for the environmental implications.

This was the challenge faced by Mayor Ed Hagedorn when he stepped into office in 1992. Immediately, he tightened enforcement of environmental laws by setting up vigilant watch teams: "Bantay Puerto" (PPC Watch) with "Bantay Gubat" (Forest Watch) and "Bantay Dagat" (Bay Watch), thereby reversing the environmental degradation trend and even increasing forest cover. He provided jobs and livelihood to the residents whose sources of income were affected by his strict environmental policies. Separately, he heightened the environmental consciousness and appreciation of the people through events such as the "Feast of the Forest" and "Love Affair with Nature," making the Puerto Princesans proud and protective of their environment. Not surprisingly, Mayor Hagedorn earned numerous awards and recognition, both for the City and for his unrelenting efforts over nearly the past two decades. The United Nations Global 500 Roll of Honor Award for Mayor Hagedorn in 1997 and the ASEAN Environmentally Sustainable City Award in 2008 are the ultimate recognition of his commitment to the environment.

STRATEGY

- **PROTECT** what is left of resources
- **REHABILITATE** what has been destroyed
- **PLAN** for intelligent utilization

Positioning Puerto Princesa as a prime ecotourism destination starting 1992 when Mayor Hagedorn first assumed office, the number of tourists grew from only 12,000 that year to over 500,000 in 2010, and projecting to 1 million within the next 5 years! Indeed, Puerto Princesa City's reputation among travelers as the "cleanest & greenest city in the Philippines" with pristine and beautiful beaches, ocean views and mountain views, is living proof that socio-economic development can go in tandem with environmental protection.

Mayor EDWARD S. HAGEDORN

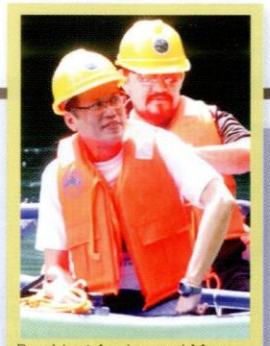
BY THE time Mayor Edward S. Hagedorn completes his current term of office in June, 2013, he would have served as Mayor of Puerto Princesa for over two decades. He was first elected in 1992, re-elected in 1995 and again 1998. Due to constitutional term limits, he could not run as Mayor in 2001; however, after only a year, a recall election was invoked by the residents, Mayor Hagedorn was allowed to run for office again and won in 2002. He has since won another 3 succeeding elections with a significant majority votes, attesting to his high approval and satisfaction ratings among the Puerto Princesans.

He is credited for transforming Puerto Princesa from a city whose natural resources were ravaged by both the needy and greedy to one of the most progressive ecotourism destinations in the country with an environment that is protected and cared for by the people.

Ecological Paradise

PUERTO Princesa City is endowed with rich natural resources and highly diverse flora and fauna found in both land and sea, unlike any of those found in the rest of the country. The City has the largest forest cover in the Philippines (65%) and boasts of one of the healthiest coral reef covers. Moreover, 105 of the 475 threatened species are found in the province (42 of which are endemic). The City is also home to the World Heritage Site: the Puerto Princesa Underground River, a finalist to the New 7 Wonders of Nature campaign.

Source: PCSD, 2008



President Aquino and Mayor Hagedorn, during the former's visit to the Underground River last Feb 9, 2011.

GEOGRAPHIC

Total Land Area	:	**253,982 hectares**
Urban	:	**5.7%**
Rural	:	**94.3%**
Flat to Gentle	:	**24%**
Moderate	:	**11%**
Rugged to Very Steep	:	**65%**
Length of Coastline	:	**416 km**
Coastal Waters	:	**327,583 ha**

DEMOGRAPHIC

Population	2007 (Official NSO)	:	**210,508**
	2009 (Projected)	:	**226,330**
Population Growth Rate		:	**3.69%**
No. of Barangays		:	**66**
Urban		:	**35** [Population: 173,981 (77%)]
Rural		:	**31** [Population: 52,350 (23%)]
Total Number of Households		:	**42,076**

ECONOMIC

Total Annual Income (2009):
Php 1,533,318,231.51

Locally-Generated Income (2009):
Php 243,085,585.71

Income Classification: **1st Class**

Major Economic Activities:
Eco-Tourism, Agriculture, Trading

Major Agricultural Products:
Rice, Vegetables, Coconut, Cashew, Mango, Root Crops

Labor Force by Occupation:

- **Service** 58%
- **Agriculture** 25%
- **Industry** 16%

Sources: PPC CPDC, 2009; NSO, 2007

CLIMATE CHANGE

WITHOUT doubt, climate change is taking place all over the world. The Intergovernmental Panel on Climate Change's (IPCC's) 4th Assessment Report reveals an average increase in world temperature of 0.74 degrees Celsius from 1906 to 2005, with most of this increase attributed to greenhouse gas emissions from human activities in the latter half of the 20th century. *Source: IPCC, 2007*

WORLD GHG EMISSIONS

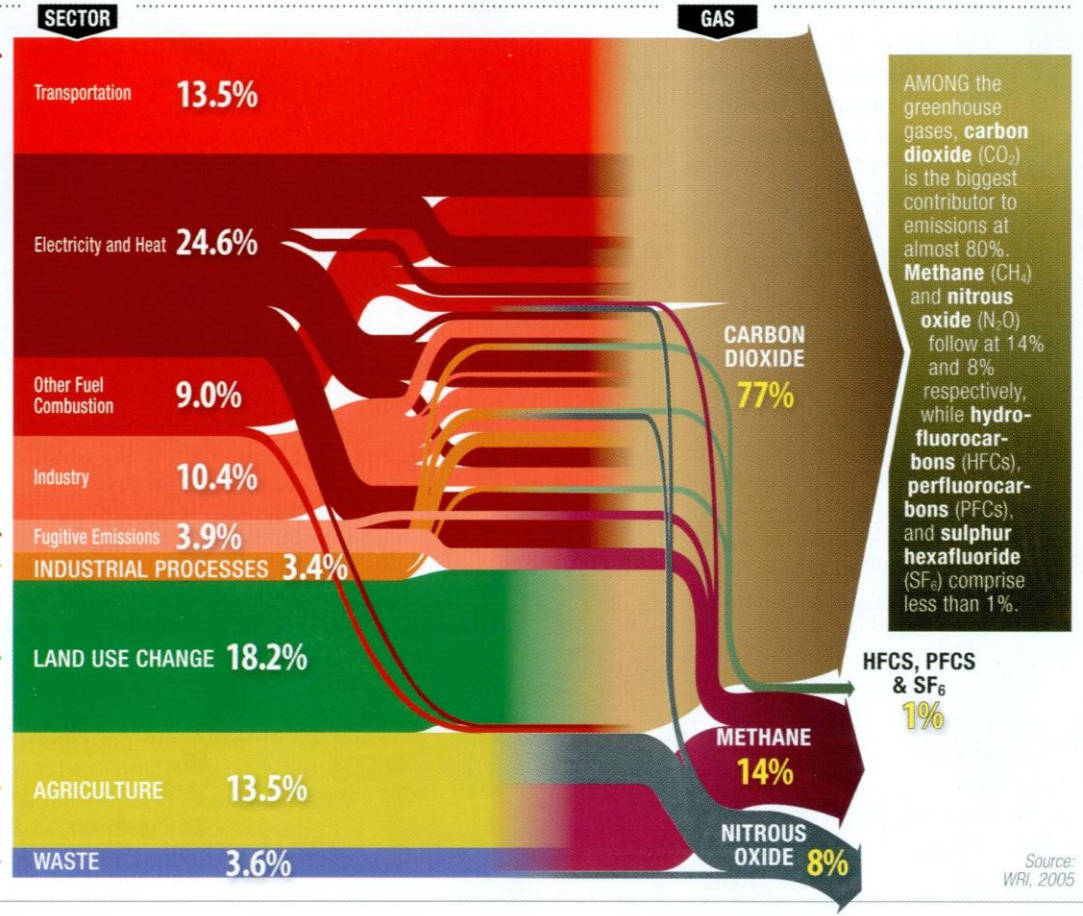
Energy
THE single biggest contributor to GHG emissions, energy is sourced primarily from fossil fuels such as oil, gas, and coal which converts mainly to CO_2 (and water) when combusted.

Industrial Processes
GHGs are also sometimes released in industrial processes that chemically or physically transform materials (e.g. blast furnace in the iron and steel industry, cement production).

Land Use Change
TREES and other plants remove carbon from the atmosphere as they grow, but they release this back into the atmosphere when decayed or burnt.

Agriculture
AGRICULTURAL practices such as the use of nitrate fertilizers to improve yield emits N_2O. On the other hand, "exhalations" of ruminant animals like cows, water buffalos, and goats release CH_4 into the atmosphere, while animal manure, depending on the management, results in CH_4 and N_2O emissions.

Waste
SOLID waste disposal as well as wastewater treatment and discharge typically result in CH_4 emissions, while incineration and open burning of waste may result in CO_2 emissions.



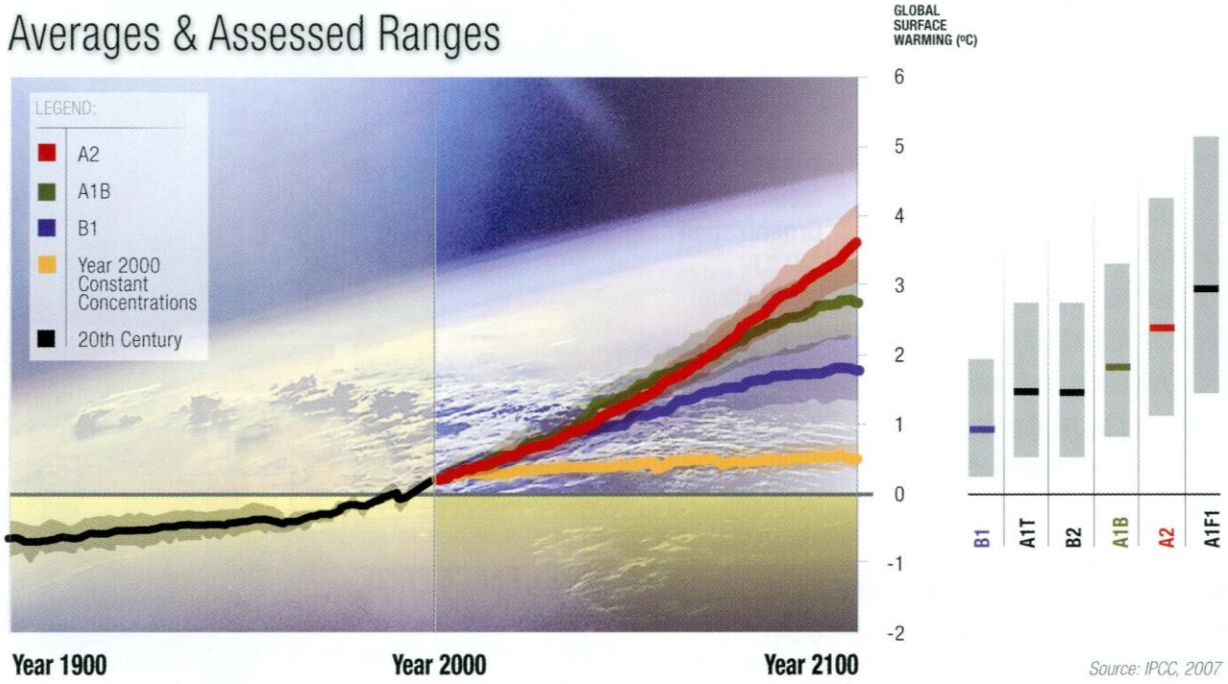
Global Warming Projections

ASSUMING no climate mitigation initiative is taken, the IPCC projects the following temperature changes.

Scenario		Temperature Change – Likely Range °C at 2090–2099 relative to 1980–1999
A1	➤ Rapid economic growth *(with varying emphasis on fossil fuels)*	**1.4 - 6.4** °C
A2	➤ Regionally oriented economic development	**2.0 - 5.4** °C
B1	➤ Global environmental sustainability	**1.1 - 2.9** °C
B2	➤ Local environmental sustainability	**1.4 - 3.8** °C

Source: IPCC, 2007

Averages & Assessed Ranges



Source: IPCC, 2007

About the UNFCCC

THE **United Nations Framework Convention on Climate Change** (UNFCCC) is an international environmental treaty adopted in 1992 and entered into force in 1994. With currently 195 Parties, it sets the framework for intergovernmental efforts towards the stabilization of GHG concentrations in the atmosphere below dangerous levels.

Countries are divided into 3 main groups, with varying commitments: **Annex I** Parties include industrialized countries that were members of the OECD (Organisation for Economic Cooperation and Development) in 1992, plus countries with economies in transition (EIT Parties), while **Annex II** Parties consist of the OECD members of Annex I without the EIT Parties. **Non-Annex I** Parties, on the other hand, are mostly developing countries.

Mitigation Efforts

Target

TO AVOID temperatures rising beyond the agreed threshold of 2°Celsius above pre-industrial levels, the Intergovernmental Panel on Climate Change (IPCC) recommends Annex I countries to reduce emissions by **25-40% below 1990 levels by 2020 and 80-95% by 2050**, while Non-Annex 1 countries are asked to substantially deviate from baseline emissions.

Current Agreement


The Japan Times

Conference adopts Kyoto Protocol

Greenhouse gas emissions to be cut by average of 5.2%

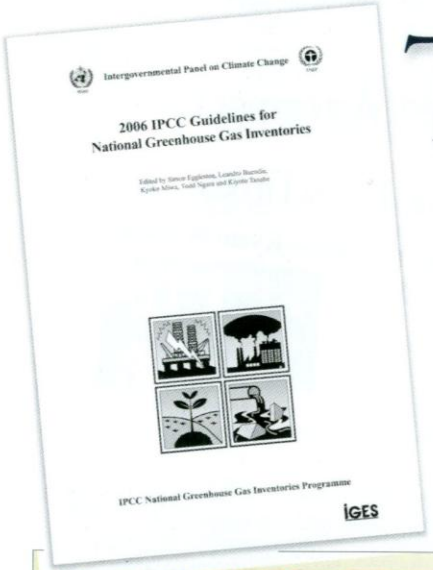
KYOTO COP3

AN INTERNATIONAL agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol commits 37 industrialized countries and the European community to reduce its greenhouse emissions by **5.2% below 1990 levels, for the 5-year period 2008-2012**. Greenhouse gases covered are CO_2, CH_4, N_2O, SF_6, HFC, and PFCs.

Adopted in 1997 and entered into force in 2005, the Protocol is premised on the "common but differentiated responsibilities" principle, where developed countries are given a heavier burden considering that they are historically responsible for the current high levels of GHG emissions.

A **GREENHOUSE GAS** (GHG) **INVENTORY** is an accounting of the amount of greenhouse gases emitted into the atmosphere from various source categories, as well as those removed by carbon sinks, in a certain geographical area and within a specific time period.

IPCC GUIDELINES



THE 2006 IPCC Guidelines for National Greenhouse Gas Inventories was used to estimate Puerto Princesa City's greenhouse gas emissions. This is the same internationally-accepted methodology used by countries to estimate their national inventories that are eventually reported to the UNFCCC. Emissions and removals were estimated by multiplying activity data with corresponding emission factors.

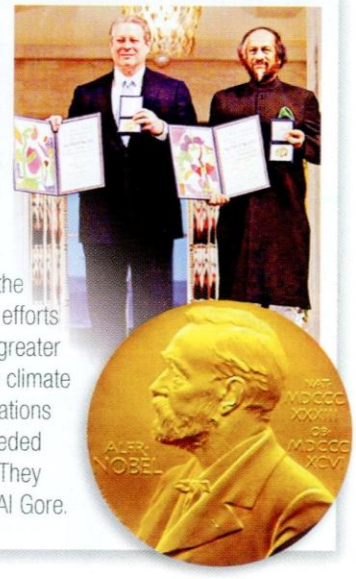
World Meteorological Organization (WMO) headquarters in Geneva, Switzerland, host to the Intergovernmental Panel on Climate Change (IPCC) Secretariat.

About the IPCC (Intergovernmental Panel on Climate Change)

ESTABLISHED in 1998 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the Intergovernmental Panel on Climate Change (IPCC), is an international scientific body that reviews and assesses all scientific, technical and socio-economic information related to climate change. One of its key activities is the creation of reports relevant to the implementation of the United Nations Framework Convention on Climate Change (UNFCCC).

NOBEL PEACE PRIZE

In 2007, the IPCC received the Nobel Peace Prize for: "their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change." They shared the Peace Prize with Al Gore.



Application (Reference Year: 2009)

FOR PPC's GHG Inventory, Tier 1 approach was adopted to make use of readily available local and national statistics, default emission factors, parameters, etc. Only the 3 main greenhouse gases: CO_2, CH_4, and N_2O were covered, with emissions/removals being grouped under the following sectors: (1) energy, (2) industrial processes and product use, (3) agriculture, forestry and land use, and (4) waste.

SECTOR

ENERGY

TYPICALLY divided into stationary and mobile fuel combustion, emissions from the energy sector were estimated using a top-down approach. Official 2009 fuel sales data from oil depots were used as source, since these were deemed more accurate as well as consistent with data used for the national inventory. As a result:

a) The Inventory assumes that all fuel sold in 2009 were consumed in 2009 and combusted within the City boundaries.

b) Since oil depot sales were classified according to their buyers who are not necessarily the end-users of the fuels, emissions for some subsectors had to be included in another subsector considered to be the biggest user of a particular fuel type.

Specifically, gas and diesel delivered to retail stations were included in the road transportation subsector even if these were also used for generators (diesel), ships (diesel) and "bangkas" or small boats (gas and diesel). Also, liquified petroleum gas, or LPG, used primarily for cooking purposes, was included in the commercial/residential subsector, even if some were consumed by LPG-based tricycles.

Taken as a whole, all energy subsectors existing in the City were estimated, except for some activities such as the possible use of fuelwood and charcoal, for which no data were available.

INDUSTRIAL PROCESSES & PRODUCT USE

SINCE industrial processes (mineral, chemical, metal, electronics, etc.) and fossil fuel use for non-energy purposes are not occurring in the City while hydroflourocarbon & perflourocarbon use could not be estimated, no emissions were reported for this sector.

AGRICULTURE, FORESTRY & LAND USE (AFOLU)

EMISSIONS were computed using data sourced from the Offices of the City Veterinarian (livestock), City Agriculturist (croplands and fertilizer application), and City Planning and Development Coordinator and City Environment and Natural Resources Officer (forest lands and other land classifications).

All data were as of 2009, except for forest cover data which were based on latest satellite images taken in 2005. Forest cover data, however, should not be much different from current cover due to the commercial log ban in place and strict implementation of the ECAN (Environmentally Critical Area Network that delineates protection and development zones). It is also because of these that land use changes, wood removals, and biomass burning are not expected to occur. Thus, data do not exist and emissions could not be estimated.

WASTE

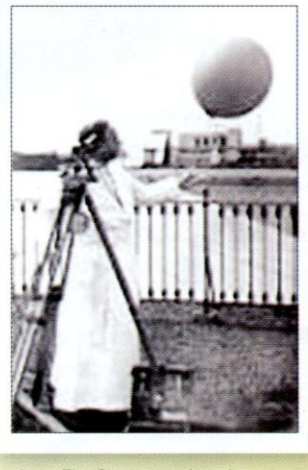
SOLID waste disposal emissions were based on actual collected waste (vs. generated – for which data do not exist), while wastewater treatment emissions were based on local population numbers. Due to methodology/data limitations, wastewater generated by the City's tourists were not estimated.

Unit of Measurement

Results are reported in terms of CO_2-equivalents – which converts all greenhouse gases in terms of their global warming potential relative to Carbon Dioxide (CO_2).

Did you know?

METHANE (CH_4) has 21 times the global warming potential of CO_2, and Nitrous Oxide (N_2O) 310 times that of CO_2, using a time horizon of 100 years.

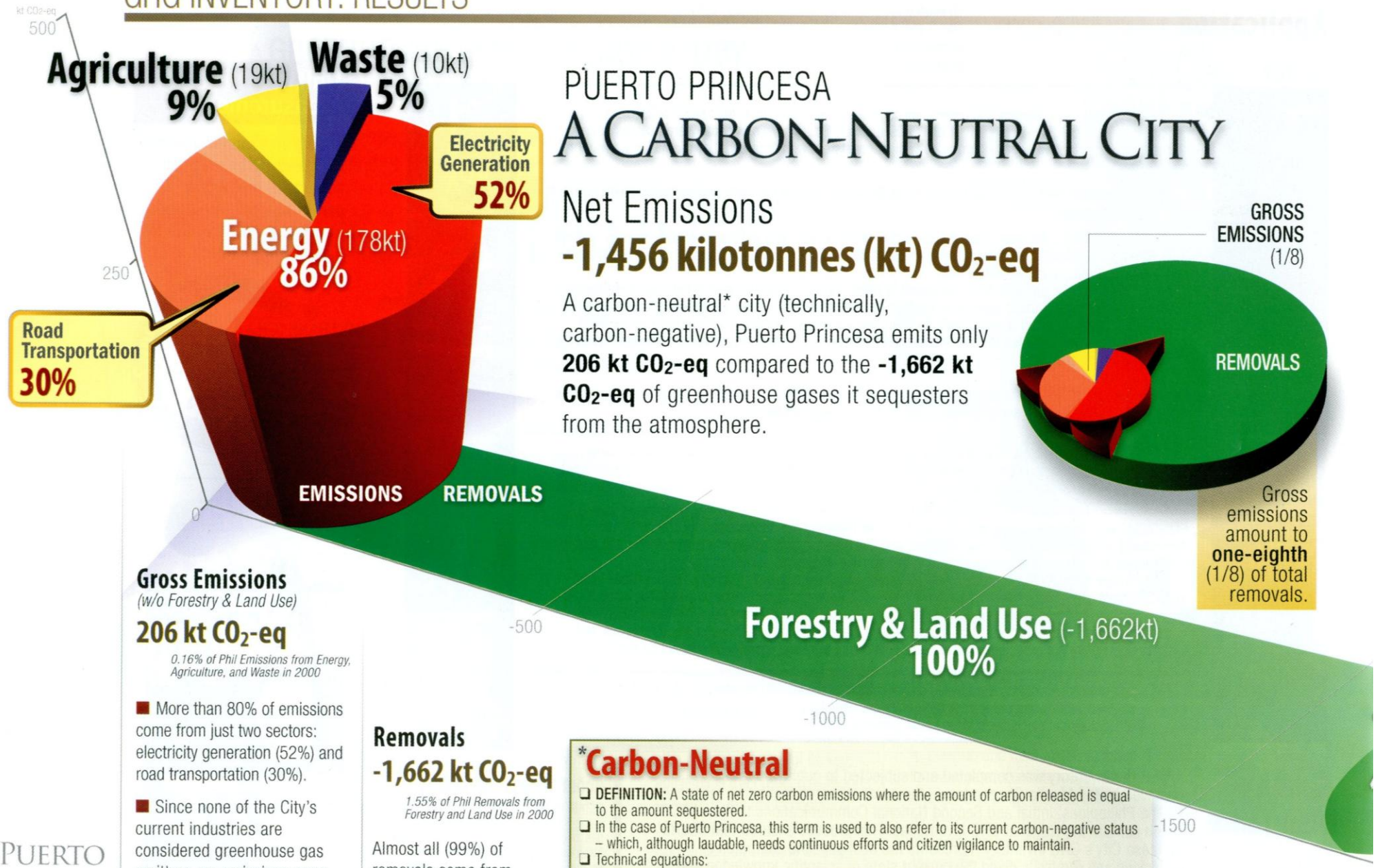


Quality Assurance

AFTER the Inventory was completed and subjected to quality control, it was reviewed by the Manila Observatory – the same research institution responsible for the Philippines' Initial and Second National Communications to the UNFCCC which contain the National GHG Inventories. This process ensures that Puerto Princesa City's GHG Inventory represents the best possible estimates of emissions and removals given the current state of scientific knowledge and data availability.

About Manila Observatory

ESTABLISHED in 1865 by the Jesuit mission in the Philippines, the Manila Observatory has long been engaged in the systematic observation of Philippine weather, even serving as the country's official weather institution during the Spanish and American regimes. The Observatory has since branched off into other fields of research, specifically seismic, geomagnetic, radio physics and solar physics and is now one of the leading institutions on climate science and impacts.



PUERTO PRINCESA
A CARBON-NEUTRAL CITY

Net Emissions
-1,456 kilotonnes (kt) CO_2-eq

A carbon-neutral* city (technically, carbon-negative), Puerto Princesa emits only **206 kt CO_2-eq** compared to the **-1,662 kt CO_2-eq** of greenhouse gases it sequesters from the atmosphere.

Gross emissions amount to **one-eighth** (1/8) of total removals.

Gross Emissions
(w/o Forestry & Land Use)

206 kt CO_2-eq

0.16% of Phil Emissions from Energy, Agriculture, and Waste in 2000

- More than 80% of emissions come from just two sectors: electricity generation (52%) and road transportation (30%).
- Since none of the City's current industries are considered greenhouse gas emitters, no emissions were registered from industrial processes.

Removals
-1,662 kt CO_2-eq

1.55% of Phil Removals from Forestry and Land Use in 2000

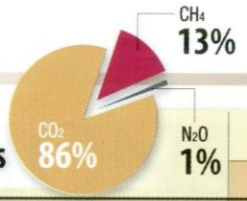
Almost all (99%) of removals come from forest lands, with the rest coming from croplands.

*Carbon-Neutral

- **DEFINITION:** A state of net zero carbon emissions where the amount of carbon released is equal to the amount sequestered.
- In the case of Puerto Princesa, this term is used to also refer to its current carbon-negative status – which, although laudable, needs continuous efforts and citizen vigilance to maintain.
- Technical equations:

Carbon-Neutral	CO_2-eq emissions	=	CO_2-eq removals
Carbon-Negative	CO_2-eq emissions	<	CO_2-eq removals

Emissions by Greenhouse Gas



		Emissions 206 kt CO_2-eq						Removals -1,662 kt CO_2-eq	
		CO_2		CH_4		N_2O		CO_2	
TOTAL		**177.22** kt CO_2-eq		**26.39** kt CO_2-eq		**2.62** kt CO_2-eq		**-1661.50** kt CO_2-eq	
ENERGY	Stationary Combustion	**110.18**	62%	**0.09**	0%	**0.27**	10%		
	Mobile Combustion	**67.04**	38%	**0.06**	0%	**0.17**	7%		
AFOLU	Agriculture			**18.34**	69%	**0.23**	9%		
	Forestry & Land Use							**-1661.50**	*100%*
WASTE	Waste			**7.90**	31%	**1.95**	74%		

Emissions/Removals

Sector	kt CO_2-eq	% of Gross Emissions (206 kt)	% of Removals (-1,662 kt)
ENERGY	**177.80**	**86.52%**	–
STATIONARY COMBUSTION	110.53	53.60%	–
Energy Industries: Electricity Generation	107.92	52.33%	–
Commercial/Residential	2.61	1.27%	–
MOBILE COMBUSTION	67.27	32.62%	–
Road Transportation	60.94	29.55%	–
Domestic Aviation	1.95	0.95%	–
Domestic Water-Borne Navigation	4.38	2.13%	–
AGRICULTURE, FORESTRY & LAND USE (AFOLU)	**-1642.94**	**9.00%**	**100.00%**
AGRICULTURE	18.56	9.00%	–
Livestock	16.20	7.86%	–
• Enteric Fermentation	9.36	4.54%	–
• Manure Management	6.83	3.31%	–
Non-CO2 Emission Sources from Land	2.36	1.15%	–
• Direct and Indirect N_2O Emissions from Managed Soils	0.14	0.07%	–
• Rice Cultivation	2.23	1.08%	–
FORESTRY & LAND USE	-1661.50	–	100.00%
Forest Land	-1645.26	–	99.02%
Cropland	-16.24	–	0.98%
WASTE	**9.85**	**4.78%**	–
• Solid Waste Disposal	4.34	2.10%	–
• Biological Treatment of Solid Waste	3.99	1.94%	–
• Wastewater Treatment and Discharge	1.52	0.74%	–
GROSS EMISSIONS (w/o Forestry & Land Use)	**206.21**	**100.00%**	–
REMOVALS (Forestry & Land Use)	**-1,661.50**	–	**100.00%**
NET EMISSIONS (w/ Forestry & Land Use)	**-1,455.29**	–	–

-2000

GHG PROJECTIONS

ASSUMING different emission growth rate scenarios, Puerto Princesa will most probably remain carbon-neutral until at least 2030 with constant removals.

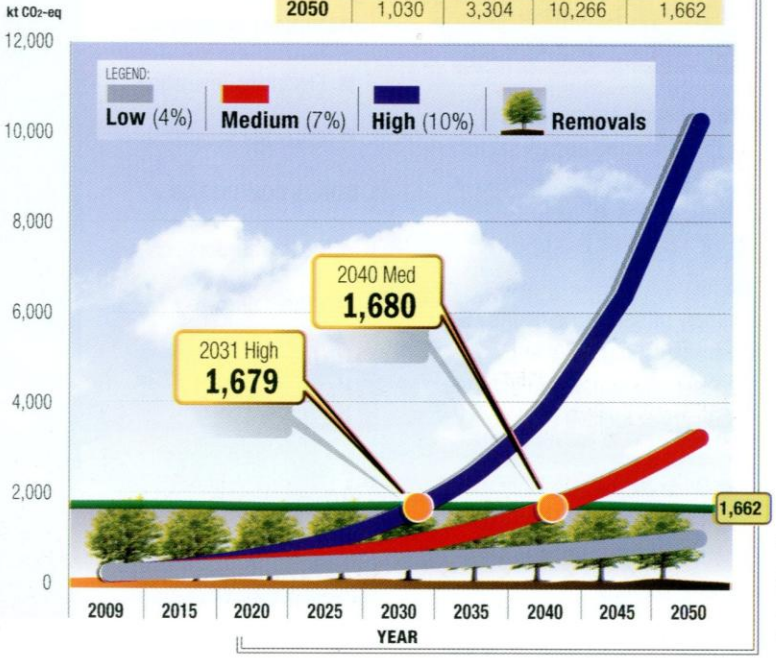
Year	Emissions kt CO_2-eq — Growth Scenario: Low (4%)	Medium (7%)	High (10%)	Removals kt CO_2-eq
2009	206	206	206	1,662
2015	261	309	365	1,662
2020	317	434	588	1,662
2025	386	609	948	1,662
2030	470	854	1,526	1,662
2035	572	1,198	2,458	1,662
2040	696	1,680	3,958	1,662
2045	846	2,356	6,375	1,662
2050	1,030	3,304	10,266	1,662

FOR REFERENCE

- City's Population Growth Rate: 3.69%
- Country's GDP Growth Rate (at 1985 constant prices)

Average 2006-2010	:	4.63%
2010	:	6.83%

Sources: PPC CPDC, 2007; NEDA, 2010



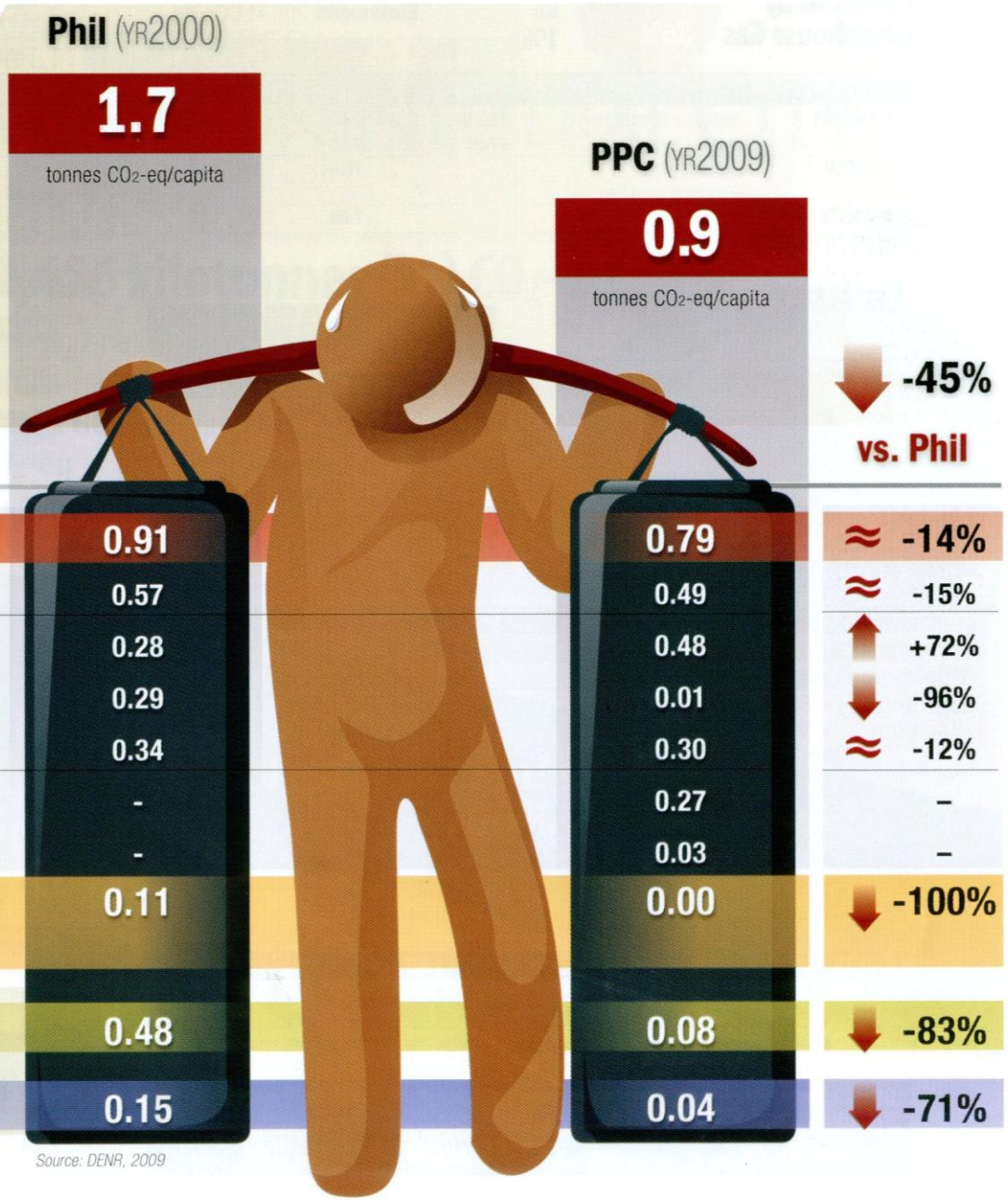
AS FRENCH political thinker Alex de Tocqueville commented, "Without comparisons, the mind does not know how to proceed," in the same manner, without comparing PPC's numbers with others, it will be difficult to conclude whether these are high or low and whether these need improvement or not. In this section, PPC's GHG emissions are presented in relation to its population (emissions per capita) and its economic output (emissions intensity), and then compared to the results of the Philippines and the rest of the world.

EMISSIONS PER CAPITA

- Puerto Princesa's emissions* of **0.9 tonnes CO_2-eq/capita** is almost half that of total Philippines' **1.7 tonnes CO_2-eq/capita** in year 2000.

- Although emissions per capita from the energy sector are slightly lower than national average (-14%), emissions from electricity generation are 72% higher, and are simply offset by the country's emissions in other energy subsectors (e.g. manufacturing industries, fugitive emissions).

- Wide disparities from national averages exist for both the agriculture and waste sectors.



SECTOR	Phil (YR2000)	PPC (YR2009)	vs. Phil
Energy	0.91	0.79	≈ -14%
STATIONARY COMBUSTION	0.57	0.49	≈ -15%
Electricity Generation	0.28	0.48	↑ +72%
Other Subsectors	0.29	0.01	↓ -96%
MOBILE COMBUSTION	0.34	0.30	≈ -12%
Road Transportation	-	0.27	–
Other Subsectors	-	0.03	–
Industrial Processes & Product Use	0.11	0.00	↓ -100%
Agriculture	0.48	0.08	↓ -83%
Waste	0.15	0.04	↓ -71%

Source: DENR, 2009

* Only gross emissions considered; removals from Forestry & Land Use Sector not included.

EMISSIONS INTENSITY

In terms of CO_2 emissions from the energy sector (fossil fuel combustion) relative to economic output, Puerto Princesa's 2009 emissions relative to its GDP* in 2009 is **0.68 kg CO_2/USD** at current prices — 15% less than the country's 2000 figures (2.40 kg CO_2/USD compared to Philippines' 2.84 kg CO_2/USD using 1985 constant prices). Its less industry-intensive economy might explain the difference.

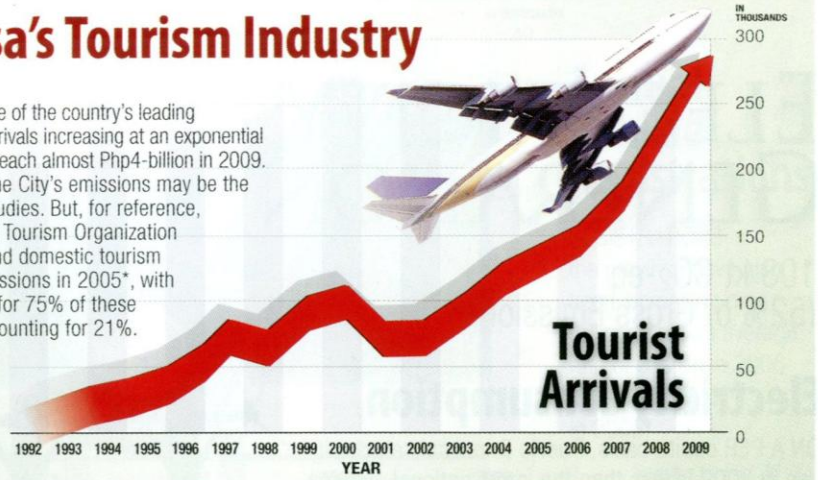
** Puerto Princesa's GDP was projected from national GDP/capita multiplied with the City's population.*
Sources: NSCB, 2011; DENR, 2009

Puerto Princesa's Tourism Industry

PUERTO Princesa is fast becoming one of the country's leading ecotourism destinations with tourist arrivals increasing at an exponential rate and tourist receipts estimated to reach almost Php4-billion in 2009.

How the industry contributes to the City's emissions may be the subject of later and more specific studies. But, for reference, a report by the United Nations World Tourism Organization (UNWTO) shows that international and domestic tourism account for almost 5% of global emissions in 2005*, with the transport subsector responsible for 75% of these emissions and accommodations accounting for 21%.

** Only CO_2 emissions from fossil fuel combustion and cement production were included.*
Sources: PPC CPDC , 2011; UNWTO, 2008

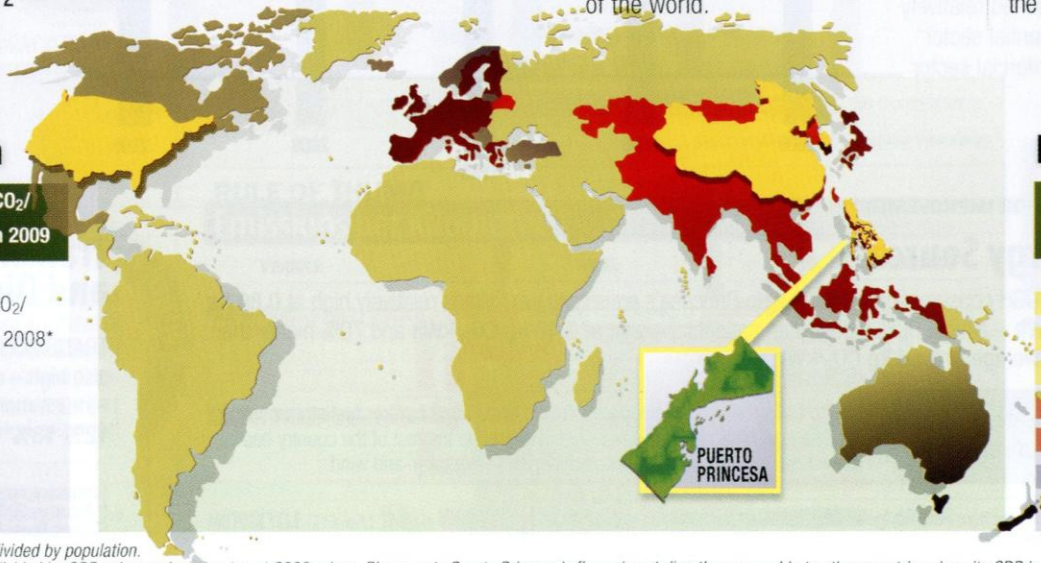


RELATIVE TO THE WORLD

ENERGY SECTOR'S CO_2 EMISSIONS

BOTH Puerto Princesa and the Philippines have significantly lower emissions per capita than the rest of the world.

But world emissions intensity for PPC and the Philippines are close to the world average and even higher than some countries, notably the USA, EU and OECD members.



Emissions per Capita

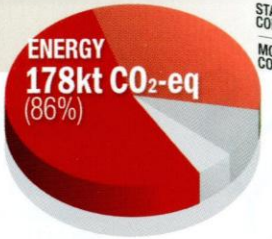
Puerto Princesa	0.79	tonnes CO_2/ capita in 2009
Philippines	0.80	tonnes CO_2/ capita in 2008*
China	4.92	
United States	18.38	
Asia	1.38	
European Union	7.72	
OECD Members	10.61	
WORLD	**4.39**	

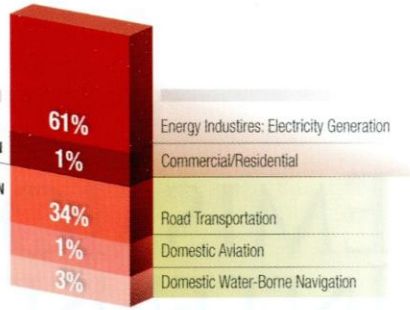
Emissions Intensity

Puerto Princesa	0.68	kg CO_2/USD in 2009 at 2009 prices
Philippines	0.65	kg CO_2/USD in 2008 at 2000 prices**
China	2.30	
United States	0.48	
Asia	1.25	
European Union	0.39	
OECD Members	0.41	
WORLD	**0.73**	

** CO_2 emissions from fossil fuel combustion divided by population.*
*** CO_2 emissions from fossil fuel combustion divided by GDP using exchange rates at 2000 prices. Please note Puerto Princesa's figure is not directly comparable to other countries since its GDP is based on current prices. Given inflation, this figure is most likely higher than what is currently reflected.*
Source: IEA, 2010.

ENERGY





ELECTRICITY GENERATION

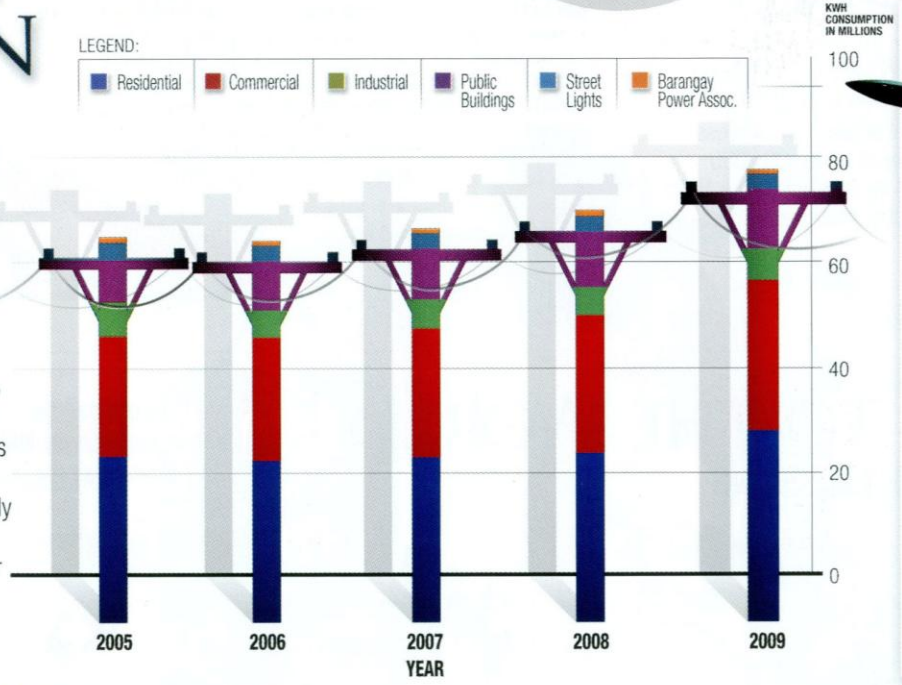
108 kt CO_2-eq
(52% of Gross Emissions)

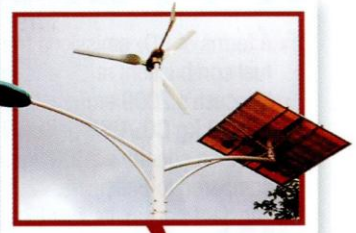
Electricity Consumption

ON A PER capita basis, Puerto Princesa's electricity use in 2009 is less than the latest national average (**383 kWh/capita** vs. **586 kWh/capita**).

This figure, however, is rapidly increasing – from 3% in 2007 to 5% and 9% in 2008 and 2009 respectively – presumably due to the increase in electric consumers (approximately 6% per annum since 2005). On the other hand, the breakdown by sector remained relatively constant through the years, with the residential sector (43%) being the largest, followed by commercial sector (33%).

Sources: WB, 2007; PALECO, 2010





THE City currently has twenty-six (26) Hybrid Solar & Wind Lamp Posts in Sabang, on the way to the Underground River.

Emission Factors

FUEL TYPE	tonnes CO_2/TJ
Coal	96.1
Fuel Oil (Bunker)	77.4
Diesel	74.1
Natural Gas	56.1
Geothermal	0.0
Hyrdropower	0.0
Solar	0.0
Wind	0.0

Source: IPCC, 2006

POINT FOR IMPROVEMENT!

Energy Sources

ALTHOUGH consumption is low, Puerto Princesa's emissions per kWh is relatively high at **0.86 kg CO_2/kWh** – almost 90% higher than national average of **0.46 kg CO_2/kWh** and 70% higher than world average of **0.50 kg CO_2/kWh**.*

REASON FOR DIFFERENCE
Grid composition

Puerto Princesa's grid is composed only of **diesel** and **bunker** fuels (responsible for 31% and 69% of emissions respectively), while the rest of the country has renewable components such as geothermal, hydropower, and wind.

** CO_2 emissions from electricity generation divided by gross kWh.*
Source: IEA, 2010

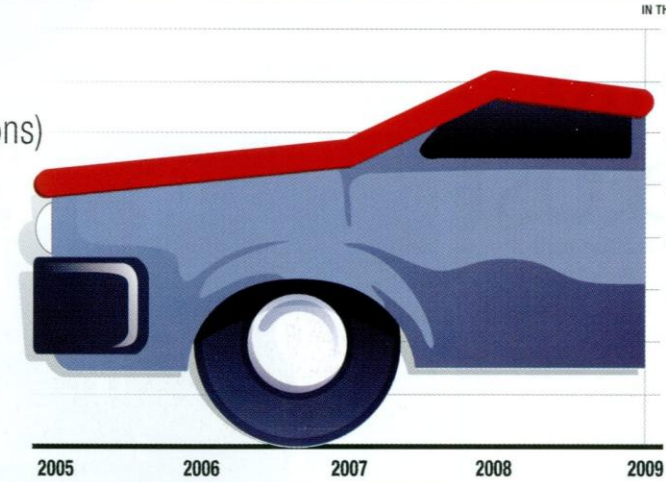
Transmission and Distribution

TRANSMISSION & distribution losses are also high – amounting to **31%*** in 2009 – much more than national average of **12%-13%****.

** Difference between gross kWh and net kWh.*
*** Based on 2000-2007 data.*
Sources: Power Plants, 2009; PALECO, 2009; WB, 2011

ROAD TRANSPORTATION 61 kt CO_2-eq (30% of Gross Emissions)

NOTE: More than half (34 kt CO_2-eq or 56%) of road transportation emissions are estimated from diesel supplied to retail stations. Based on a survey conducted, of the 34 kt CO_2-eq diesel generated emissions, generators account for about 30% (or 10 kt) while ships account for 10% (or 4 kt). But since these do not constitute official data, they could not be used.



Annual Vehicle Registrations

REGISTRATIONS in the province have also been increasing over the years, at an average rate of **8%** since 2005 peaking at 23% in 2008!

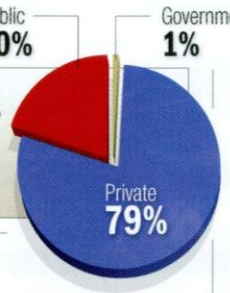
Source: LTO-PPC, 2010

CONSIDER THIS!

Number of Vehicles

Vehicles registered in 2009 number **21,421**.

Source: LTO-PPC, 2010



Persons Per Vehicle

AN AVERAGE of **11 persons** share 1 vehicle in Puerto Princesa – unlike the rest of the country which squeezes in about 4 more persons for every vehicle.

	PPC	Phil
Total Vehicles	11 pax	15 pax
Private	9 pax	18 pax
Public	34 pax	99 pax

Source: LTO-Main, 2010; LTO-PPC, 2010

Did you know?

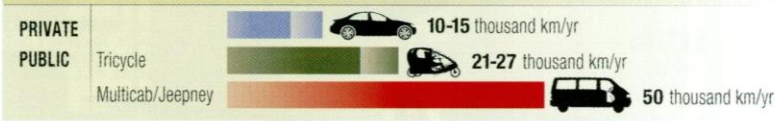
A round-trip flight from Puerto Princesa to Manila results in 15 tonnes CO_2-eq or 0.08 tonnes/passenger – 5% of yearly emissions per capita national average!

** Unfortunately, due to their cross-boundary nature, assignment of responsibilities for aviation emissions is being debated. For this report, similar to what was done in the national inventory, only fuel loaded into aircrafts while in the City was considered.*
Sources: EOSAN, 2010; Airbus S.A.S., 2011; Cuadra, 2010

ESTIMATES

Kilometers Traveled per Year

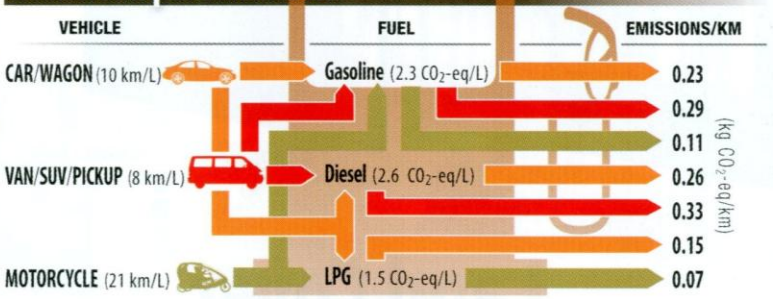
ALTHOUGH public vehicles comprise only about 20% of total vehicles registered in the City, they cover an estimated 2-5 times more distance than private vehicles.



Sources: Magay, 2010; various interviews

RULE OF THUMB

Emissions per Kilometer



Sources: US EPA, 2010; US DOT, 2010

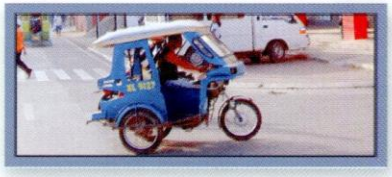
BEST PRACTICES!

50/50 Traffic Scheme

Banned tricycles from the road 3 days each week:
- Traffic improved by at least 14%.
- Emissions were reduced by at least 20%.

With less tricycles competing for passengers:
- Driver income increased by 50%!

Source: PPC CPDC, 2011

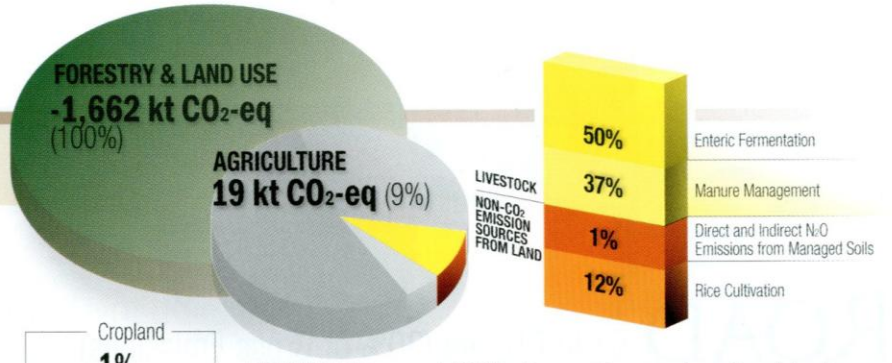


TRIKE Fund

- Financed direct injection and conversion of tricycle engines to LPG and 4-stroke.
- Provided alternative livelihoods.
- From USD150-thousand in 2006, starting fund has grown to Php12-million!
- 2,600 beneficiaries; 96% repayment rate.
- Established with the help of the Asian Development Bank (ADB).

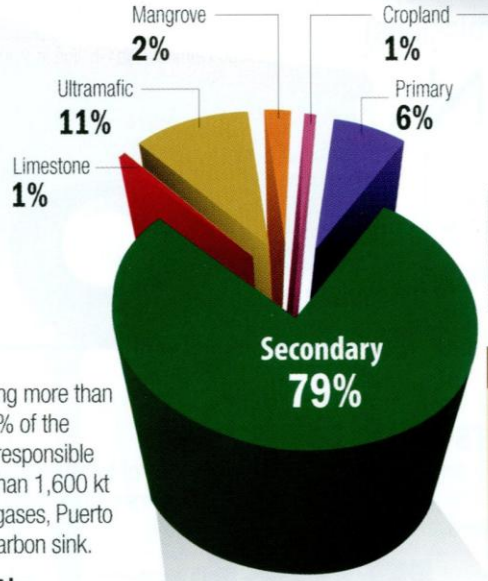
Source: Bustamante, 2010

AGRICULTURE, FORESTRY & LAND USE



FORESTRY & LAND USE

-1,662 kt CO_2-eq
(100% of Removals)



NINETY-NINE percent (99%) of removals come from forest lands, particularly secondary forests (79% of total), which not only comprise most of the forests but also has a larger sequestration rate (because they tend to grow at a faster rate).

CROPLANDS also contribute to the sequestration, but only a minimal amount (1%) since their numbers are a sum of: (a) their total removals from biomass growth and area increase as well as, (b) emissions from trees harvested for lumber (as in the case of coconut and mahogany for Puerto Princesa).

Did you know?

COMMERCIAL logging and mining are banned in Puerto Princesa.

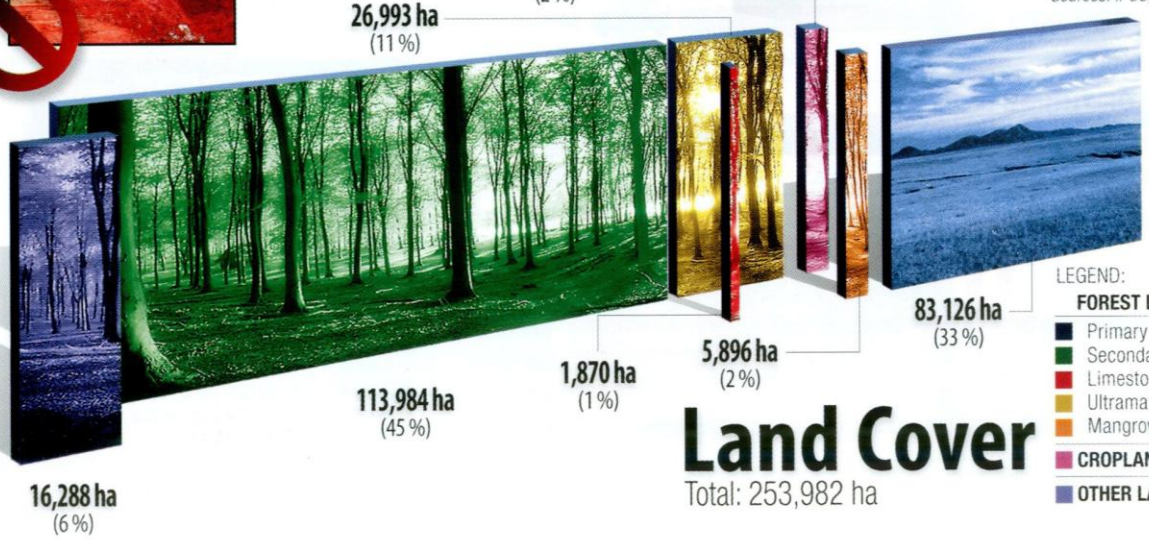
WITH a forest cover totalling more than **165,031 hectares** (65% of the City's land area) that is responsible for sequestering more than 1,600 kt CO_2-eq of greenhouse gases, Puerto Princesa is deemed a carbon sink.

RULE OF THUMB

Annual Removals/Emissions

	Removals		Emissions	
	t C/ha	t CO_2/ha	t C/ha	t CO_2/ha
Forest Land				
Secondary	3	11	Depends on actual amount removed	
Non-Secondary	2	7		
Cropland	**2-6**	**7-22**	**9**	**33**

** Location: Asia–Developing Country; Mean Annual Temp: 28°C; Climate Regime: Tropical Dry Climate. To convert carbon (C) to carbon dioxide (CO_2), multiply by 44/12 (ratio of the molecular weight of carbon dioxide to carbon).*
Sources: IPCC, 2006; Lasco & Pulhin, 1998 as cited in MO,1999.



Land Cover

Total: 253,982 ha

LEGEND:
FOREST LAND
- Primary
- Secondary
- Limestone
- Ultramafic
- Mangrove

CROPLAND

OTHER LAND

SOMETHING TO THINK ABOUT:

Each hectare of forest stores an estimated 145 tonnes of carbon* (equivalent to 532 tonnes of CO_2-eq)

THIS means that, if for some reason, Puerto Princesa's current forest cover is lost, almost **90 thousand kt CO_2-eq** will be released into the atmosphere – equivalent to more than 400 years of emissions by the City (at current rate of 206 kt CO_2-eq/year), not to mention loss of potential sequestration of -1,645 kt CO_2-eq/year.

** Carbon stock figures for South/Southeast Asia Source: FAO, 2010*

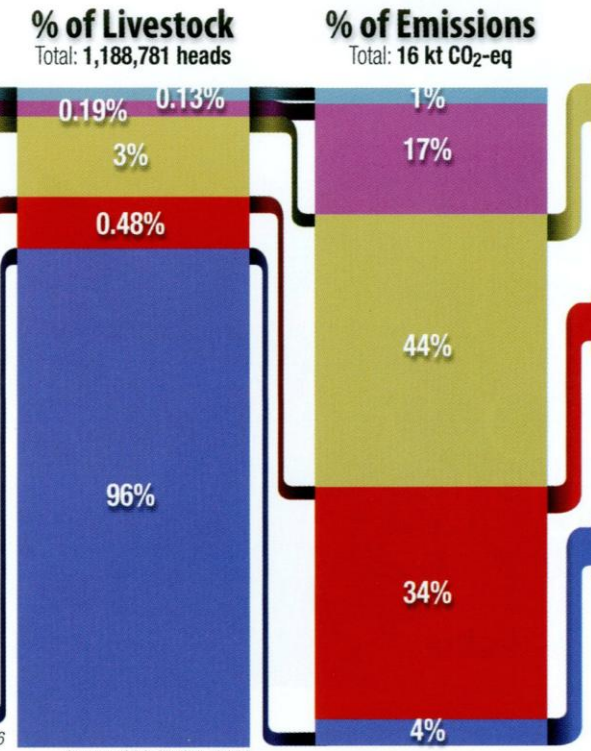
LIVESTOCK

16 kt CO_2-eq (8% of Gross Emissions)

ANIMAL	Annual Methane Emissions kg CH_4 per head: Farts & Burps	Manure
GOAT	5	0.22
CARABAO	55	3
SWINE	1.5	7
CATTLE	44	2
CHICKEN	-	0.02

Location: Asia – Developing Country; Mean Annual Temp: 28°C; Manure Management System: Pasture/ Range/ Paddock

Source: IPCC, 2006



Source: PPC City Vet, 2010

Swine contribute almost half of the emissions from livestock (44%) due to their relatively large population (40 thousand heads).

Cattle are the next largest emitters (34%) – due more to the large emission factor of their farts and burps than their population.

Despite numbering more than 1 million, **chickens** do not contribute much to emissions due to small and non-existent emission factors.

BEST PRACTICES!

- Every last Saturday of June, Puerto Princesa celebrates "Pista y ang Cagueban" or "Feast of the Forest" where the citizens join in reforestation efforts. More than 2 million trees or 296 hectares have been planted since the start of the program.

- Every Valentine's Day, the City celebrates "Love Affair with Nature", where the Mayor weds hundreds of couples at the same time with only one condition: that they plant a mangrove tree. Seventy-five (75) hectares of coastal areas have been planted with mangrove trees since 2005.

Source: PPC City ENRO, 2010

RICE CULTIVATION

2 kt CO_2-eq (1% of Gross Emissions)

Emissions per Hectare

CLASSIFICATION	kg CO_2-eq/ha
Irrigated	1,130
Rainfed	67
Upland*	0

** Fields are never flooded for a significant period of time*

Sources: IPCC, 2006; GEF & UNDP, 1999; PPC City Agri, 2010

WASTE

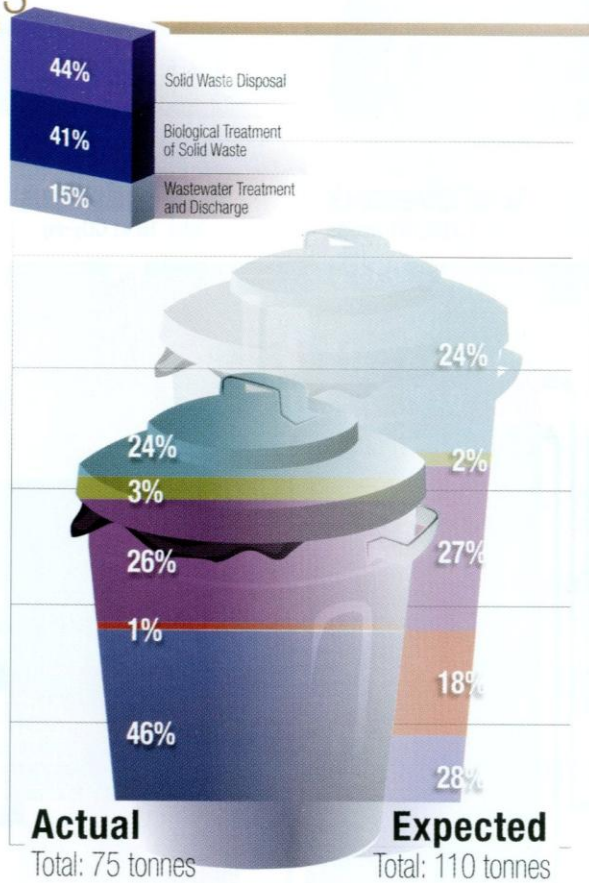
SOLID WASTE

8 kt CO_2-eq
(4% of Gross Emissions)

Daily Generated Waste

AMOUNT of waste per capita is much less than national average (**0.33 kg/capita** vs. **0.5 kg/capita**), most likely because of waste segregation at source, causing the amount of collected waste to drop considerably, and possibly because of a generally simpler lifestyle.

Source: PPC SWMO, 2010



WASTEWATER

2 kt CO_2-eq (1% of Gross Emissions)

Each person contributes approximately 7 kg CO_2-eq from his/her waste each year.

Source: IPCC, 2006

Emissions per Tonne

	tonnes of waste/day	tonne CO_2-eq/ tonne of waste
Agricultural Waste	18	0.40
Market / Slaughter Waste	2.5	0.18
Food Waste	19	0.18
Recyclables	1	0
Residual	34	0.35

**Assumptions: Agricultural, Market and Food Wastes composted; Residual Waste deposited in Sanitary Landfill*
Sources: PPC SWMO, 2010; IPCC, 2006

Did you know?

THE City's sanitary landfill is the first one in the Philippines. Funded by ADB & DILG, it was built even before the Solid Waste Management Act became a law.

BEST PRACTICES!

- A Hall of Fame Awardee for the "Cleanest and Greenest City," Puerto Princesa has been practicing waste segregation at source.

- Fifty-nine (59) out of its 66 barangays have a Materials Recovery Facility that takes care of recycling activities as well as composting of organic waste.

- Puerto Princesa is only one out of a few cities in the Philippines with its own sanitary landfill.

Source: PPC SWMO, 2010

A CARBON-NEUTRAL CITY

Puerto Princesa envisions a city where man and nature co-exist in balance and harmony.

AS THE Inventory has established, Puerto Princesa City is not only carbon-neutral but, in fact, significantly carbon-negative. Despite this and consistent with its avowed commitment, the City does not wish to rest on its laurels.

Already, opportunities for improvement exist, specifically in terms of cleaner sources of energy and a more efficient transmission and distribution system. The increasing number of vehicles, now registering a higher per capita average than the rest of the country, is also another area of concern. The forests – the main reason for the City's carbon-neutrality – must be continuously protected against possible socio-economic impacts.

Long term, growth is inevitable. People will always aspire and strive hard to improve their standard of living, more often than not influenced by and patterning after the capitalist/consumerist culture of the West. And because the City will have to find ways to satisfy the needs and aspirations of its citizens, the environmental impacts of production and consumption systems will have to be minimized while consumer behavior is shifted to more sustainable patterns.

Puerto Princesa, like many other cities, must meet this challenge: ensuring development is achieved in a sustainable manner – not at the expense of the environment, the less privileged and future generations.

"IF YOU CAN'T MEASURE IT, YOU CAN'T MANAGE IT."
– Peter Drucker, Management Guru

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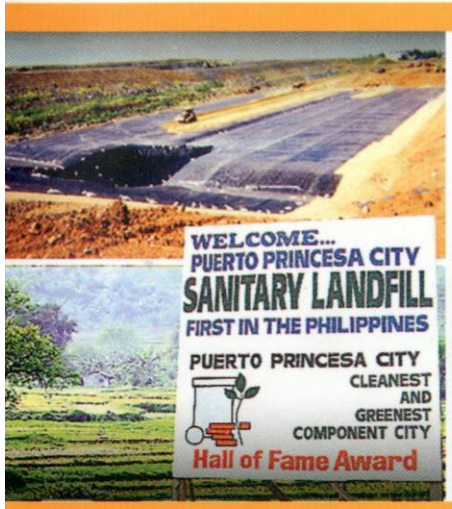



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