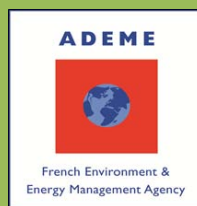




Action towards Resource-efficient and Low Carbon Cities in Asia

Experiences and Highlights



Asian Institute of Technology

February 2013

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PUBLISHED BY

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Pathumthani 12120
Thailand

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Website: <http://lcc.ait.asia>

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TEXT AND LAYOUT: Pravakar Pradhan and Pujan Shrestha

PHOTOS: Contributed by partner cities and AIT

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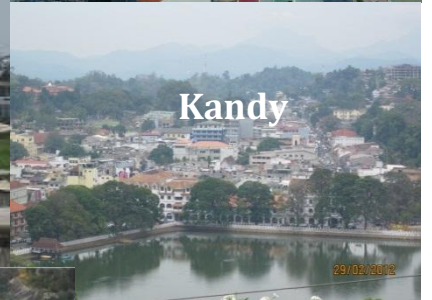
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Contents

FOREWORD	i
SUMMARY	ii
THE 'ACTION TOWARDS RESOURCE-EFFICIENT AND LOW CARBON CITIES IN ASIA' INITIATIVE	1
PARTNER INSTITUTIONS	2
LEAD INSTITUTE	2
PARTICIPATING CITIES	3
CHAU DOC, VIETNAM	4
CHIANG MAI, THAILAND	6
DA NANG, VIETNAM	8
HUE, VIETNAM	10
KANDY, SRI LANKA	12
KURUNEGALA, SRI LANKA	14
LUANG PRABANG, LAO PDR	16
MATALE, SRI LANKA	18
NONTABURI, THAILAND	20
RAYONG, THAILAND	22
OPINION OF BENEFICIARIES	24
COMMUNICATION AND DISSEMINATION PRODUCTS	26
EVENTS AND ACTIVITIES	27
MEDIA COVERAGE & RELATED PROJECTS	30
LESSONS LEARNED AND WAY FORWARD	33
PROJECT OUTPUTS AND PRESENTATIONS	35
PEOPLE	37



Foreword

Expanding population and economic growth contribute to increasing demand for energy in the cities of developing Asia. Increased fossil fuel energy consumption has resulted in higher concentration of greenhouse gases (GHG) in the atmosphere, which leads to global warming, and thus to climate change. Cities are, therefore, at the forefront of action plans for mitigating GHG emissions and addressing the impacts of climate change. Small and medium (growing) cities in Asia face challenges of inadequate (human resource) capacity to address climate change, lack of knowledge of the emissions inventory, and specific activities that they could carry out to mitigate GHG emissions and adapt to changing climate.

To address the above issues, the French Environment and Energy Management Agency (ADEME) supported a regional programme entitled “Action towards Resource-efficient and Low Carbon Cities in Asia”. The programme involved building capacity of the city authorities and local partner institutions on issues related to climate change, estimating greenhouse gas emissions, developing city level climate and energy plans, and carrying out pilot activities to mitigate GHG emissions or undertake adaptive measures. The programme, carried out during 2010 - 2013, was coordinated by the Asian Institute of Technology (AIT) and involved ten small and medium cities from four Asian countries: Lao PDR, Sri Lanka, Thailand and Vietnam. Five local organizations (educational institutions, private sector and non-governmental organizations) and AIT assisted the city authorities in conducting these activities. The programme activities were carried out at AIT and in the participating cities through workshops, emission inventory of various activities, research, pilot initiatives and visits.

This booklet summarises the activities carried out, and presents the impressions and views of the major stakeholders – the city authorities and beneficiaries. We trust that the details presented here would be useful to those interested in mitigating GHG emissions and adapting to climate change at the city level.

We are grateful to the French Environment and Energy Management Agency (ADEME) and the SDCC/AIT-France Network for providing technical and financial assistance to implement the project. We are also thankful to Dr. Brahmanand Mohanty for his continuous guidance and support during this implementation period.

S. Kumar, K. Kusakabe, C. Marpaung, LAS R. Perera, P. A. Salam, C. Visvanathan
Principal Investigators, *Action towards Resource- efficient and Low Carbon Cities in Asia*

February 2013

Summary

With support from the French Environment and Energy Management Agency (ADEME) and SDCC/AIT- France Network, the Asian Institute of Technology (AIT) initiated “*Action towards Resource-efficient and Low Carbon Cities in Asia*” to promote low carbon society through improved resource efficiency and environmental sustainability in ten small and medium cities in Asia (Lao PDR, Sri Lanka, Thailand and Vietnam). The project aimed to strengthen capacity of city authorities, local institutions and other stakeholders of the cities in climate change mitigation and adaptation initiatives.

The activities carried out in the project included training on Bilan Carbone© analysis and ‘Territorial Climate and Energy Plan’ approach, assessing greenhouse gas emissions at the city level, developing climate and energy plan, initiating pilot projects on mitigation and adaptation involving local stakeholders, and sharing experiences among participating cities. The major outcomes of these activities are discussed in this document. The project made an important contribution in sensitizing urban authorities (mayors, councilors, etc.) on the impacts of climate change, and on the need to take action at policy and implementation level for both mitigation and adaptation, following the principle of ‘think globally and act locally’.

The innovativeness of this project was manifold: sensitization of senior city officials about climate change issues, involvement of different stakeholders, and development of preliminary city energy and climate plans. For example, the authorities of Chau Doc, Da Nang and Hue in Vietnam, and Kandy and Kurunegala in Sri Lanka have developed ‘city level climate and energy plan’ based on the guideline of national plan for mitigation and adaptation to climate change, thereby linking the “bottom up” and “top down” approaches for the implementation of plans and actions. The participating cities created awareness among various stakeholders on climate change mitigation and adaptation issues to encourage the adoption of environmentally friendly practices. Three cities (Luang Prabang, Kandy, and Matale) initiated pilot activities on waste management practices at the community level. Four other cities (Chau Doc, Hue, Nonthaburi, and Rayong) undertook pilot energy conservation projects. Da Nang conducted GHG reduction activities at school level and Kurunegala constructed a green path around the lake.

The project faced several challenges during the execution of above activities such as capacity of city personnel, availability of data for GHG emissions analysis, level of awareness of the general public, etc. In spite of these constraints, the project has paved a way towards more low carbon related initiatives by the city authorities based on the success of their initial efforts.

The 'Action towards Resource-efficient and Low Carbon Cities in Asia' Initiative

With more than two-fifth of the world's population, Asia now has the largest number of urban dwellers. The role of cities as engine of economic growth has been increasingly important as the region urbanizes. However, as units of production and consumption, cities do not only consume natural resources, but also degrade the environment through generation of waste and pollution of land, water and air. Cities account for more than 71% of global greenhouse gas (GHG) emissions and their share is expected to rise to 76% by 2030.

As engines of economic growth and as centers of innovation, cities can adopt clean energy systems, promote sustainable transportation and waste management. Targeting cities as the first line of action would help countries simultaneously address resource conservation and progress towards low carbon societies.

The Asian Institute of Technology (AIT) with support from the French Environment and Energy Management Agency (ADEME) carried out the "Action towards Resource-efficient and Low Carbon Cities in Asia" project with the objective to assist a number of small and medium cities of Asia in their efforts towards improving resource efficiency and environmental sustainability.

The Project in a Nutshell

Objectives

- To assist small and medium cities of Asia in their efforts towards low carbon society through improved resource efficiency and environmental sustainability.
- To strengthen capacity of city authorities and other stakeholders in climate change mitigation and adaptation.

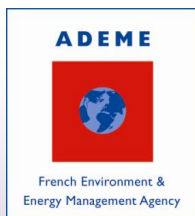
Implemented Activities

- Trained partner city authorities and relevant stakeholders on using Bilan Carbone® tool, its applicability and analysis.
- Assisted partner cities to develop their Territorial Climate and Energy Plan (TCEP) for mitigation and adaptation to climate change at the city level.
- Assisted cities to identify strategic areas for greenhouse gas (GHG) mitigation and support them to conduct pilot activities.
- Disseminated information among a wide spectrum of stakeholders.

Project Outputs

- Personnel of municipalities and local institutions with enhanced knowledge to deal with climate change issues.
- GHG emissions of the cities participating in the project.
- TCEP for climate change mitigation and adaptation at the city level.
- Pilot activities in the cities for GHG emissions mitigation and climate change adaptation.

Partner Institutions



The French Environment and Energy Management Agency (ADEME) (www2.ademe.fr) is a public agency under the joint authority of the Ministry of Ecology, Sustainable Development and Energy, and the Ministry for Higher Education and Research. The agency is active in the implementation of public policy in the areas of the environment, energy and sustainable development. ADEME provides expertise and advisory services to businesses, local authorities and communities, government bodies and the public at large, to enable them to establish and consolidate their environmental action. As part of this work the agency helps finance projects, from research to implementation, in the areas of waste management, soil conservation, energy efficiency and renewable energy, air quality and noise abatement.



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The regional program "SDCC/AIT - France Network" (www.sdcc.ait.asia) is co-funded and implemented as a partnership between AIT and French Ministry of Foreign Affairs. This network aims to strengthen common research strategy of AIT and France toward SDCC – Sustainable Development in the context of Climate Change. Established by an agreement between AIT and the French Ministry of Foreign and European Affairs (MAEE), through the Regional Office for Cooperation of the Embassy of France in Thailand, the program consists of joint research projects for scientific development in the ASEAN region. By financing mobility and networking, the program aims to promote and support scientific and technological cooperation between French research institutions and universities, AIT, and other research institutions and universities based in Asia, also involving the public, non-governmental and private sectors.

Lead Institute



AIT
Asian Institute of Technology

AIT (www.ait.ac.th) has been serving as a regional hub for higher education and research in natural sciences, engineering & technology, management and societal development for over five decades. Low carbon issues and its promotion (technology and policy) is an important focus area of training and research at AIT.

Under the institute's major research focus, a centre of excellence 'Sustainable Development in the context of Climate Change (SDCC)' has been formed. One of its thematic focuses is 'Lower Carbon and Sustainable Production and Consumption Technologies and Management' which offers expertise, capacity building and research in the areas of low carbon technologies and initiatives.

Participating Cities

- Chau Doc, Vietnam
- Chiang Mai, Thailand
- Da Nang, Vietnam
- Hue, Vietnam
- Kandy, Sri Lanka
- Kurunegala, Sri Lanka
- Luang Prabang, Lao PDR
- Matale, Sri Lanka
- Nonthaburi, Thailand
- Rayong, Thailand





1. Chau Doc, Vietnam

Chau Doc is the second largest town in An Giang Province which was classified as the third-level city in 2007. The total area of Chau Doc town is 10,464 km², divided into 4 wards and 3 communes. Chau Doc town is the tourist center of An Giang Province. It is near the Mekong delta with interesting natural landscapes, historical and cultural

Message from Mr. Mai Ming Hung, Vice President of Chau Doc People's Committee

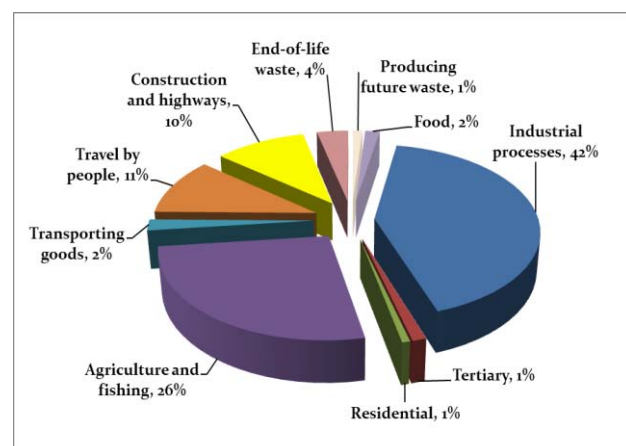
"The project titled 'Action towards Resource-efficient and Low Carbon Cities in Asia' helped Chau Doc's officers to be aware of climate change and the method to calculate carbon emissions. The pilot activity involving raising awareness about energy efficiency and 'one obliged, five reduced' training activities in agriculture cultivation, was demonstrated so well that we could replicate these models in order to adapt to climate change and mitigate carbon emissions. In future, Chau Doc will continue to update carbon emission database and further climate change mitigation and adaptation programs based on the implementation of its Territorial Climate and Energy Plan (TCEP). It was a good opportunity for Chau Doc to take part in the project to fight against climate change."



Greenhouse gas (GHG) Inventory of Chau Doc

The Bilan Carbone® analysis for estimating GHG emission by **territorial activities** of Chau Doc Town in the year 2010 led to the following results:

- ✚ Total GHG emissions: 143,160 tCe (524,920 tCO₂e)
- ✚ Average emissions per capita: 1.2 tCe (4.4 tCO₂e)
- ✚ 78% of the GHG emissions contributed by three major sectors:
 - ❖ Industrial processes: 60,270 tCe (220,990 tCO₂e)
 - ❖ Agriculture and fishing: 37,880 tCe (138,890 tCO₂e)
 - ❖ Travel by people: 15,440 tCe (56,610 tCO₂e)



Pilot activity in Chau Doc

A survey of energy consumption in Chau Doc showed that the various stakeholders (farmers, households, technical staff in factories and government officers) have fairly low awareness on the cause and effects of climate change. Therefore, Chau Doc Town initiated a pilot activity to increase households' awareness and knowledge on energy saving, to apply energy saving solutions at local authority office and to assist farmers in cultivating rice with reduced carbon emissions. These activities also aimed to lay foundation for the implementation of solutions recommended in the Territorial Climate and Energy Plan (TCEP) of the city.

Awareness campaigns and training programmes in Chau Doc



Outputs

- ✚ Developed and distributed communication materials on reducing energy use in households.
- ✚ Replaced incandescent lights by fluorescent lamps with reflectors in residential houses and office buildings.
- ✚ Planned to introduce green industrial zones and policies for efficient energy consumption.
- ✚ Farmers not only saved materials and money by using less fertilizer but also reduced carbon emissions, (i.e. reduction of 435 tCe/year).

2. Chiang Mai, Thailand

Chiang Mai is the second largest city in Thailand. Located 700 km north of Bangkok, it covers an area of 40,216 km². The city is on the Ping River, a major tributary of the Chao Phraya River. It is also a well-known historical city with rich cultural heritage and environmental amenities. In recent years, Chiang Mai's economy has grown largely driven

Message from Mrs. Rongrong Duriyapunt, Chief of Air Quality and Noise Management, Chiang Mai Municipality

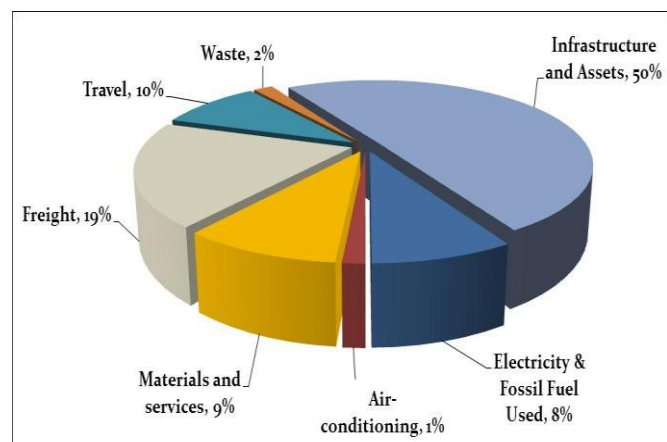
"Thanks to Chiang Mai municipality's participation in the 'Action towards Resource-efficient and Low Carbon Cities in Asia' project with the Asian Institute of Technology, we have gained more experience and ability to self-assess the carbon footprint of our assets and facilities. We also have been able to disseminate this knowledge to other organizations. Further, the results of this project have been used for creating public energy saving awareness. We have launched many energy efficiency activities, such as instruction to turn off light in lunchtime in offices, vehicles fossil fuel management and solid waste segregation. All these activities have helped us to save our CO₂ emissions."



Greenhouse gas (GHG) Inventory of Chiang Mai

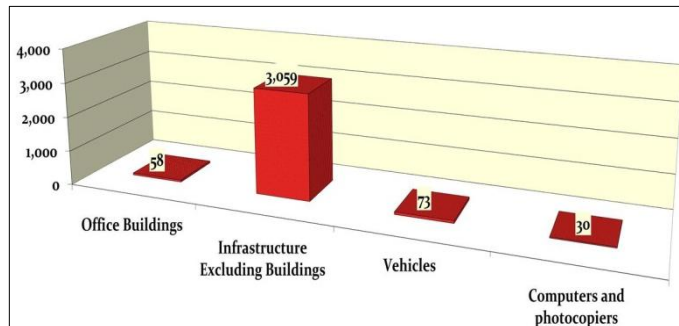
The Bilan Carbone® analysis for estimating GHG emission by **assets and services** of Chiang Mai municipality in the year 2011 led to the following results:

- ✚ Total GHG emissions: 6,400 tCe (23,480 tCO₂e)
- ✚ Average emissions per employee: 3tCe (4.4 tCO₂e)
- ✚ 79% of the GHG emissions contributed by three major sectors:
 - ❖ Infrastructure & Assets: 3,220 tCe (11,800 tCO₂e)
 - ❖ Freight (internal goods transport): 1,240 tCe (4,560 tCO₂e)
 - ❖ Travel (staff and visitors): 610 tCe (2,240 tCO₂e)

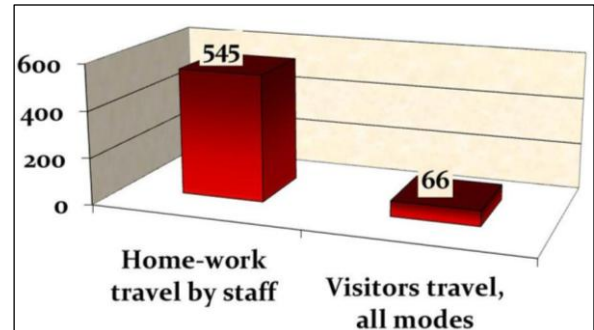


Options to reduce Greenhouse Gas (GHG) emission

- Infrastructure and Assets: Long term use of infrastructure and assets such as office buildings, roads, vehicles, computer, machine, etc. can reduce GHG emissions.



Emission linked with Infrastructure and assets (tCe)



Emission linked with travel (tCe)

- Freight (Internal goods transport): Municipality provides services, such as waste collection and disposal, infrastructure construction and maintenance (e.g. road construction, electricity maintenance), etc. The emissions due to travel for these activities can be reduced by using clean vehicles (operated by CNG, LPG or NGV).
- Travel: Use of public bus or non-motorized transport (NMT) by staff and visitors can reduce up to 10% (61 tCe) GHG emissions per year.

Products and services provided by Chiang Mai municipality to reduce GHG emissions



3. Da Nang, Vietnam

Located on the central coast of Vietnam and encompassing an area of 1,256 km², Da Nang is the largest city in central Vietnam and one of the country's most important ports, surrounded by mountains on one side and the East Sea on the other. Da Nang is a political,

Message from Mr. Nguyen Dieu, Director of Da Nang Department of Natural Resources and Environment

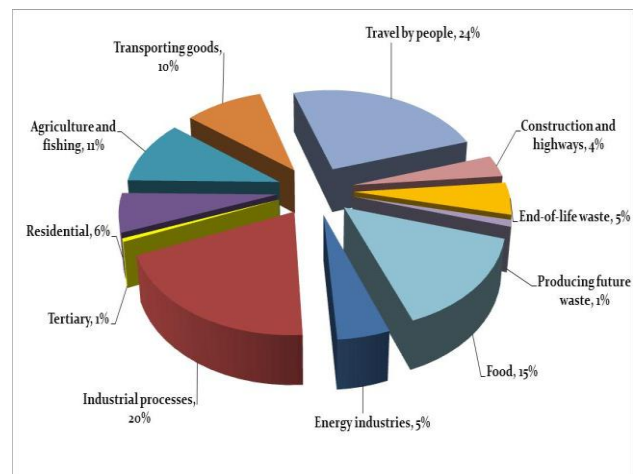
"Climate change is one of the biggest global challenges which will have serious impact on living beings and on the environment. Viet Nam is one of the five countries of the world that are heavily affected by climate change and sea level rise. Since Da Nang is a coastal city, it can be directly affected by the impacts of climate change. Rising temperature and increased sea level rise will cause flooding thereby affecting agriculture, industry and the livelihood. Da Nang is no exception to these impacts of climate change."



Greenhouse gas (GHG) Inventory of Da Nang City

The Bilan Carbone® analysis for estimating GHG emission by **territorial activities** of Da Nang in the year 2010 led to the following results:

- ✚ Total GHG emissions: 2,012,390 tCe (7,378,760tCO₂e)
- ✚ Average emissions per capita: 2.2 tCe (8 tCO₂e)
- ✚ 79% of the GHG emissions contributed by three major sectors:
 - ❖ Travel by people: 491,852 tCe (1,803,457 tCO₂e)
 - ❖ Industrial Process: 393,124 tCe (1,441,455 tCO₂e)
 - ❖ Food Production: 296,301 tCe (1,086,437 tCO₂e)



Pilot activity in Da Nang

In 2008, Da Nang city People's Committee issued Decision No. 41/2008/QĐ-UBND promulgating the Plan "Developing Da Nang - Environmental city". It also approved the project "Research to integrate environmental education into the national education system". The Department of Natural Resources and Environment, and the Department of Education and Training worked to develop criteria for green school, including the criteria for efficient use of energy, saving resources, recycling, reusing waste, etc. Therefore, the pilot activity "Reducing carbon emissions and efficient use of resources in schools in Da Nang city, Vietnam" was chosen which was appropriate and responsive to the need and the general direction of Da Nang city, as well as to the general goal of the project as a basis for replication in the future.

The pilot activity aimed to reduce GHG emission through efficient use of resources, energy saving, climate-friendly and environmental protection initiatives at Quang Trung's Primary School.

Awareness programmes, training and GHG reduction activities at the Quang Trung Primary School, Da Nang



Outputs

- ✚ Positive changes observed in pupils' perceptions and habits towards low carbon initiatives.
- ✚ Strengthened capacity of school teachers in climate change mitigation and adaptation issues.
- ✚ Integrated climate change, energy and resources efficiency subjects in environmental education activities.
- ✚ Established 'Environmental Protection Board' to provide environmental education at the school as well as to execute environmental friendly activities, such as waste management, tree plantation, energy saving measures, solar energy use for hot water, etc.
- ✚ Calculated GHG emissions by the school activities in the year 2010 and prioritized the GHG mitigation options to achieve the mitigation target set by the school.

4. Hue, Vietnam

Hue is the capital city of Thua Thien Hue province. The city covers an area of 70.99 km² and is located in central Vietnam on the banks of the Perfume River, 700 km south of Hanoi. Hue is best known for its historical monuments, greeneries and sites of outstanding natural beauty. The city has twice received UNESCO accreditation, once when its royal citadel complex was recognized as a world cultural heritage site in 1993,

Message from Mr. Phan Trong Vinh, Chairperson of Hue People's Committee

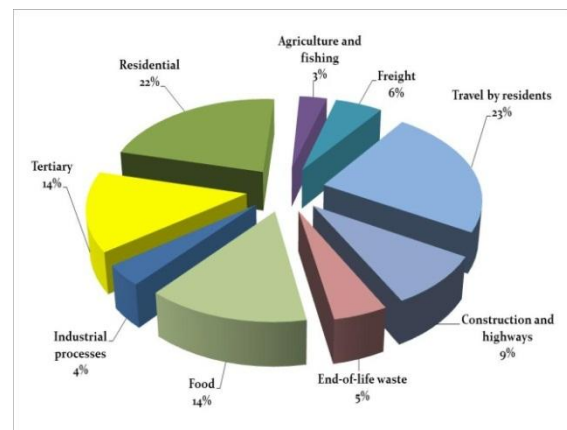
"Hue is the capital city of Thua Thien Hue province, one of the most vulnerable provinces to climate change in Vietnam. Therefore, our mission to energy efficiency coupled with an increase of the city's capacity to deal with climate change mitigation and adaptation is one of our priorities in Hue city. With this in mind, I do hope all economic players, various local institutions, city administrative departments and Hue City's residents will make a strong and collective commitment for the implementation of the project 'Action towards Resource-efficient and Low Carbon Cities in Asia'. The very success of this project will definitely improve the capacity of Hue city in climate change mitigation and adaptation, whilst contributing to create and promote an environmentally friendly image of the city."



Greenhouse gas (GHG) Inventory of Hue

The Bilan Carbone® analysis for estimating GHG emission by **territorial activities** of Hue city in the year 2011 led to the following results:

- ✚ Total GHG emissions: 283,728 tCe
(1,040,336 tCO₂e)
- ✚ Average emissions per capita: 0.8 tCe
(3 tCO₂e)
- ✚ 59% of the GHG emissions contributed by three major sectors:
 - ❖ Travel by residents: 66,685 tCe
(244,512 tCO₂e)
 - ❖ Residential: 62,480 tCe (229,093 tCO₂e)
 - ❖ Tertiary sector: 40,371 tCe (148,027 tCO₂e)



Pilot activities in Hue

- ✚ The Recycling and Cycling Festival attracted more than 500 young people to join GHG mitigation activities which included cycling tours around the city, competition on recycling initiatives, awareness raising campaigns, etc.
- ✚ Energy Saving Day was held in Huong So and Huong Vinh wards. In this multi-activity event, 300 incandescent light bulbs were replaced by compact fluorescent lamps.
- ✚ Handbooks and posters providing simple guidelines on how to use electricity and municipal water efficiently were designed and delivered to 70 administrative units of Hue authority, and 80 faculties and departments of Hue University.

Activities conducted during Recycling and Cycling Festival and Energy Saving Day in Hue



Outputs

- ✚ Initiated awareness activities related to climate change mitigation and adaptation in Hue.
- ✚ Strengthened capacity of city authorities and Hue University staff related to climate change through Bilan Carbone training, organized by Hue People's committee.
- ✚ Developed awareness materials (handbook and posters) accompanied by an official mandate of the City Mayor asking relevant units to disseminate and implement such guidelines produced.
- ✚ Expected reduction of approximately 19 tCe per year due to use of efficient compact fluorescent lamps.

5. Kandy, Sri Lanka

Kandy is located at the center of Sri Lanka and is recognized as the island nation's cultural capital. Kandy has an area of 25.4 km² and is 116 km north-east of Colombo. Kandy is surrounded by many mountains and bounded by River Mahaweli along the entire western, northern and eastern sections. The city is also on the UNESCO World Heritage List. Kandy is a major centre of administration and commerce for the region and

Message from Mr. Mahindra Ratwatte, Mayor

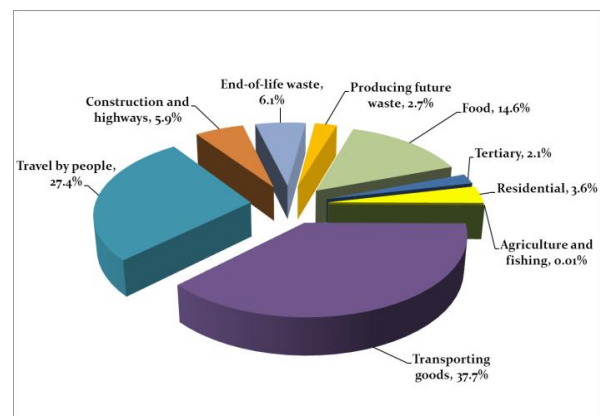
"Kandy is much vulnerable to climate change and air pollution as it is surrounded by many mountains. With the participation in this project we were able to estimate our own carbon footprint and carbon emissions of various other activities in Kandy. The knowledge and experience gained through this project is of immense help to my city for its future activities in making the city a more comfortable and safer place to live. Today, I am happy to state that already a number of initiatives to lower our carbon footprint are in progress and the results and responses so far from both my fellow citizens and the visitors to the city are very much encouraging. Finally, while congratulating our team for the success of this project, I would like to take this opportunity to express my municipality's warmest gratitude to ADEME and AIT for inviting us to participate in this project."



Greenhouse gas (GHG) Inventory of Kandy

The Bilan Carbone® analysis for estimating GHG emission by **territorial activities** of Kandy Municipal Council 2011 led to the following results:

- ✚ Total GHG emissions: 2,334,680 tCe (1,227,140 tCO₂e)
- ✚ Average emissions per capita: 3tCe (10 tCO₂e)
- ✚ 80% of the GHG emissions contributed by three major sectors:
 - ❖ Transporting goods: 126,270 tCe (462,990 tCO₂e)
 - ❖ Travel by people: 91,610 tCe (335,903 tCO₂e)
 - ❖ Food Production: 48,980 tCe (179,593 tCO₂e)



Pilot activities in Kandy

The Bilan Carbone analysis revealed that solid waste collection and disposal practices at the Kandy Municipal Council (KMC) contribute to over 30% of its carbon footprint. Therefore, the solid waste management at KMC was considered as one of the most critical areas that needed attention of the authorities. To address this, KMC initiated a pilot program at its Katugastota zonal area to explore possible ways of reducing the amount of solid waste collection and improve its carbon footprint. Katugastota zone was selected mainly because it is the second-largest waste generator out of the six zones and the Katugastota zone is host to all features that should be in a town, e.g. hospital, police station, central market, residential areas, schools, etc.

Awareness and training programmes, products and services for solid waste management in Kandy



Outputs

- ✚ Introduced home composting and waste segregation to reduce solid waste generation. The total solid waste collection was reduced by 33% (i.e. reduction of 270 tCe/year).
- ✚ Ensured better market for recyclable materials as a result of proper waste segregation.
- ✚ Created additional re-cycling center for a competitive market.
- ✚ Considered the possibility of replicating similar programmes in other zones.

6. Kurunegala, Sri Lanka

Kurunegala town is the capital of the north-western province of Sri Lanka. The town is a busy commercial and transport hub, located at the junction of several main roads linking important parts of the country. It is situated about 94 km from Colombo, and 42 km from Kandy. Kurunegala has an area of 11 km² excluding the surrounding rock out crops. Commerce, Services, Industry & Agriculture are the major economic activities of

Message from Mr. Anuradha Gamini Peramunage, Mayor

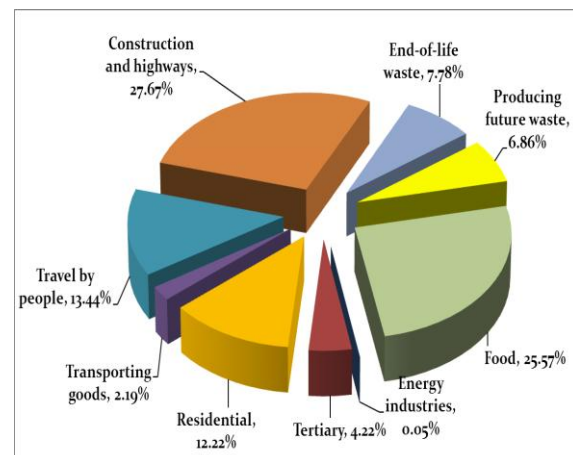
"This project has given us the opportunity to assess the carbon emissions due to various activities within the municipality boundary and helped us to prioritize actions to implement various measures and achieve our quest for becoming a low carbon city in Asia. Kurunegala municipality has been judged as the best municipality in Sri Lanka for a couple of years in the past and our intention is to convert our city into one of the best low carbon cities in Asia by optimizing our resource usage but without compromising our responsibility of providing comfort and safety to our citizen. While expressing my warmest gratitude to ADEME and AIT for providing us with this wonderful opportunity to participate in this project, I congratulate our project team for its successful completion."



Greenhouse gas (GHG) Inventory of Kurunegala

The Bilan Carbone® analysis for estimating GHG emission by **territorial activities** of Kurunegala Municipal Council 2011 led to the following results:

- ✚ Total GHG emissions: 60,350 tCe (221,284 tCO₂e)
- ✚ Average emissions per capita: 1.5 tCe (5.5 tCO₂e)
- ✚ 67 % of the GHG emissions contributed by three major sectors:
 - ❖ Construction and highways: 16,700 tCe (61,233 tCO₂e)
 - ❖ Food production: 15,430 tCe (56,577 tCO₂e)
 - ❖ Travel by people: 8,110 tCe (29,737 tCO₂e)



Pilot activities in Kurunegala

Results of the GHG emission estimation was used to create a greater awareness among the municipal authorities and the general public on the GHG emissions status of the municipality and the possibility of adopting low carbon initiatives to mitigate GHG emissions. A pilot activity for constructing a green path was proposed. The municipality constructed a 1 km long and 3.5 m wide green path using interlocking cement blocks between concrete curbs, and undertook road side landscaping with trees, turfing and flower beds. The pilot activity helped to reduce GHG emissions due to the drop in the use of individual motorized transport in that area while creating greater awareness among the citizens to engage in similar activities for environmental protection. This also serves as a demonstration for school children to understand, appreciate and engage in environmental protection activities as part of their life style.

Construction of green path in Kurunegala municipality



Outputs

- ✚ Initiated awareness activities related to climate change mitigation and adaptation in schools and communities.
- ✚ Created jobs for the local people during the construction of green path.
- ✚ Involved private sector entities such as banks, insurance companies and other private entities to maintain the landscape of green path.
- ✚ Reduced risk of accidents associated with walking on public roads as the green path is dedicated only to walking.
- ✚ Considered to scale up green path project to cover the entire road around the lake with the length of approximately 4.5 km.

7. Luang Prabang, Lao PDR

Located in the north-central region of Laos where the Nam Khan River meets the Mekong River about 425 km north of Vientiane, Luang Prabang is also the capital of Luang Prabang Province. The Luang Prabang town has an area of 818 km² and a major part of town is covered by mountains. Luang Prabang is Lao PDR's second-most popular destination after Vientiane for local and foreign visitors. The city is also recognized as a

Message from Mr. Phoumy Ophetsane, Vice Governor of Luang Prabang District

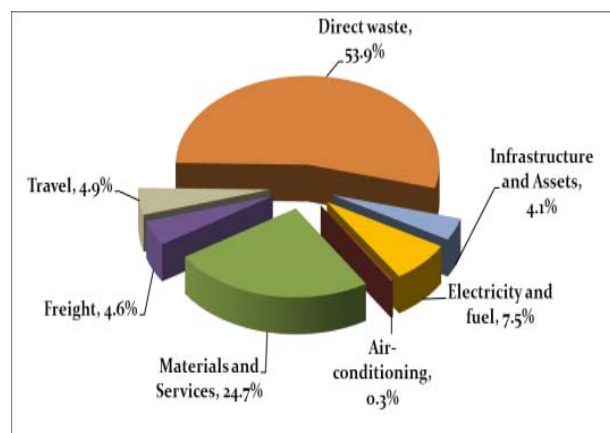
"Involvement in the Project 'Action towards Resource-efficient and Low Carbon Cities in Asia' has proven to be a great opportunity for Luang Prabang municipality to impart awareness to its citizens regarding the greenhouse gas emission, particularly related to waste disposal. Based on the results of Bilan Carbone analysis, solid waste was found to be the main source of greenhouse gas emissions of Luang Prabang municipality, and therefore, the municipality has initiated activities to address it."



Greenhouse gas (GHG) Inventory of Luang Prabang

The Bilan Carbone® analysis for estimating GHG emissions **by source** for the Urban Development Administration Authority (UDAA) of Luang Prabang in 2010 led to the following results:

- ✚ Total GHG emissions: 337 tCe (1,561 tCO₂e)
- ✚ Average emissions per employee: 6 tCe (22 tCO₂e)
- ✚ 86 % of the GHG emissions contributed by three major sectors:
 - ❖ Waste and wastewater: 180 tCe (660 tCO₂e)
 - ❖ Materials and services: 80 tCe (293 tCO₂e)
 - ❖ Electricity and fuel: 25 tCe (92 tCO₂e)



Pilot activities in Luang Prabang

Based on the Bilan Carbone analysis, the municipality selected solid waste as an important element to implement pilot scale activity and mitigate GHG emissions. The objective of this pilot scale activity was to segregate solid waste such as plastic, glass, metal, and food or vegetable at source like households, restaurants, guesthouses, etc. The pilot activity selected two villages - Xiengmouane village and Choumkong village - to address the problems of organic wastes, as these villages had a number of restaurants and guesthouses that produced large amount of organic waste. Display Panels at the Luang Prabang airport and the National Museum in Luang Prabang were put up to impart awareness to people regarding environment and sanitation in the town, especially, on organic waste disposal.

Waste management activities in Luang Prabang



Outputs

- ✚ Built capacity of 12 local authority staff and 72 community members on waste management issues and solutions, and environmental activities.
- ✚ Improved awareness among the community members (approximately 60% of total population) on waste management issues and solutions.
- ✚ Enhanced knowledge of community members (360 persons) on environmentally sustainable alternative income generating activities such recycling banks.
- ✚ Distributed 28 waste bins in 10 villages to segregate organic and non-organic wastes.
- ✚ Designed and fabricated two display panels related to environment and sanitation (in local language).
- ✚ Facilitated income generation for households and collectors from the sale of recyclable waste materials.
- ✚ Created decent jobs for 36 people related to waste management (e.g. door to door waste collection by tricycles).

8. Matale, Sri Lanka

Matale is a town in the hilly areas of Sri Lanka and is surrounded by Knuckles foothills called Wiltshire. It is located 142 km from Colombo and 26 km from Kandy and covers an area of 8.6 km². It is an area steeped in history and village living. The Matale administrative district also contains the historic Sigiriya rock castle, Aluwihara rock cave temple and Dambulla cave temple. The city is mainly an agricultural area, dominated by

Message from Mr. Hilmy Mohamed, Mayor

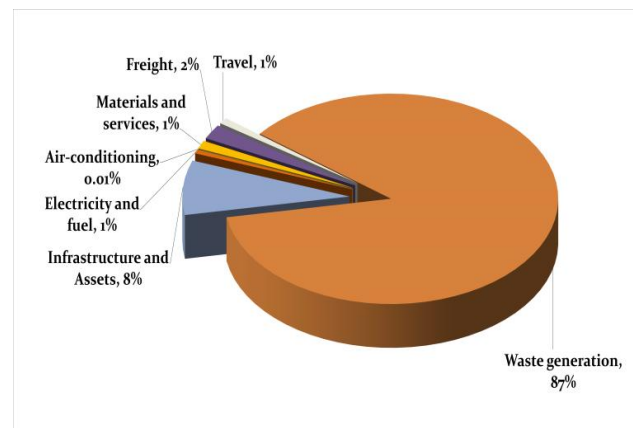
"It is the first time we were able to develop our carbon inventory in Matale and this opened our eyes to how to plan our future development with the sustainable activities involving mitigation and adaptation measures for preserving our environment. So I would like to thank the Asian Institute of Technology (AIT) and ADEME for selecting Matale and rendering fullest support to implement this project in my city. And I hope to work closely with these institutions for our city's future activities."



Greenhouse gas (GHG) Inventory of Matale

The Bilan Carbone® analysis for estimating GHG emission of **assets and services** of Matale Municipal Council 2010 led to the following results:

- ✚ Total GHG emissions: 4,130 tCe
(15,130 tCO₂e)
- ✚ Average emissions per employee: 9 tCe
(33 tCO₂e)
- ✚ 97 % of the GHG emissions contributed by three major sectors:
 - ❖ Waste generation: 3,570 tCe
(13,100 tCO₂e)
 - ❖ Infrastructure and assets: 350 tCe
(1,270 tCO₂e)
 - ❖ Electricity and fuel: 90 tCe (350 tCO₂e)



Pilot activities in Matale

Based on the Bilan Carbone analysis, Matale municipality decided to promote the 3R (reduce, reuse and recycle) concept and home gardening in Mandandawela ward of the municipality as pilot activities. Through the pilot implementation, the municipality aimed to reduce GHG emissions by disseminating knowledge and information on how to encourage practical action in everyday living and by establishing low carbon village as a model in Matale. The main objective of the pilot activity was to achieve 5% reduction of solid waste sent to the dump yard through the promotion and implementation of 3R concept within three months.

Promotion of 3R (reduce, reuse and recycle) activities in Matale



Outputs

- ✚ Trained about 400 residents, 250 students and 15 community leaders on 3R concepts.
- ✚ Reduced the environmental and public health problems created by waste (drop of 8 dengue cases in 2010 to 2 in the year 2011).
- ✚ Created 30 home gardens within 3 months (August-October 2011) by promoting home composting.
- ✚ Reduced the waste by a tonne per day by composting and recycling, resulting in a reduction of around 97 tCe of GHG emissions per year.
- ✚ Enhanced private and public participation achieved through active support of Madandaela National School, Police, Mosque, Hindu temple, Buddhist temple, Village secretariat, and Civil defense committee.

9. Nonthaburi, Thailand

Nonthaburi municipality was established by the Royal Decree in February 14, 1953 covering about 2.5 km². In 1988, this area was expanded to 38.9 km². The Nonthaburi city is located in the eastern side of Chao Phraya River and is 20 km far from central Bangkok. The city is second densely populated in Thailand and most of the city lands are used for

Message from Mr. Somnuk Thanadechakul, Mayor

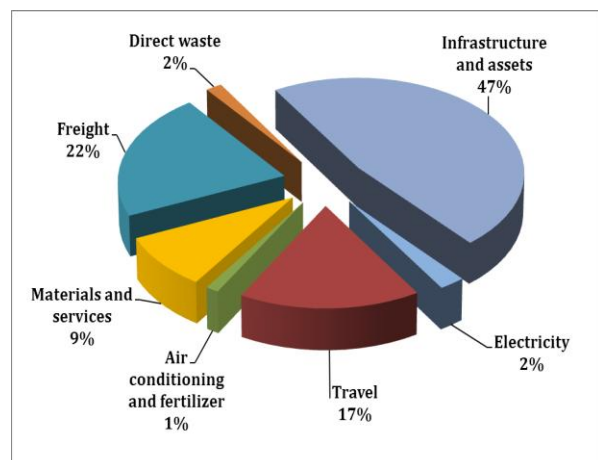
"Big thanks to AIT and ADEME for selecting Nonthaburi municipality as one of three cities from Thailand to be involved in the 'Action towards Resource-efficient and Low Carbon Cities in Asia' project. Based on the result of GHG emission analysis, Nonthaburi municipality has emphasized on decreasing energy consumption through two main activities: replacing T8 fluorescent lamps by LED and conducting awareness for staff on energy efficiency. The 'Action towards Resource-efficient and Low Carbon Cities in Asia' project is obviously helpful for our city as it has assisted us to identify the magnitude of GHGs emission from each source. This is a small step towards low carbon city and we will keep going to make this city suitable for sustainable living."



Greenhouse gas (GHG) Inventory of Nonthaburi

The Bilan Carbone® analysis for estimating GHG emission of **assets and services** of Nonthaburi municipality 2010 led to the following results:

- ✚ Total GHG emissions: 6,671 tCe (24,460 tCO₂e)
- ✚ Average emissions per employee: 4 tCe (15 tCO₂e)
- ✚ 86 % of the GHG emissions contributed by three major sectors:
 - ❖ Infrastructure and assets: 3,166 tCe (11,609 tCO₂e)
 - ❖ Freight (goods transport): 1,436 tCe (5,265 tCO₂e)
 - ❖ Travel (staff and visitors): 1,114 tCe (4,085 tCO₂e)



Pilot activities in Nonthaburi

The Bilan Carbone analysis showed that assets and infrastructure of the municipality such as administrative buildings, schools, pawn shop, pumping station and health clinics consume maximum electricity thereby emitting high level of GHG. Therefore, the municipality selected its own administration buildings for reduction of energy consumption and energy saving as a pilot activity. The main aim was to mitigate GHG emissions from the municipality building through awareness campaign for municipality staff on energy efficiency and reduce energy consumption by replacing T8 fluorescent lamps with Light Emitting Diode (LED) lamps.

Energy conservation awareness and activities in Nonthaburi municipality



Outputs

- ✚ Replaced T8 fluorescents light by LED lights in the municipality administration buildings.
- ✚ Reduced electricity use by 186 kWh/day, resulting in savings of around 67,737 kWh/year.
- ✚ Reduced GHG emissions up to 11 tCe (41 tCO₂e) per year.

10. Rayong, Thailand

Famous for tourism, agriculture and recognized as an industrial city, Rayong is located about 180 km from Bangkok. It covers 16.95 km² of area and is a mixture of residential, commercial, financial and educational centers of the province. Rayong's best known attractions are undoubtedly the beautiful islands offering its serene beaches, and some of them are located just a few kilometers away from the heart of the city. Commerce, service,

Message from Mr. Worawit Suprachokchai, Mayor

"Low carbon society is a concept that refers to an economy which has a minimal output of GHG emissions. Rayong municipality has implemented the concept for creating a low carbon society in partnership with the French Environment and Energy Management Agency and the Asian Institute of Technology, focusing on three components.

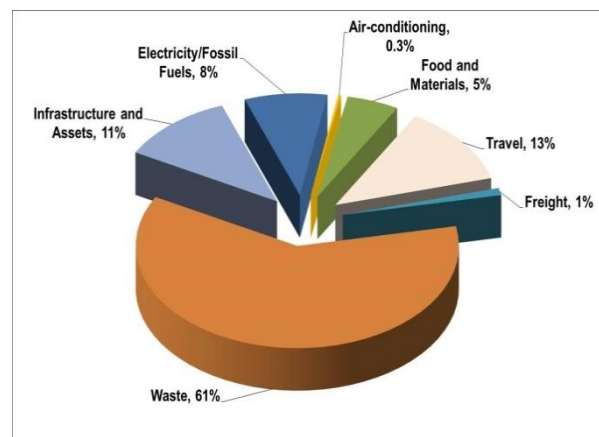
- *Carbon minimization: lowering carbon dioxide emission from all sectors in the city.*
- *Simple lifestyle for social benefit: engaging in simple activities in order to reduce greenhouse gas emissions, and help to benefit the city.*
- *Co-existence with nature: maintaining and restoring natural environment such as reforestation that is essential for a low carbon society."*



Greenhouse gas (GHG) Inventory of Rayong

The Bilan Carbone® analysis for estimating GHG emission of **assets and services** of Rayong municipality 2010 led to the following results:

- ✚ Total GHG emissions: 11,340 tCe (41,580 tCO₂e)
- ✚ Average emissions per employee: 14 tCe (51 tCO₂e)
- ✚ 93 % of the GHG emissions contributed by four major sectors:
 - ❖ Waste: 6,920 tCe (25,373 tCO₂e)
 - ❖ Travel (people): 1,420 tCe (5,207 tCO₂e)
 - ❖ Infrastructure and Assets: 1,300 tCe (4,767 tCO₂e)
 - ❖ Electricity and Fossil Fuels: 940 tCe (3,447 tCO₂e)



Pilot activities in Rayong

The diagnosis of the energy consumption of municipal buildings, mainly electricity usage, showed that the municipal offices and the public library are the major consumers of electricity. The municipality therefore took measures through mayor's announcement of reduction on energy consumption and energy saving in these buildings. In addition, the municipality initiated a pilot activity in parallel with this announcement for adopting efficient electrical appliances in the library building. The main aim was to mitigate GHG emissions from the public buildings and demonstrate them as model learning centers.

Replacement of inefficient lighting and improvement of the illumination level at the public library in Rayong



Outputs

- ✚ Replaced 186 sets of fluorescents lamps and ballasts with energy efficient bulbs.
- ✚ Saved 54 kWh of electricity per day, resulting in savings of 19,710 kWh/year.
- ✚ Reduced GHG emissions up to 3 tCe or 12tCO₂e/year.

Opinion of Beneficiaries...

Dr. Tran Xuan Binh
Director, Center for Social
Sciences & Humanities,
Hue College of Sciences, Hue



"The City Mayor's mandate not only helped us to understand Hue city's commitments to combat climate change, but also contributed to raising our awareness and consciousness about resource conservation.

To improve the project activities, good practices on energy efficiency should be promoted throughout Hue University and Bilan Carbon for analyzing GHG emissions produced by Hue University should be used."

Mr. Nalaka Wijekoon
A health conscious
citizen of Kurunegala



"This green path provides us the right environment to engage in our morning exercises which we never enjoyed before. We are very much impressed by the way it has been constructed without damaging the natural beauty of the lake. In fact, it enhances the beauty of the environment. Furthermore, this is an ideal incentive for us to walk to the city centre without using our motorized vehicles.

We would like to suggest that this be extended to cover the entire 4 km road around the lake and be lit in an environmentally friendly manner, enabling us to use it at night too."

Ms. Chanya Ditsayaphong
3R Volunteer
Rayong Municipality



"I joined as a volunteer three years ago. We helped Rayong municipality to promote and campaign about waste separation in the community in the first year and extend to separate organic waste, plastic and hazardous waste. Before, we only knew that the recycled waste helped us get money and the waste separation will help to reduce the volume of waste at landfill site. It is an activity that creates environmental awareness among the public. But now we also know that waste recycling will help us to reduce the use of resources, reduce energy use in their production and reduce greenhouse gas emissions that cause global warming."

W.A Wimalarathna
A retired survey officer
Matale



"I am happy that now there are no environmental problems and dengue cases reported in our areas and we learnt many lessons like how to work as a team with various people to the benefit of the society. Now, we also have a good relationship between various government, private institutions and officers after the implementation of this low carbon city project."

Mrs. Le Thi Anh
Head, Quang Trung Primary School
Sơn Trà district, Danang



"Before the project, students paid little attention to environmental protection, but now they also know how to keep the general hygiene, especially in terms of waste management and resource use. In December 2012, all the students collected waste paper and joined the movement 'small plan' where each student collected about 1 - 2 kg, thus saving 2 million Dong to be used for environmental protection of the school.

From the experimental energy saving activity in classrooms, the average level of lighting at the desk in classroom was raised from 251 lux to 497 lux, meeting Vietnamese regulations. Result shows that the total saved electricity per classroom was in average 9kWh per day. The school also explained about this to the parents who were very pleased with the improved quality of classrooms.

Through the project, communication materials developed for mural painting were really significant. It covered an area of 200m² including 8 different topics on natural resources, energy and environment. It created a beautiful landscape and a meaningful medium of environmental education. The use of walls to paint saves materials and increases its life span. We intend to use these products for the next 5 - 7 years."

Mr. Sengphon Bounluesai
Deputy Chief
Waste Management Section, UDAA
Luang Prabang



"After the implementation of the project, UDAA and the selected communities knew the importance of waste management and greenhouse gas reduction. The project created awareness about waste management in Ban Choumkong and Ban Xiengmoune villages within Luang Prabang town. Now these communities have become clean and the quantity of waste generation has reduced significantly. UDAA is planning to expand similar waste management activities in other villages to reduce global warming."

Mr. Nguyen Huu Tri
Representative
Farmer's Union, Chau Doc



"Thanks for the training on how to cultivate rice efficiently. I applied these good practices into my rice field this year. The result was impressive as I could reduce water use; minimize loss of seeds, fertilizers and pesticides remarkably. I will guide my neighbours and friends to adopt such good practices."

Communication and Dissemination Products...



Energy Saving Manual- Chau Doc



Display panels related to environment and sanitation- Luang Prabang



Poster and Handbook used for utility conservation- Hue



Pilot activity awareness brochure- Rayong



Display board for waste collection schedule- Kandy

Events and Activities...



The Mayors of Matale and Kurunegala at the seminar on 'Low Carbon Initiatives of Cities for GHG Mitigation and Adaptation to Climate Change (16-17 May 2011, Bangkok)



AIT delegation's visit to ADEME Office in France and their meeting with Bilan Carbone and TCEP trainers (30 August 2010, France)



Advisory Group Meeting (10 August 2010, Bangkok)



Bilan Carbone® Training (5-10 January 2011, AIT)

Events and Activities...



Mr. Vue Yang and Mr. Sengkeo calculating GHG emission of Urban Development Administration Authority of Luang Prabang by using Bilan Carbone spreadsheet (24-26 August 2011, Luang Prabang)



Dr. Dominique Campana, Director of International Affairs, ADEME welcoming participants and sharing the French experience and ADEME's role in promoting low carbon cities (16-17 May 2011, Bangkok)



Territorial Climate and Energy Plan (TCEP) Training (18-21 May 2011, AIT)



TCEP participants observing Solar Photovoltaic Panels at the Services and Environmental Quality Development Center (18-21 May 2011, Nonthaburi)



Participants observing different products made by recycling waste by Bangkok Metropolitan Authority (18-21 May 2011, Bangkok)



Mr. Gamini Senanayake (Sri Lanka) making a presentation on environmentally sustainable transport in Asian cities (22 June 2011, Bangkok)



Technical support mission from AIT to Rayong municipality (9 August 2011, Rayong)



Mr. Tran Anh Tuan presenting Hue city Bilan Carbon Analysis at the National Conference on “Wetland and Climate Change” (8 February 2012, Hanoi)



Mr. Fouzi Benkhelifa (from left) providing technical support to develop TCEP by the partner cities (13-14 June 2012, AIT)



Mrs. Aurélie Bernard (from left) discussing the progress made by the project at AIT (9 July 2012, AIT)

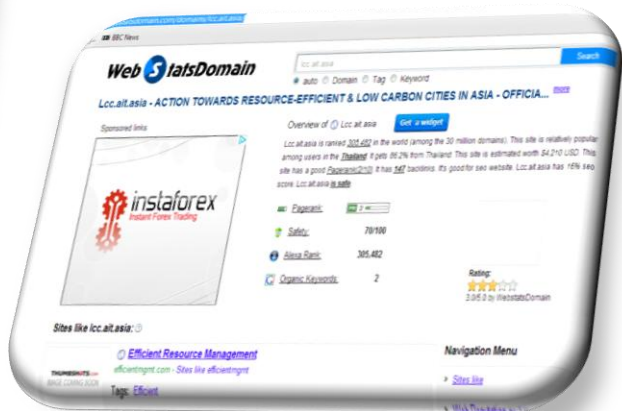


Mayor of Kurunegala (left) and Mayor of Nonthaburi (right) (14 September 2012, Nonthaburi)

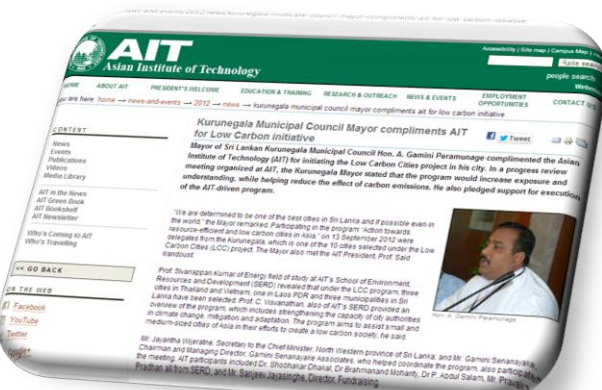
Media Coverage and Related Projects...



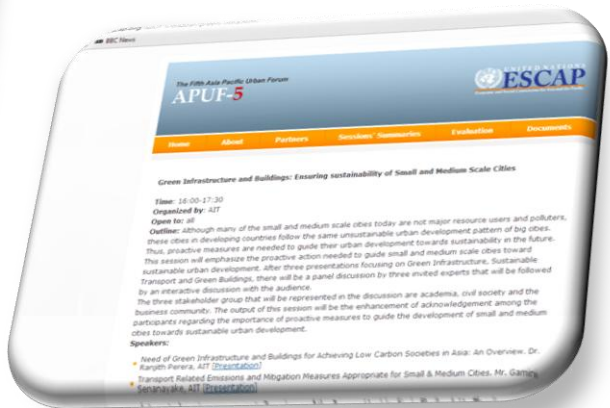
Open Energy Info Database
(http://en.openei.org/wiki/Main_Page)



Reference to the project website
(<http://www.webstatsdomain.com/domains/lcc.ait.asia/>)



AIT website
(<http://www.ait.ac.th/>)



UNESCAP website
(<http://www.unescap.org/apuf-5/>)

Media Coverage and Related Projects...

AIT collaborated with Chiang Mai (Thailand) and Hue (Vietnam) in conducting a study titled 'Sustainable urban tourism through low carbon initiatives: experiences from Hue and Chiang Mai'. This project was funded by Sumernet-CDKN during January - December 2012. Details are available in the website: <http://sut.ait.asia>



Media Coverage and Related Projects...

The United Nations Framework Convention for Climate Change (UNFCCC) 'Momentum of Change' web-database includes selected projects/initiatives/programmes or activities that have been implemented to successfully address climate change mitigation or adaptation. An entry into the web-database increases the visibility of the project in gaining better recognition, providing opportunities for networking with other project developers that could help up-scale and replicate the project. The project 'Action towards Resource-efficient and Low Carbon Cities in Asia' was selected and is in the database. Details are available in the website: http://unfccc.int/secretariat/momentum_for_change/items/7130.php



Lessons Learned and Way Forward...

Lessons Learned

Some of the lessons from the implementation of the project in terms of conceptualization (for the selection of small and medium cities), organizational setup, pilot activities, technical feasibility, and networking, for other cities to consider and follow are discussed below:

- ✚ Small/medium cities lack human resources and sufficient budget to initiate activities to address climate change. However they have the opportunity to avoid the unsustainable path followed by big cities in urban development. Resources can be leveraged by using existing budget with additional funds, and support of other organizations. For example, Da Nang city supported Quang Trung Primary School in promoting environmental friendly technologies (e.g. energy efficiency, waste management, etc.) at the school.
- ✚ Small/medium cities could reduce GHG emissions and create a cleaner environment by introducing innovative environment friendly technologies, such as green infrastructure and buildings, eco-friendly vehicles, renewable energy, 3R concept, etc. which could also provide decent jobs for local people. For instance, the construction activity of green path in Kurunegala created local jobs. Kandy, Luang Prabang and Matale, introduced 3R concept to minimize garbage collection. This resulted in an increased number of home gardens that facilitated home composting, and the waste collectors received better market for recyclable materials.
- ✚ Sensitization of urban decision makers (mayors, councilors, etc.) on the impacts of climate change, and on the need to take actions (both at the policy level and implementation for mitigation and adaptation measures) is vital for the success such initiatives. For example, the Mayor of Kurunegala municipality and his team visited AIT, Nonthaburi and Rayong in September 2012 to learn about the low carbon initiatives in other cities.
- ✚ Partnership between public, private and academic institutions are important to conduct technical studies and therefore regular technical consultation is essential between partners. For example, Kandy municipality was supported by the University of Peradeniya, while Kurunegala municipality was supported by M/s Gamini Senanayake Associates Pvt. Ltd and Hue city was supported by Hue University of Sciences for conducting the Bilan Carbone analysis to estimate GHG emissions and to develop the TCEP.
- ✚ Pilot activities (e.g. demonstration project) are important to convince stakeholders. Such activities could also be carried out with limited budget through public private partnership, e.g. Kurunegala involved private sector entities such as banks, insurance companies and others to maintain the landscape of green path. Similarly, Matale favoured public private participation through active support of Madandaela National School, Police, Mosque, Hindu temple, Buddhist temple, Village secretariat and Civil defense committee for the management of solid waste.
- ✚ Initiatives which can provide business opportunities for local people will help sustain green activities. For example, the waste segregation activity in Matale, Kandy and in Luang Prabang facilitated income generation of households and collectors, who gained additional income from the sale of recyclable waste materials.

- ✦ Activities need to be linked with local government plans for effective outputs, for obtaining additional funds and for scaling up activities. For example, Kandy municipality replicated the solid waste management activities conducted at Katugastota zone in other areas of the municipality. Similarly, Kurunegala is planning to scale up green path project to extend the present road length of 1 km to 4.5 km around the lake.
- ✦ Guidelines from national plan for mitigation and adaptation to climate change can be adopted to develop 'city level climate and energy plan'. For example, the authorities of Chau Doc, Da Nang and Hue in Vietnam, and Kandy and Kurunegala in Sri Lanka have developed 'city level climate and energy plan' based on the guidelines of their national plan for mitigation and adaptation to climate change. This ensured the linking of "bottom up" and "top down" approaches for the development/implementation of plans and actions.

Way Forward

Many more options and activities can be contemplated in future for replicating and scaling up this project. The scale up can be at two levels: project level and city level. At project level, Bilan Carbone® (GHG emission calculation tool) and Territorial Climate and Energy Plan (TCEP) were introduced and applied in participating cities to mitigate and adapt to climate change. Similar approach and methodology could be introduced to other interested cities and regions.

At city level, several activities and initiatives can be considered for expanding and scaling up low carbon efforts. For example:

- ✦ Expansion of solid waste management activities at city level. Realizing the multiple benefits from the pilot activity at Katugastota (Kandy), Ban Choumkong and Ban Xiengmoune villages (Luang Prabang), Mandandawela ward/Grama Niladari area (Matale), the city authorities have planned to introduce similar programs in other areas of the city as well.
- ✦ Utilization of technical expertise. Cities can use the technical expertise gained from this project to further develop their infrastructure and plan their activities in an environment friendly manner. For instance, Kurunegala Municipal council has already prepared a plan to scale up its green path pilot activity to cover the entire lake. By extending the green path, greater public awareness on the use of alternative transport modes will be promoted.
- ✦ Promotion of awareness program related to low carbon initiative at schools. Based on the results of the pilot activity at Quang Trung Primary School in Da Nang, the Da Nang Environmental Protection Agency in Vietnam is planning to propose to the Department of Education and Training for testing similar activities in other schools of Da Nang city.
- ✦ Sector-wise mitigation and adaptation studies and activities at city level could be implemented based on the results of the city's emission inventory and the climate and energy plan. For example, AIT, Chiang Mai municipality and Hue city carried out a project entitled 'Sustainable urban tourism through low carbon initiatives: experiences from Hue and Chiang Mai' funded by Sumernet-CDKN.
- ✦ Development and implementation of adaptation and mitigation action plans addressing climate change on a medium and long term basis in the cities could be applicable to the forthcoming infrastructure projects related to buildings, transport, etc.

Project Outputs and Presentations...

Bilan Carbone Analysis Reports

1. Bilan Carbone 2010 Chau Doc Town, An Giang Province, Vietnam, (2011) People's Committee of Chau Doc Town, Vietnam.
2. Carbon Emission Situation of Da Nang City for the Year 2010, (2011) People's Committee of Da Nang City, Department of Natural Resources and Environment, Vietnam.
3. Bilan Carbone Study of Hue City Authority for the Year 2010, (2011) People's Committee of Hue City and Hue City's Natural Resources & Environment Division and Department of Environmental Science, Hue College of Sciences, Vietnam.
4. Bilan Carbone Analysis for the Year 2010-11, Footprint for Kandy Municipal Council Sri Lanka Using the Bilan Carbone Tool, (2011) Kandy Municipal Council, Sri Lanka.
5. Territorial Greenhouse Gas Emissions of Kandy Municipal Council for the year 2011, (2012) Kandy Municipal Council, Sri Lanka.
6. Bilan Carbone Study of Kurunegala Municipality for the Year 2010, (2011) Kurunegala Municipal Council, Sri Lanka.
7. Territorial Bilan Carbone Analysis of Kurunegala Municipality for the Year 2011, (2012) Kurunegala Municipal Council, Sri Lanka.
8. Bilan Carbone Study of Matale Municipality for the Year 2010, (2012) Matale Municipal Council, Sri Lanka.
9. Bilan Carbone Study of Urban Development Administration Authority Luang Prabang for the Year 2010, (2011) Urban Development Administration Authority (UDAA), Luang Prabang, Lao PDR.
10. Bilan Carbone Study of Nonthaburi Municipality Thailand, (2012) Nonthaburi Municipality, Thailand.
11. Bilan Carbone Study of Rayong Municipality Authority, Thailand, (2012) Rayong Municipality, Thailand.

Pilot Project Reports

1. Climate Change Mitigation and Adaptation Project in Chau Doc town, Vietnam year 2011, (2012) People's Committee of Chau Doc Town, Vietnam.
2. Greenhouse Gas Emission Analysis of Quang Trung's Primary School for the Year 2011, (2012) Da Nang City's Environmental Protection Agency and Quang Trung's Primary School, Vietnam.
3. Pilot Project: Reducing Carbon Emissions and Efficient Use of Resources at School in Da Nang, Vietnam, (2012) People's Committee of Da Nang City, Department of Natural Resources and Environment, Environmental Protection Agency, Vietnam.
4. Pilot Project Activity Report Hue City, Vietnam, (2012) People's Committee of Hue City and Hue City's Natural Resources & Environment Division and Department of Environmental Science, Hue College of Sciences, Vietnam.
5. Pilot Project Report: Reducing Greenhouse Gas Emission from Solid Waste Management Kandy Municipal Council, (2012) Kandy Municipal Council, Sri Lanka.
6. Pilot Project under Bilan Carbone Study of Kurunegala Municipality Sri Lanka, (2012) Kurunegala Municipal Council, Sri Lanka.
7. Pilot Project: Improve Solid Waste Management through Implementation of 3R Concept in Mandandawela-Matale, (2012) Matale Municipal Council, Sri Lanka.

8. Implementation of Pilot Scale Project on Solid Waste, Final Activity Report, (2012) UDAA, Luang Prabang, Lao PDR.
9. Energy Saving in the Library Building Project, Rayong Municipality, Thailand, (2012) Rayong Municipality, Thailand.

Territorial Climate and Energy Plan (TCEP)

1. Territorial Climate and Energy Plan Year 2012–2050 Chau Doc town, An Giang Province Vietnam, (2012) People's Committee of Chau Doc Town, Vietnam.
2. Climate and Energy Plan Year 2012 - 2015, Da Nang, Vietnam, (2012) People's Committee of Da Nang City, Department of Natural Resources and Environment, Environmental Protection Agency, Vietnam.
3. Territorial Climate and Energy Plan of Hue City, Vietnam (2012-2020), (2012) People's Committee of Hue City and Hue City's Natural Resources & Environment Division and Department of Environmental Science, Hue College of Sciences, Vietnam.
4. Territorial Climate and Energy Plan of Kandy Municipal Council (2012-2025), (2012) Kandy Municipal Council, Sri Lanka.
5. Territorial Climate and Energy Plan of Kurunegala Municipality, Sri Lanka (2012-2016), (2012) Kurunegala Municipal Council, Sri Lanka.
6. Action Plan for Mitigation Global Warming Urban Development Administration Authority Luang Prabang (2013-2017), (2012), UDAA, Luang Prabang, Lao PDR.
7. Action Plan for Mitigation Global Warming Rayong Municipality (2013-2017), (2012) Rayong Municipality, Thailand.

Presentations

1. S. Kumar, "The International Forum for Sustainable Asia and the Pacific (ISAP)" organized by the Institute of Global Environmental Strategies, Yokohama, Japan, 12-13 July 2010.
2. S. Kumar, "2010 Cities International Conference on Renewable Energy and Sustainable Development", Kaohsiung, Taiwan, 8-9 September 2010.
3. S. Kumar, "2010 Asia-Pacific Leadership Programme on Environment for Sustainable Development", Shanghai, PR China, 17-23 September 2010.
4. S. Kumar, "A Territorial Climate Plan Approach Leading to Resource Efficient Cities", 1st Regional Symposium on Integrated Energy and Environmental Management, Palembang, Indonesia, 15-16 December 2010.
5. P. Abdul Salam, "Save Our Planet Carbon Score Card" at "Save Our Planet Conference Series – 2011", Shangri-La Hotel, Bangkok, Thailand, 18 March 2011.
6. S. Kumar, "Managing Innovations for Low Carbon Green Development", Policy Dialogue on Working together for a Green Asia, Hong Kong, China, 21 April, 2011.
7. R. Perera, "Seminar on Emerging Cities and Urbanization in Southeast Asia: Tools for Challenges and Opportunities", International Cooperation and Training Center, Vientiane, Lao PDR, 20–21 June 2011.
8. R. Perera and C. Visvanathan, "Fifth Asia-Pacific Urban Forum" UN Conference Center, Bangkok, Thailand, 22-24 June 2011.
9. S. Kumar, "Indicators for Low Carbon Green Growth", Climate Change and Green Asia Technical Workshop, New Delhi, India, 12– 13 September, 2011.
10. C. Visvanathan, "Asia LEDS FORUM 2012", Bangkok, Thailand, 18-21 September 2012.

People ...

Project Team, Asian Institute of Technology

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