

# Driving Khon-Kaen Province, Thailand, Towards LCC in the Context of GMS

*The 18<sup>th</sup> AIM International Workshop*



**Savitri Garivait, Penvadee Cheewapongphan,  
Awassada Phongphiphat, Agapol Junpen, Komsilp Wang-Yao,  
and Sirintorthep Towprayoon**

The Joint Graduate School of Energy and Environment,  
Center of Excellence of Energy Technology and environment,  
King Mongkut's University of Technology Thonburi

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# Khon-Kaen

## Location

Latitudes 15°21'5" N

Longitudes 101°44'45" E

Total Land 10,885.99 km<sup>2</sup>

Climate Tropical climate under SW monsoon with dry zone

Annual Temperature 13.5 – 41.2°C (Average = 27.8°C)

Average Annual Precipitation 1,230 mm (131 days)

Population (2010) 1,767,601 inhabitants females)

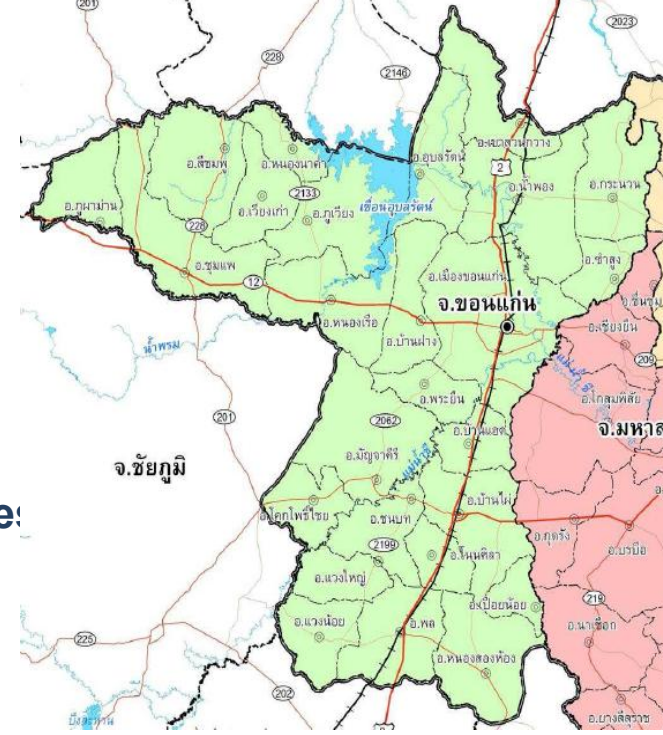
Population Density (2010) 162.4 inhabitants/km<sup>2</sup> (Top 22<sup>nd</sup> of Thailand)

Administration Structure : 26 Districts and 198 Sub-districts

Socio-Economics Structure : 2<sup>nd</sup> largest economy of the NE region

GPP (2009) 143,806 Million Baht

GPP/cap (2009) 76,385 Baht



# Towards LCSS for Khon-Kaen

## Motivation

- Khon Kaen has developed a roadmap of Khon Kaen towards Low Carbon City since 2009 to support Khon Kaen's Declaration on Climate Change Adaptation and Mitigation 2020
- Khon Kaen's vision of LCS : To become the Low Carbon City of Greater Mekong Sub-region
- Khon Kaen's Socio-economic Development Plan : To become the 3H = Happiness Community, Healthy City, and Hub of GMS

## Vision

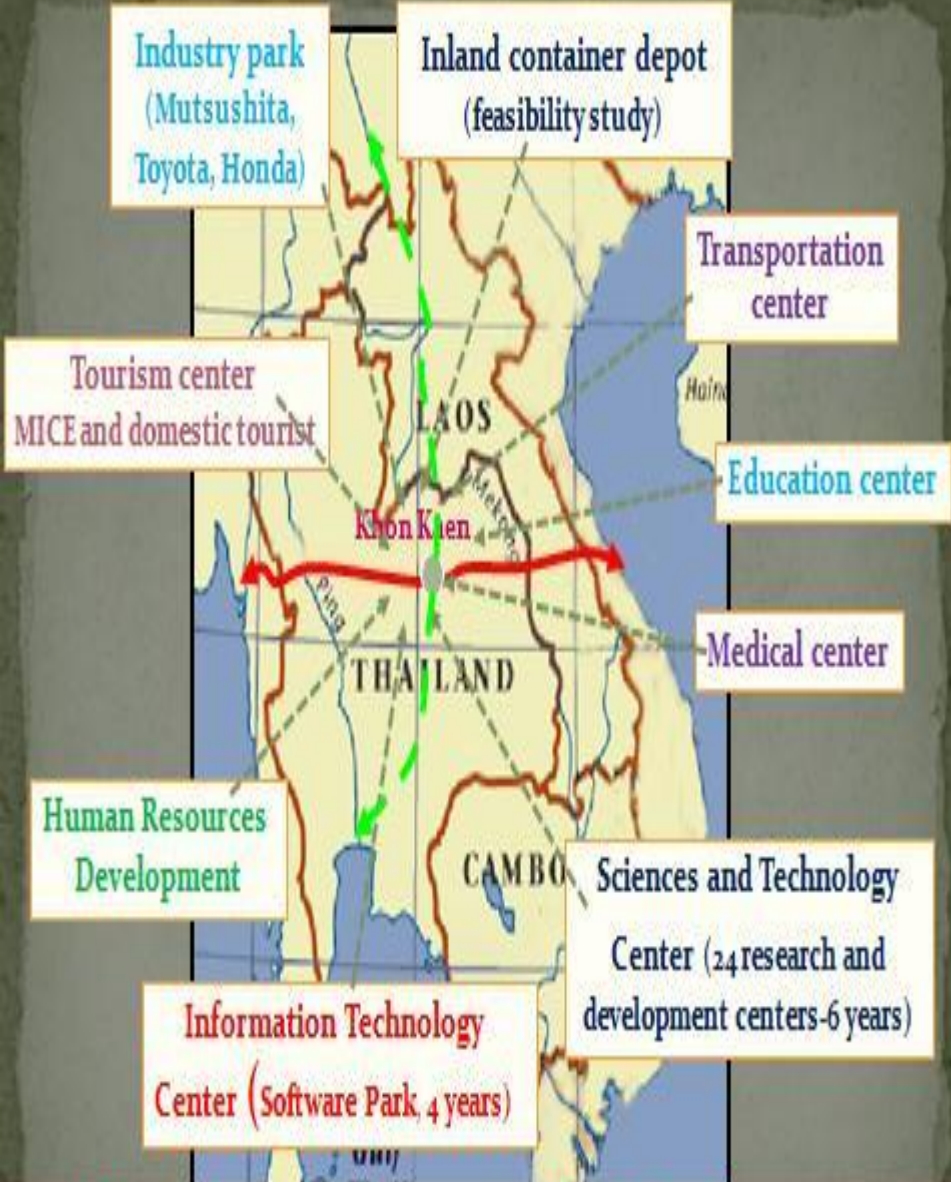
Khon Kaen should be the Model of the GMS in Global Warming Reduction Through Participation of All Stakeholders

## Strategies

1. Reduce GHG Emissions
2. Raise Public and All Stakeholders Awareness to Implement Mitigation Actions
3. Develop Efficient System of Environmental Management
4. Increase Capacity in Getting Prepared to Face and Prevent Climate Change

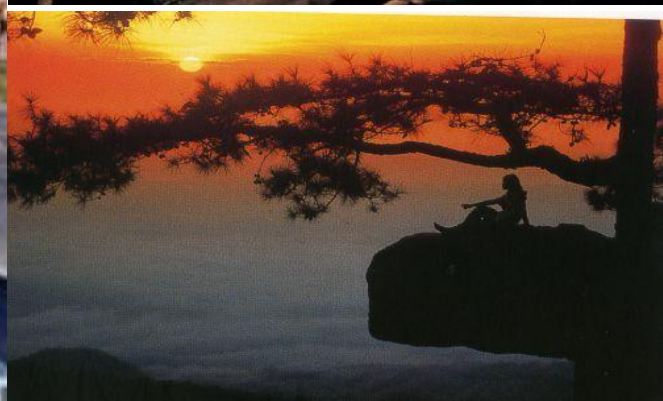
# Khon Kaen's Vision

Khon Kaen to Become The Coolest and Happiest Place to Live in the World within 2020  
 &  
 The Model of Low Carbon City in the Mekong Region



Khon Kaen is the center for Development

# Khon-Kaen – Attractions

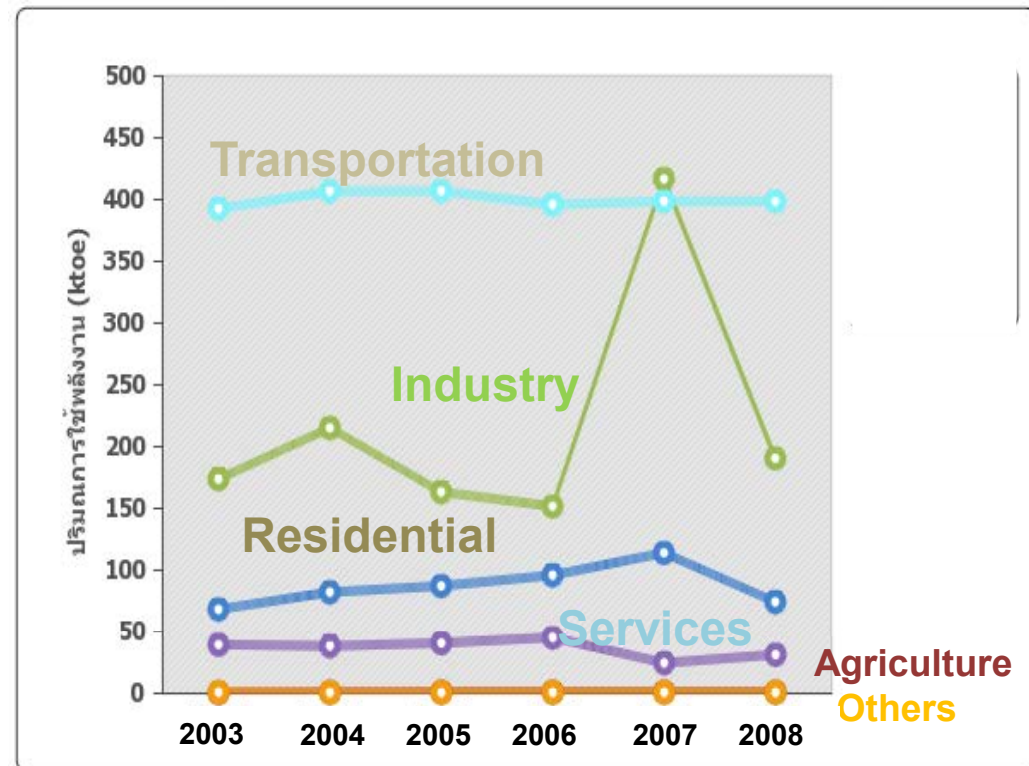


# Khon-Kaen

## Energy Consumption

Khon Kaen's final energy consumption in 2008 was about **696.44 ktoe** including 68.6% of oil, 13.7% of renewable energy and 17.7% of electricity. Considering the final energy consumption classified by sector, 57.2% of the total or 398.6 ktoe were from transportation sector, followed by industry, residential, commercial, and other sectors.

Year	Energy consumption (ktoe)
2001	600.77
2002	635.60
2003	675.43
2004	743.63
2005	699.79
2006	690.39
2007	955.78
2008	696.44



# Khon-Kaen

## Agriculture

Agricultural land = about 1.12 Mha (or about 60.8% of Konkaen area). Main crop products : rice, sugarcane, cassava, soil bean. Livestock : cattle, swine, and poultry

## Industry

Total = 1,368 factories including non-ferrous industry (208 factories), metal industry (202 factories), transportation industry (179 factories), food manufacturing (131 factories), agricultural industry (111 factories), machinery manufacturing (114 factories), saw mill and wood product (56 factories), and other (137 factories)

In 2009	In Million Baht
<b>Agriculture</b>	<b>18,505</b>
Agriculture, Hunting and Forestry	17,753
Fishing	753
<b>Non-Agriculture</b>	<b>125,301</b>
Mining and Quarrying	1,442
<b>Manufacturing</b>	<b>54,565</b>
Electricity, Gas and Water Supply	2,667
Construction	6,300
<b>Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods</b>	<b>20,470</b>
Hotels and Restaurants	2,187
Transport, Storage and Communications	4,469
Financial Intermediation	4,460
Real Estate, Renting and Business Activities	2,791
Public Administration and Defence; Compulsory Social Security	6,871
<b>Education</b>	<b>14,580</b>
Health and Social Work	3,760
Other Community, Social and Personal Services Activities	593
Private Households with Employed Persons	146
<b>Gross Provincial Product (GPP)</b>	<b>143,806</b>

# Khon-kaen – Approaching LCSS

## Top 3 of Economic Activities

Unit: million baht

	2005	2006	2007	2008	2009
<b>GPP</b>	<b>97,098</b>	<b>116,870</b>	<b>126,016</b>	<b>134,399</b>	<b>143,806</b>
Manufacturing	31,255	43,341	45,394	51,174	54,565
Wholesale and Retail Trade	16,865	18,211	19,776	19,705	20,470
Agriculture and Forestry	11,030	12,920	14,786	15,618	17,753

Source: NESDB

## Approach to Develop LCSS for Khon-kaen

- Identification of sources and sinks of GHG in Khon-kaen
- Conduct GHG emission estimation/inventory including all key categories
- Projection of the emissions for BAU and Countermeasure Cases
- Assessment of undertaken countermeasures





# Key sources and sinks of GHG in Khon-kaen

## 1. Energy sector

- Industry (Not yet completed due to lack of data)
- **Transportation**
- **Other (Commercial/ Residential/etc.)**



## 2. Agriculture sector

- **Fermentation**
- Manure management
- **Rice Cultivation**
- Open burning
- Agricultural soil



## 3. Land use change and **Forestry sector**

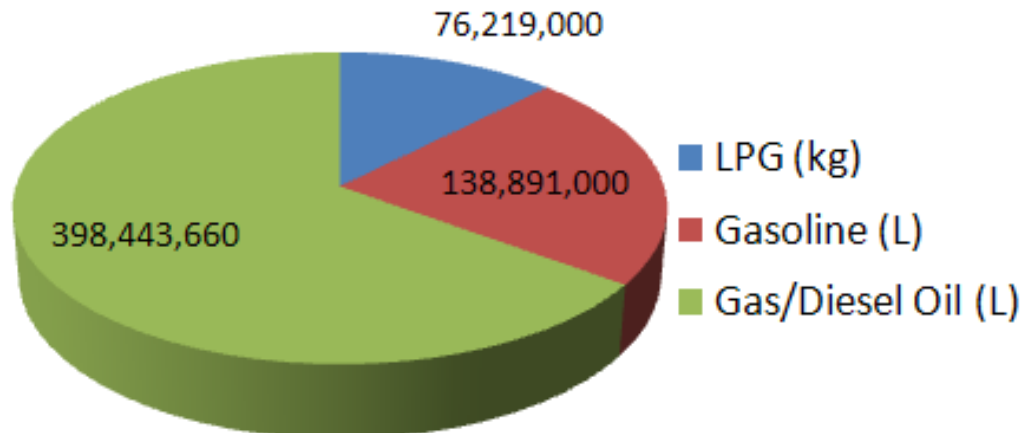
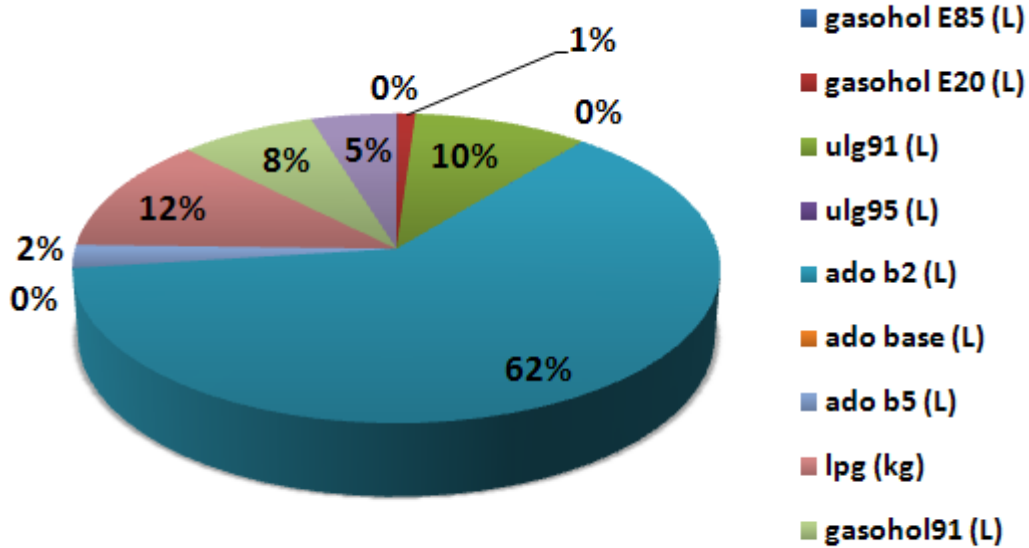
# Khon-Kaen

## Transportation - Number and share of register vehicle in 2007 and 2008

Type	Yr 2007		Yr 2008	
	Share (%)	Vehicle	Share (%)	Vehicle
Small passenger (< 7 person)	10.40	56,765	11.02	61,737
Passenger (> 7 vehicle)	0.90	4,872	0.90	5,042
Small truck	20.40	111,670	21.01	117,704
Motorcycle	64.30	351,705	63.06	353,281
Bus	0.60	3,120	0.56	3,137
Large truck	3.50	19,323	3.45	19,328
Small vehicle	0.01	55	0.01	56
<b>Total</b>	<b>100.00</b>	<b>547,401</b>	<b>100.00</b>	<b>560,286</b>

# Energy Sector

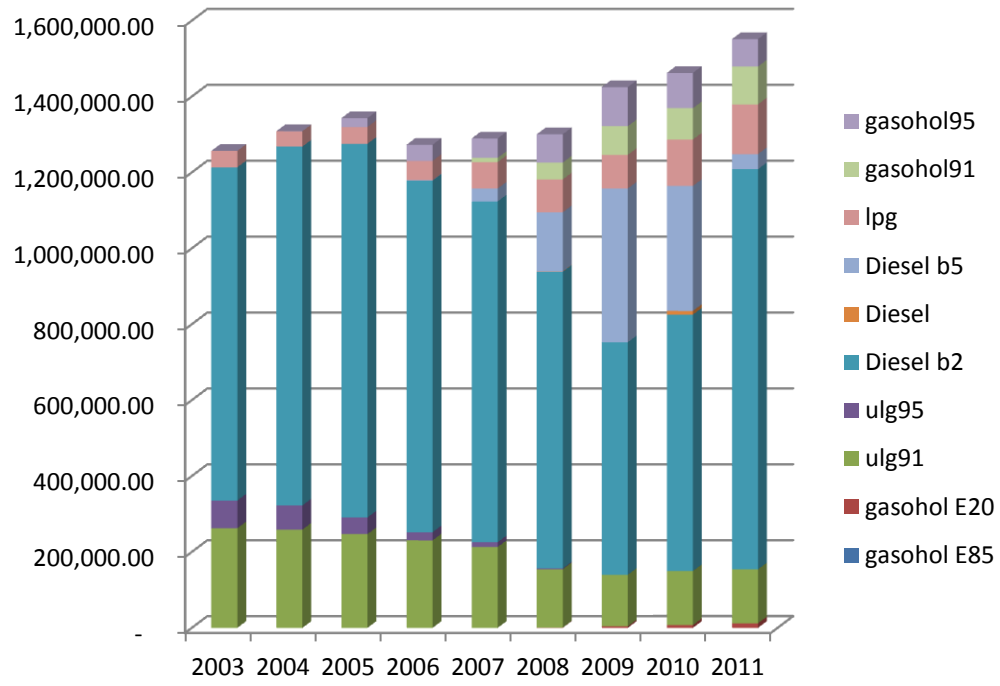
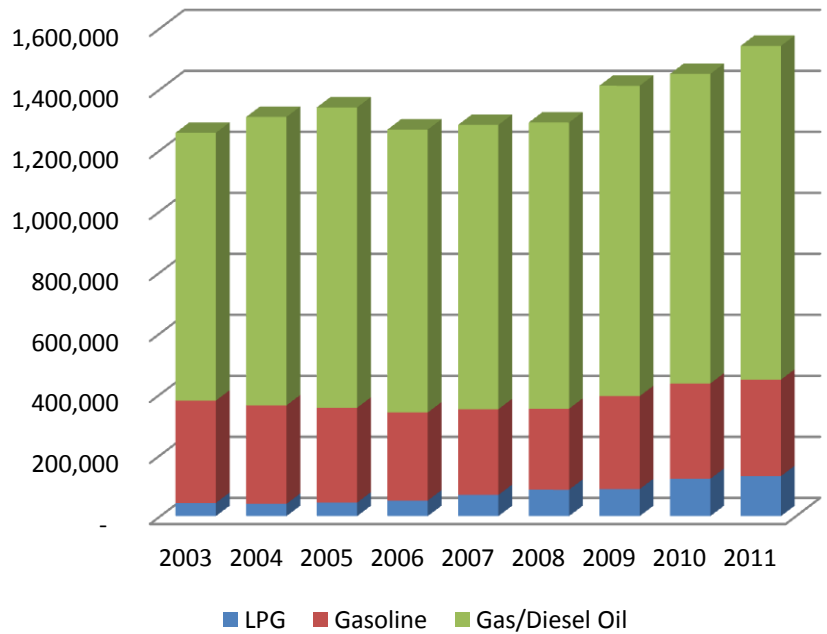
## Fuel consumption – Transportation activity



# Emission CO<sub>2</sub> – Energy Sector

## Transportation activity

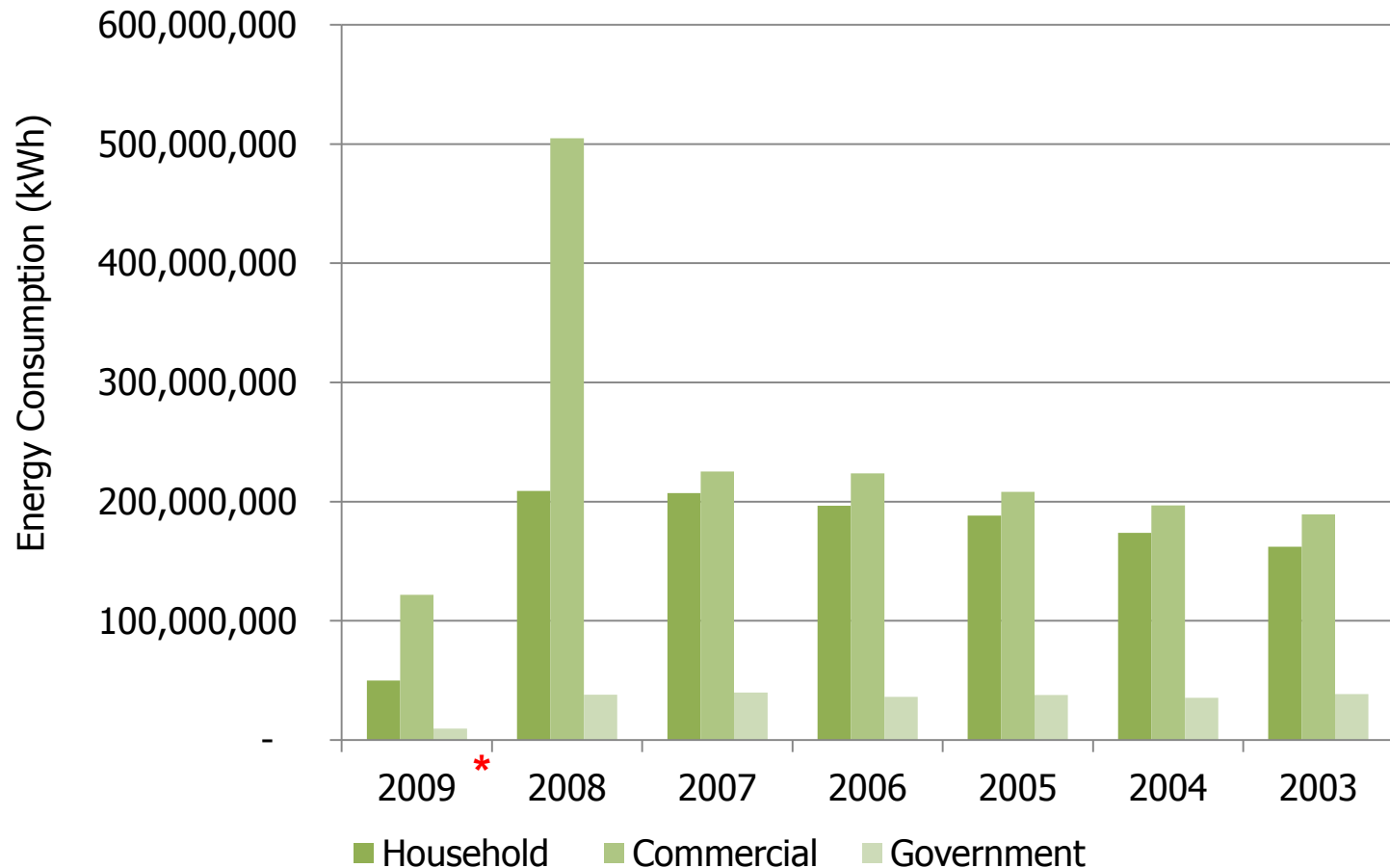
CO<sub>2</sub> e from Transportation sector



## CO<sub>2</sub> e by type of fuel

# Energy Sector

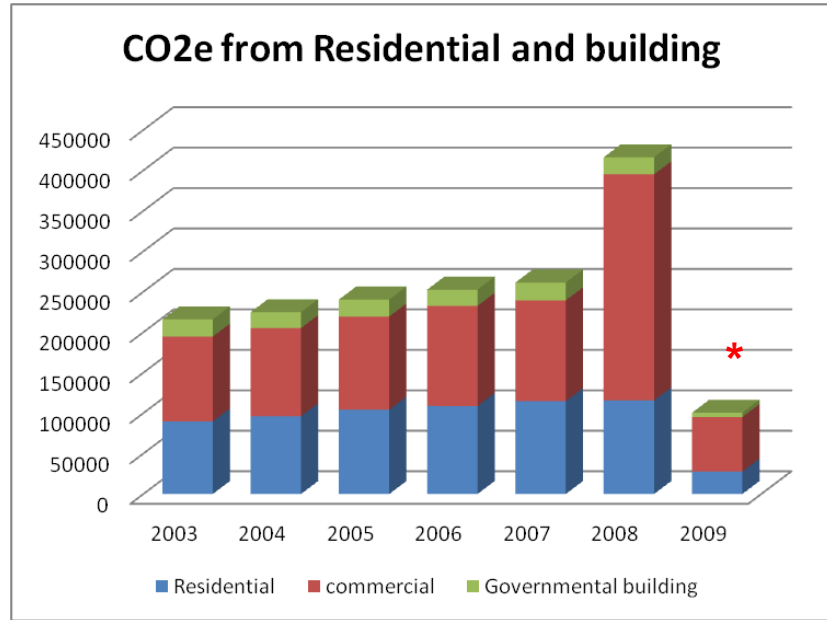
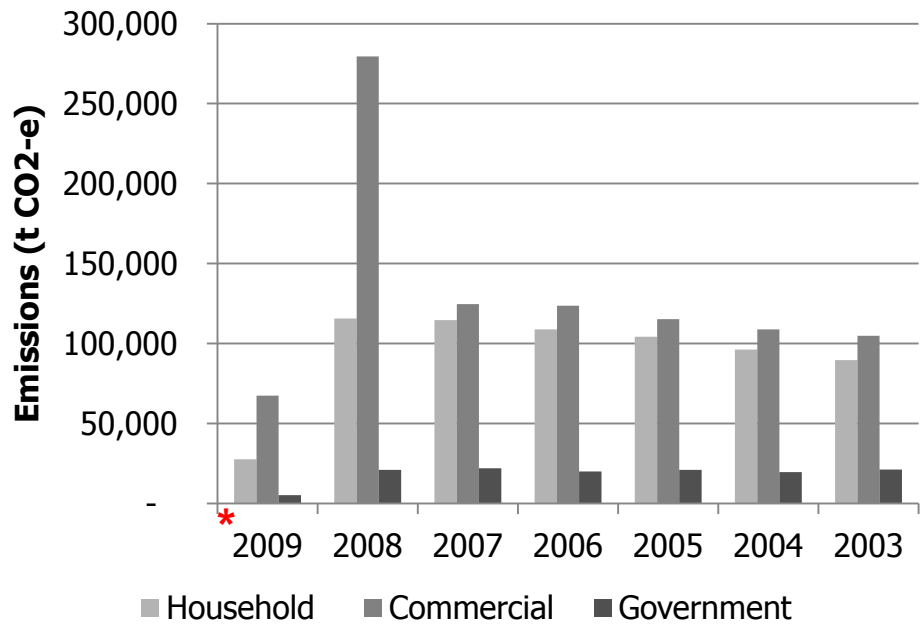
## Energy consumption (Household/ Commercial/ Governmental activities)



\* Data until May, 2009

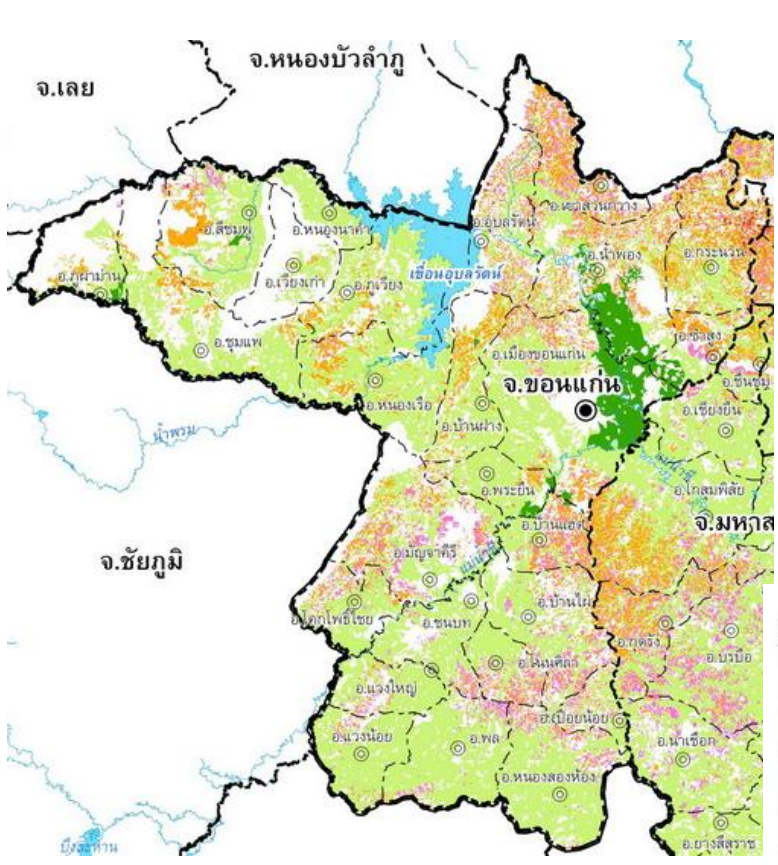
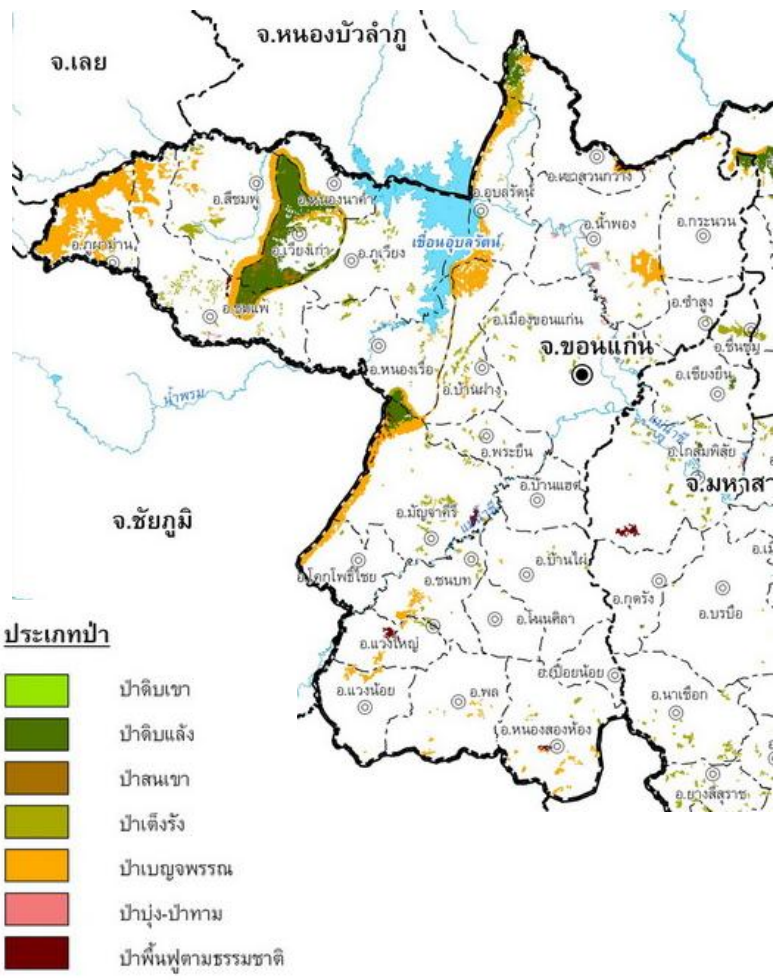
# Emission CO<sub>2</sub>-e- Energy Sector

## Household/ Commercial/ Governmental activities



Ave. 959 kCO<sub>2</sub>-e / household  
 Ave. 17,420 kCO<sub>2</sub>-e/ commerce  
 Ave. 28,637 kCO<sub>2</sub>-e/government

# Land used in Khon-kaen



# Removal CO<sub>2</sub>-Forestry

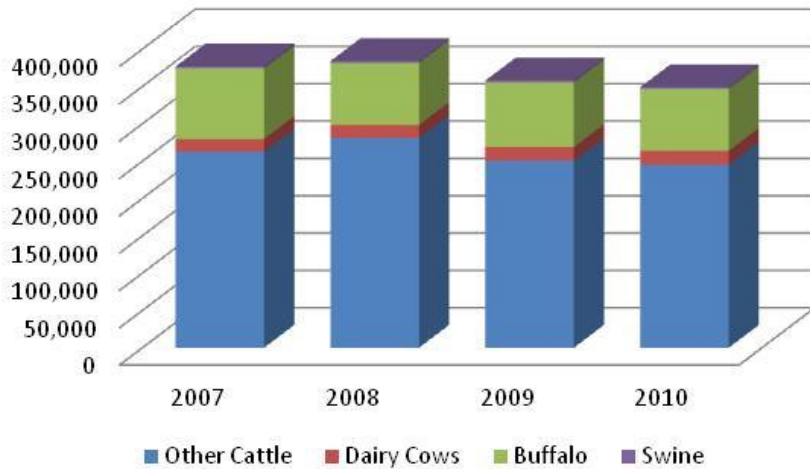
## Annual increase in biomass stocks due to biomass growth

Year	Forest Area (ha)	Annual increase in biomass	Annual increase in biomass
		stocks due to biomass growth (tons C/year)	stocks due to biomass growth ( tons CO <sub>2</sub> /year)
2009	128,736	604,091	2,215,001
2008	128,736	604,091	2,215,001
2007	96,698	453,754	1,663,764
2006	123,110	577,692	2,118,202
2005	123,110	577,692	2,118,202
2004	123,110	577,692	2,118,202
2003	125,380	588,343	2,157,258
2002	125,380	588,343	2,157,258
2001	118,234	554,813	2,034,313
2000	125,380	588,343	2,157,258

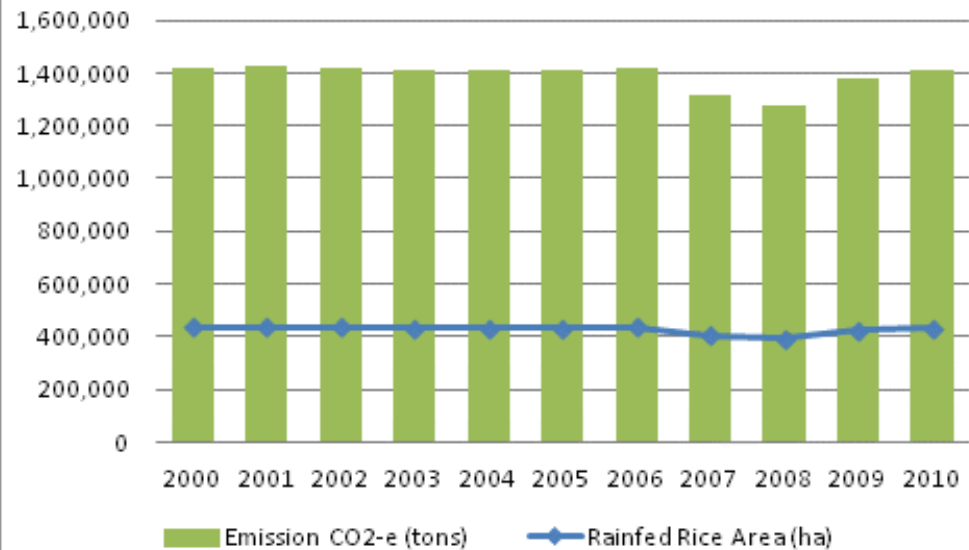


# Agriculture

Tonnes CO<sub>2</sub>e from livestock: enteric fermentation



Tonnes CO<sub>2</sub> e Emission from rice field



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Forest fire area (ha)</b>											
	1,197	825	1,152	248	670	1,270	529	758	412	385	174
<b>Emission from forest fire (tons)</b>											
<b>CH<sub>4</sub></b>	27.35	18.85	26.32	5.6	15.3	29.01	12.09	17.3	9.4	8.8	3.9
<b>CO</b>	418.28	288.2	402.5	86.9	234.1	443.6	184.9	265.0	144.0	134.68	60.8
<b>N<sub>2</sub>O</b>	0.80	0.55	0.77	0.1	0.4	0.8	0.3	0.5	0.2	0.26	0.1
<b>NO<sub>x</sub></b>	6.4	4.43	6.1	1.3	3.6	6.8	2.8	4.0	2.2	2.0	0.9
<b>CO<sub>2</sub>-e</b>	877.0	604.05	844.0	183.5	491.6	930.7	389.6	556.6	303.4	283.2	128.7

## Emission of non-CO<sub>2</sub> – Forest Fires

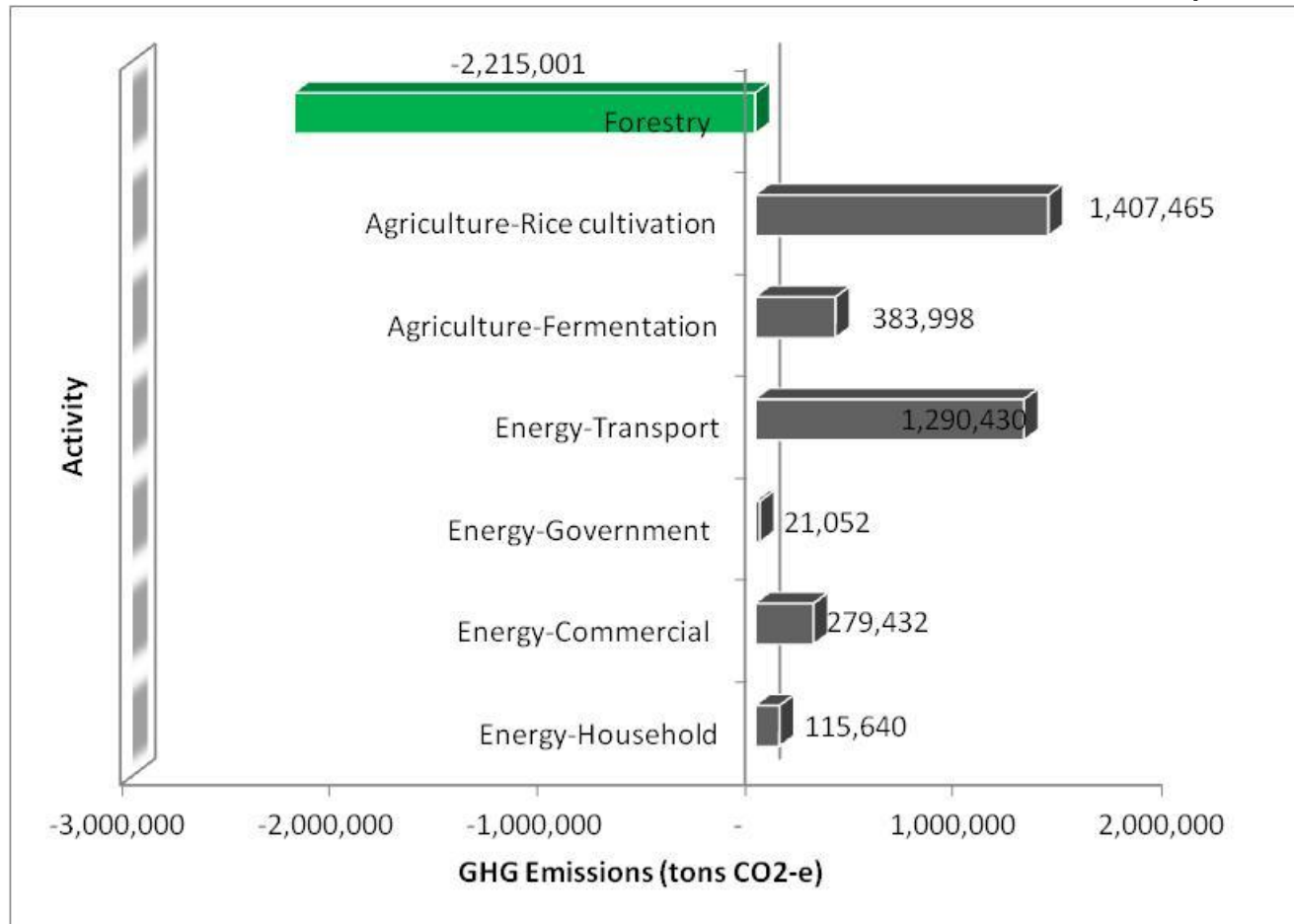
	2004	2005	2006	2007	2008
<b>Burned Area (ha)</b>					
- Sugarcane	35,520	39,440	34,240	35,040	42,640
- Rice	216,821	216,608	217,644	202,215	196,576
<b>Emission from biomass burning (tons)</b>					
CH <sub>4</sub>	7,176	7,272	7,167	6,742	6,778
CO	244,519	247,784	244,194	229,743	230,937
N <sub>2</sub> O	186	189	186	175	176
NO <sub>x</sub>	6,645	6,733	6,636	6,243	6,275
CO <sub>2</sub> -e	222,725	225,699	222,429	209,266	210,354

## Emission of non-CO<sub>2</sub> – Agricultural burning

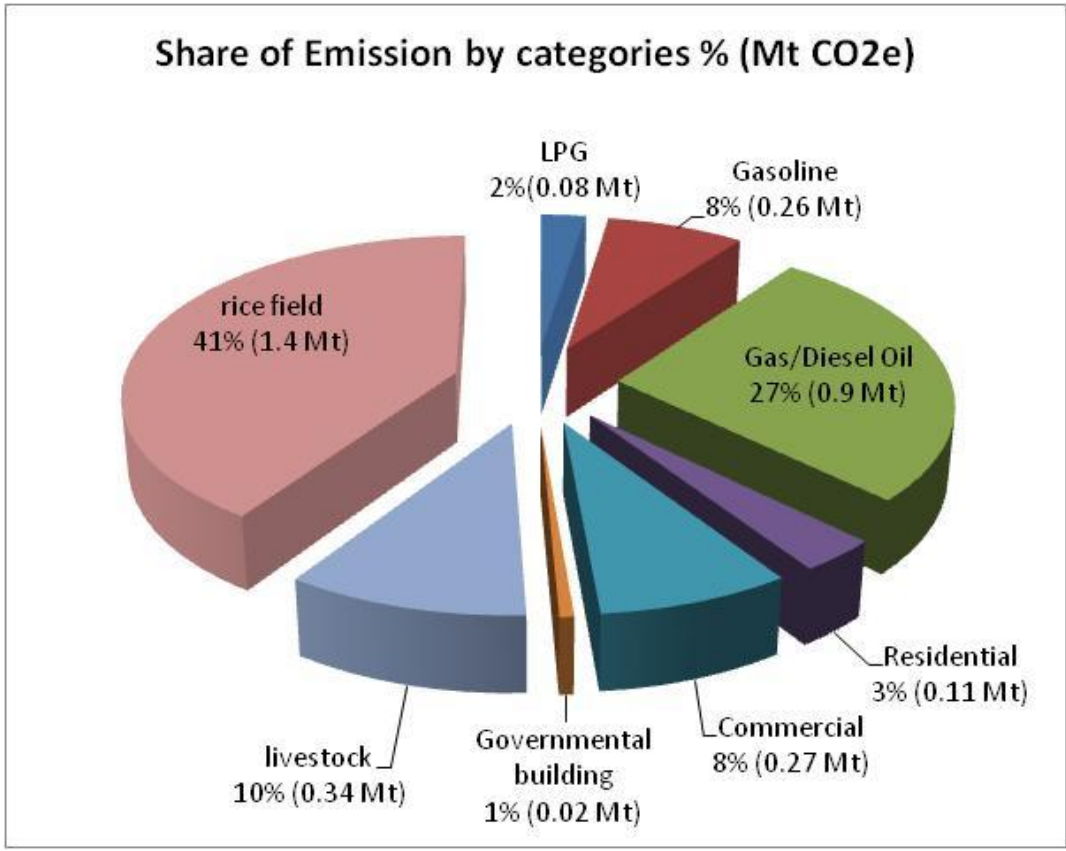
# GHG Emission/Removal Key Category Analysis, 2008

Total source 3.46 Mt CO<sub>2eq</sub> (excluded industrial sector)

Total sink -2.21 Mt CO<sub>2eq</sub>



# GHG Emission/Removal from each Sector in 2008



Total GHG emission 3.46 Mt CO<sub>2</sub>-e

Total GHG removal – 2.22 Mt CO<sub>2</sub>-e

# Khon Kaen's Strategic Plan for Emission Mitigation Proposed in the Provincial Development Plan 2011-2014

## **Strategy 1 Competitive and Sustainable Economic Development**

### **Strategy 1.1 : Developing Agriculture To Become the Center of Economic Agriculture of the Region**

- Strengthening the “Good Agricultural Practice” for Crop Production → **Mitigation in Agricultural Sector**
- Increasing the Yield/ha while Decreasing the Cost/ha for Cassava Production to Increase the Feedstock for Biofuel Production → **Mitigation in Energy and Agricultural Sectors**
- Development of Biofuel Industry (Bio-Ethanol) Infrastructure → **Mitigation in Energy Sector**
- Promotion of Eucalyptus Plantation to Support Paper Industry → **Enhancement of Removal by LU**

### **Strategy 1.2 : Development of Industries Based on the Unique Characteristics of Khon-Kaen's Land**

- Focusing on the Use of Locally Produced Economic Crops and Feedstocks → **Mitigation in Transportation Sector**
- Focusing on Becoming the Center of Bio-Ethanol Production and Increasing the Production Capacity of Bio-Ethanol → **Mitigation in Transportation Sector**
- Enhancing the Energy Efficiency in Transportation Sector → **Mitigation in Transportation Sector**
- Enhancing the Energy Efficiency in Production Process Starting from Cassava Starch Industries → **Mitigation in Energy in Industry Sector**
- Zoning of Land for Cassava Plantation to Enable a Continuous Supply to Factories → **Mitigation in Energy and LU Sectors**

# Khon Kaen's Strategic Plan for Emission Mitigation Proposed in the Provincial Development Plan 2011-2014

## ***Strategy 1.3 : Development of Trade, Tourism, Services, and Infrastructure to Become the Center of the Region***

- Enhancing the Capacity of Rail Transportation by Constructing New Rail Routes → **Mitigation in Transportation Sector)**
- Establishing of Storage and Distribution Centers of Goods → **Mitigation in Transportation Sector**
- Development of Public Transport System and Reducing Number of Trips Using Personal Vehicles by Constructing BRT and Bike Ways → **Mitigation in Transportation Sector**

## **Strategy 3 : Natural Resource and Environment Management for Sustainable Development**

### ***Strategy 3.1 : Conservation and Rehabilitation of Soil Quality***

- Promotion of Organic Farming → **Enhancement of Removal by Cropland**

### ***Strategy 3.2 : Development of Water Reservoir to Increase Fresh Water Resource, of Water Distribution System, and of Efficient Water Quality Management System***

- Promotion of Wetlands Conservation → **Enhancement of Removal by LU**

# Khon Kaen's Strategic Plan for Emission Mitigation Proposed in the Provincial Development Plan 2011-2014

## **Strategy 3.3 : Conservation and Sustainable Rehabilitation of Forest Resource**

- Forest Conservation and Rehabilitation by Planting Trees on Abandoned Lands or by Developing Community Forests → **Enhancement of Removal by Forestry**
- Control and Increase the Area of Protected Forest → **Enhancement of Removal by Forestry**
- Strengthening of Control of Burned Areas by Forest Fires → **Reduction of Emissions from Forest Fires**

## **Strategy 3.4 : Natural Resource and Environment Management System Enabling to Support the Extension of the City**

- Enhancing the Efficiency and Quality of Livestock Production and Associate Manure Management → **Mitigation in Agricultural Sector**
- Development of Green Space → **Enhancement of Removal by Forestry**
- Promotion of Clean Technology in Industrial Production → **Mitigation in Industrial Sector**

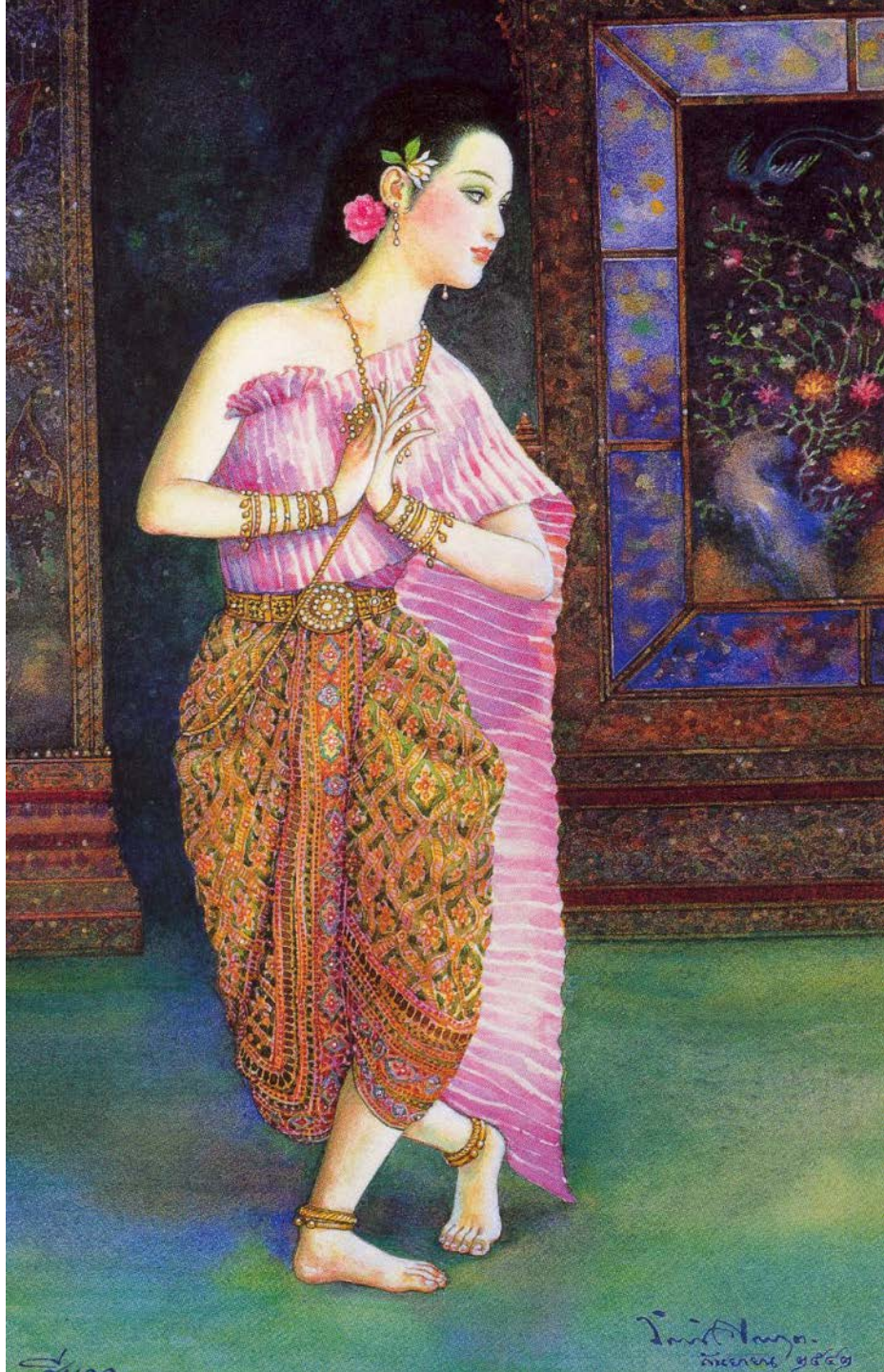
## **Strategy 3.5 Promotion of Renewable Energy Enabling Sustainable Energy Use**

- Development of Renewable Energy and Renewable Energy Resource to Assure Energy Security → **Mitigation in Energy Sector**

# Next Steps Forward

- To continue the inventory of Energy in Industry and Waste Sectors
- To perform emissions projections for BAU and CM scenarios using ExSS for Energy Sector, and IPCC+Econometrics for AFOLU and Waste Sectors
- To evaluate the effectiveness of the CM set based on Khon Kaen's Development Plan
- Use findings and lessons learnt to support Bangkok Metropolitan Administration in developing the BMA Master Plan on Climate Change Adaptation and Mitigation 2013-2023 funded by JICA





*Finally...  
Live Coolly with Strategy  
(LCS)*

*ขอบคุณค่ะ  
Khob Khun Kha*

*สวัสดีค่ะ  
Sawasdee Kha*