WORKSHOP ON LOW-CARBON DEVELOPMENT PLAN SCOPING-MEETING - SCIENTIFIC APPROACH TO LOW-CARBON DEVELOPMENT PLANNING IN CAMBODIA

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RESEARCH ACTIVITIES AT THE DEPARTMENT OF ENVIRONMENTAL SCIENCE, ROYAL UNIVERSITY OF PHNOM PENH

Kok Sothea

Lecturer Department of Environmental Science Royal University of Phnom Penh Email: kok.sothea@rupp.edu.kh

Agenda of the Talk

- 1. About the Department of Environmental Science (DES)
- 2. Existing Researches
- 3. Current Researches
- 4. Overview of researches which contribute to low carbon society
 - Assessment of Co-benefit on Air Quality and Climate Research
 - 2. Anaerobic Digestion of MSW
 - 3. Emission Inventory and Modeling for Urban Air Quality Management in Phnom Penh



1. About DES

- Officially established in 2001
- The first and leading institution to offer an undergraduate degree in Environmental Science.
- Program: (1) <u>Natural Resource</u> <u>Management</u> and (2) <u>Urban Pollution</u> <u>Environmental Studies.</u>
- Faculties: 18 (1 PhD, 5 pursuing PhD & 12 MSc./Mphil.)
- Facilities: Internal Library with more than 2500 books; water quality analysis laboratory
- Services: Lecturing, Researches, outreach training and consultations



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Key Statistics



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Snapshots of Lab Instruments and Library



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2. Selected Existing Researches

- Sustainable management on river bank erosion along the Mekong River
- Costs and Benefits Analysis of Small-Scale Jatropha curcas plantation in Cambodia
- The role of Phnom Penh Wetlands in Sustainably Treating Sewage Discharges to the Mekong & Bassac River System [published in Asian Journal of Water, Environment and Pollution]
- Low cost water treatment technologies at the poor community
- Emission Inventory and Modeling for Urban Air Quality Management in Phnom Penh [published in International Conference Proceeding]
- Anaerobic Digestion of Municipal Solid Waste in thermophilic Continuous Operation [publishing in international Conference Proceeding]



3. Selected Current Researches at DES

- Assessment of co-benefits on air quality and climate resulted from various control strategies in Southeast Asia
- Groundwater Quality Verification for Construction of Arsenic Treatment Technology in Prey Veng Province, Cambodia
- A Dynamic Modeling Approach as a Decision-making Tool to Assess Hydrologic and Water Quality Pressures on Natural Wetlands Treatment of Wastewater in Phnom Penh, Cambodia, under Urban Development and Climate Change Scenarios
- Identification of Reduced Emission from Degradation and Deforestation (REDD) Mechanism Potential and Variation in Wood fuel Demand in the Chamriey Mountain Area, Cambodia

4.1 Assessment of Co-benefit on Air Quality and Climate

Partners:

- Asian Institute of Technology, Thailand
- Laboratoire des science du climate et de l' environment (LSCE), France
- Institute de combustion, Aerothermque, Reactivete et environment (ICARE), France
- Royal University of Phnom Penh, Cambodia
- Duration:
 - > 2 years (2011-2012)



Why this research?

- The co-benefits of control strategies have been specifically emphasized in COP15 (Pachauri, 2009)
 - Lower levels of air pollution and associated health benefit
 - Higher energy security
 - Larger employment and stable agricultural production
 - Greater food security
- Lack of co-benefit study in the region
- Lack of report on emission projection for the region which realistically reflect the real economical development and regional climate modeling study which takes into account the cobenefit consideration

Research Objectives

- To prepare the emission inventory for SEA with suitable spatial and temporal resolution for regional climate-air quality model applications
- To development emission project of key pollutants under various realistic economic, demographic and technological scenarios
- To assess and quantify the co-benefit of the emission scenarios on air quality and climate for major categories
- To enhance capacity building for SEA region in Pollutants: SO₂, NOx, NH₃, NMVOC, BC, OC, CO, CO₂ and CH₄

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Study Area



 9 ASEAN countries

- 3 provinces in Southern part of china
- Grid Resolution
 [204x0.25 deg;
 160x0.25 deg]
- Cambodia case will be used for the validation purpose



4.2 Anaerobic Digestion of MSW

This research aims at assessing the effectiveness of the AD method as the pretreatment technology of OFMSW prior to landfill using different detention times in a pilot scale reactor in a continuous mode of operation.

- Experimental Site: Asian Institute of Technology
- Feeding Waste: Organic fraction of MSW, cow dung and sludge



Feedstock Characteristics and Results

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Parameters	Value	Parameters (mg/kg TS)	Value	
Moisture content (MC) (%WW)	88-91	Cadmium (Cd)	0.3	
Total solid (TS) (%WW)	9-12	Lead (Pb)	Not Detectable	
Volatile solid (VS) (%TS)	82.3-83.7	Zinc (Zn)	72.2	
Fixed solid (FS) (%TS)	17.7-16.3	Copper (Cu)	15.3	
N (% DM)	3.0	Chromium (Cr)	7.3	
P (% DM)	0.2	Nickel (Ni)	4.1	
K (% DM)	0.2	Manganese (Mn)	88.1	
C (%)	45.7	Mercury (Hg)	0.04	
C/N	15.0			





Key Conclusions

- In Loading 1, Methane production rate is 140.35 L/Kg VS meanwhile 62.55 CH₄ L/kg VS from the loading 2
- VS degradation of 51% was in loading 1 operation compares to 43.22% in loading 2.
- \blacktriangleright Colorific value of digestate is 11.15 MJ/Kg \rightarrow potential to be used as RDF
- Energy surplus from the system is 67%.

4.3 Emission Inventory & Modeling for UAQM in Phnom Penh

- Develop an emission inventory for air pollution in Phnom Penh city and to assess the air pollution load from different source types
- Apply a modeling system [Dispersion Model] to produce the overall picture of air quality in the city
- Propose measures for improvement

on AQM for the city [Generate options and apply model]

Pollutants: SO_x, NOx, VOC, PM, CO



Research Framework



Emission Contribution by Sources



Emission Loads Under Proposed Scenarios



■ BAU ■ Bio-diesel ■ CNG Bus & Minibus ■ MTS

The MTS option shows a satisfactory reduction of the concerned pollutants



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Maximum CO Concentration under Various Scenarios





Thank You for Your Attention!

