Vietnam Academy of Science & Technology
INPC – Department of Natural Resource and Environment protection

Case study on Technology transfer and Technical capacity building in resource utilization - GHG mitigation in Vietnam

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VAST -18 Hoang Quoc Viet – Hà Nội

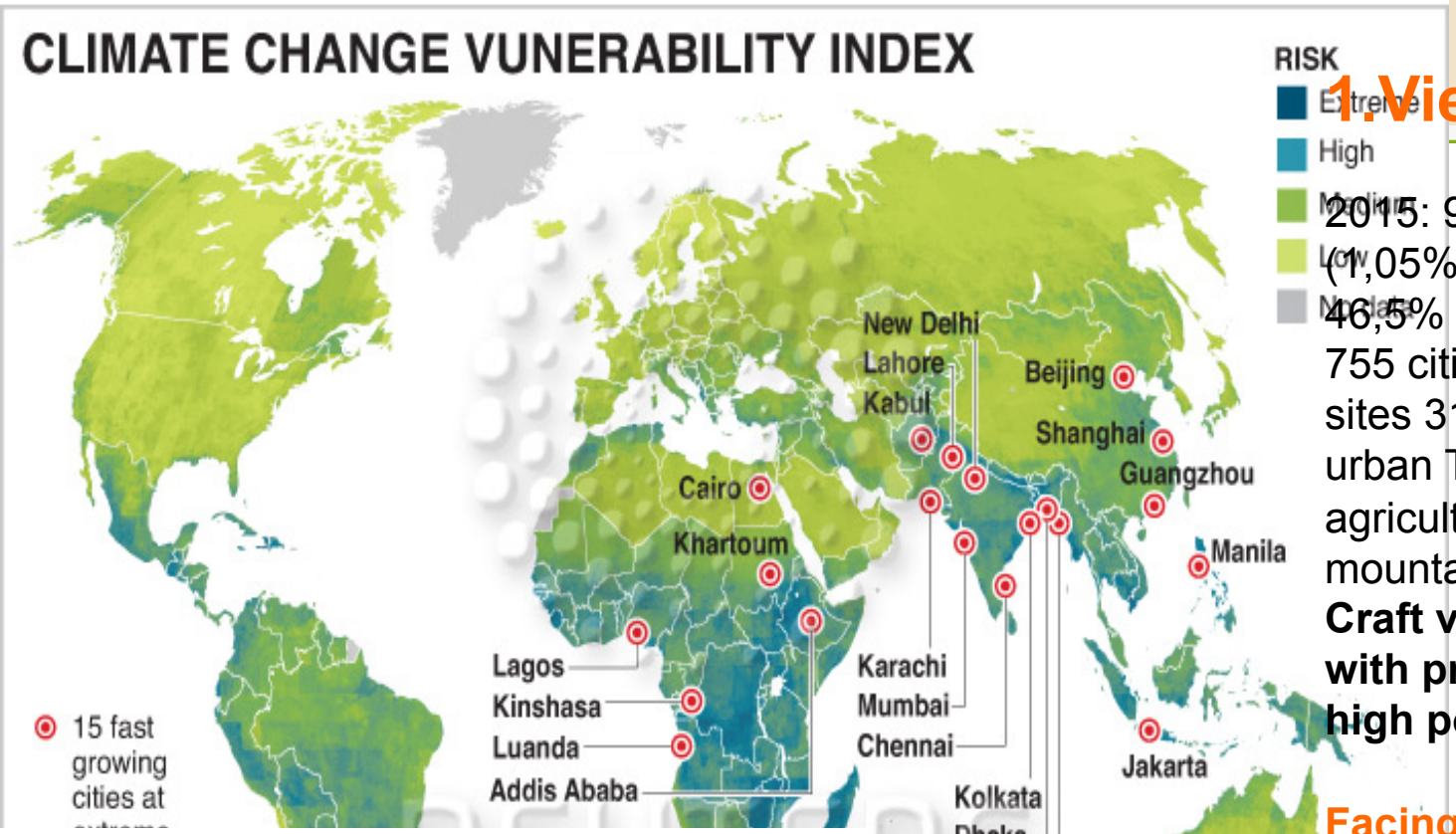
CONTENTS

1. CC adaptation-mitigation - Technology Transfer need
2. TT in Resource utilization and learning from Case studies
3. Barries – challenge - opportunities

I. Self introduction

Name : Ngo Kim Chi, Ass. Prof. MBA
Year of graduation:1985 Chemical engineer
Advanced education : MBA 1999, PhD (2001)
Working office : R.801,802, INPC – VAST
Position: Head of Department on Natural Resource Processing and Environmental Protection -VAST
Main results (2003-2016) : Waste water, solid waste treatment, Biomass conversion, integrated waste management
Biomass Waste Potential Studies
Biological, Thermochemical & Chemical Conversion to biofuels/resources, Biomass Testing
Biomass Management-Energy-GHG Reduction

1.Vietnam & CC



2015: 92 million (1,05%-1,15%/year)
46,5% urban citizen
755 cities, 232 Industrial sites 31.061/325.360km2 - urban The rest land – agriculture, forestry, mountainous area
Craft villages : 1450 living with processing job in high population areas.

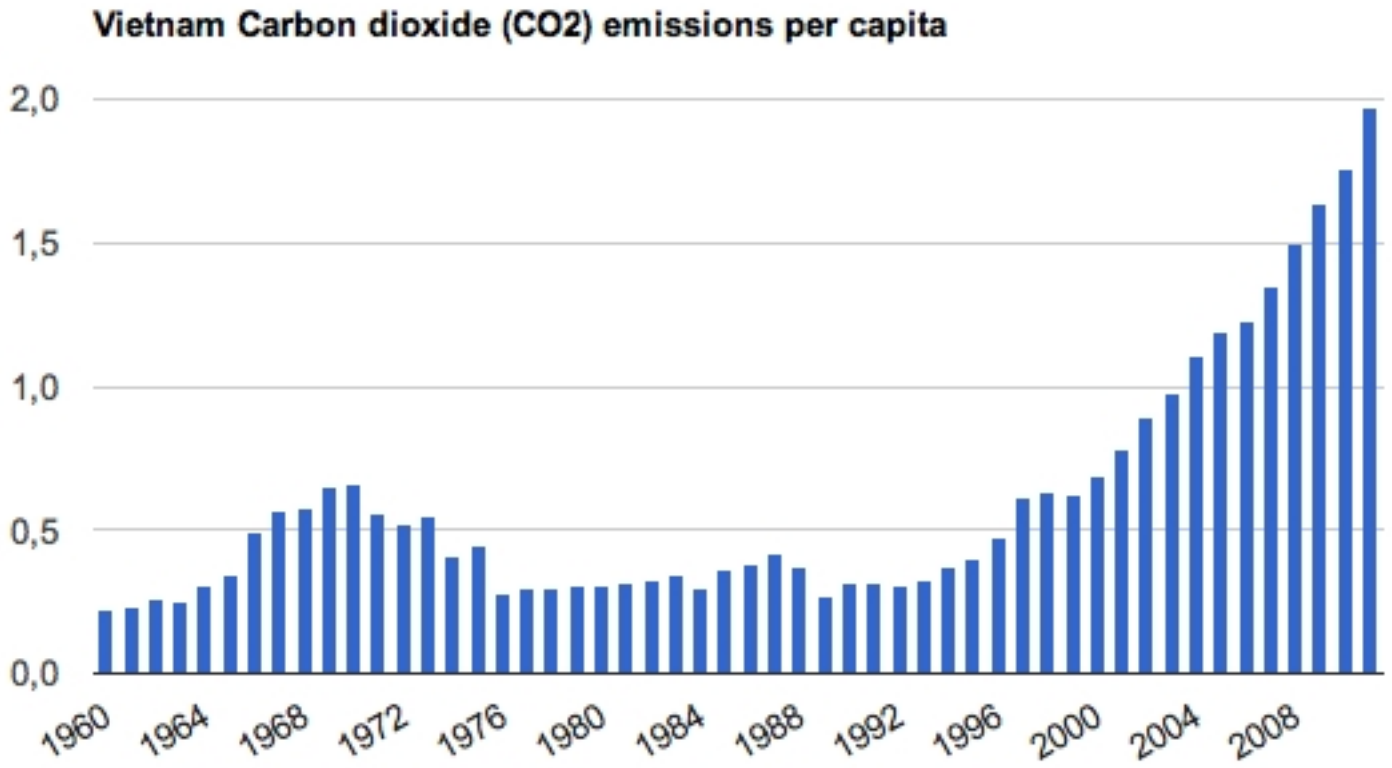
Facing with CC:
+ SLR, T, extremely whether
Poor peoples in fast growing cities, sanitation - health
+Water security for urban, for irrigation, water supply for other sectors, need water recycling, water pollution control
+ Big energy demand

South Asia

Việt Nam

SLR Scenario: 100 cm

Vietnam: GHG emission



Source: TheGlobalEconomy.com, The World Bank

- Waste, waste water accounted for 5,3% of GHG emission - Role of solid, liquid waste prevention
- Resource utilization for CC adaptation and Mitigation

Ngo Kim Chi, Kobe Japan 6-7 December, 2016

1. Vietnam: CC

Threats

- Water resource: Flooding
  - Sea level rise (saltwater intrusion)
  - Storm surge (typhoons)
  - Precipitation (surface and riverine), water borne diseases
- Water resource: Drought
  - Water and food security
- Water pollution – sanitation
- Waste (water, solid)– GHG emission – resource lacking
- Energy lacking
- Heat shock – air pollution – diseases

Constraints

- Population growth
- Past building locations
- Ageing infrastructure
- Economic incentives
- Resource limitation/ energy shortage

Need technology transfer on non building/building measurements

2. Tech. transfer on resource utilization

1. Technology transfer (TT): *process of bringing technologies to the marketplace. In VN: Institutions accomplished through licensing intellectual property (IP) to companies (that have the resources and desire to develop and produce the outputs of technology for users) and receive payments.*
2. Role of TT & Science –Technology – R-D: Priority in National strategy on Socio-Economic Development to 2020
3. Legal framework for TT
4. Technical guideline and technical models
5. Technical capability building (HR, tools)
6. Taxes free for TTs, training and tech. capacity building and special budget line for Technology Transfer
7. M & E in Technical transfer
8. Creating chain for TT
9. Action plan and priority in Technology Transfer in key Governmental Program 2016-2020 and vision to 2025.

2. Case study on TT in Resource utilisation for GHG mitigatio

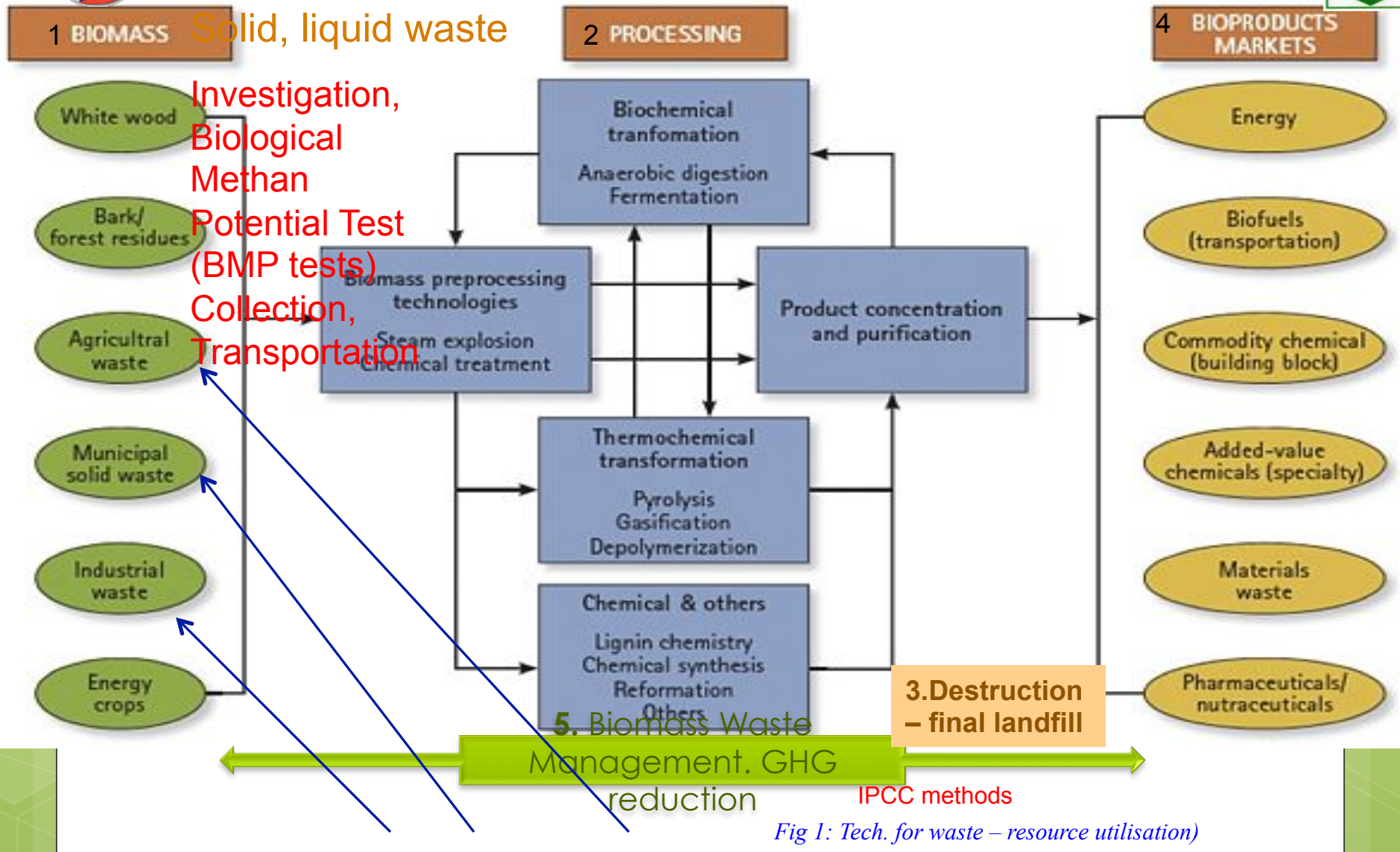


Fig 1: Tech. for waste – resource utilisation)

Solid Liquid Waste (IW, MSW, AgW) –resource utilisation–GHG link

2. Technology transfer in Resource utilization

a. *Water resource protection-utilization*

Case study on: Water resource protection and PCM in VN before 2010 and 2011-2015

Objectives/main activities: 1. Water monitoring in key areas 2. Capacity building 3. WWT Technology demo - Organo technology 4. Technology transfer (imported and locally made) 5. Dissemination

Main Outputs:

1. **Technique on Water pollution monitoring**

2 **Technique on Waste generation rate and characteristics, collection, transportation**

3 **How to reduce waste water, solid waste (biomass), treat/ convert for energy recovery**

4. **Technology demonstration (waste water treatment plant installed in Trang An Co, technology demonstration in Minh Duong Co.)**

5. **Learning from capacity building and technology transfer**

2. Best practices with Trang An Demo and Disseminate

WWT technology demonstration 100m3/day, at Trang An Co. 2002

2016

2. Best practices with Minh Dương Demo and expand

Case study: WWT – biogas energy – fertiliser

a.Objectives: Biomass: water hyacinth, cassava residues, organic MSW, vegetable waste, pig, cow manure, high organic WW

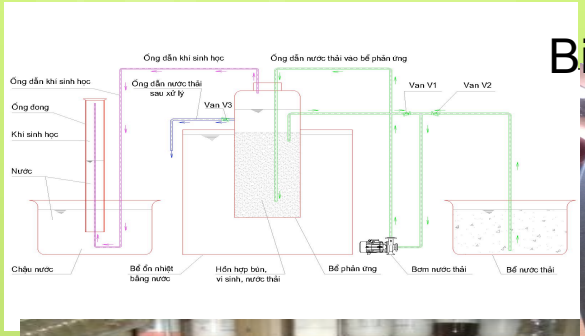
b. Experiment studies

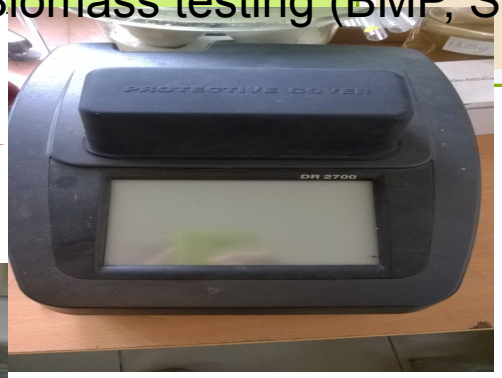
- Biomass composition analysis (by ASTM on C,H,O,N,S, heat value, other metal by ICP and standard methods)
- BMP test (ml CH4/kgVS) of biomass (pretreated lignocellulosic biomass)
- Kinetic studies and SMA assessment (VS/1gVS/day)
- Lab scale AD by batch studies

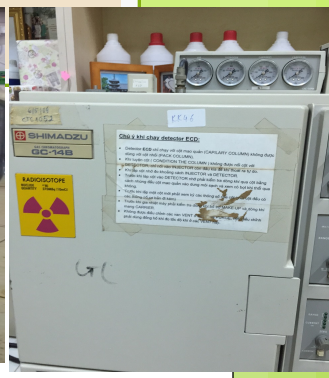
c. Tech demo: Pilot scale 12m3 of ADigestion (NEDO support) and pilot syngas system (20kg rice husk /batch – INPC testing design)

Biogas - DO dual generator (Kobuta engine); Syngas – DO dual generator (Kobuta engine); fuel comsuption & emission?

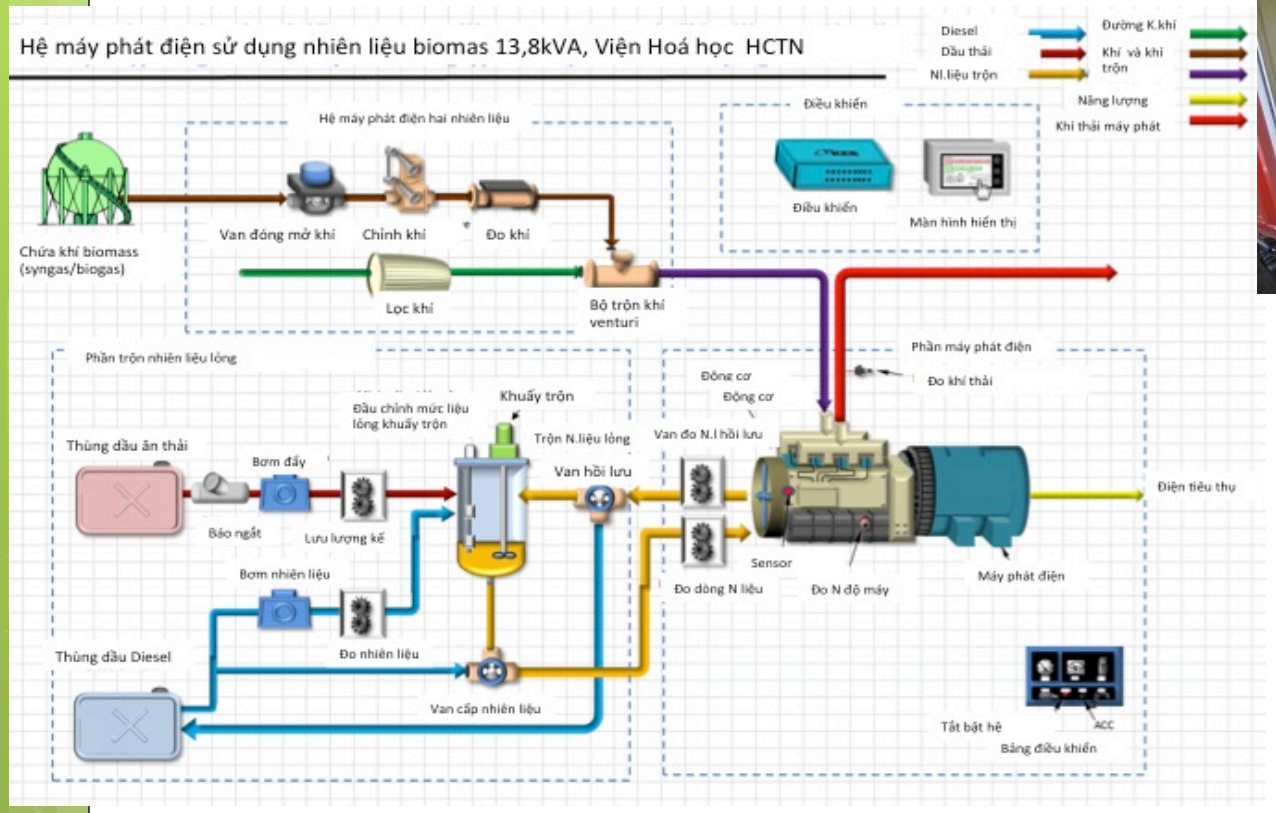
Biomass testing (BMP, SMA, gas composition)







. Biomass gas use testing in Dual fuel generators: test Biogas –DO; syngas (rice husk – DO)



2. Case study: Biomass waste to energy for enterprises

[6] Scientific Research & Cooperation in small scale Waste Water Treatment suitable for Craft Village in Vietnam, INPC & Kansai with NEDO-Japan support, 2011-2012

[7]N. K. Chi. Giảm phát thải khí metan trong thay đổi phương thức quản lý phân và xử lý dịch thải sau biogas. Tạp chí KH và CN. ***50 (1), 89-96, 2012***

[8]N.K.Chi.Khảo sát phát sinh, quản lý chất thải chăn nuôi. Tạp chí Môi trường-Sức khoẻ - ISSN 1859-0292. ***Số 24 (122), 15-17, 2009***

[9].Ngo Kim Chi et al. Tính toán giảm phát thải khí mêtan của hộ chăn nuôi quy mô nhỏ bằng phương pháp AMSIIIR. Tạp chí Khoa học Công nghệ. ISSN 0866 708X. ***Số 48(4A), 416-422, 2010***

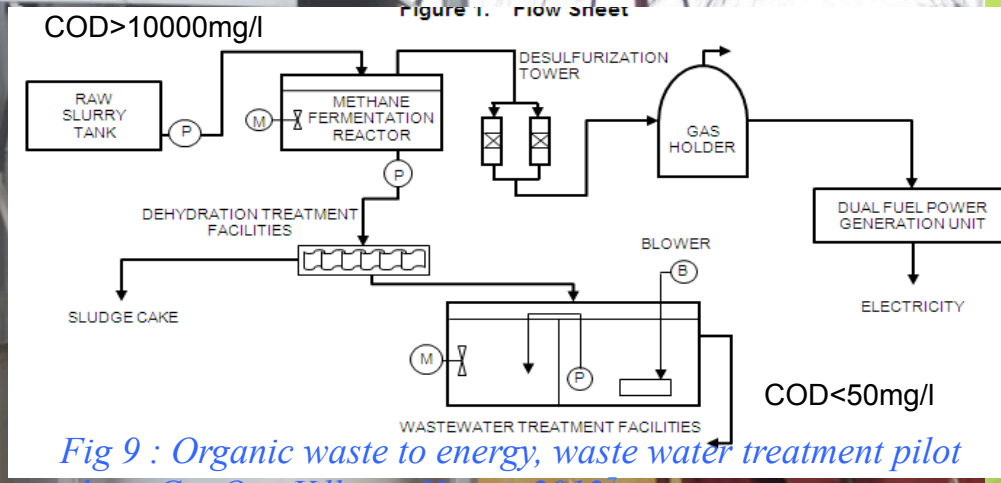


Fig 9 : Organic waste to energy, waste water treatment pilot plant, Cat Que Village- Hanoi, 2012[7]

Comparative study of methane production yield from domestic organic solid waste digestion and lignocellulosic biomass

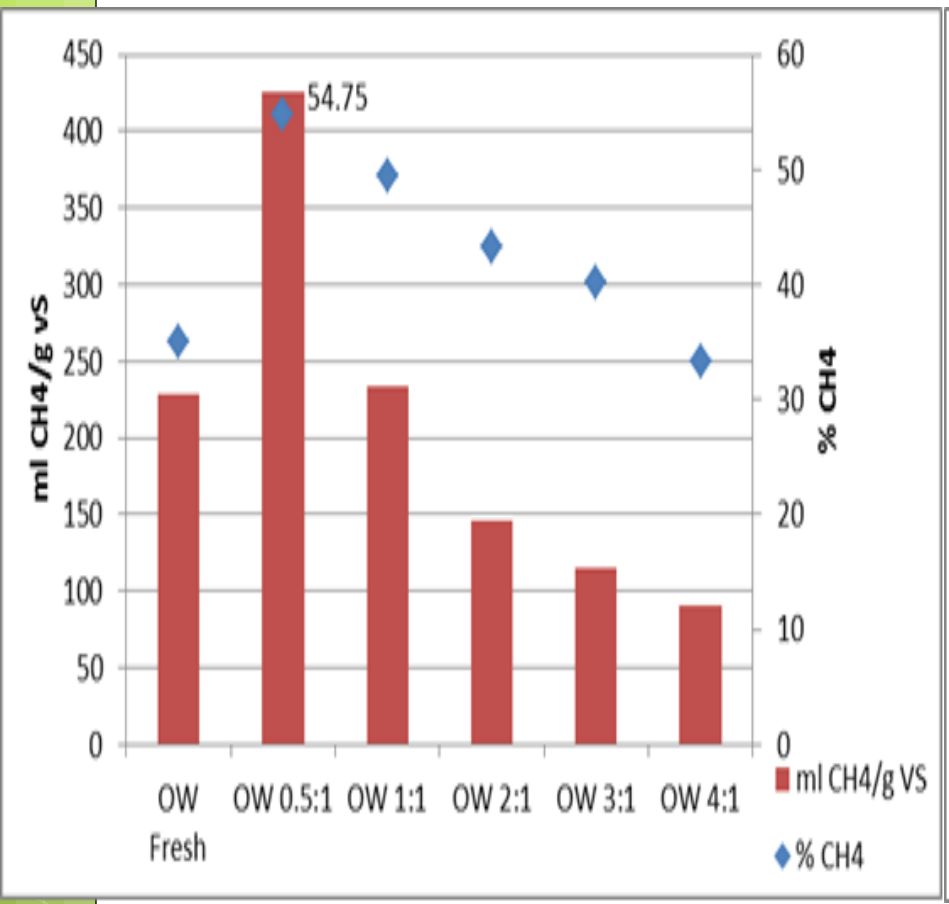


Fig . Methane production yield from organic waste with pig manure

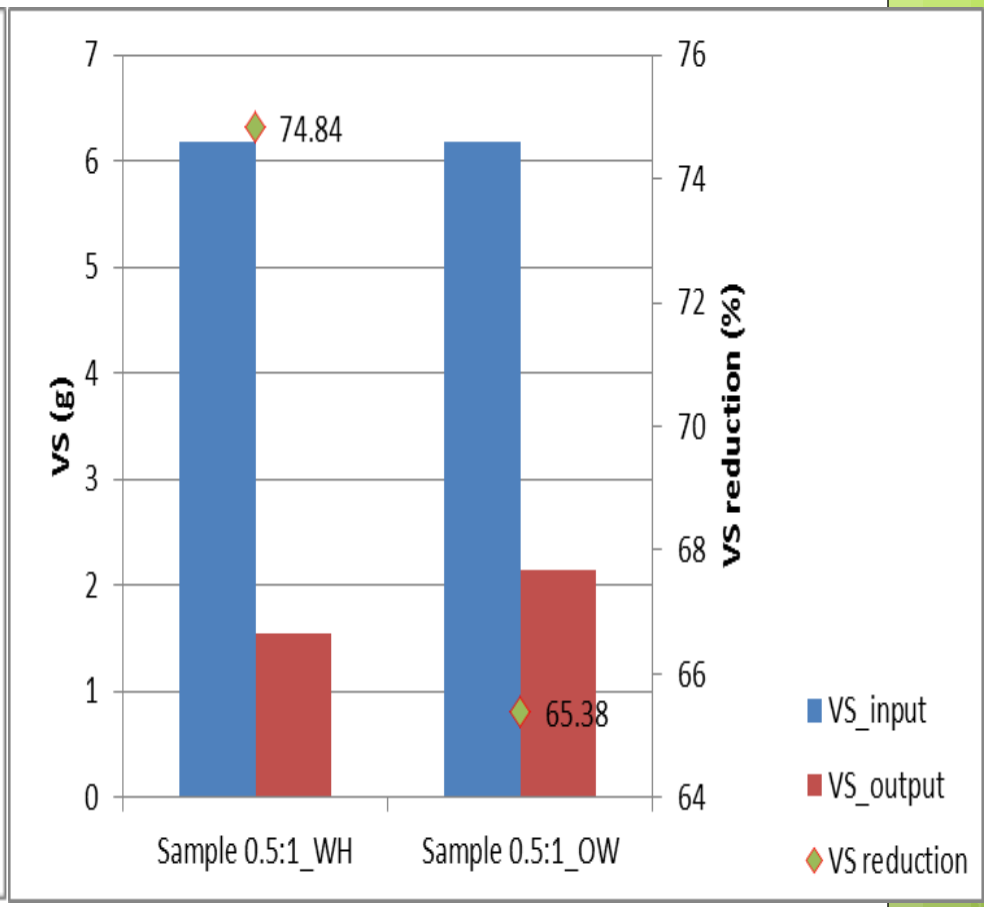


Fig . Solid substance removal efficiency of organic waste+ hyacinth

2 Slurry –energy at small scale and disseminate

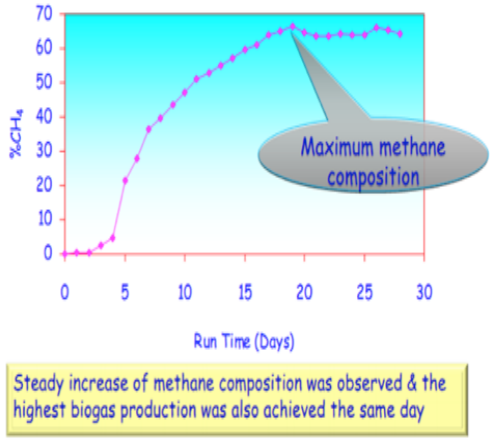
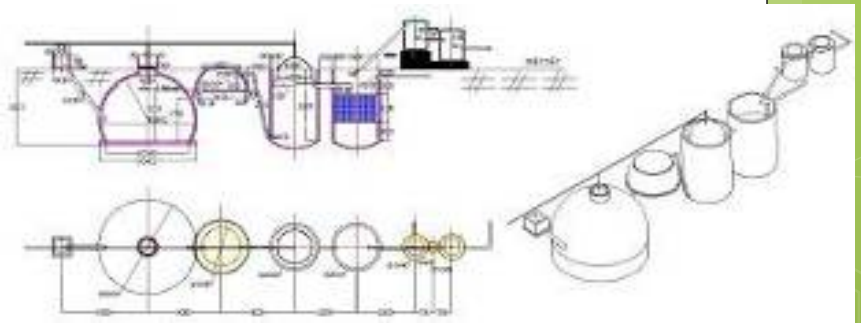


Fig : Low cost organic waste to energy and WWT in lab and Nguyet Duc Village, Vinh Phuc province

1. Finding key factors impact to Biogas: pH, VFA, T-NH4, Alkalinity, TS, VS.
- Role of removing solid or solid separation
- Membrane Biological Reactor.
2. Anearobic digestion reduce >75% COD. With MBR, final efluent meets environmental requirement
3. Development lab scale to meet enterprise scale
4. Normal digester reduces 0.315tCO2e/animal/year, upgraded system (with solid separation/MBR achieved 0.476 tCO2e/animal/year & sanitation improvement

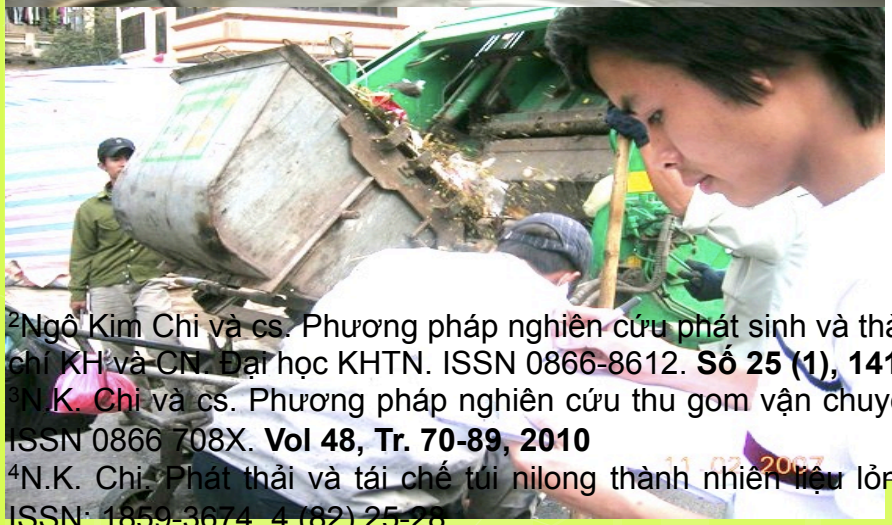


[5]VAST R-D project: "Treatment of organic waste and application of carbon credit in environ. protection in Yen Lac – Vinh Phuc",2009

2.Biomass studies – capacity building : Categories, Collection, Transportation studies and primary test

Sampling, composition analysis

INPC BMP testing



- Biomass waste BMP test results: 177-420 l CH4/ kgVS (water hyacinth, vegetable waste, MSW, cassava residues)
- Methodology developments on Biomass waste generation rate and composition assessment (lignin, cellulose, hemicellulose)
- Methodology developments of biomass waste collection, transportation to evaluate MSWM efficiency and create biomass waste data.
- Method for testing Biogas – DO; syngas – DO at Kobuta dual engine generator - NEDO-INPC 2013

[2]Ngô Kim Chi và cs. Phương pháp nghiên cứu phát sinh và thành phần chất thải rắn. Nghiên cứu tại 6 địa điểm của Hà Nội. Tạp chí KH và CN. Đại học KHTN. ISSN 0866-8612. **Số 25 (1), 141-151, 2009**

[3]N.K. Chi và cs. Phương pháp nghiên cứu thu gom vận chuyển rác. Nghiên cứu tại 6 địa bàn của Hà Nội. Tạp chí KH và CN, ISSN 0866 708X. **Vol 48, Tr. 70-89, 2010**

[4]N.K. Chi. Phát thải và tái chế túi nilong thành nhiên liệu lỏng-Nghiên cứu tại Hà Nội (2013). **Môi trường đô thị Việt Nam** ISSN: 1859-3674, 4 (82) 25-28

2. Biogrease/Biodiesel from Waste Cooking Oil with Van Dao Co.

Parameters	Waste cooking oil
Acid number (mg KOH/g)	25.5
Soap index (mg KOH/g)	251.98
Viscosity 40^0C (cSt)	45.88
M (g/mol)	743.25
Iodine index (mg/g)	63,45

Generation biodiesel production equipment

Biodiesel and biogrease

Waste cooking oil as raw biodiesel and bio greases

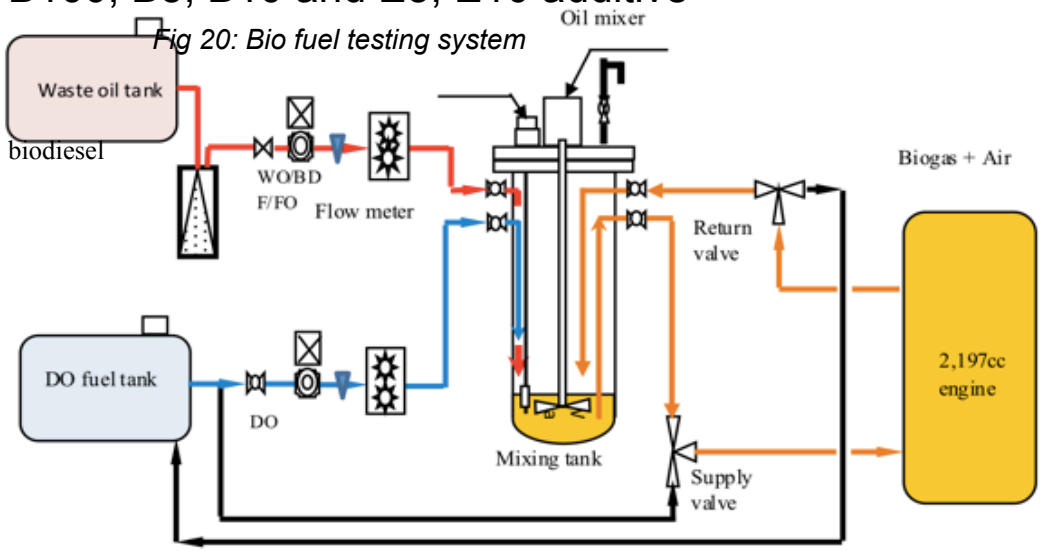
[15]Ngo Kim Chi et al., Biodiesel từ dầu ăn thải có trị số axit cao và etanol sử dụng xúc tác đồng thể. ***Tạp chí hóa học 50,2, 196-200,2012***

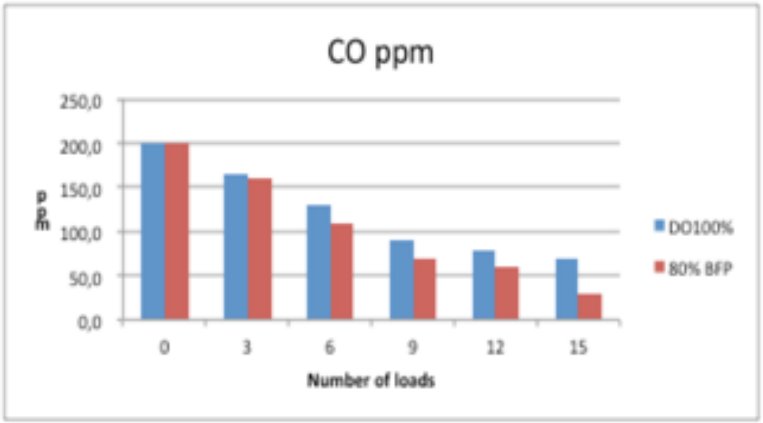
[15b]Ngo Kim Chi và cs. Comparative study on production of FAME and FAEE from waste cooking oil: perspective to use ethanol for biodies in Vietnam. ***Journal of Science & Technology, 49 (5), 735-742, 2011***

2. Biofuels: Case studies

Development of biofuel testing tools include B100, B5, B10 and E5, E10 additive

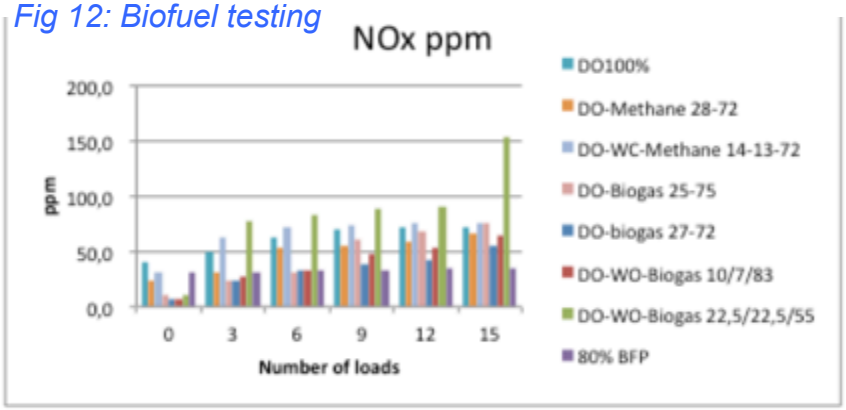
Fig 20: Bio fuel testing system



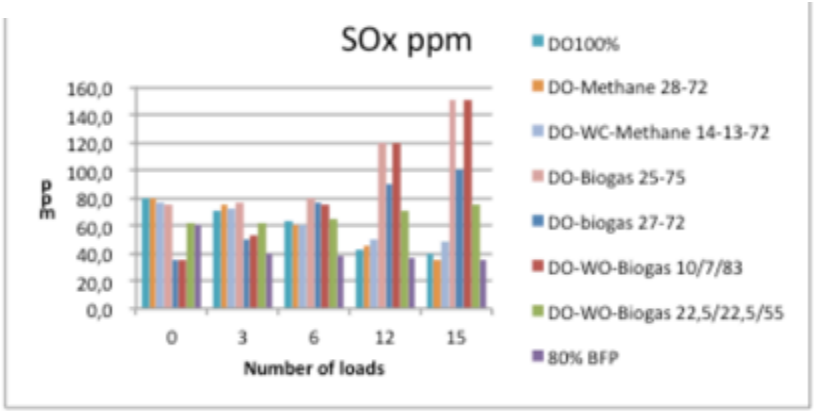


Đồ thị 3.9: Nồng độ CO trong khí thải

Fig 12: Biofuel testing



Đồ thị 3.7: Lượng NO_x trong khí thải



Đồ thị 3.8: Lượng SO_x trong khí thải

[17] N.K.Chi và cs. Thực trạng, giải pháp và tiềm năng sử dụng khí biogas cho động cơ máy phát điện. Tạp chí Môi trường. Số 9 năm 2013.

[18]Ngô Kim Chi và cs. Tổng hợp vật liệu ZrO2 pha tạp Vanadi và nghiên cứu khả năng xúc tác cho phản ứng tổng hợp biodiesel từ dầu ăn thải và etanol, Tạp chí Hóa học, tập T51 số 2AB, 287-291, 2013.

[19]N.K.Chi và cs. Biodiesel từ dầu ăn thải có trị số axit cao và etanol sử dụng xúc tác đồng thể. Tạp chí HH, ***50 (2)196-200, 2012***

[20]Ngô Kim Chi và cs. Comparative study on production of FAME and FAEE from waste cooking oil: perspective to use ethanol for biodiesel in Vietnam. Tạp chí Khoa học và Công nghệ. ISSN0866 708X. ***Số 49 (5B), 735-742 , 2011***

[21] N.K.Chi và cs. cứu so sánh sử dụng dầu DO, biogas, biodiesel, methan, dầu ăn thải làm nhiên liệu thay thế cho máy phát điên. TCHH, 2013

2. Technology transfer – capacity building for enterprises, managers, young scienctists

Biogas & WWT technology and training courses on water pollution control and human resource development

Cassava waste, wine production, livestock slaughter …

Waste – energy recovery soil conditioner

	Waste water input	Slurry	Waste to JKS	Output from JKS
COD (mg/l)	10000-40000	17000	2000	30 - 40
T-N (mg/l)	120	3000	353	20
T-P (mg/l)	95	1090	25	5
SS (mg/l)	8000 - 13000	21000	800	10

Waste

H2S removal

biogas

Digester

Slurry

Jokasou-

Decanter

Waste water To JKS

Output follow QCVN 40-2011/ BTNMT

Slurry Injection combined with the use of fertilizers for crops

Translate the following waste digesters used to improve soil quality and maintain the productivity of agricultural land as organic fertilizer

Heating

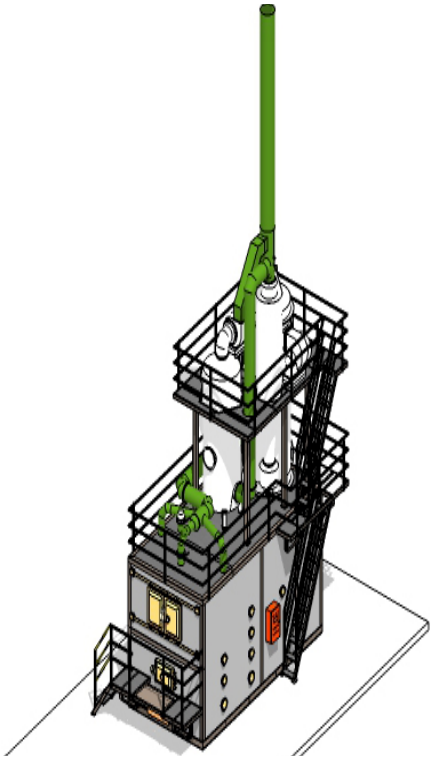
Electricity

Soil conditioner

Liquid fertiliser

INPC

2. Technology transfer: waste - energy



Gastification locally made

JP technology demo- WtE, Hanoi 2016

2. Case study: Existing – Potentials on RE from waste, biomass: Technology transfer needs

Table : Existing Renewable Energy MW, Data 2010 (EVN)			
Hydro power, MW	Biomass energy, MW	Solar, MW	Wind, MW
600	151	2	37,5

Table : Potential on Renewable energy MW, (EVN, 2015)				
Hydro power	Biomass energy	Solar	Wind	Geo heat
7000	150million ton/year; >44 million gasoline	2500 h 230-250kcal/m2	1800-9000	300

2010:
3,5%

2020:
4-6% (wind, biomass), 6,5% Hydro power

*The National Strategy on Energy development to 2020, vision to 2050 (issued 2007) with the target on RE only 5%min 2010 and 11% in 2030

* Recently, Government required on the New National Strategy on RE development to 2030, vision 2050 (8/2015) in which Stage program on development of RE has just launched in 8/2015 by required from Government in which the Program has the following targets:

Integrated with international RE policy

Clear analysis the technology solution and investment capital ??$/MW

Draft National objectives and Action plan on RE development

Develop the market and Planning and Promotion policy and Financial solution to facilitate the RE

Achievements: Sugar cane industry: 6/41(500MW) generated76,5 MW. Investment 715.000 USD/MW; 50 kWh/ton sugar cane (compare to 200KWh/ton by CHP technology)

INPC

Co benefice 2R, 3R in resource utilization for CC Adaptation – Mitigation

Landfill Gas Recovery Technology in Nam Sơn landfill – Hanoi city – first CDM project in MSWM of Vietnam -pending

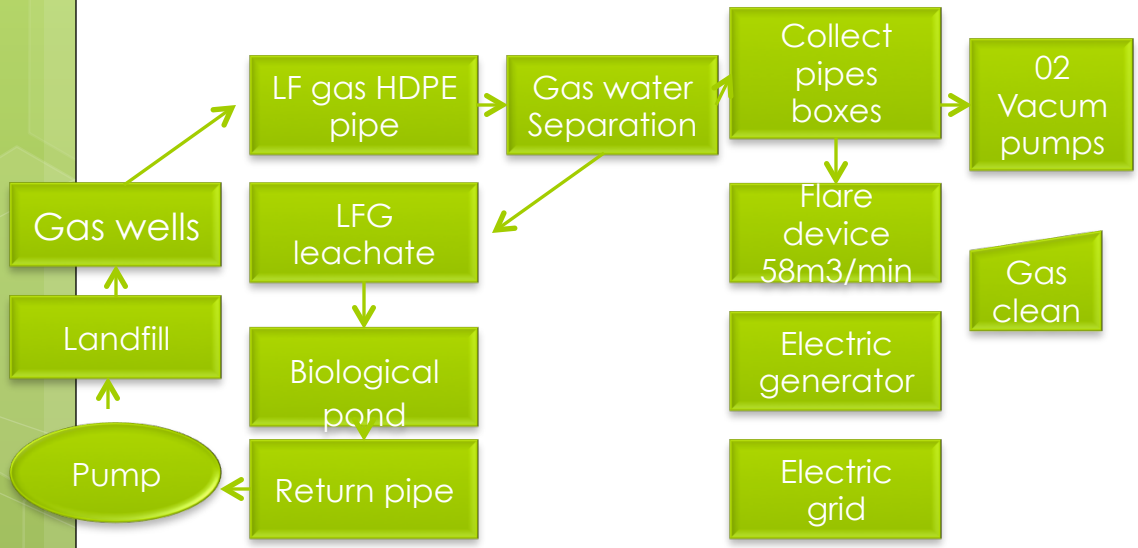


Fig: LF gas collection technical system Nam Sơn Hanoi Landfill, 2009[14]

Learning from case studies

Technical transfer + Capacity building

Waste prevention, control

Waste treatment models (JKS, Solid waste Composting?..)

WtE, Waste to Energy

[14]N.K. Chi. FS and EIA of the Project on LFG recovery at Nam Sơn – Hà Nội.

3. Lession from case studies

- Regulation and logistics on Technology transfer (technical standards, norm, guideline, promotion)
- Technology transfer link with tech. capacity building (HR and equipment)
- Technology demonstration to test best practice tech. , role of institution, private, government
- Competition in technology transfer (imported and locally made tech.)
- Role of R-D and scientists, 3 key cycle and IP
- Identifying barries, challenges, opportunities on maketing best technology/science products

Thanks for your listening

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