

Theme 7

Typical researches and applications on renewable energy

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Objectives

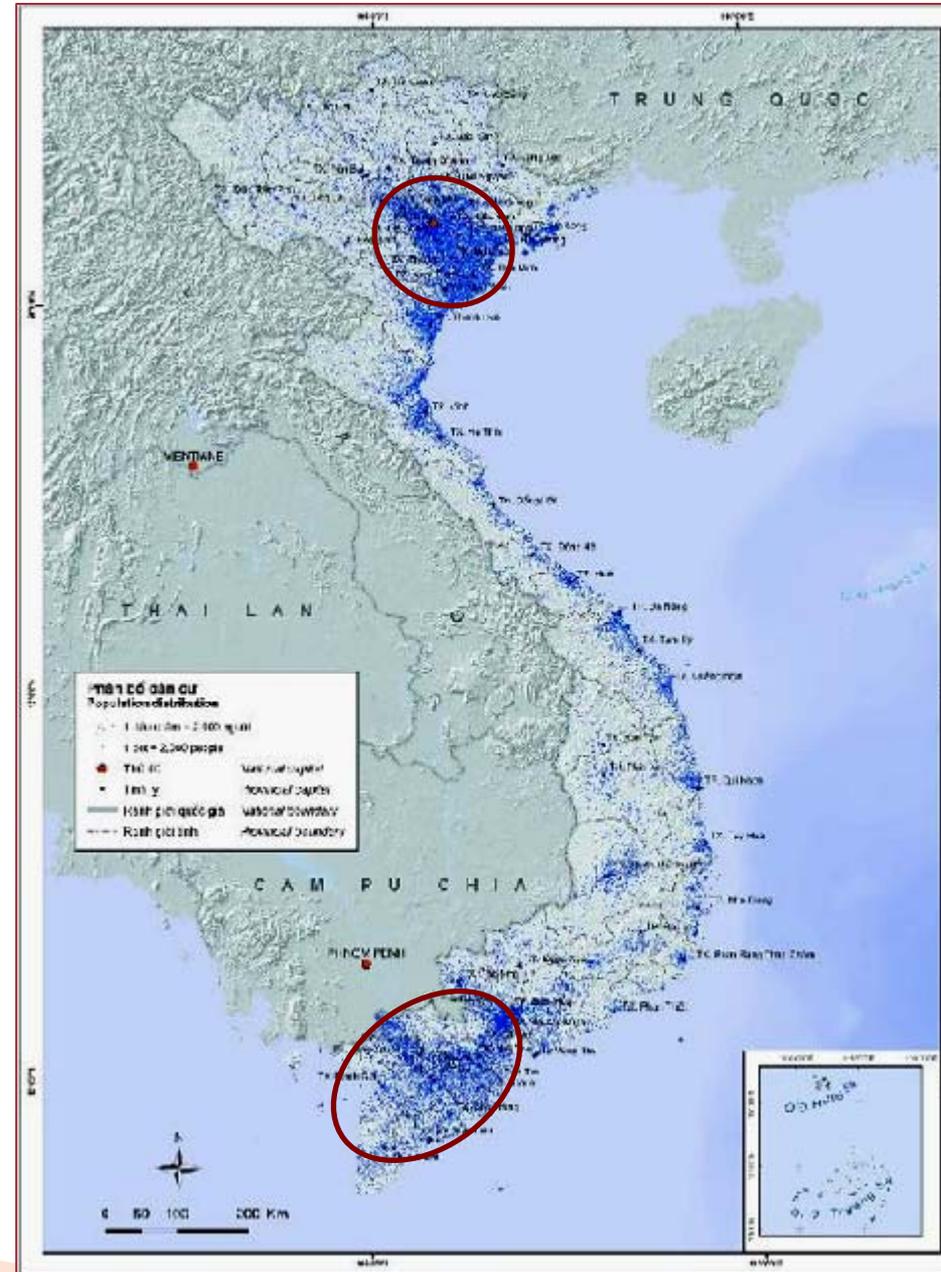
- ▶ **Provide information on typical researches and applications on renewable energy in Vietnam**
 - **Researches and applications on RE: Policy, technology, community participation, etc.**
 - **Experience lessons**
- ▶ **To improve knowledge on RE and their benefits for students**
- ▶ **To help students be able to work independently on RE - related fields**

Contents

- ▶ **The demand for RE in Vietnam**
- ▶ **Typical researches and applications on renewable energy and experience lessons**
- ▶ **Discussion on applicable model, RE deployment for Vietnam**

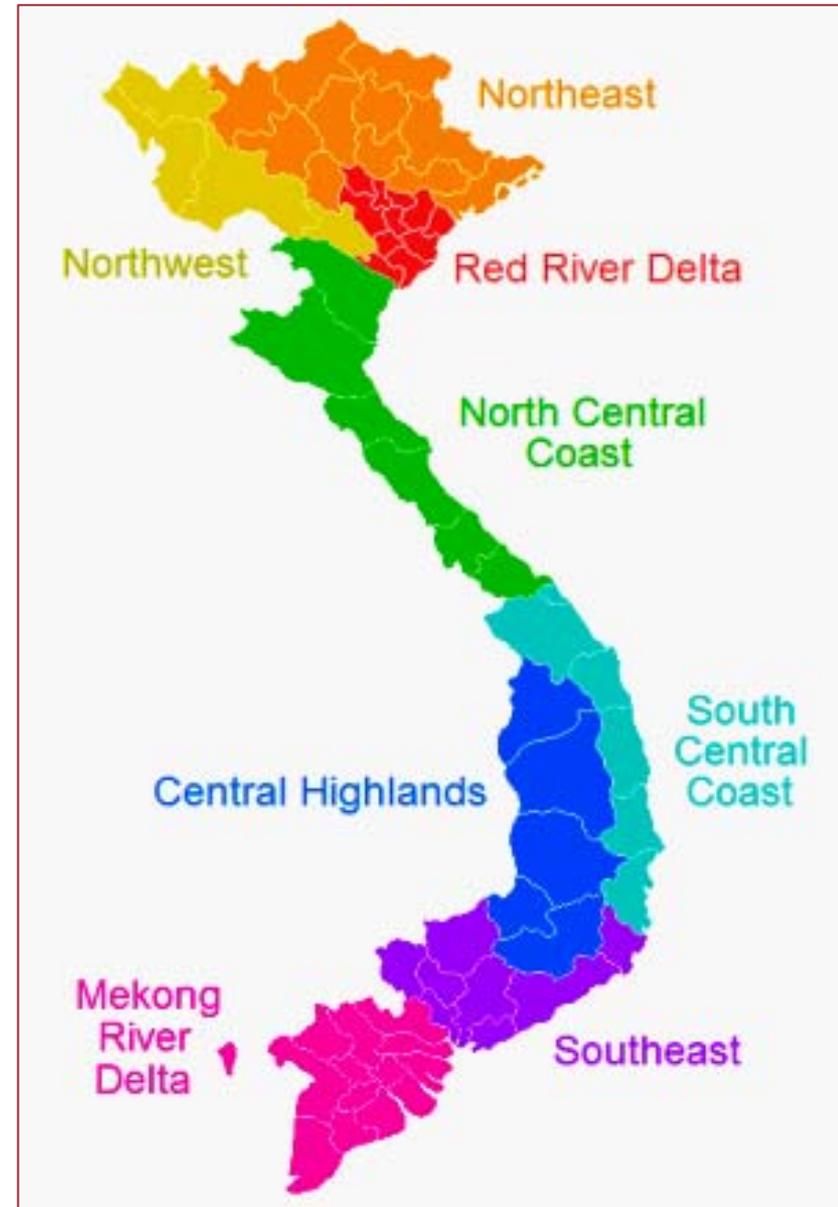
Population data

- ▶ Population growth rate:
 - 3 times, 30.2 → 86.2 million in 48 years (1960 – 2008)
 - Growth rate: 2.2%/year
- ▶ Rapid urbanization
- ▶ Uneven population distribution
 - Nation-wise: 260 persons/km²
 - Red river delta: 933 persons/km²
 - Mekong river delta: 436 persons/km²

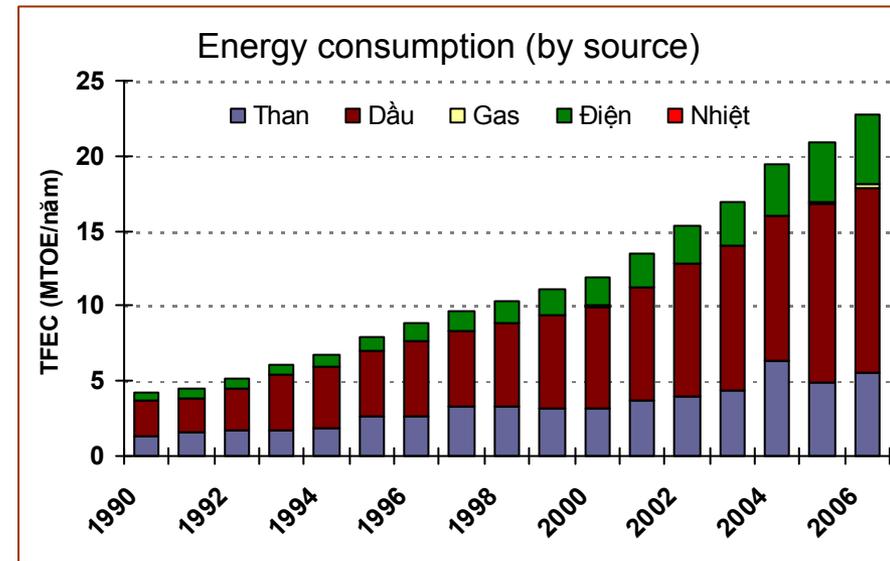
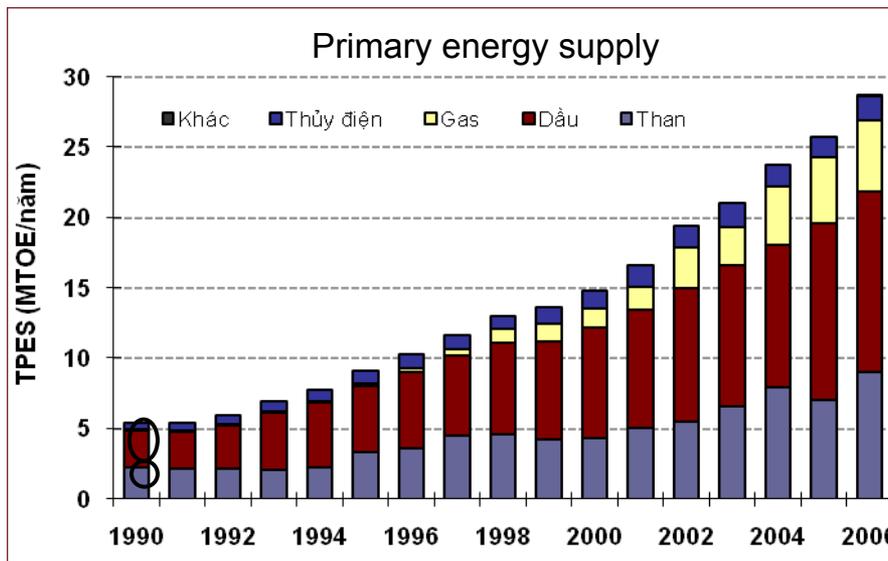


Economic achievements

- ▶ Economic development policies:
 - **Since 1986: Doi moi – reform process**
 - Shifting to a multi-sector economy based on the market
 - Strengthening external co-operations
 - Administration reform
- ▶ Achievements
 - Rapid economic growth
 - Economic structure transfer
 - Poverty eradication
 - Living condition improvement

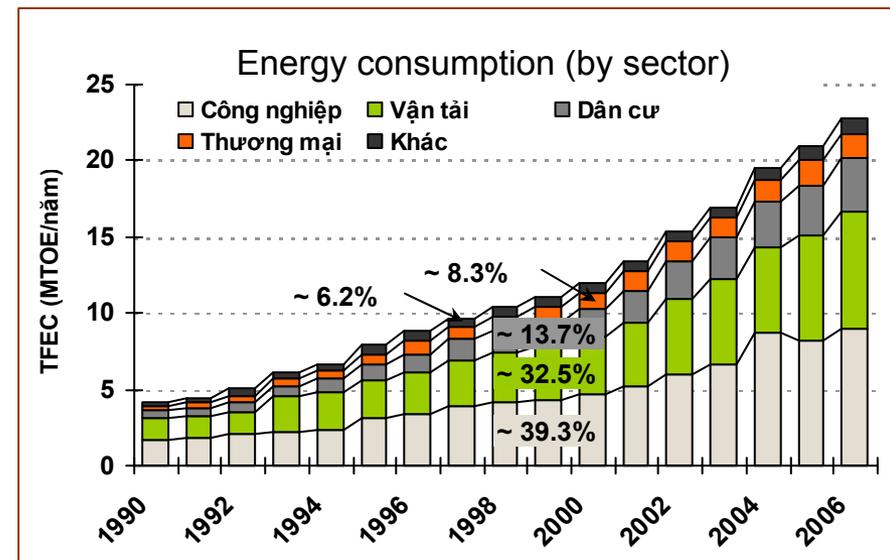


Energy data



Balance import-export:

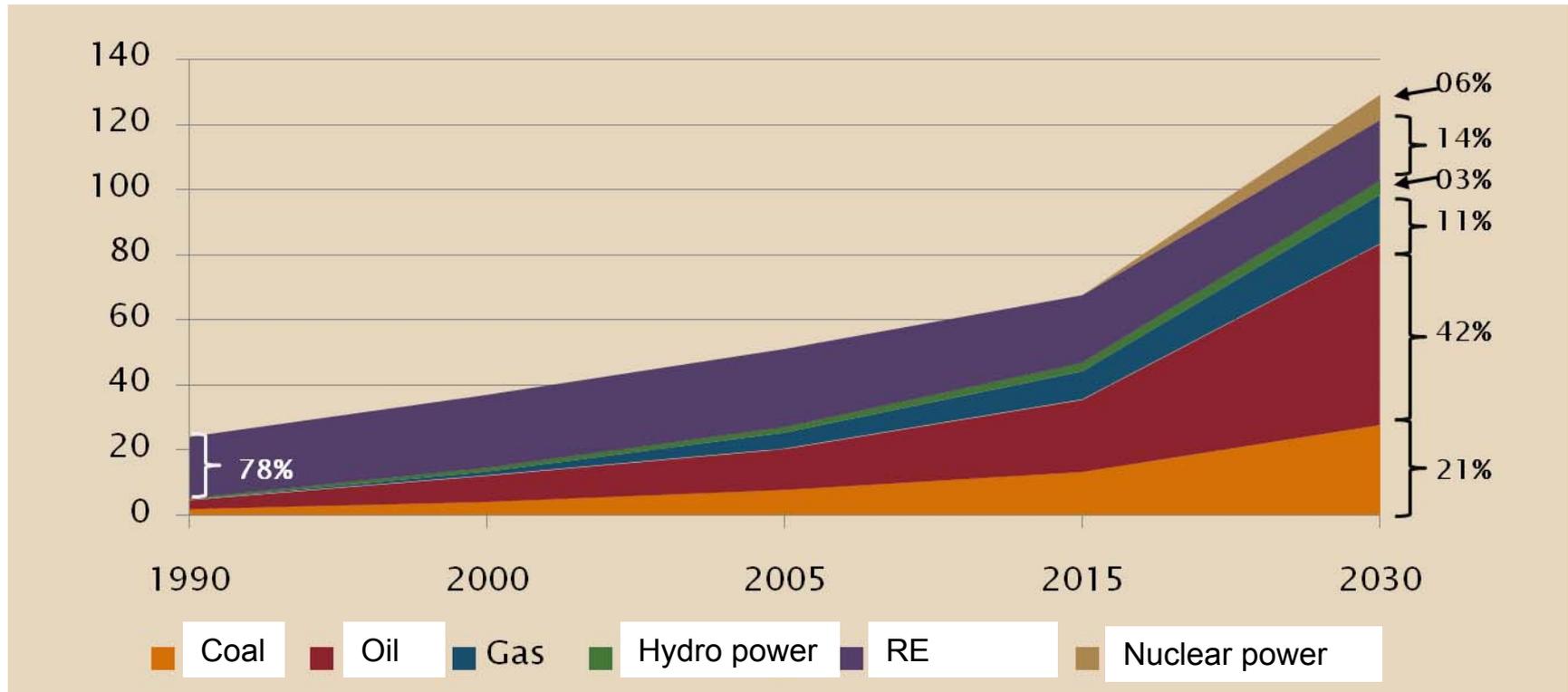
- Shift from import to export
- Export turn-over: Increase from 300 KTOE (1990) to 11,400 KTOE (2003)
- 100% petroleum is from import



GHGs emission

Fuel type	CO ₂	CH ₄	N ₂ O	NO _x	CO	Equivalent CO ₂ (CO ₂ + CH ₄ + N ₂ O)	
							%
Fossil fuels	19,833.47	1.88	9.89	102.66	216.54	22,938.85	83.43
Electricity generation	3,585.76	0.77	7.54	27.77	13.79	5,939.33	21.60
Industry	6,931.54	0.00	0.00	0.00	0.00	6,931.54	25.21
Traffic	2,663.90	0.92	0.16	66.99	199.55	2,732.82	9.94
Commerce & service	3,818.00	0.12	1.46	5.30	2.20	4,273.12	15.54
Others	2,834.27	0.07	0.73	2.60	1.00	3,062.04	11.14
Gases	0.00	38.09	0.00	0.00	0.00	799.89	2.91
- Solid fuel	0.00	38.09	0.00	0.00	0.00	799.89	2.91
- Oil and gases	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Biomass	0.00	162.38	1.12	38.59	1,420.84	3,757.18	13.66
Total	19,833.47	202.35	11.01	141.25	1,637.38	27,495.92	100.00

Prediction on energy use in Vietnam (Mtoe)



	1990	2000	2005	2015	2030
Import (Mtoe)	-0,4	-10,9	-18,2	-8,9	32,1
Self - production (Mtoe)	24,7	48,1	69,5	77,5	99,4
Primary energy use (Mtoe)	24,3	37,2	51,3	68,6	131,5
CO ₂ emission (Mt)	17	44	81	140	312

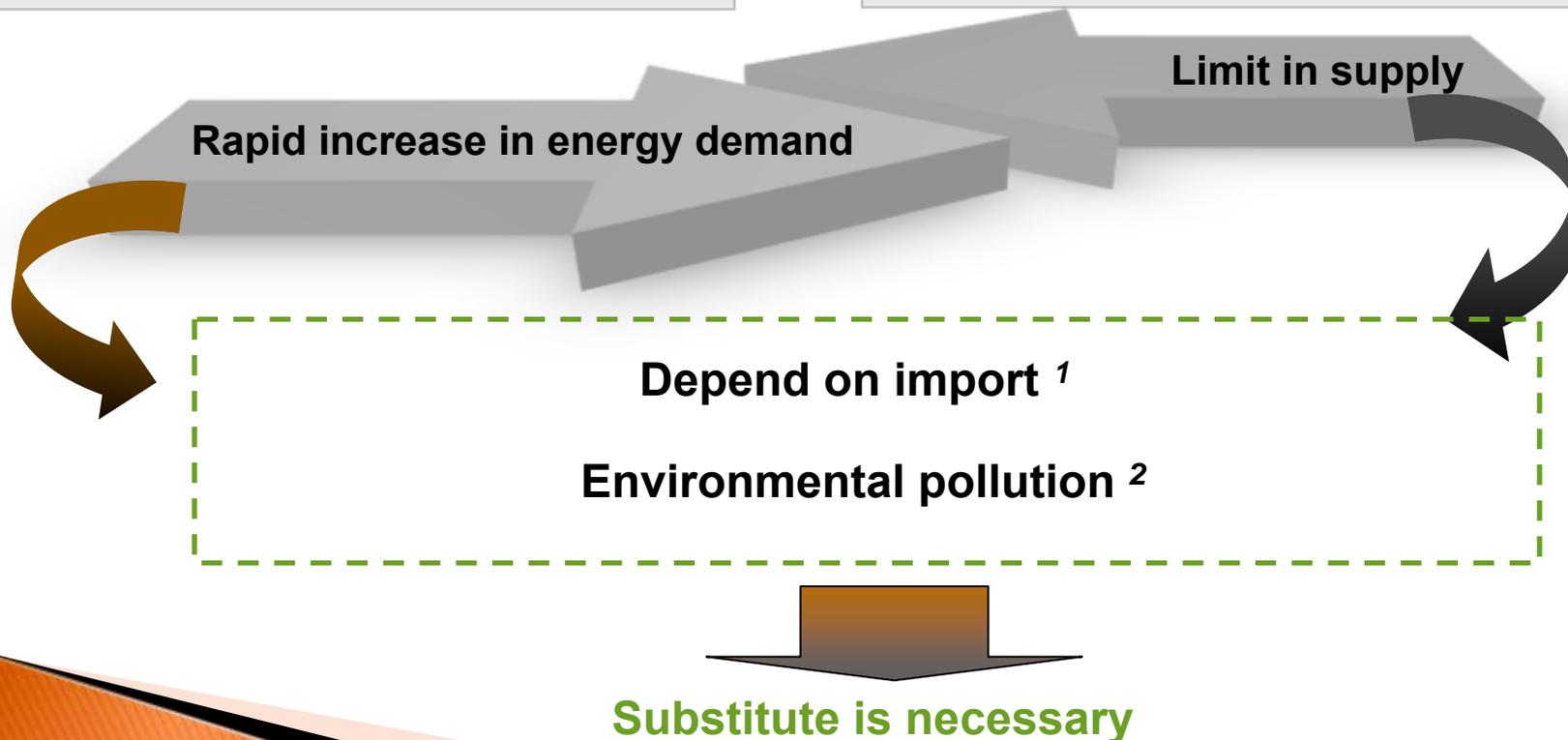
Challenges of energy sector in Vietnam

Motivation¹

- Economic development
- Population growth
- Urbanization and industrialization
- Living condition improvement

Constrain¹

- Natural resource depletion
- Shortage of techs and infrastructure of oil refinery



Potential and status of RE in Vietnam

	Potential	Status
Wind energy	8% total country area, (~1800 MW)	1,25 MW
Solar energy	4 – 5kWh/m ² /day	1,2 MW
Small hydropower	4.000 MW	300 MW
Biomass	800 MW	150 MW
Waste	350 MW	2,4 MW
Biogas	>150 MW	2MW
Geothermal	340 MW	0 MW

Pros & cons; barriers of RE in Vietnam

Pros/cons

- Diversify energy sources
- Reduce independence on fossil fuels
- Energy security
- Use indigenous energy sources
- Avoid high price of imported fuels (energy crisis)
- Mitigate air pollution
- Create jobs for local labors
- ...

Barriers

- Policies is not appropriate
- Lack of knowledge on REs
- Lack of professional business on RE
- Lack of capital
- Lack of high and affordable techs
- Lack of information

Typical examples on RE use



1. Biogas

Data on animal husbandry section in Vietnam

Unit: thousand

		1990	1995	2000	2005	2010
Cattle	Amount	5.971,0	6.601,7	7.025,1	8.462,9	8.829,7
	Growth (%)	-	2,0	1,3	3,8	1,0
Pig	Amount	12.260,5	16,306.4	20.193,8	27.435,0	27.373,1
	Growth (%)	-	5,9	4,4	6,3	(-0,1)
Horse	Amount	141,3	126,8	126,5	110,5	93,1
	Growth (%)	-	(-2,1)	(-0,1)	(-2,7)	(-3,4)
Goat	Amount	372,3	550,5	543,9	1.314,1	1.288,7
	Growth (%)	-	8,1	(-0,2)	19,3	(-0,4)
Poultry	Amount	107.400,0	142.100,0	196.100,0	219.900,0	300.500,0
	Growth (%)	-	5,8	6,7	2,3	6,4

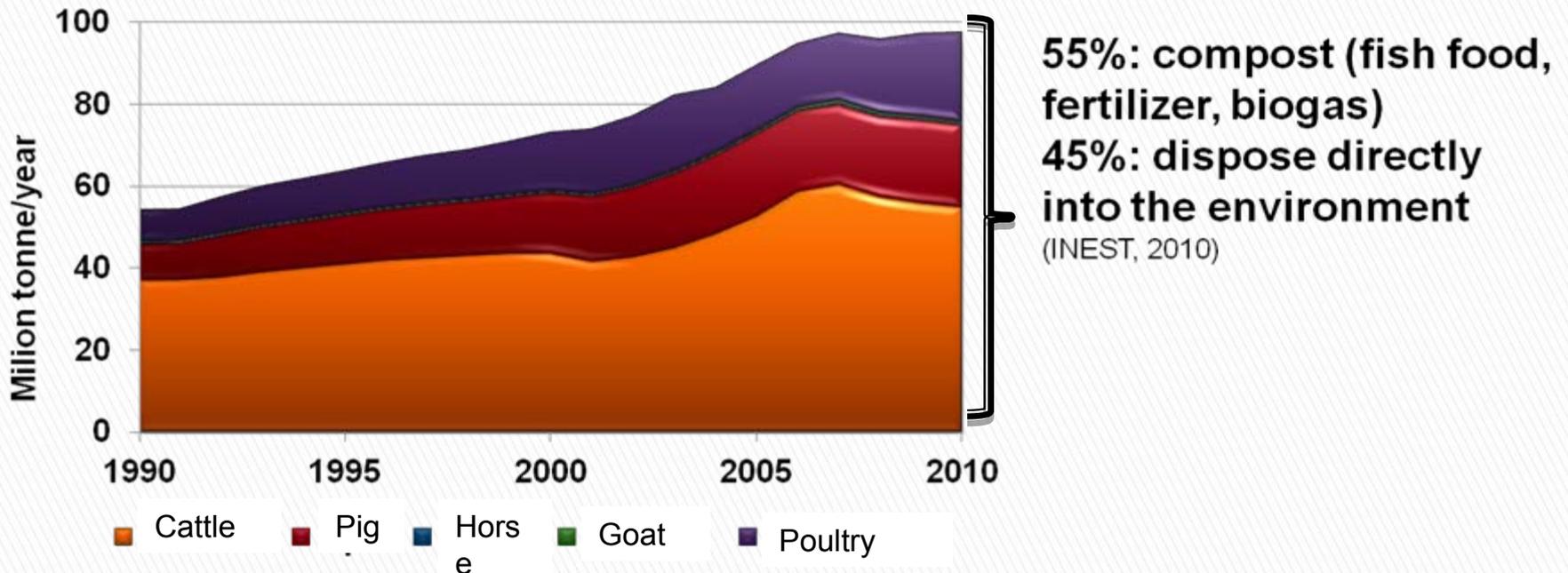
Solid waste from animal husbandry section

Unit: kg/head/day

	Cow	Buffalo	Pig	Goat	Horse	Poultry
Waste	10 – 20	15 – 25	1,2 – 4	-	-	0,01 – 0,05
Average	18	15	2,0	1,5	4,0	0,2

Source: Institute of agriculture (2008)

Solid waste per year



Biogas from cattle dung

Classification	Biogas (m^3 /Tonne)	CH ₄ (% Volume)	Aver thermal calorie (MJ/ m^3)
Cattle	260 - 280	50 - 60	35,9
Pig	561		

Source: Dương Nguyen Khang

Biogas for electricity generation

Volume (m^3)	Number of animal (head)	Capacity (kW)	Operation time (h/day)
12	20 – 30	1 – 1,5	4 – 5
15	30 – 40	2,5	6 – 7
20	45 – 50	3,0	6 – 7
25	50 – 60	3,5	6 – 7
30	60 – 70	5,0	6 – 7
35	> 70	7,0	6 – 7

Source: Ho Lan Huong, IE, 2008

Clean water and sanitation for Ha Tay province” (1999–2003)

Mitigation of GHGs by using biogas at Phu Dong – Hanoi (2000)

Biogas applying for innovative stove in Quang Ngai (2001–2003)

Biogas program in Quang Ngai (Plan, 2005 – 2006)

RE for centre provinces in Thua Thien Hue, Quang Binh, Quang Tri (2001–2003)

Biogas in rural areas of Vietnam

innovative stoves in Gia Viễn, Ninh Bình

Protecting buffer zone of Ba Vi ” (CARE, 2004 – 2006)

Biogas program for animal husbandry section in Vietnam” (2003)

.....

“Biogas program for animal husbandry section in Vietnam” (2003)

General goals

- To improve livelihood and living condition for rural residents
- To sustainably and professionally develop and apply biogas



“Biogas program for animal husbandry section in Vietnam” (2003)

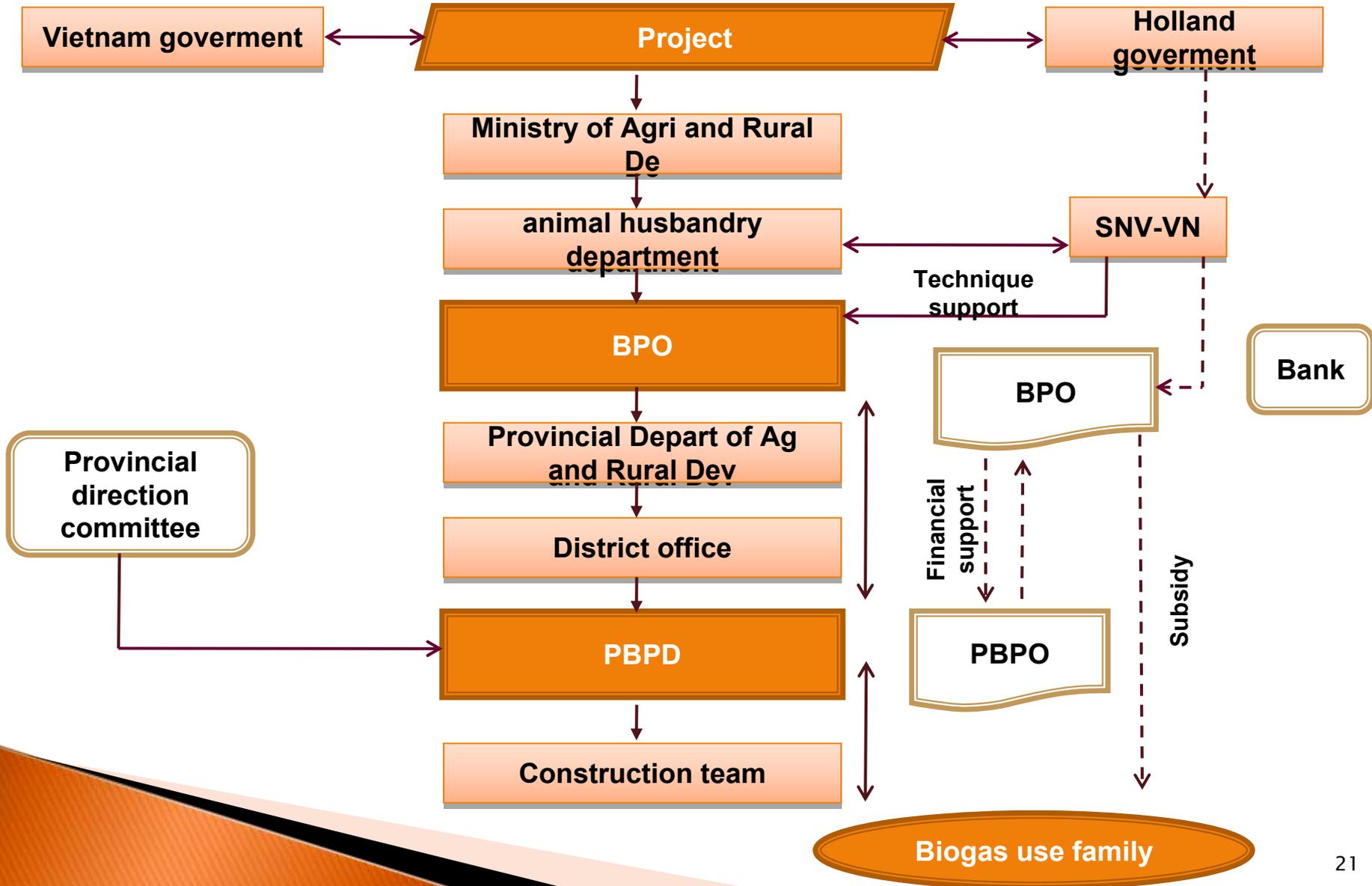
Detailed goals:

- ▶ Prevent and reduce environmental pollution**
- ▶ Generate clean and cheap energy for residents**
- ▶ Provide biogas by-products**
- ▶ Establish professional business on biogas**
- ▶ Generate sustainable and market-oriented biogas sector**

Project areas

Economic zone	Stage 1 (2003 – 2006)	Intermediate (2006)	2009	2010	2011
Red river delta	03 (Bắc Ninh, Hải Dương, Hà Nội)	04 (Hải Phòng, Ninh Bình, Hà Nam, Hà Tây)	04 (Thái Bình, Vĩnh Phúc, Bắc Giang, Hưng Yên)	-	-
Northeast	02 (Lạng Sơn, Thái Nguyên)	02 (Phú Thọ, Yên Bái)	02 (Nam Định, Quảng Ninh)		
Northwest	01 (Hòa Bình)	01 (Sơn La)	01 (Lào Cai)	02 (Hà Giang, Tuyên Quang)	Cả vùng Tây Bắc
North Central Coast	02 (Nghệ An, Thừa Thiên)	01 (Thanh Hóa)	-	01 (Hà Tĩnh)	-
South Central Coast	01 (Bình Định)	-	03 (Quảng Ngãi, Quảng Nam, Khánh Hòa)	01 (Phú Yên)	-
Central highland	01 (Đắk Lắk)	-	03 (Đắk Nông, Gia Lai, Lâm Đồng)	-	-
Southeast	01 (Đồng Nai)	-	02 (Bến Tre, Bà Rịa Vũng Tàu)	-	01 (Tây Ninh)
Mekong delta river	01 (Tiền Giang)	-	04 (Trà Vinh, Kiên Giang, Cần Thơ, Vĩnh Long)	01 (Hậu Giang, An Giang, Long An, Bạc Liêu)	02 (Sóc Trăng, Cà Mau)

Project organization



Organization of BPO



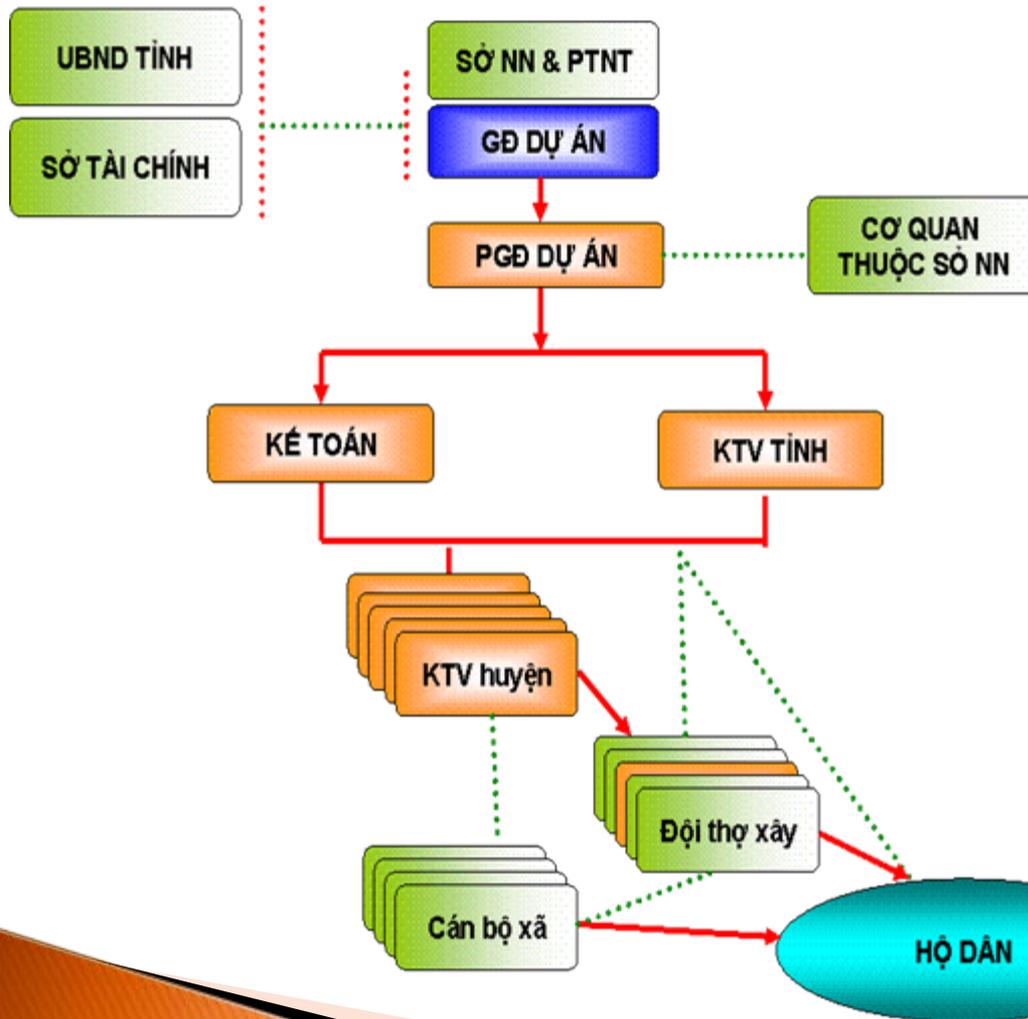
Function and duty

- Xây dựng nội dung hoạt động, kế hoạch và ngân sách hàng năm để trình các cấp có thẩm quyền phê duyệt;
- Điều phối kế hoạch tổng thể của Dự án và thông qua kế hoạch của các tỉnh;
- Tổ chức thực hiện và giám sát các hoạt động Dự án;
- Chỉ đạo và hỗ trợ các PBPD triển khai Dự án ở cấp tỉnh;
- Quản lý tài chính, Kế toán và xây dựng các báo cáo hàng tháng, hàng quý và hàng năm theo yêu cầu của các cấp có thẩm quyền;
- Chuẩn bị báo cáo cuối cùng vào giai đoạn cuối Dự án;
- Điều phối và liên kết các đối tác trong và ngoài nước;
- Tổ chức tuyển dụng và quản lý nhân sự của Văn phòng.

Organization of BPO

Function and duty

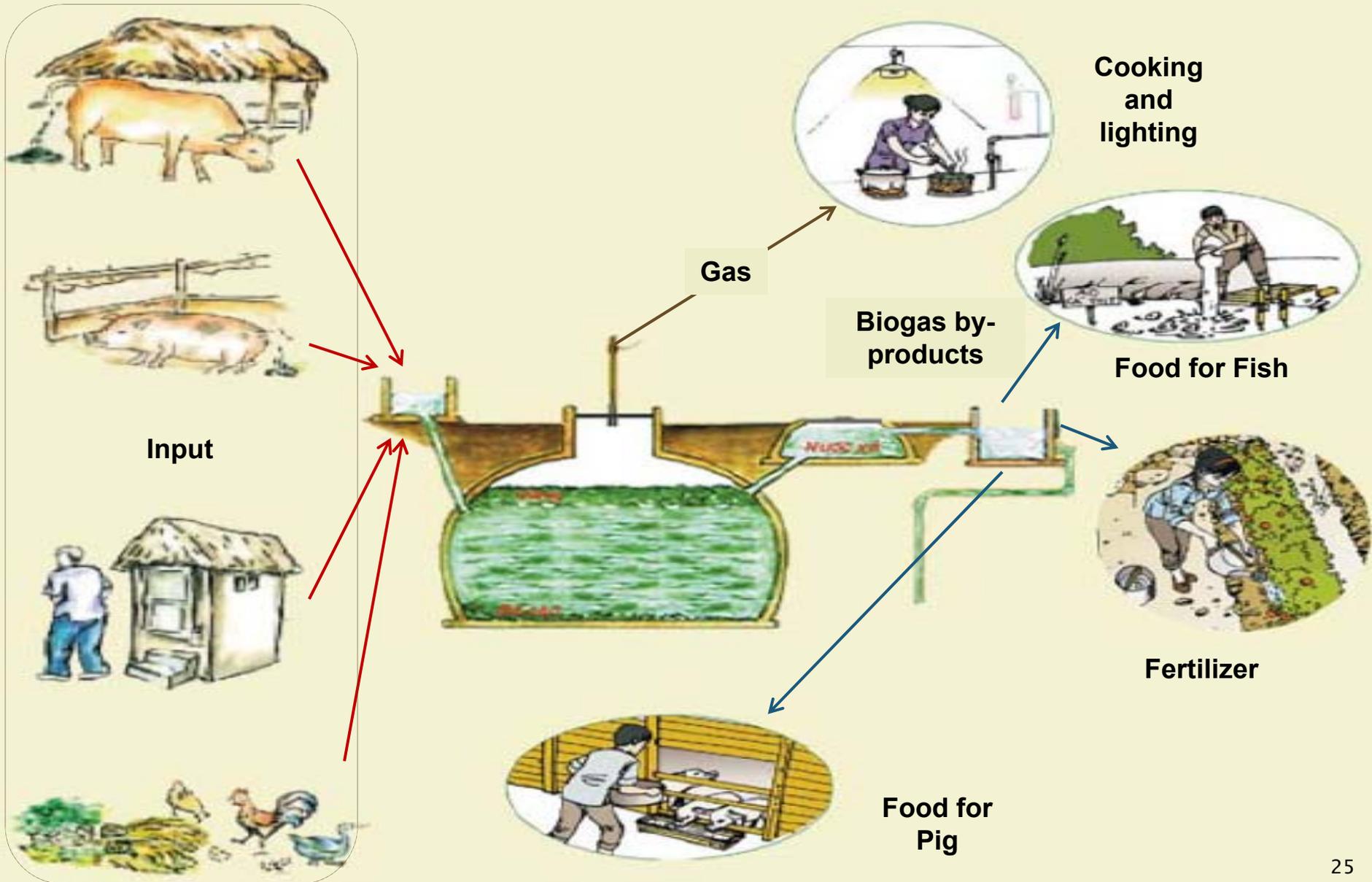
- Thông qua kế hoạch năm, kế hoạch cả giai đoạn của **Dự án cấp tỉnh, thành phố**;
- **Điều chỉnh các kế hoạch và hoạt động** do Văn phòng Dự án KSH tỉnh đề nghị với điều kiện:
 - ✓ Không làm thay đổi mục tiêu tổng quát và mục tiêu cụ thể của Dự án
 - ✓ Không nằm ngoài khung ngân sách của Dự án.
- **Đánh giá kết quả triển khai Dự án hàng năm và của cả giai đoạn** của tỉnh/thành phố;
- **Tư vấn xây dựng chính sách hỗ trợ phát triển chương trình KSH** trong phạm vi tỉnh/thành phố.



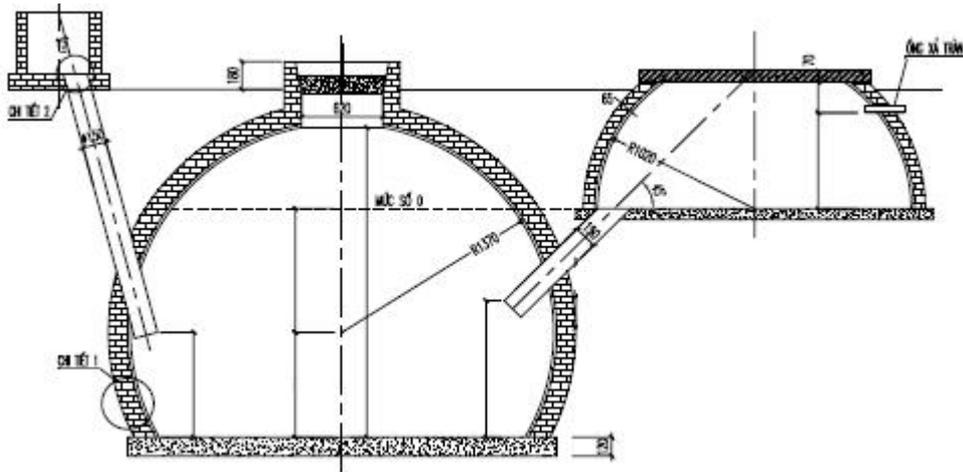
Main activities

- ▶ Construct biogas works (systems) at provinces
- ▶ Propagandize about biogas
- ▶ Support biogas system management
- ▶ Training
- ▶ Research on biogas tech, application, etc
 - Biogas-related equipment
 - Biogas use process
- ▶ Financial management and enlarge the project scale

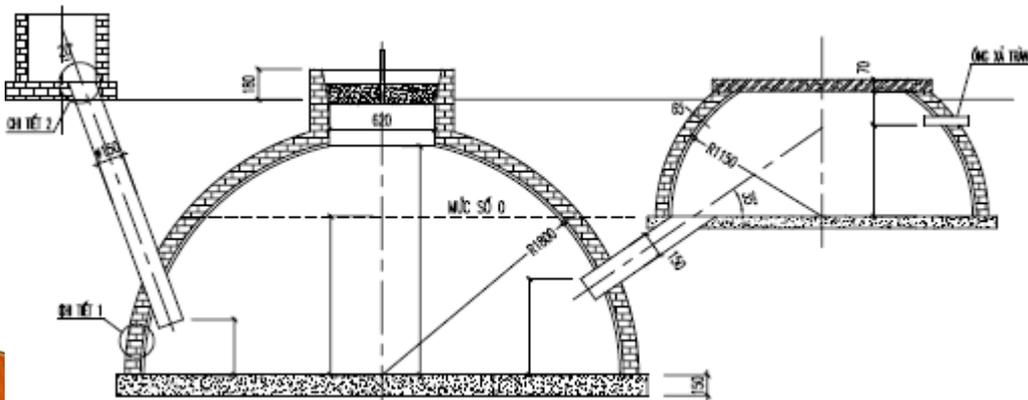
Biogas for family



Biogas techs



KT1 unit



KT2 unit

Subsidized biogas works

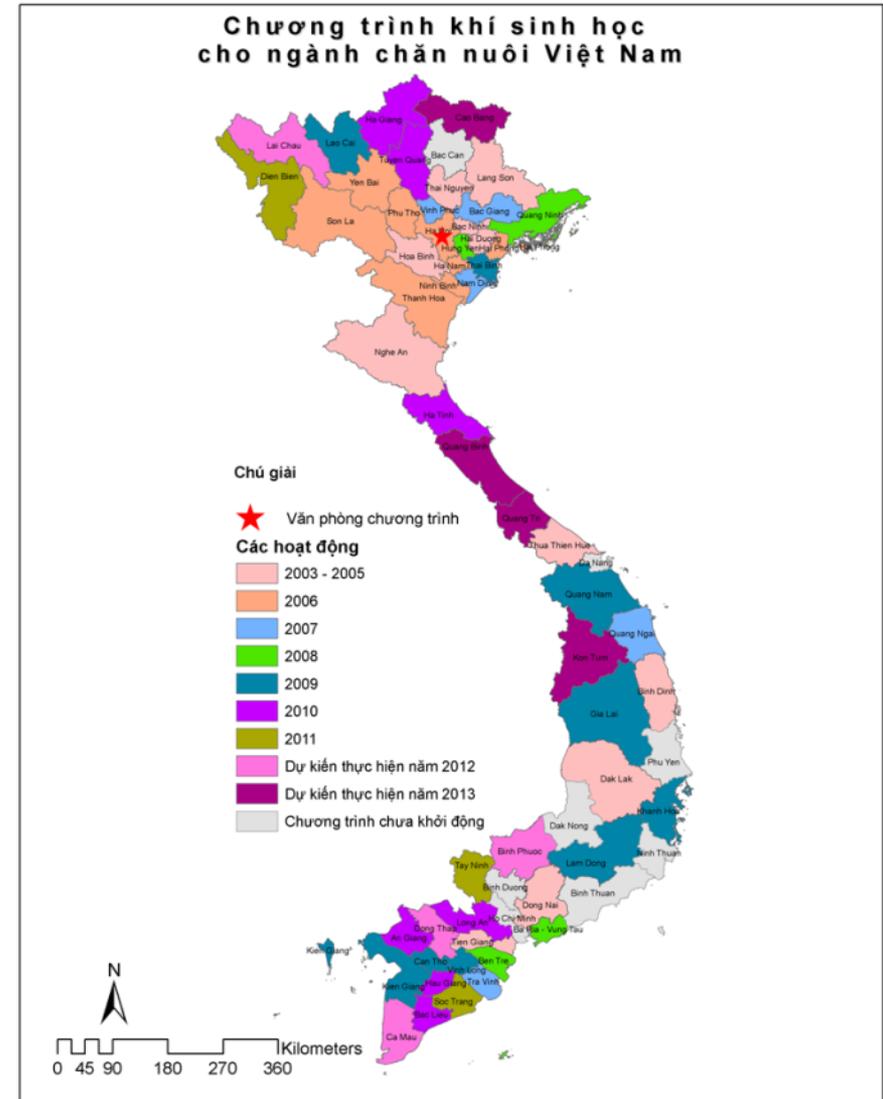
	2007	2008	2009	2010	Tổng
Number of province (project deployed)	25	29	36	44	44
Number of subsidized works	7.350	17.012	25.775	22.349	72.486
Growth rate of works	-	131%	52%	(-13%)	

Investment cost and return

Content	Size of work		
	8 m ³	10 m ³	12 m ³
Cost	5,92 - 9,28 Mill. VND	7,4 - 11,6 Mill. VND	8,88 - 11,6 Mill. VND
return	31 months (aver)		

... By the end of 2012

- ▶ Completed 164.000 works in 58 provinces
- ▶ Reduced 109 million working hours (women)
- ▶ Increased 67% number of domestic animal
- ▶ Agricultural yield increased 5-20%
- ▶ Reduced 65% living cost
- ▶ Environmental friendly agriculture
- ▶ Reduce 1.5-3 tonne of GHGs/work/year



Benefits

Technology view

- Lighting, cooking
- Green environment
- Reduce household work for women
- Food for fish, pig, etc

Participant (family)

- Subsidy (1,2 mill. VND/work)
- Be training
- Be consulted on Biogas techs
- 1 year – warranty for each work

Saving

- Fuel
- Time
- Fertilizer
- Income (increase)
 - ✓ Plant yield
 - ✓ Food for fish, pig, etc

On-field images

- ▶ Long Hpa, Long Thoi, Ben Tre



On-field images

▶ Tien Giang





Hầm biogas quy mô hộ gia đình tại Quảng Ngãi



Sử dụng biogas cho đun nấu tại Chương Mỹ, Hà Nội



Đèn chiếu sáng sử dụng biogas



Máy phát điện sử dụng nhiên liệu biogas

Video (how to generate electricity form biogas)

(: <http://devi-renewable.com/2011/03/26/how-to-operate-biogas-electric-generator/>)

Project contribution

- ▶ **Provide clean energy of 2.800 TJ/year, equivalent to**
 - 245.000 tonnes of agricultural by products
 - 326.000 tonnes of firewood;
 - 36.000 tonnes of charcoal;
 - 6.593 tonnes of oil;
 - 39.405 MWh
 - 4.677 tonnes of LG
- ▶ **if 140.000 work is installed → save: 591,6 bill. VND/year (only cooking and lighting)**

Project contribution

▶ **Environmental protection:**

- **Reduce air pollution;**
- **Reduce deforestation;**
- **Less GHGs;**
- **Fertilizer;**
- **Improve living condition, sanitation;**
- **Reduce surface water pollution (waste water from animal husbandry);**
- **Improve air quality in house**

Project contribution to sustainable development

▶ **To economy:**

- **Reduce electricity bill;**
- **Fertilizer (self-provide);**
- **Improve crop yield**
- **Create jobs for local labors**

▶ **To society:**

- **Reduce household works (women and children)**
- **Prevent respiratory and digestive diseases**

Project contribution

- ▶ **Conformity with VN policies and strategies**
 - **Mitigate pollution, natural resource degradation, improve water quality,...**
 - **Improve living condition;**
 - **Enhance the number of household using clean energy up to 5%**
 - **Following the strategies on environmental protection, etc**

Experience lessons

- ▶ **Propagandize and improve awareness on biogas and the project's related information through various media**
- ▶ **Project management and biogas works quality inspection were strict**
- ▶ **The training program was assigned to provincial staffs by that the project could be easily spread and more effective**
- ▶ **Financial support is obvious and explicit**
- ▶ **The research and development were cooperated by research institutes and university**

Disadvantage of biogas application

▶ **The biogas unit provided by the project is a fixed system, brick - made**

- Easy to be broken and leak out
- Require long construction time
- Irremovable or used in a new area
- Unable pressure self-adjusting

➔ **Solution: Replace by composite material**

- Durable material
- Light, movable, easy to be installed
- Short setup time
- Pressure self - adjusting



2. Application of Solar energy

Solar energy equipments



Lighting



Water heating



PV

Solar energy equipments



**Hệ thống nước nóng NLMT
quy mô hộ gia đình**

Bếp đun sử dụng NLMT

2.1. Water heating

General information

- ▶ **Developed and applicable technology**
- ▶ **Applied in industrial and household scales in Vietnam**
- ▶ **Produced by 10 Vietnamese medium-small scale enterprises**
- ▶ **One of long-lasting and effective energy resource, recommended by EVN**
- ▶ **Support method of projects: directly financial support 50\$ for each installed equipment (household)**

Typical projects



**Holiday Luxury Apartment
Building - Becamex Binh
Duong**

**Water heating capacity:
18000L/ day**



Typical projects



**3 star resort:
SonLongThuan Resort -
Phan Rang
Công suất Máy nước nóng
Water heating capacity:
16000L/day**



Typical projects



**5 star hotel: MAJESTIC , Ho
Chi Minh city**

**Water heating capacity:
NLMT: 23000L/day**

**4 star hotel: SAI GON- MORIN HUE
CITY**

**Water heating capacity: 10000L/
day**

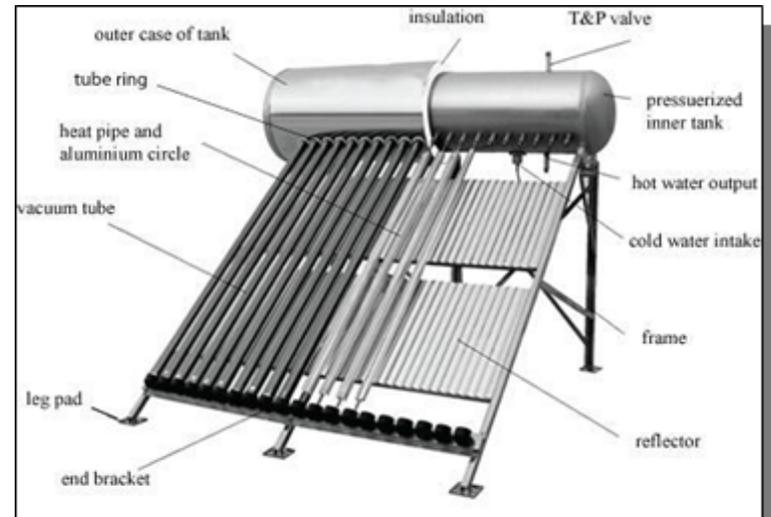


Typical projects



**Water warming
system for pools**

Water heating - household scale



Solar water heating and electric water heating systems

Parameter	SOLAR SUN	Electric heating
Number of user	4 – 5 (02 bathrooms)	4 – 5 (02 bathrooms)
Number of room	1 device/several rooms	1 device/1 room
Aver temp	65°C	65°C
Monthly cost	None	168.000 VND
Risk	None	Electric shock, fire
Environmental impacts	None	Yes
Warranty	5 years	1 year
Life span	> 15 years	05 years
Initial investment cost	9.000.000 VND/device/2 bathrooms	4.000.000 VND
Next 10 years investment cost	None	8.000.000 VND
Total cost	9.000.000 VND	42.240.000 VND
Saving amount	33.240.000 VND	

2.2. Solar electricity for mountainous and remote areas

General information

- ▶ **Project:**

Applying solar electricity for mountainous areas in Vietnam

- ▶ **Investor:** The Committee for Ethnic Minorities

- ▶ **Goals:**

- **To provide electricity for no-electricity-access mountain villages**
- **To improve and develop essential infrastructure in order to improve awareness, develop economy, protect environment and national security**

Investment and construction

▶ Contents:

- Provide solar electric devices and electric spare parts for 70 villages
- Provide electricity to:
 - Village people's committee
 - Healthcare center
 - Vaccine box
 - Village culture center
 - Television station (400W)

Devices: Imported from Finland
(FORTUM NAPS)

Related infrastructure will be
constructed

▶ Location:

- **The North:** Nghe An (17), Lai Chau (8), Dien Bien (7), Ssn La (5), Cao Bang (7)
- **The Middle :** Quang Ngai (5), Quang Nam (19), Quang Binh (2)

Total investment (197,3 Bill. VND)

Indexes	Amount	Percentage(%)
Total	7.920.739 EUR	100,0
- Devices, training, tech transfer	5.802.038 EUR	73,3
- Construction, installment	1.117.726 EUR	14,1
- Project management	183.858 EUR	2,3
- Consult	258.162 EUR	3,3
- Other	255.251 EUR	3,2
- Spare	303.704 EUR	3,8

Management method

- ▶ **The investor managed through central solar electricity management committee**
- ▶ **Management, operation after investment**
 - **Give the device to village people's committee (management)**
 - **Operation unit: be allocated by village people's committee**
- ▶ **Electric devices will be pass to other villages if the invested villages can access to electricity grid**

Video

2.3. Project: Solar-diesel hybrid electricity, Bai Huong, Quang Nam

General information

▶ Project

Solar-diesel hybrid electricity,
Bai Huong, Quang Nam

▶ **Location:** Bai Hường, Tân Hiệp, Củ
Lao Cham, Hội An, Quảng Nam

▶ **Investor:** Quang Nam Industrial
project management committee

▶ Participant

- Systech company Vietnam (entrepreneur)
- CAC Vietnam (designer)



*Các tấm panel thu năng lượng
mặt trời tại khu vực dự án*

General information

▶ **Total investment capital:** 412.000 USD

▶ **Source of capital:**

- Supported by SIDA, Sweden **80%**
- Quang Nam province: **20%**

▶ **Devices**

- Solar PV: 28kW:
 - 65 modules, Sharp, Japan, 175 Wp/module
 - Control system: 5 controller SMC 600 and 7 inverter SI5048, SMA – German
- Diesel electric generator 5.5 + 15 kW

General information

- ▶ **Transfer and utilize:** 10/2010
- ▶ **Installed capacity:** Provide electricity to 90/500 household
- ▶ **Before the project:** 03 diesel electricity generators, electricity price: 7 – 9 thousand VND/kW
- ▶ **Status: ineffective due to:**
 - Provide electricity only at certain time (not continuous)
 - Operation capacity decreases
 - ➔ Unable to collect electricity bill (unable to supply the electricity demand)

3. Projects on Bio-fuels in Vietnam

Dai Tan Ethanol Factory

- ▶ **Dai Tan Ethanol Factory**
- ▶ **Investor:**
Dong Xanh joint-stock company
- ▶ **Investment capital:** 600 Bill. VND
- ▶ **Construction and operation:**
 - Middle 2007: Started
 - 9/2009: the first batch of ethanol
 - 4 – 6/2010: 50% capacity
 - 7/2010: 60 – 70% capacity



Ethanol distil tower - Ethanol Dai Tan

Dai Tan Ethanol Factory

- ▶ **Installed capacity:**
125 l/year
- ▶ **Input material:**
Dried cassava (300 thousand tonne/year)
- ▶ **Product:**
 - Ethanol: 100.000 tonne/year
 - CO₂: 20.000 tonne/year
 - Fertilizer: 40.000 tonne/year
- ▶ **Main market: 50% domestic, 50% export (Japan, Philippines, Indonesia)**



Under construction projects of Petro Vietnam

Bio-ethanol factory – Phu Thu



- ▶ **Capital:**
80 mill. USD
- ▶ **Installed capacity:**
100.000 tonne/year
- ▶ **Material:**
Sugar cane and cassava
(7.000 tonne/day)
- ▶ **On-operation:**
2011

Under construction projects of Petro Vietnam



Ethanol Binh Phuoc

Ethanol Dung Quat



THANK YOU FOR YOUR ATTENTIONS!!!