EfD VIETNAM

Economy & Environment Partnership for Southeast Asia SEA

Workshop

Economic Approach for Environmental Management in Southeast Asia

UEH University of Economics Ho Chi Minh City Sida

Ho Chi Minh city, 10 January 2018

Workshop

Economic approach for environmental management in Southeast Asia

Economy and Environment Partnership for Southeast Asia
University of Economics Ho Chi Minh city

Venue: Room A205, University of Economics Ho Chi Minh city
59C Nguyen Dinh Chieu street, District 3, Ho Chi Minh city

10 January 2018	
8:00 – 8:30	Registration
8:30 – 8:40	**Introduction** Dr. Pham Khanh Nam, EEPSEA Partnership
8:40 – 9:00	**Market-based Instruments in Malaysia: Applications and Future Research** Prof. Dr. Awang Noor Abd. Ghani, Economy and Environment Association – Malaysia
09:00 –09:15	Q & A
09:15 – 9:35	**The distributional Effects of the November 14 "Big Bang" Fuel Subsidy Reform in Indonesia** Prof. Dr. Arief Anshory Yusuf, Economy and Environment Institute - Indonesia
9:35 – 9:50	Q & A
9:50 – 10:10	**Market-based Instruments for environmental management in Vietnam: Applications and Future Research** Dr. Lai Van Manh, Institute of Strategy and Policy on Natural Resources and Environment, Vietnam
10:10 – 10:25	Q & A
10:25 – 10:50	Coffee break
10:50 – 11:10	**Economic Impact of Geothermal operations in the Philippines** Dr. Gem B. Castillo, Economy and Environment Group – the Philippines
11:10 – 11:25	Q & A
11:25 – 11:45	**Behavioral insights and a new design to enhance new technology adoption among Thai farmers** Dr. Phumsith Mahasuweerachai, Economy and Environment Institute for Lower Mekong Sub-region
11:45 – 12:00	**Q & A**
12:00	Workshop close

Workshop

Economic Approaches to Environmental Management in Southeast Asia

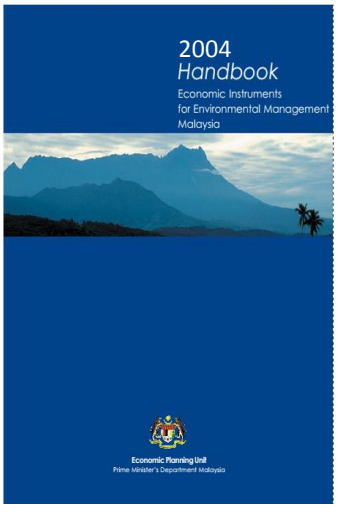
Economy and Environment Partnership for Southeast Asia
University of Economics Ho Chi Minh city
10-11 January 2018

Market-based Instruments in Malaysia Applications and Future Research

Awang Noor Abd. Ghani
Malaysian Environmental Economics Association (MEEA)

Outline

- Introduction
- Historical background
- MBI in Malaysia
- Challenges
- Future research
- Conclusion



Introduction

- The Government of Malaysia is committed to ensuring conservation of the environment and sustainable management of resources as stated in the various development plans, policies
- Various strategies have been formulated
- One of the strategies is wide application of economic instruments to ensure sustainable use of natural resources.
- Natural resources and ecosystems will ensure long term benefits to the society → the ecosystem benefits cannot be bought or sold in the marketplace
- E.g. clean water, biodiversity, climate regulation, erosion control, ecotourism and habitat protection

  → Market-based instrument can be implemented to address conservation of biodiversity and its ecosystem – e.g. PES, biod financing

The Need for Developing PES Mechanism

- Current regulations may have not been sufficient to protect these services and provide significant economic return to the government.
- Alternative policy ? To create and develop systematic economic instruments that would improve the way ecosystem services are used and managed
  - Using the market -
  - Create the market -
  - Command and Control
  - Public engagement

MBI

What is an Economic Instrument?

- EIs are market-based mechanisms that are designed to influence people's behaviour
  - E.g. incentives (e.g. subsidies) reward desired behaviour; disincentives (e.g. taxes) penalise undesired behaviour.
- EIs attempt to ensure the polluter pays for the environmental mess that they have created or caused
- Economic instruments affect prices causing consumers and producers to change their consumption and production behaviour.
- Economic instruments help to integrate environmental considerations into economic policies, thus promoting sustainable development & **improving the quality of life**.

Advantages

- Help change consuming and producing behaviour towards a more sustainable use of resources
- Encourage economic efficiency and productivity
- Adaptable to specific issues
- Reduce bureaucracy required for enforcement approaches.

Command and control approaches (CAC) vs. economic instruments: advantages and limitations

Approach	Command and control	Economic instruments
Advantages	• Certainty of outcomes assuming effective enforcement	• Cost effective • Incentives improve and stimulate innovation • Faster results • Lower compliance and administrative costs • Potential to raise revenue, especially for environmental • Expenditure
Limitations	• High costs due to demands on monitoring and policing • Inflexible	• Information required to set prices or limits • May involve a certain level of monitoring, policing and regulation.

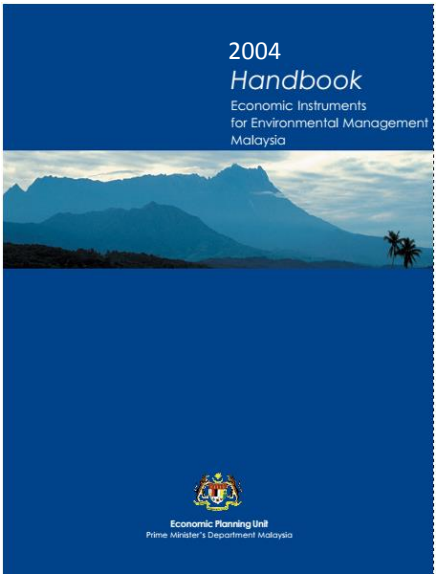
Historical development

- 7th Malaysia Plan (1996-2000)
- 8th Malaysia Plan (2001-2005)
- 9th Malaysia Plan (2006-2010)
- 10th th Malaysia Plan (2011-2015)
- 11th Malaysia Plan (2016-2020)

- **Statement on economic instruments in OPP3 [Chapter 1 para 1.83] (2001-2010)**
  "The Government will continue to implement the **Polluters Pay Principle (*PPP*),** and intensify enforcement efforts to ensure that environmental laws and regulations are complied with. However, these measures will be complemented by the use of **innovative economic and tax instruments**, including the **removal of distortions and barriers** that impede the efforts of **improving environmental quality and optimal natural resource use**."

- **Statement on complementary role of economic instruments in OPP3 [Chapter 7 para 7.68]**
  "Existing **legislative framework** for environmental protection will be further complemented by the **use of market-based instruments to encourage the adoption and development of environmentally sound technologies and environmental products**."

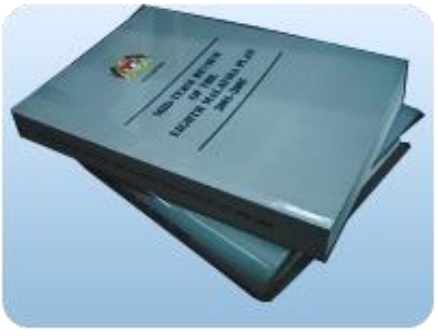
Economic Instruments for Environmental Management in Malaysia (EPU, 2004)



- **Statement promoting the use of market-based instruments in 8MP [Chapter 19 para 19.26] (2001-2005)**
  "Increasing the use of **fiscal policy in pursuit of environmental objectives** and promoting the use of appropriate **market-based instruments** and self-regulatory measures among industries."

- **Statement on Polluter-Pays-Principle in the Mid-Term Review of 8MP**
  "The shift towards sustainable *consumption* and *production* will entail using a mix of appropriate regulatory, **economic and voluntary instruments** that will include identifying tools for changing consumer and producer behaviour, applying the polluter pays principle, internalising environmental costs, promoting the supply and demand for green products and services, adopting social responsibility codes and informing and educating consumers."

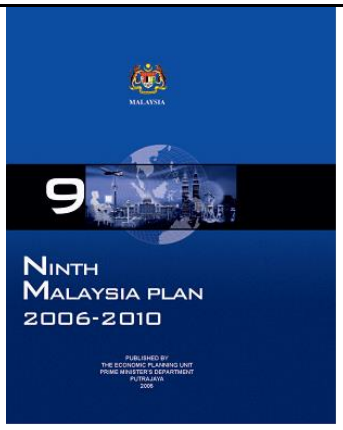
Eight Malaysia Plan (RMK8)



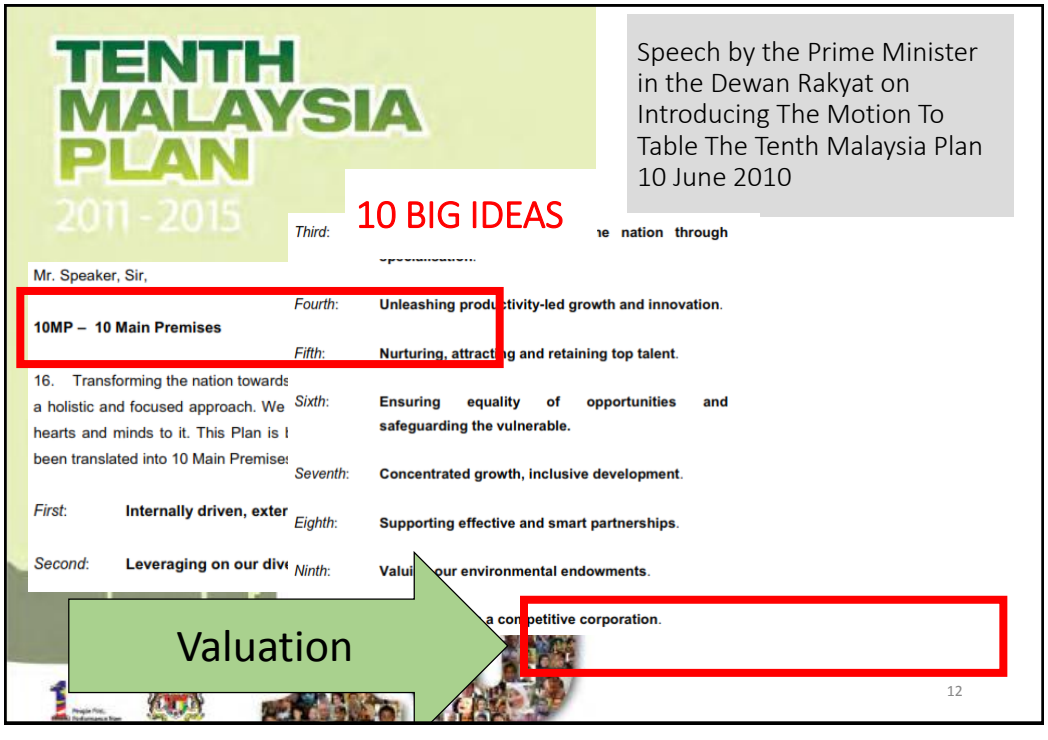
Enhance protection of the environment and conservation of natural resources and contribute towards improving the quality of life

Strategic thrusts for addressing environmental and natural resources issues will focus on:

- ❑ promoting a healthy living environment
- ❑ utilising resources sustainably and conserving critical habitats
- ❑ strengthening the institutional and regulatory framework as well as intensifying enforcement
- ❑ **expanding the use of market-based instruments**
- ❑ developing suitable sustainable development indicators
- ❑ inculcating an environment-friendly culture and practice at all levels of society



22.34 Economic Approaches. Measures will be undertaken to expand **the use of economic instruments and market-based measures**, such as the incorporation of the **polluter pays principle, user fees and economic valuation techniques**, to address environmental issues effectively and efficiently. The use of **innovative funding mechanisms** to facilitate the conservation of critical and protected areas will be explored. **Pilot studies and projects** will be undertaken to operationalise the implementation of these innovative market-based instruments.



Speech by the Prime Minister in the Dewan Rakyat on Introducing The Motion To Table The Tenth Malaysia Plan 10 June 2010

Pursuing green growth for sustainability and resilience

Focus Area

- To achieve these, the Government will focus on four key areas in pursuing green growth for sustainability and resilience as follows:
- Focus area A: Strengthening the enabling environment for green growth
- Focus area B: Adopting the sustainable consumption and production concept
- Focus area C: Conserving natural resources for present and future generations
- Focus area D: Strengthening resilience against climate change and natural disasters

Pursuing green growth for sustainability and resilience

Strategies

- Strategy A1: Strengthening governance to drive transformation by enhancing regulatory and institutional framework, coordination, capacity as well as monitoring and evaluation mechanisms;
- Strategy A2: Enhancing awareness to create shared responsibility through comprehensive communication, education, and awareness programmes and platforms for knowledge sharing; and
- Strategy A3: Establishing sustainable financing mechanisms by **expanding existing and identifying new economic instruments.**

Pursuing green growth for sustainability and resilience

Outcomes

1) To reduce GHGs emission intensity of GDP by up to 40% compared to 2005 levels by year 2020, in line with the voluntary target announced by the Prime Minister at the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change in 2009
2) To conserve at least 17% of terrestrial and inland water areas, as well as 10% of coastal and marine areas as protected areas in line with the Aichi Biodiversity Targets.

Focus area A

Strengthening the enabling environment for green growth

Strategy A3: Establishing sustainable financing mechanisms by expanding existing and identifying new economic instruments

Expanding existing economic instruments
Implementation of existing mechanisms such as **Polluter Pays Principle** and **Payment for Ecosystem Services** will be expanded to support funding needed to address environmental pollution and conserve biodiversity and its ecosystem.

ELEVENTH MALAYSIA PLAN
2016-2020
ANCHORING GROWTH ON PEOPLE

Economic instruments in environmental protection

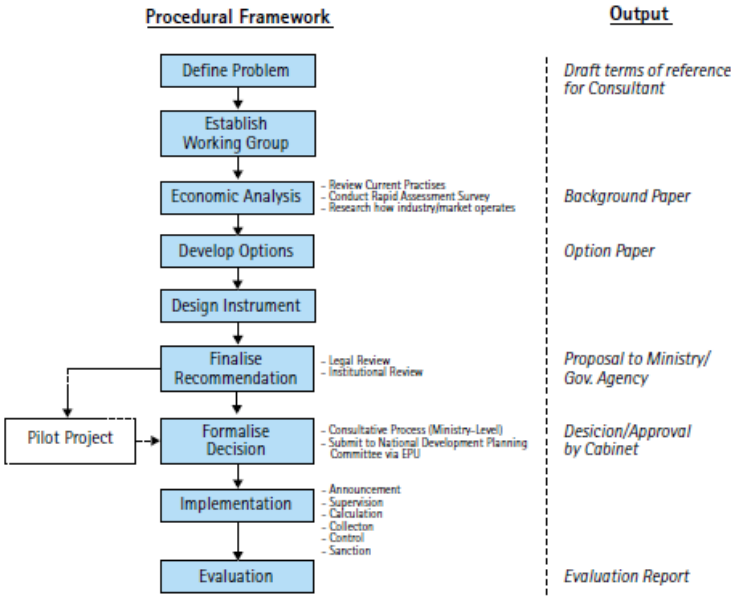
Category Demonstration	Types	Projects in Malaysia
Taxes, charges, cess, user fees	Charges and taxes are imposed products or activities to change behaviour. Charges are payments for the use of resources, infrastructure and services. They are collected by service providers (or public agencies) to recover costs of services, as well as to maintain the system. Taxes are commonly used to generate revenue for general use, and to achieve equity goals. A cess is a tax that is collected for a specific purpose.	• Cess for pesticides • Cess for lubricant waste oil • Sales tax for tyres • Entrance fees to protected, recreation areas, marine parks • Tourism tax • Timber fees
Subsidies and incentives; fiscal incentives/allowances ; grants/ funds for environmental development	These include subsidies, grants, soft loans and fiscal incentives that are used to encourage compliance with environmental objectives and to promote the use of technology, products, or resources that are less damaging to the environment.	Incentives for recycling, such as old newspapers, bottles
Deposit Refund (D-R) System	This D-R system is meant to encourage the return of a recyclable item to the manufacturer	Deposit refund scheme for pesticides

Source: Raja Dato' Zaharaton (updated)

Economic instruments in environmental protection

Category Demonstration	Types	Projects in Malaysia
Performance Bond	Advance payment as a guarantee that manufacturing and developing conditions are met.	Used in the mining industry to persuade miners to restore the land after they have been mined
Market creation • Emissions trading	Applied to resources that are difficult to divide physically and extend beyond local boundaries, such as air, water and fishery. By limiting these rights, and devising a mechanism for the trading of these rights, a market is created that will price these rights.	Voluntary carbon market, emission charges
• Voluntary initiatives; eco-labelling; recognition schemes	Voluntary actions initiated by industry, mainly in the form of information disclosure such as eco-labelling, energy efficiency performance rating, recognition schemes and environmental reporting	Several timber certification cases tested and adopted Malaysian Timber Certification Scheme Malaysian Sustainable Palm Oil (MSPO)

Framework to develop and design an economic instrument



Source: Raja Dato' Zaharaton (undated)

Success Factors for the Implementation of MBI in Malaysia

- Simplicity
- Good coordination and cooperation at the inter-ministry level
- Enforceable legislation and functioning markets
- Involvement of relevant stakeholders in the design of the economic instrument
- Transparency and accountability
- Cost efficient implementation
- Timing, ease of introduction and advance notice

Challenges

- Awareness of MBI by the government officers, corporate sector, professionals and public
  - "free-rider" problem
- Socioeconomic implications & impacts of the new MBI
  - Income distribution vs. economic efficiency or revenue generating mechanism
- Implementation
  - Administratively simple to implement
- Technical capability – human resource development
- Legal and institutional frameworks
- Political will
- Research and development

FUTURE RESEARCH

- Cost and benefits of MBIs implementation
- Types of MBIs
- Financing mechanism
- Economic valuation
- Social, economic and ecological impacts of MBI
- Institutions and governance
- Legal framework

In summary, market-based instruments for environmental conservation and management have been implemented in many sectors.

Clear policy direction on MBIs

↓

Improve framework and more R&D, including PES, ensure sustainable ecosystem management

↓

Enhance quality of life

THE DISTRIBUTIONAL EFFECT OF THE NOVEMBER'14 "BIG-BANG" FUEL SUBSIDY REFORM IN INDONESIA

Arief Anshory Yusuf
Niken Kusumawardhani Asri
Yusrina
Ridho Al Izzati
& Iqbal Wibisono

FOSSIL-FUEL SUBSIDY REFORM MAY CONTRIBUTE A GREAT DEAL TO ACCELERATE SDGS#1 ENDING POVERTY

Domestic Capacity for Redistribution to End Global Poverty at Various Poverty Lines

Poverty line	$1.90	$2.50	$5	$10
Year – end of global poverty on growth alone	2048	2061	2096	2131
Marginal tax rates of 50% or less on those living on $15/day or more	50.47	23.39	6.22	5.59
Marginal tax rates of 50% or less on those living on $10/day or more	52.39	24.81	25.07	7.5
Reallocation of fossil-fuel subsidy to poverty transfers	**69.08**	**69.93**	**38.74**	**8.12**
Reallocation of surplus military spending to poverty transfers	59.38	66.79	32.49	8.82

Hoy & Sumner (2016)

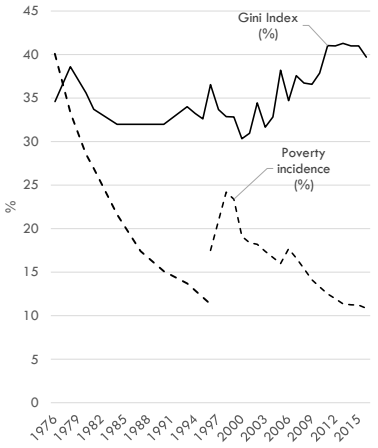
THREE CONTEMPORARY INDONESIAN DEVELOPMENT CHALLENGES

Slower economic growth

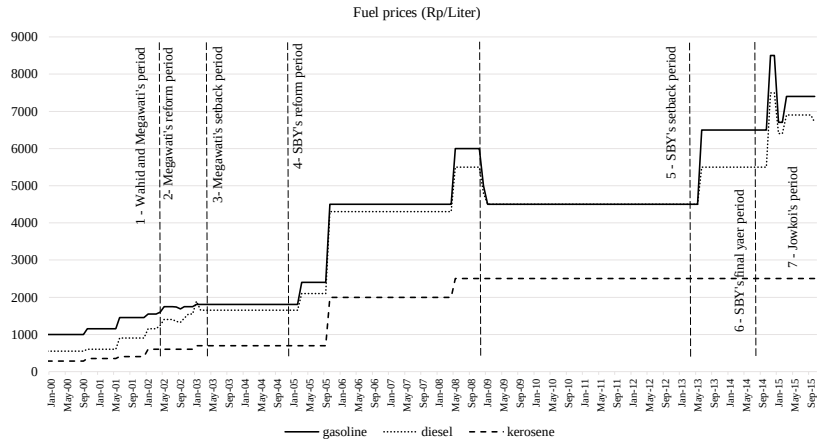
Slower poverty reduction

- Growth elasticity of poverty of the 2000s is half of the 80-90s.

Unprecedented rising inequality



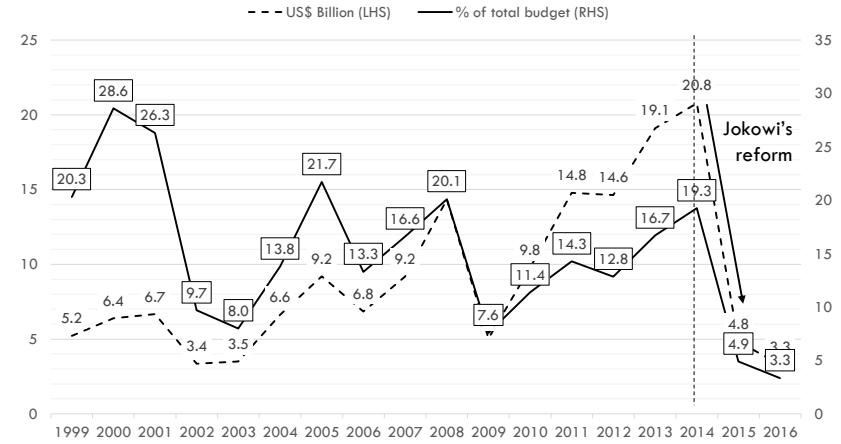
IN INDONESIA, BEFORE JOKOWI, REFORMS HAVE BEEN UNDERTAKEN BUT NEVER CLOSE TO ELIMINATE IT



CHARACTERISTICS OF INDONESIAN FUEL PRICE REFORMS FROM 2000-TODAY

1. The fluctuation in world oil prices has been the dominant reform-promoting factors
2. Reform inconsistency. The same government can reduce subsidy or introduce progressive reforms can also introduce setbacks to the reform by abolishing or reducing the strength of the reform.
3. Politics has been the key factor of this inconsistency as reform reversal normally occur during the time when incumbent government was about to go for re-election
4. Compensating the poor has always been a pre-condition in all episodes of important pricing reforms.

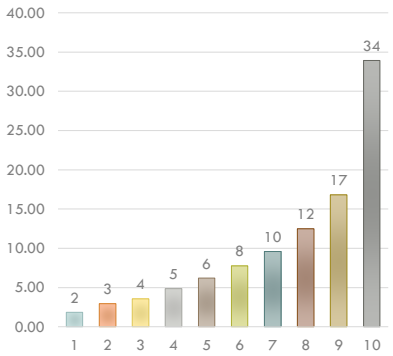
IN NOVEMBER 2014 (A FEW DAYS AFTER INAUGURATION), JOKOWI ABOLISHED GASOLINE SUBSIDY.



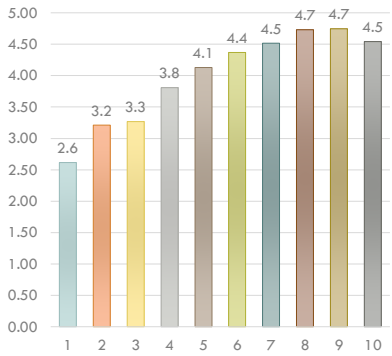
Source: MoF

FUEL SUBSIDY IS REGRESSIVE

Vehicle fuel spending allocation (%) by decile of expenditure per person



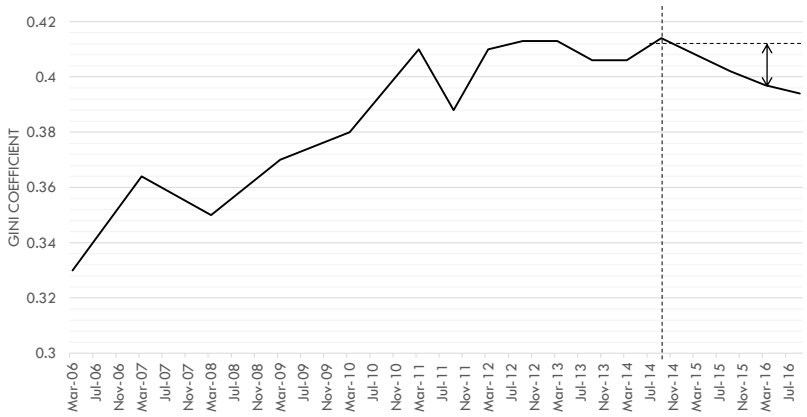
Share of vehicle fuel spending in total expenditure (%) by decile



Source: SUSENAS 2014

FROM NOVEMBER 2014, INEQUALITY IN INDONESIA DECLINE SLIGHTLY. ISSUE RAISED ON WHETHER FUEL SUBSIDY REFORM CONTRIBUTE TO THE DECLINING INEQUALITY.

Gini Coefficient



Source: BPS

OBJECTIVE OF THE PAPER

To estimate the impact of November 2014 fuel pricing reform on household welfare particularly its distribution

- We focus on the impact via increased cost of living aknowledging that increased fuel price has secondary impact on price of other commodities

METHODOLOGY AND DATA

We estimate the relationship between inflation of 8 different commodities group and inflation of fuel/gasoline using time-series econometric approach.

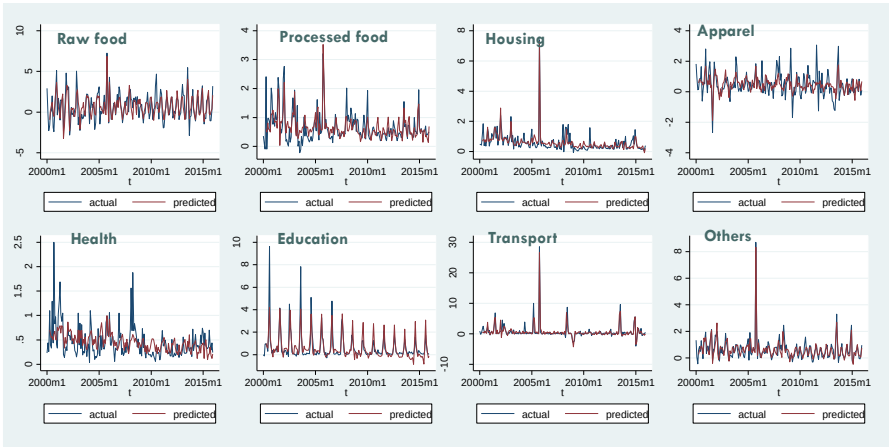
- We use monthly data of inflation from 2000-2015

We estimate how inflation of 8 different commodities affect household consumption by estimating the Almost Ideal Demand System (AIDS).

- We use household socio-economic survey data of SUSENAS 2014 of more than almost 200 thousand household.

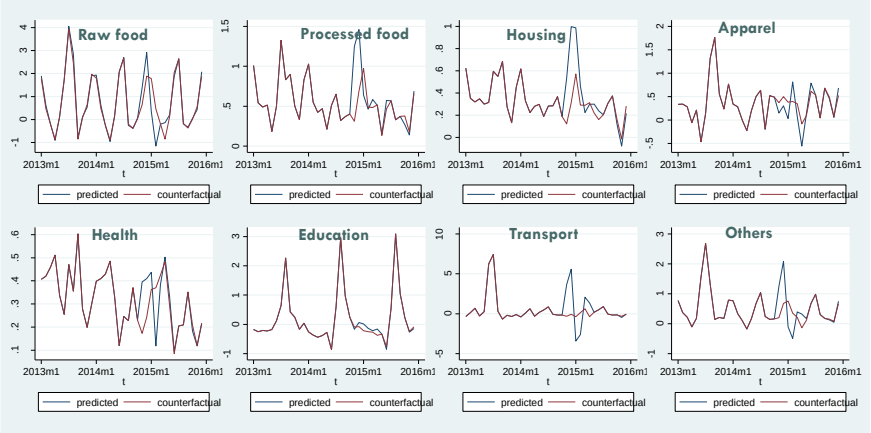
INFLATION MODEL ESTIMATION

Inflation of each of the 8 commodities groups is modeled as function of gasoline price, lag of gasoline price, monthly-seasonality, exchange rate and interest rate. The resul of the prediction and actual is:



Source: author's calculation

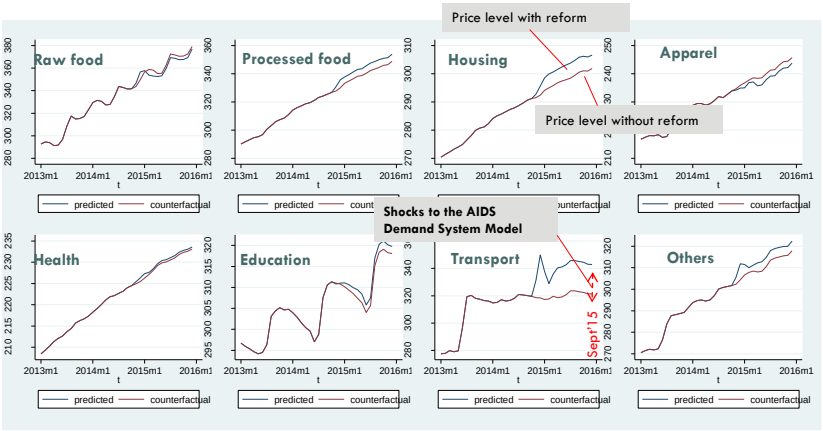
WE CONSTRUCT COUNTER-FACTUAL INFLATION – HAD REFORM NEVER HAPPENED



Source: author's calculation

WE THEN USE IT TO ESTIMATE COUNTER-FACTUAL OF PRICE LEVEL OF 8 DIFFERENT COMMODITIES

Result: Price impact from inflation model



Source: author's calculation

WE ESTIMATE THE AIDS PARAMETER USING SUSENAS 2014 DATA

$X_i = F(P_1, \ldots, P_n; M)$ $\quad w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_j + \beta_i \ln \left\{ \frac{m}{a(\mathbf{p})} \right\}$

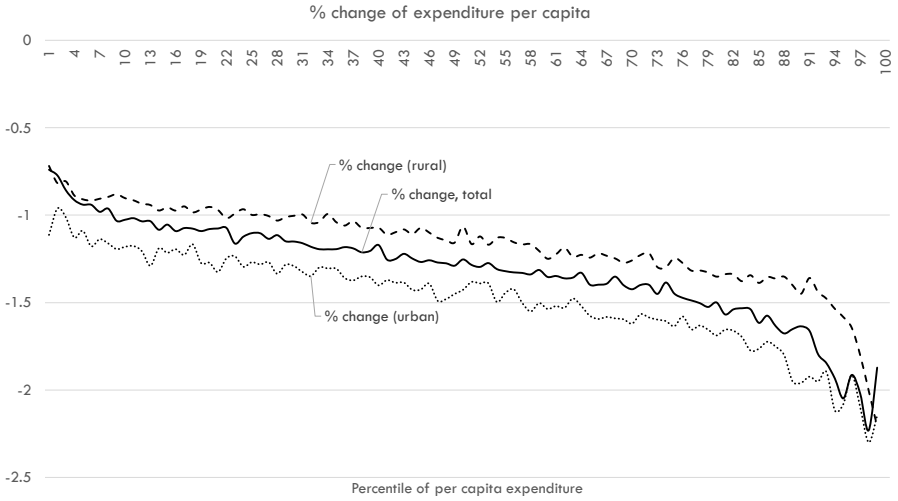
And calculate household specific price (own-price and cross-price) elasticities and income elasticity for each of the 8 commodities categories.

We then calculate real household expenditure for each of the 200,000 households in the sample for both actual and counter-factual (with and without reform).

$$Y_h^0 = \frac{1}{H_h} \sum_{i=1}^{N} P_i^0 X_{ih}^0$$ With reform

$$Y_h^1 = \frac{1}{H_h} \sum_{i=1}^{N} P_i^0 X_{ih}^1$$ Without reform

RESULT: THE DISTRIBUTIONAL EFFECT OF NOVEMBER 2014 FUEL PRICING REFORM



Source: author's calculation

THE EFFECT OF NOVEMBER'14 FUEL PRICING REFORM ON GINI COEFFICIENT OF INEQUALITY

Inequality in September 2015 with and without November 2014 fuel subsidy reform

				Simulation 1: Fuel Price Reform			Simulation 1 + 50% of Cash Transfer			Simulation 1 + Cash Transfer		
	Sep-14	Sep-15	Change (%)	Gini	Change (%)	% Contri-bution	Gini	Change (%)	% Contri-bution	Gini	Change (%)	% Contri-bution
Total	0.414	0.402	-2.98%	0.411	-0.52%	17.52%	0.406	-1.40%	46.79%	0.397	-2.27%	76.15%
Urban	0.433	0.419	-3.23%	0.431	-0.44%	13.16%	0.427	-0.92%	27.65%	0.421	-1.41%	42.15%
Rural	0.336	0.329	-2.12%	0.334	-0.57%	27.02%	0.327	-2.26%	106.08%	0.314	-3.96%	186.01%

Source: Authors' calculation

CONCLUDING REMARKS

The "Big bang" fuel subsidy reform of November 2014 was progressive.

- Its impact on household through increased cost of living is larger the richer the household are.
- The impact on the welfare of households in urban areas, in general, are larger than rural households.

The progressivity of the distributional impact is equivalent to the reduction of Gini coefficient by 0.52%. This is amount to 17% of the reduction in Gini cofficient observed one year after the reform.

We didn't take-into account the potential benefit of the reallocation of the fuel subsidy spending on other more productive and socially-progressive spending. This has not only significant inequality reduction but also poverty reduction.

However, Indonesia's reform is attributed more to strong political leadership and favorable external factors (low oil price). Replicability for other countries and under other general circumstances is a challenge.

Economy & Environment Partnership for Southeast Asia

SEA

ponre Viet Nam

Market-based instruments for environmental management in Vietnam

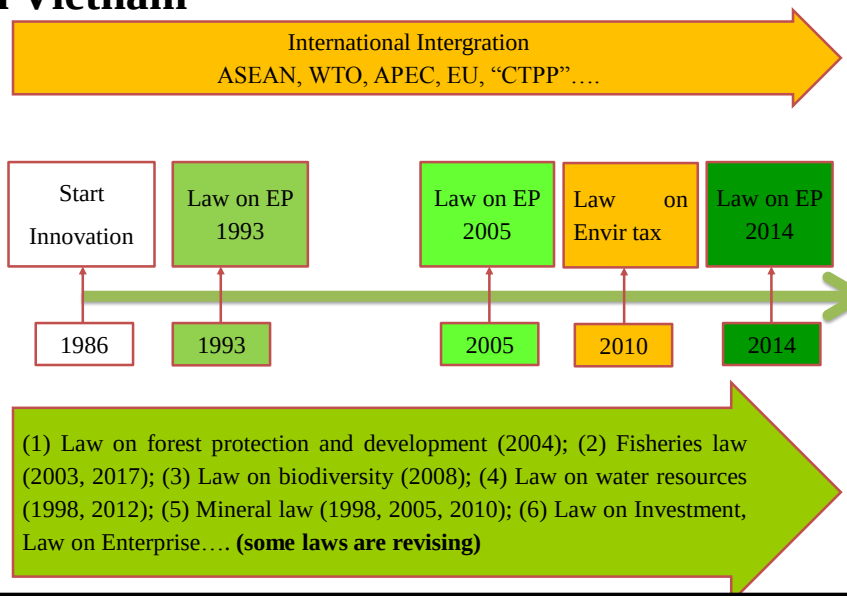
Lai Van Manh

Institute of Strategy and Policy on Natural Resources and Environment

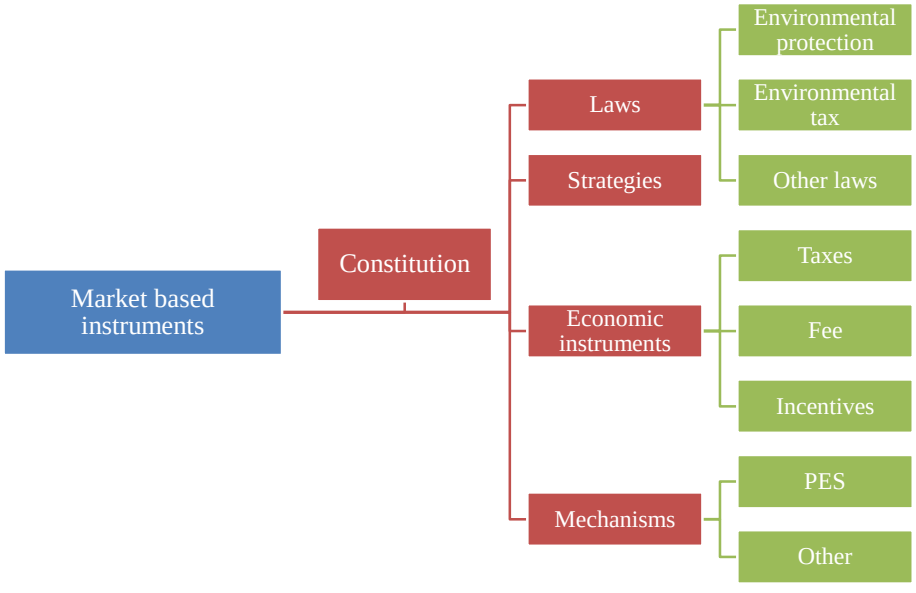
Structure

- Overviews
- Results, problems and causes
- ISPONRE's mission

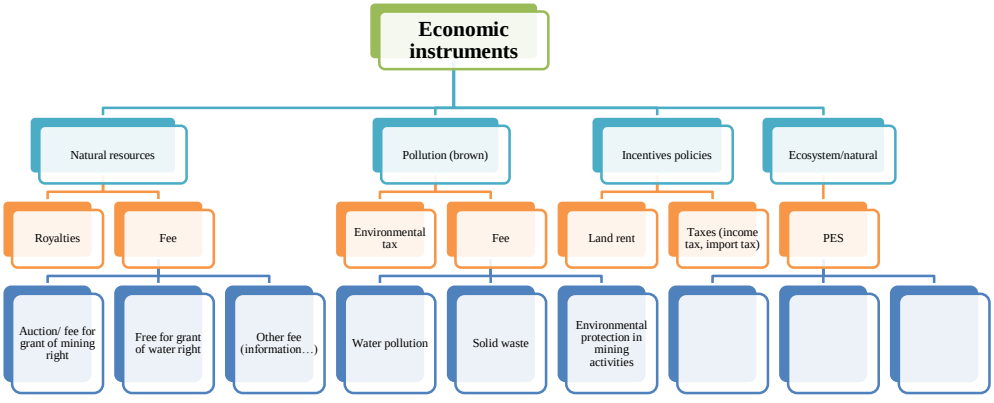
Legal framework on environment protection in Vietnam



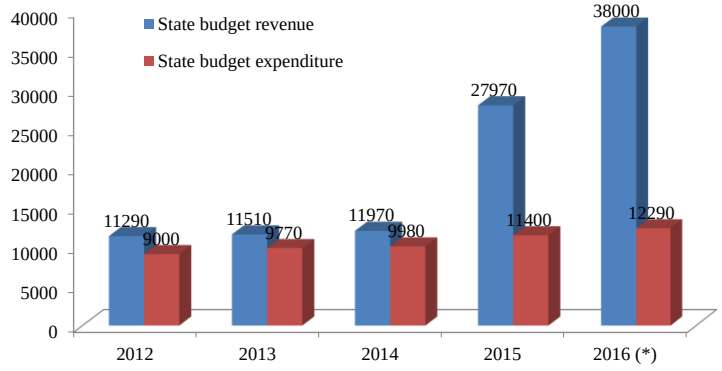
System of market-based instruments for environmental management in Vietnam



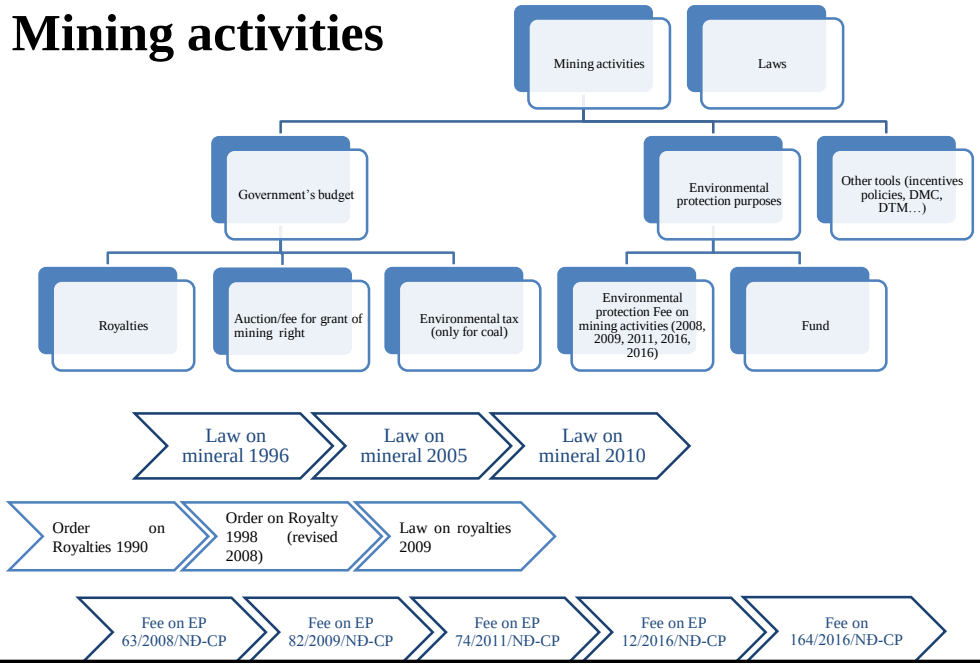
System of economic instruments on environmental protection



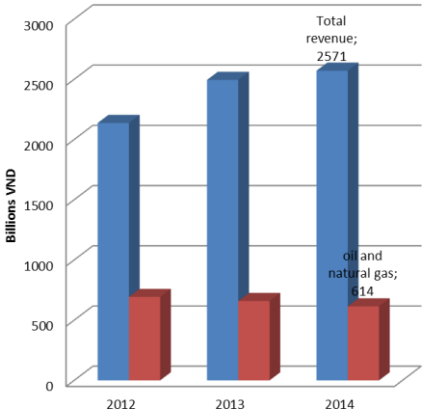
State budget revenue and expenditure for environmental protection



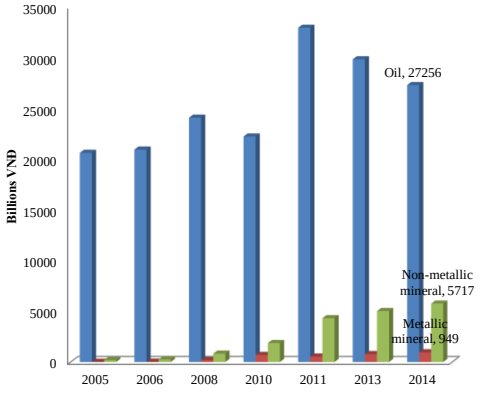
Mining activities



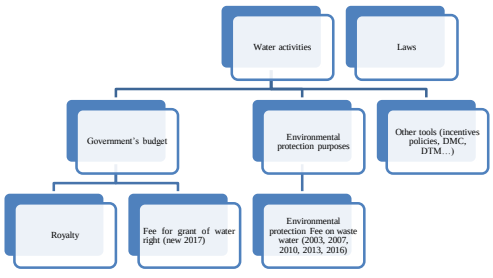
Fee for environmental protection in mining activities

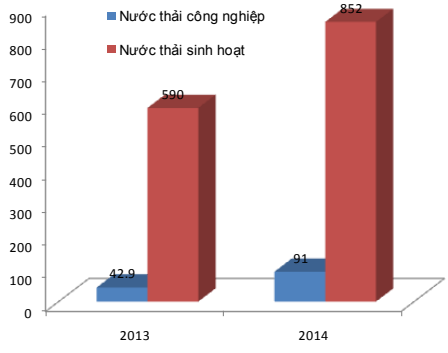


State budget's revenue from mineral's royalties



Water resources





Solid waste

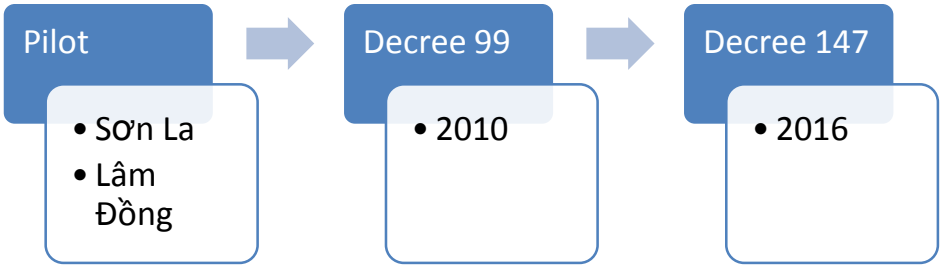
Order on fees and charges 2001

- Fee on environmental protection for solid waste (2007)

Law on fees and charges (2015)

- Price of waste treatment services (2015)

Payment for ecosystem services



Payment for ecosystem services

5 types of ES are specified

3 types have implemented

(1) Soil protection, restriction of erosion and sedimentation of reservoirs, rivers and streams.

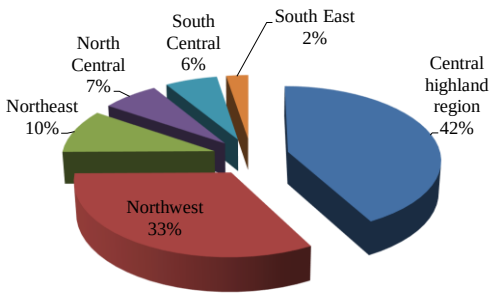
(2) Regulation and maintenance of water sources for production and social life.

(3) Protection of natural landscape and conservation of biodiversity of eco-systems for tourism services

Piloting services: Provision of spawning grounds, sources of feed and natural seeds, use of water from forests for aquaculture.

unaccomplished : Forest carbon sequestration and retention, reduction of greenhouse gas emissions by measures of preventing forest degeneration and forest area decrease and developing forests in a sustainable manner;

The rate of revenue from payment for environmental services by region



Totol revenue by 3 types of ES from 2011 to 2015 iss 5.226.025.000.000 VND

Incentives policies

Supply

- Land
- Income tax
- Export tax (for example eco products)
- Import duties
- Start up
- Environmental Standard and green labels
- Environmental Award
- FDIs attractions
- ….

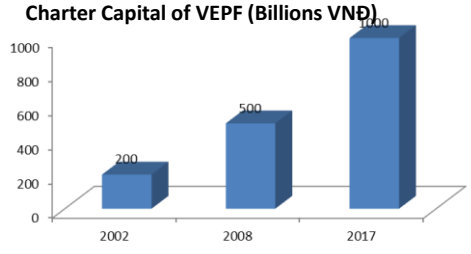
Demand

- Public expenditure
- Media
- Regulations (law on consumer protection, green label…)

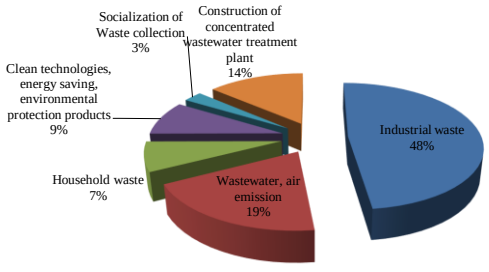
Vietnam's environmental protection fund (VEPF)

Main activities

- Soft loan
- Interest rate support
- Funding and Co-funding
- Clean Development Mechanism (CDM)
- Price subsidies for environmental protection products
- ODA and entrusted loans
- Other activities



Structures of soft loan by VEPF in 2014



Achievements

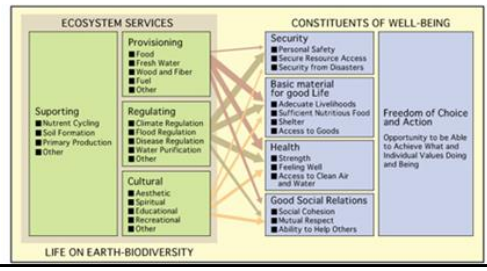
- The legal system is quite comprehensive: Laws and legislation systems such as environmental protection law in 2005, environmental protection law in 2014, environmental tax law in 2010, economical and efficient use of energy law
- A lot of market tools are applicable:
  - Internalize costs such as environmental protection taxes, environmental protection fees for industrial waste water and domestic waste water, other subsidies in environmental protection activities on land, infrastructure, Capital, tax, charge, price subsidy, etc.
  - Create a market for example pollution quota in carbon credits, environmental services
  - Establishment of responsibilities such as deposits for rehabilitation and restoration of the environment in mineral mining
  - Market pressures including clean production, green labeling, energy labels, environmental standards

Gaps, limitations

(i) Natural resources have not been managed, exploited and used effectively and sustainably, some resources are over-exploited leading to degradation and exhaustion..

Environmental pollution continues to increase,
in some places, the market for industrial and environmental services has not yet developed

Biodiversity is declining, the risk of ecological imbalance



Responding to climate change is remaining passive, confused; Natural disasters occur more and more offenly, causing damage to people and property

Rubber broke down due to Hurricane Doksuri (No.10) in Ha Tinh, 2017

Vietnam is deeply involved in new trade agreements, international commitments on environment and climate change.

Limitations

- Other tools, other than tax, are still in the early stages of development, with little effect, especially tools for creating market pressures, creating markets..
- The effectiveness of the current tools is limited (the environmental problem is more and more serious), due to many reasons :
  - The content of the policy use tools still need to be finalized, especially to have a real impact on the behavior of the target group in the direction of protecting the environment, narrowing, determining tax rates, fees, regulations on reward and punishment, compensation has not been appropriated, v.v.

Limitations

The implementation process:

- There are many issues that affect the effectiveness of the tool, for example, the environmental tax should ensure proper collection, avoid losses, reduction in the effect of tools;
- Lack of synchronism between regulations to ensure efficiency.
- Lack of mechanisms to monitor, assess impacts and adjust the implementation of existing regulations, resulting in limited impact.
- Supervision of expenditures from environmental taxes.

Difficulties currently facing

(i) The awareness and level of development is low,

(ii) Legal system is not completed

(iii) Resources effeciency use...

(iv) Productivity is low

(v) Technologies are backward.

(vi) Brown economic sectors is high, lack of green sectors.

(vii) Limitation of resources for changing technologies.

(viii) Environmental conflicts are increasing

Causes

i. The legal system is inadequate, not synchronous, unstable, not transparent, even overlapping and contradictions.

ii. The rights of citizens in the system of the entire people's ownership of natural resources; Disqualification of property rights disputes between the state, organizations and citizens are not satisfactory

iii. The allocation of national resources is ineffective, including resources as follow land, minerals and water resources

iv. Market factors and the type of market formation and function development is still slow, asynchronous

v. The market relations have not been set up synchronously, the natural resource market which is related to environment and climate change are not developed or operating smoothly, not transparent and ineffective

Causes

vi. Infrastructure and technology for functional markets are very backward. Environmental protection is mainly based on the "command and control" mechanism. Prices of natural resources do not reflect the market price.

vii. The role of the State is to use market tools to create, support, develop, monitor and regulate the market in the field of natural resources and environment is limited.

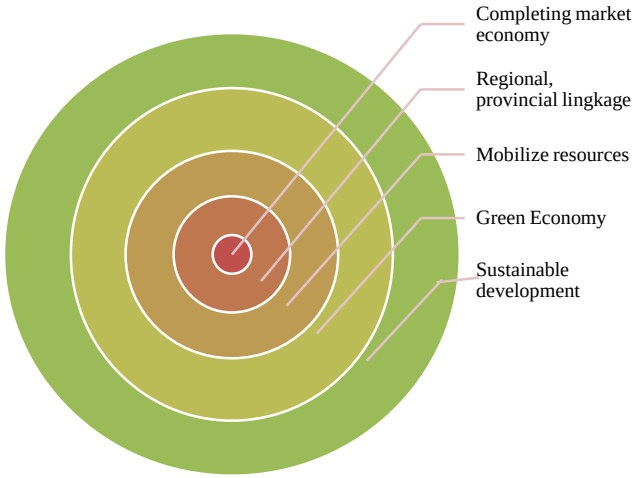
viii. Participation and role of elected bodies, socio-political organizations, social organizations, and occupations in policymaking, implementation and monitoring and protection of enterprises and consumers interests are limited

ix. The mobilization of social resources for environmental protection, response to climate change is very limited..

x. The organizational structure and capacity of the implementation staff are still limited to fit the market economy institutions.

ISPONRE's mission

- ❖Policies and laws
- ❖The organizational structure
- ❖Role of stakeholders
- ❖**International experiences**



Economic and Welfare Impacts of Geothermal Operations on the Local Economy

Workshop on Economic approaches to environmental management in Southeast Asia

University of Economics
Ho Chi Minh City, Vietnam
January 10, 2018

CONTENTS

- Overview and Project Design
- Framework of the study
- Economic Impact
- Local Welfare Effects
- Implications for EDC

Brief Profile of Energy Development Corporation – Negros Island Geothermal Business Unit

- Total power generation capacity - 1,457.8 MW coming from geothermal, wind, hydro and solar energy sources.
- Geothermal operation is eighty percent (80%) or 1,169 MW of its generation capacity
- 61% installed capacity of the geothermal energy in the entire country
- Leads globally in electricity production from geothermal steam energy with the largest integrated plant/field operations (World Energy Council, 2016).

EDC's Negros Island Geothermal Business Unit (EDC-NIGBU)

- Production of geothermal steam (Industry Classification 176) for use at the geothermal power plants [operated by its subsidiary, the Green Core Geothermal Inc. or GCGI]
- Generation and sale of electricity through these geothermal power plants (Industry Classification 175)

EDC-NIGBU's operation from 2006 to 2009 produced and sold steam for use by the National Grid Corporation of the Philippines, and with regional electric cooperatives

Local and National Impact Geothermal Operations

If the geothermal operations have positive environmental impact, then what about economic impact?

How much does NIGBU contribute to the local economy apart from its contribution to the national economy?

Are local taxes and revenues improving welfare of households

"*Ripple Effects*" of geothermal investments in the local and national economy

EDC-NIGBU, the oldest of the four is located 21 kilometers northeast of Dumaguete City in the municipality of Valencia, Negros Oriental and generating 192.5 MW

Geothermal Investment

Inter-industry growth

Royalties & Taxes

Local (Brgy, Municipal & provincial) & national growth

Local and national jobs created

Improved welfare of households

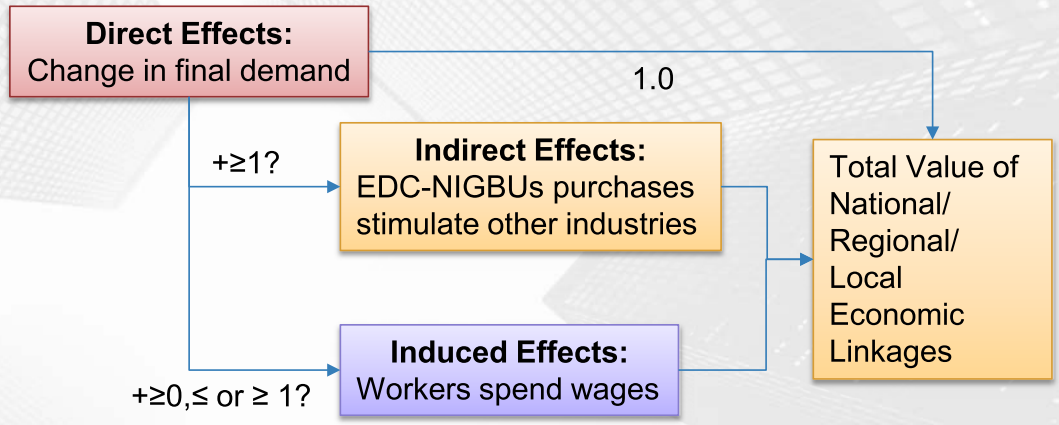
Methods Used for Economic Impact Analysis

- ❑ Used the National Input-Output Table developed in 2006
- ❑ Household-modified I-O
- ❑ A simple Location Quotient (LQ) technique was used to localize impact
- ❑ Industry survey (EDC-NIGBU Contractors)

Methods Used for the Welfare Impact Assessment Assessment

- ❑ Survey-Based Impact Assessment
- ❑ Survey of Employees
- ❑ Survey of Impact Areas (host *barangays* - villages) and areas of coverage of EDC-NIGBU
- ❑ Survey of households in impact and non-impact areas
- ❑ Analysis of survey results using Polychoric Principal Component Analysis

Types of Economic Impacts



Direct

- Initial effects caused by a change in final demand (ΔY) for (the industry's) output;

Indirect

Direct & indirect effects on other sectors/ industry directly or indirectly related to the industry "responding" to the change in final demand

Induced

Direct & indirect effects arising from changes in earnings and spending patterns of households in the local economy as a result of direct and indirect effects from the initial economic activity

INPUT-OUTPUT ANALYSIS

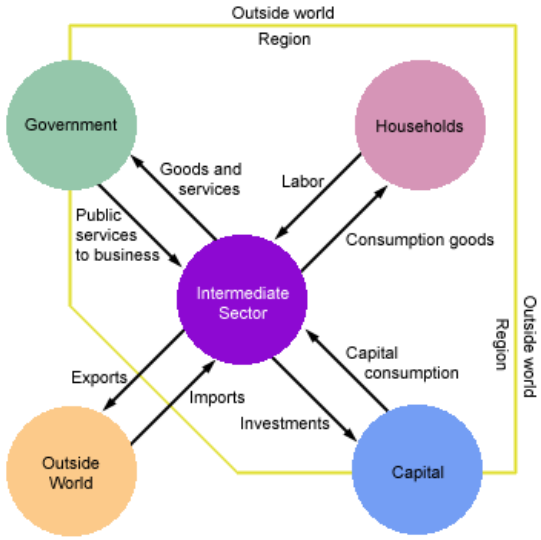
Basic input-output framework developed by Prof. Leontief (1930's) to estimate economic impact

→ The sector or industry uses outputs from its own and from other sectors.

→ Sector's outputs used as intermediate inputs and final consumption

	Construction	Transport	Energy	Manufacturing	Final Consumption	Total Product (Q = Output)
Construction						$Q_{Construction}$
Transport						$Q_{Transport}$
Energy						Q_{Energy}
Manufacturing						$Q_{Manuracturing}$
Compensation, Capital Dep, Profit, Taxes, Subsidy						
Total (Inputs)			Total $Inputs_{Energy}$			

- The I-O Model quantifies these interactions between industries (or sectors)
- Each industrial or service activity is assigned to an economic sector.
- The number of sectors included in an I-O Model depends on the desired level of detail (e.g., 11, 60, 120 or 240 sectors).
  - ❑ each industry produces only one homogeneous commodity,
  - ❑ each industry uses a fixed input ratio in the production of its output, and
  - ❑ that production is subject to constant returns to scale.



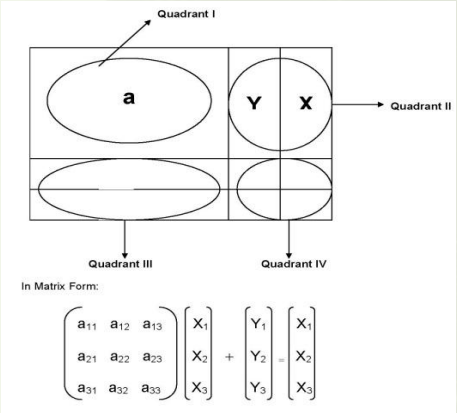
Transactions Tables

Structure of the Transactions Table

	Consuming Sectors	Final Demand (Y)	Total Output (X)
Producing Sectors	Quadrant 1 Intermediate Demand	Quadrant 2 Final Demand	X_1 X_2 . . . X_n
Primary Inputs	Quadrant 3 Primary Inputs	Quadrant 4 Primary Inputs	
Total Input	X_1 X_2 . . . X_n		

- For this study, the 2006 240-industry Transactions Table is used
- Steam generation and geothermal power plants is under Steam and Hot Water Supply industry (Industry Code (IC)176);
- Generation and sale of electricity from geothermal power is under Electricity Generation, Collection and Distribution industry (IC175)

Schematic Diagram of Transactions Table



Form of System of Linear Equations

$$X_i = \sum_{j=1}^{n} x_{ij} + Y_i$$

Technical Coefficients Table (Direct Requirements Table)

Table 2. Technical (Direct Requirement) Coefficients Matrix, Conventional 240-Sector, Philippines, 2006

IO Codes/Description		001	002	003	004	005	006	007	008	009	010	011
		Palay	Corn	Coconut	Sugarcane including muscovado sugar-making	Banana	Mango	Pineapple	Coffee	Cassava	Rubber	Sweet potato
175	Generation, collection and distribution of elec	0.00000	0.00126	0.00004	0.00500	0.00620	0.00019	0.00054	0.00003	0.00000	0.00370	0.00049
176	Steam and hot water supply	-	-	-	-	-	-	-	-	-	-	-
177	Collection, purification and distribution of wa	0.00078	0.00038	0.00020	0.00062	0.00136	0.00047	0.00012	0.00040	0.00004	0.00050	0.00005
178	Bus line operation	0.00052	0.00180	0.00095	0.00170	-	-	-	-	-	-	-
179	Jeepneyand other land transport services	0.00130	0.00451	0.00241	0.00426	0.00330	0.00050	0.00045	0.00003	0.00048	0.00087	0.00061
180	Railway transport	0.00001	0.00006	0.00002	0.00006	-	-	-	-	-	-	-
181	Public utility cars and taxicab operation	-	-	-	-	-	-	-	-	-	-	-
182	Tourist buses and cars including chartered an	-	-	-	-	-	-	-	-	-	-	-
183	Road freight transport	0.00042	0.00146	0.00078	0.00463	0.00104	0.00016	0.00011	-	0.00019	0.00020	0.00030
184	Sea and coastal water transport	0.00183	0.00624	0.00393	0.00288	0.00029	0.00061	0.00112	0.00318	0.00048	0.00397	0.00183
185	Inland water transport (including renting of shi	0.00014	0.00048	0.00030	-	-	0.00023	0.00011	0.00141	0.00010	0.00034	0.00030
186	Air transport	-	0.00521	0.00087	-	0.00124	0.00047	-	-	-	-	-
187	Supporting services to transport	-	0.00561	0.00110	-	0.00782	0.00011	0.00056	0.00001	-	0.00098	0.00061
188	Storage and warehousing	0.00074	0.00155	0.00030	0.00121	0.00024	-	0.00168	0.00141	0.00000	-	0.00020
189	Tour and travel agencies and tour operators; t	-	-	-	-	-	-	-	-	-	-	-
190	Activities of other transport agencies (includin	-	-	-	-	0.00110	-	-	-	-	-	-
191	Postal and courier activities	0.00006	0.00034	0.00006	0.00012	0.00014	-	-	-	-	0.00007	0.00030
192	Telephone service includes telegraphs	0.00117	0.00600	0.00120	0.00181	0.00264	0.00005	0.00011	0.00035	0.00001	0.00148	0.00274
193	Wireless telecommunications	0.00087	0.00445	0.00089	0.00135	0.00196	-	-	0.00018	0.00001	0.00114	0.00183
194	Telecommunication services, n.e.c	0.00006	0.00029	0.00006	0.00009	0.00014	-	-	-	-	0.00007	-
195	Wholesale and retail trade	0.02159	0.01474	0.01949	0.03406	0.01540	0.00654	0.02616	0.00941	0.00509	0.00606	0.01811
196	Repairs of motor vehicles, motorcycles, persc	-	-	0.00019	0.00380	0.00148	-	0.00045	0.00018	-	-	-
197	Banking Institutions	0.01029	0.00940	0.00095	0.02894	0.00033	0.00047	0.00840	0.00141	0.00049	0.00101	0.00186

$a_{ij} = x_{ij}/X_j$ or

$x_{ij} = a_{ij} X_j$

Where:

a_{ij} = technical coefficients

Each element in the intermediate demand component of the Transactions Table is divided by the total input of each sector.

Electricity Generation, Collection and Distribution industry (IC175) Inputs Coefficient = 0.32:

- **39% - industry, itself**
- **19% - steam & HWS industry**
- **19% - manufacturing**
- **11% - mining and quarrying**
- **5% - real estate, renting, and other business activities**
- **3% - transport, storage and communication**
- **4% - other sectors**

(9% - Compensation)

Leontief Inverse (Matrix)

(or Total Requirements Matrix, provides a link between production and final demand)

$$X_i = \sum_{j=1}^{n} a_{ij} X_i + Y_i$$

In Matrix Form:

$X = AX + Y$

or $X - AX = Y$

$(I - A) X = Y$

$X = (I - A)^{-1} Y$

Where:

X = column vector of sectoral total outputs

Y = column vector of final demand

A = n x n matrix of technical coefficients, a_{ij}

I = Identity matrix (matrix with "1" in the diagonal and "0" in all other fields)

$(I - A)^{-1}$ = "Leontief Inverse (Matrix)" or total requirements matrix

= B (or B' if induced effects are included)

Regional I-O Model

- Uses simple Location Quotient (LQ) method, a non-survey technique of producing regional I-O tables based on the national I-O coefficients
- The technique quantifies the concentration of an industry in an area;
- This study used employment data by industry for the Philippines and for Region VII based on the 2006 Census of Philippine Business & Industries (CPBI)

Household-Modified I-O Model

- Captures induced effects through earnings and spending patterns of households receiving income from sectors/industries
- I-O Model is modified to include household activity as an endogenous activity in the Transactions Table
- Household sector is reflected as a producing industry selling services (labor) and purchasing inputs for consumption

LQ-Adjusted Technical Coefficients

Input Sources	Steam and HWS industry (176)	Electricity generation, collection & distribution industry
Imported	78%	36%
Supplied Locally	22%	64%

Multipliers

Factors of proportionality that measures the total economic impact given exogenous change

Two types:

- ❖ Estimated using the conventional I-O model:
  - ❑ direct
  - ❑ indirect (inter-industry interactions)
- ❖ Derived from the modified I-O model:
  - ❑ induced effects of household expenditures

Output Multipliers:

- An industry output multiplier of 2.00, for example, indicates that a change in sales to final demand of, say PhP100 by that industry will result in a total impact in the economy's output by PhP200.

Income Multipliers:

- For a direct industry, a 1.50 income multiplier, for example, indicates that a PhP100 change in income in that industry will generate a total change in income within the economy by PhP150.

Employment Multipliers:

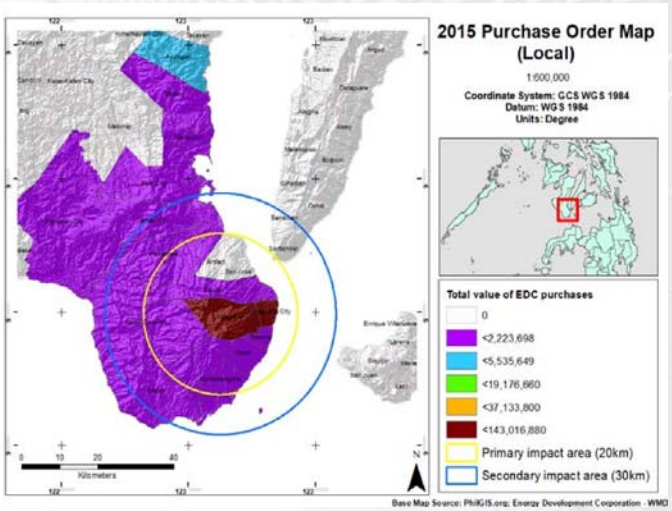
- For example, an employment multiplier of 1.50 indicates that the creation of one new job in the direct industry will result in an additional 1.50 total jobs in the economy.

Inter-Sectoral Linkage Effects

Relative importance of an industry (e.g., geothermal power industry) as a supplier or purchaser of inputs from the entire production system,

- **Backward linkage** or derived demand measures an industry's relative importance as a purchaser of inputs.
- **Forward linkage** measures an industry's relative importance as supplier of raw materials.

Backward and forward linkage indices greater than one indicate that a sector is a key sector in the economy in terms of investment, the growth of which will stimulate production in the other sectors in the economy.



The higher the value of an industry's backward (or forward) linkage index, the stronger is its influence as a purchaser (or supplier) of intermediate inputs to the entire production system.

Welfare Impact Assessment

What is the impact or causal effect of a program P on an outcome of interest Y?

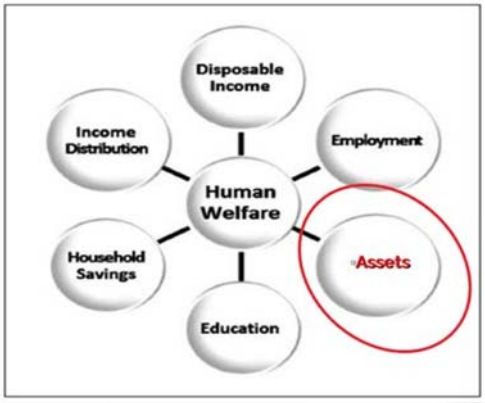
$\alpha = (Y \mid P = 1) - (Y \mid P = 0)$

$(Y \mid P = 1)$ is the treatment

$(Y \mid P = 0)$ is the counterfactual

Although we can observe and measure the outcome (Y) in this case, geothermal operations beneficiaries (Y | P = 1), there are no data to establish what their outcomes would have been in the absence of the geothermal operations (Y | P = 0).

If the two groups are identical, except only that one group participates in the program and the other does not, then we can be sure that any difference in outcomes must be due to the program (geothermal operations beneficiaries).



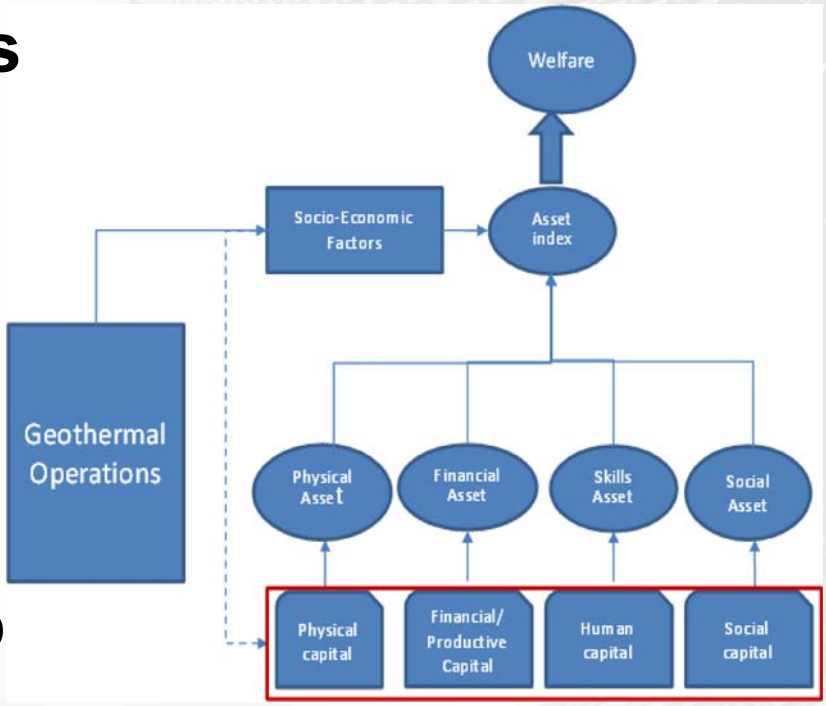
Assets as indicators/ measures of human welfare

Polychoric Principal Component Analysis

- A household's capital portfolio can be measured in terms of a number *i* of types of capital, A. Each is composed of *j* types of assets, c.
- Each c may be measured using a binary, ordinal, or cardinal variable.
- A weight, w, is assigned to each item and then the weighted variables is summed up to arrive at the estimate of A

$$A_j = \sum_{j=1}^{n} wc_{in}$$

$$A'_j = (A_j - A_{min})/(A_{max} - A_{min})$$



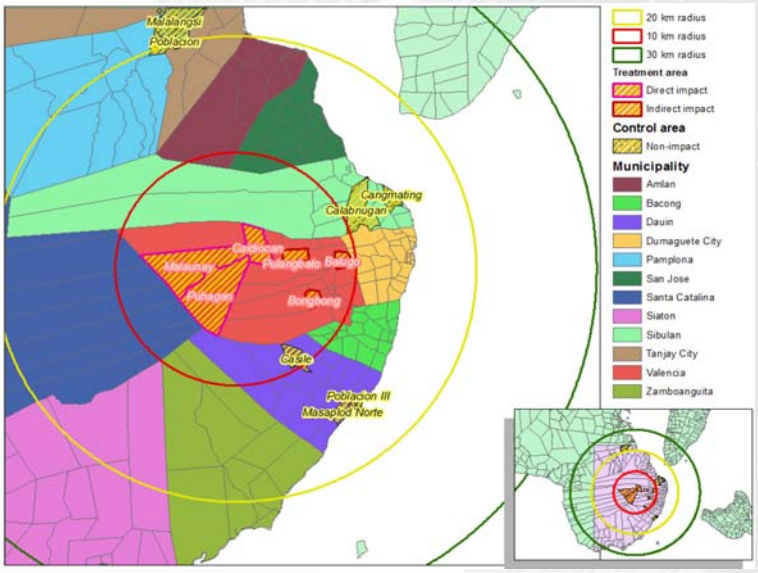
Impact Group, Levels of Welfare Assessment and Sampling

The most basic question is how we know if we can attribute the welfare condition in the household to the existence of geothermal operations.

Two layers of local level welfare impact assessment :

- Household level comparing the impact and non-impact groups
- community level which looks into the infrastructure and other social services impact of geothermal operations

564 Households: 282 Treatment and 282 control groups



HH survey sampling area: (a) smaller radius 10 km, (2) middle radius is 20 km, (3) larger radius is 30 km from geothermal plan

Economic Impact on Output

Combined electricity generation and steam production output multiplier - 2.53

- 1.33 for electricity generation and
- 1.20 for steam production

IC175 & IC 176(EGS)	2.53
Direct	0.79
Indirect	1.60
Induced	0.14

An output multiplier of 2.53 means that a PhP10 Million (or Billion) increase in sales of its product to final demand will induce the production of PhP25.3 Million (or Billion) worth of total output within the local economy (RVII).

Disaggregation of the total output multiplier:
Electricity Generation, Collection and Distribution (IC 175)

I-O Code/Description		RVII LQ-Adjusted I-O Model			
		Direct Effects	Indirect Effects	Induced Effects	Total Economic Impact (D+I+I)
01 ('001-035)	Agriculture, Hunting, Forestry and Fishing	-	0	0.005	0.005
02 ('036-044)	Mining and Quarrying	-	-	-	-
03 (045-173)	Manufacturing	0.006	0.005	0.029	0.04
04 (174)	Construction	-	-	0	0
05 ('175-177)	Electricity, Gas & Water Supply	0.189	1.031	0.005	1.224
175	Generation, collection and distribution of electricity	0.121	1.02	0.004	1.145
176	Steam and hot water supply	0.06	0.008	0	0.068
177	Collection, purification and distribution of water	0.008	0.002	0.001	0.011
06 (178-194)	Transport, Storage & Communication	0.002	0.001	0.004	0.007
07 (195-196)	Trade and Repair of Motor Vehicles, Motorcycles, Personal & Household Goods	0.002	0.004	0.02	0.026
08 (197-202)	Financial Intermediation	0.002	0.001	0.005	0.008
09 (203-220)	Real Estate, Renting, and Other Business Activities	0.004	0.003	0.001	0.008
10 (221)	Public Administration & Defense; Compulsory Social Security	-	-	-	-
11 (222-240)	Other Services	0	0	0.015	0.015
241	HH (Labor Income)		-	0.123	0.123
	Imports	0.115			0.115
	Total	0.32	0.931	0.082	1.333

- **36% (0.115) is imported outside the region**
- **64% is supplied by local industries,**
  - 38% (0.121) of which, is supplied by the industry itself (IC 175),
  - 19% (0.060) by the steam and HWS industry (IC 176),
  - the rest by other industries in the region.

Disaggregation of the total output multiplier:
Steam and Hot Water Supply Industry (IC 176)

IO Codes/Description		RVII LQ-Adjusted I-O Model			
		Direct Effects	Indirect Effects	Induced Effects	Total Economic Impact (D+I+I)
01 ('001-035)	Agriculture, Hunting, Forestry and Fishing	-	0	0	0.003
02 ('036-044)	Mining and Quarrying	-	-	-	-
03 (045-173)	Manufacturing	0.03	0.011	0.021	0.061
04 (174)	Construction	-	-	0	0
05 ('175-177)	Electricity, Gas & Water Supply	0.033	1.009	0.003	1.046
175	Generation, collection and distribution of electricity	0.023	0.007	0.003	0.032
176	Steam and hot water supply	-	1.002	0	1.002
177	Collection, purification and distribution of water	0.011	0.001	0	0.012
06 (178-194)	Transport, Storage & Communication	0.012	0.001	0.003	0.016
07 (195-196)	Trade and Repair of Motor Vehicles, Motorcycles, Personal & Household Goods	0.005	0.007	0.015	0.027
08 (197-202)	Financial Intermediation	0.005	0.001	0.004	0.01
09 (203-220)	Real Estate, Renting, and Other Business Activities	0.021	0.003	0.001	0.024
10 (221)	Public Administration & Defense; Compulsory Social Security	-	-	-	-
11 (222-240)	Other Services	0	0.002	0.011	0.013
241	HH (Labor Income)			0.091	0.091
	Imports	0.364			0.364
	Total	0.47	0.671	0.061	1.201

- **78% (0.364) is imported outside the region**
- **22% is supplied by local industries,**
  - Mainly manufacturing, electricity generation, real estate, etc., and transport, storage and communication.

Impact on (Labor) Income

The compensation coefficient:

- 8.8% - electricity generation, collection and distribution (IC 175)
- 6.2% - steam and water supply industries (IC 176)

Any increase in revenue for the sectors' output is not expected to generate a significant amount of additional labor income

Type of Effect	Using RVII LQ-Adjusted Tech. Coefficients	Using National I-O Tech. Coefficients
EGS (IC175 & 176)	0.21	0.36
Direct	0.15	0.15
Indirect	0.04	0.12
Induced	0.02	0.09

An increase by PhP10 Million in the combined sectoral revenue (final demand) from steam production and electricity generation from geothermal power implies a PhP0.19 Million (0.15 + 0.04) increase in labor income in the economy from direct and indirect effects and by PhP 0.21 Million when induced effect is included.

Impact on Employment

Type of Effect	Using RVII LQ-Adjusted I-O Coefficients		Using National I-O Coefficients	
	Conventional I-O Model	Modified I-O Model	Conventional I-O Model	Modified I-O Model
EGS (IC175 & IC 176)	4.93	5.87	7.44	9.96
Direct	2	2	2	2
Indirect	2.93	2.93	5.44	5.44
Induced		0.94		2.53

A total employment multiplier of 5.87 indicates that 5,870 additional jobs will be generated in the economy for 1000 jobs created in the steam and HWS industry and in the electricity generation, collection and distribution industry; 4,930 (2,000 + 2,930) from direct and indirect effects and 5,870 when induced effect is included.

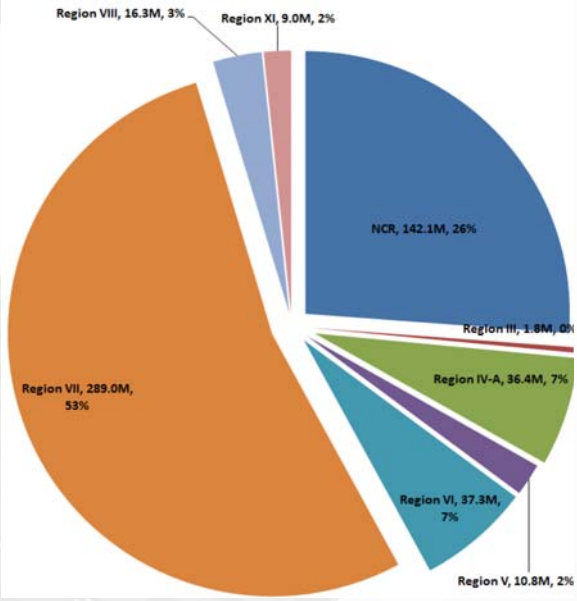
Inter-sectoral Linkage Effects

2006 I-O Industry Code	Industry	Backward Linkage			Forward Linkage		
		Total Backward Linkage	Index of Dispersion	Index Rank	Total Forward Linkage	Index of Sensitivity	Index Rank
Using RVII LQ-Adjusted Technical Coefficients							
175	Generation, collection & distribution of electricity	1.25	0.93	132	8.67	6.48	2
176	Steam & hot water supply	1.14	0.85	198	1.52	1.13	26
Using National Technical Coefficients							
175	Generation, collection & distribution of electricity	1.58	0.75	199	13.01	6.15	4
176	Steam & hot water supply	2.01	0.95	143	1.78	0.84	66

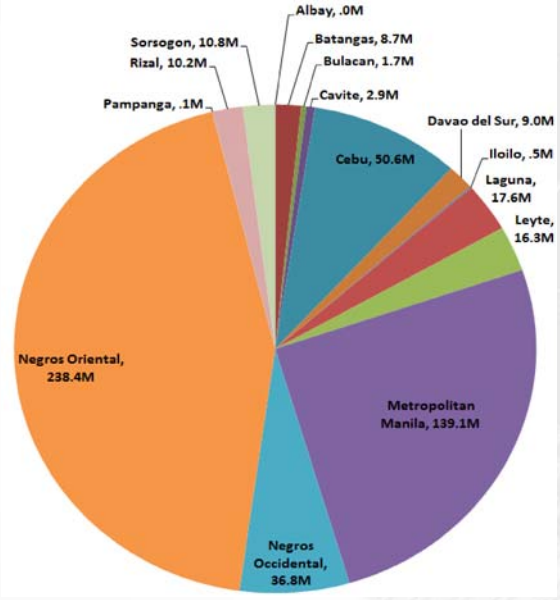
Based on the RVII LQ-Adjusted coefficients, the total forward linkage is greater than the total backward linkage (TFL > TBL) of Electricity generation, collection and distribution (IC 175) and Steam and HWS (IC 176) indicating that both industries are relatively more important as a supplier than as a purchaser of inputs from other industries for further production.

Based on the national coefficients, however, IC 176 is relatively more important as a purchaser with TFL less than TBL (1.78 vs. 2.01).

Distribution of Backward Linkages in 2015



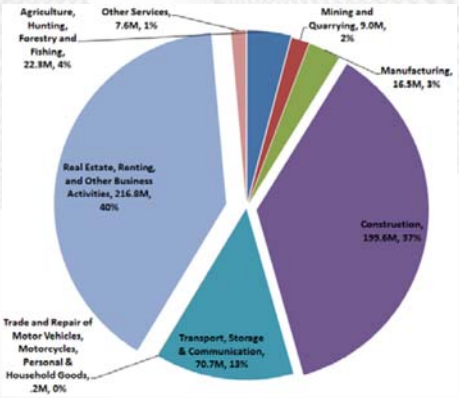
Distribution of purchases by administrative region

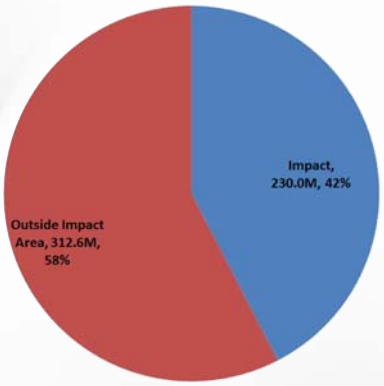


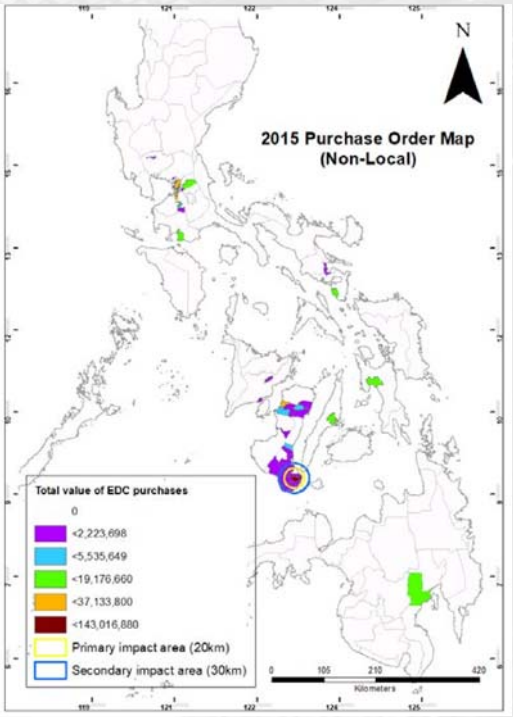
Distribution of purchases by province

Distribution of NIGBU supply contracts by impact area and industry category

The total of purchases of NIGBU in 2015 regardless of capital goods or intermediate inputs is PhP 542.6 million



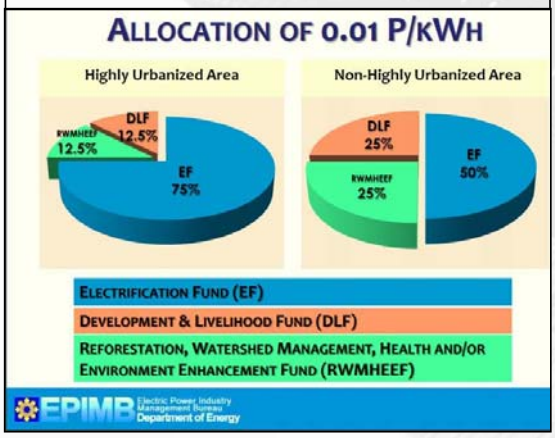




Welfare Impact Assessment

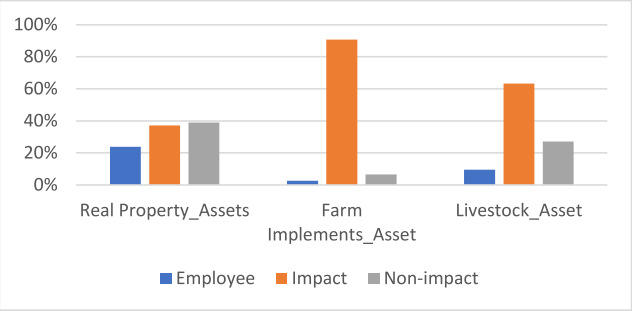
- Benefits are being extended to host communities in the form of royalty payments which started in 1992
- Benefits Funds mandated under Energy Regulation (E.R.) 1-94 or the one-centavo per kilowatt-hour benefit beginning in 1994.
- These contributions derived from the company's operations are being used to subsidize the electricity cost of host barangays and finance their development and livelihood projects.
- A host community is a local government unit (barangay, municipality, city or province) where the energy resource and/or energy generating facility is physically located.

RA 7638 (DOE Act of 1992)
Section 5(i) to "devise ways and means of giving direct benefits…

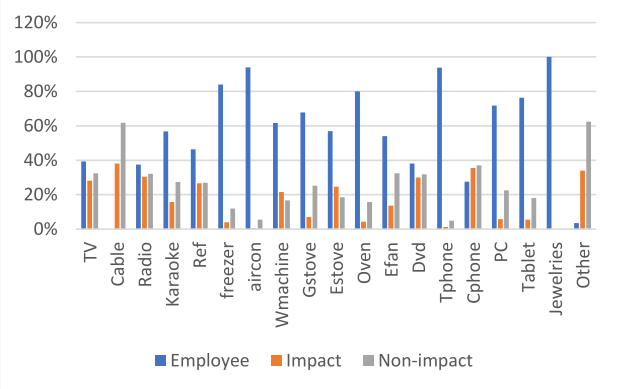


Summary of Assets

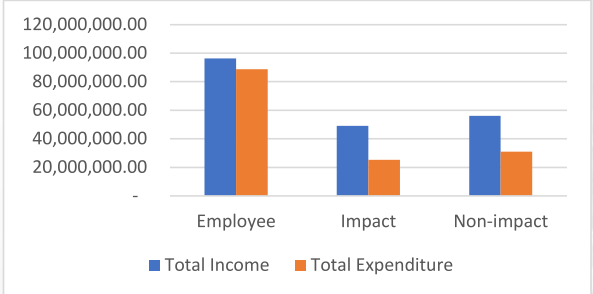
Physical Assets



Durable and Productive Assets

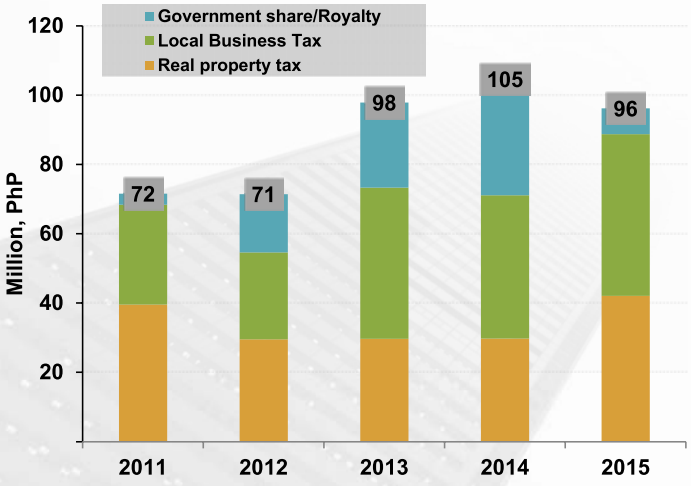


Financial assets

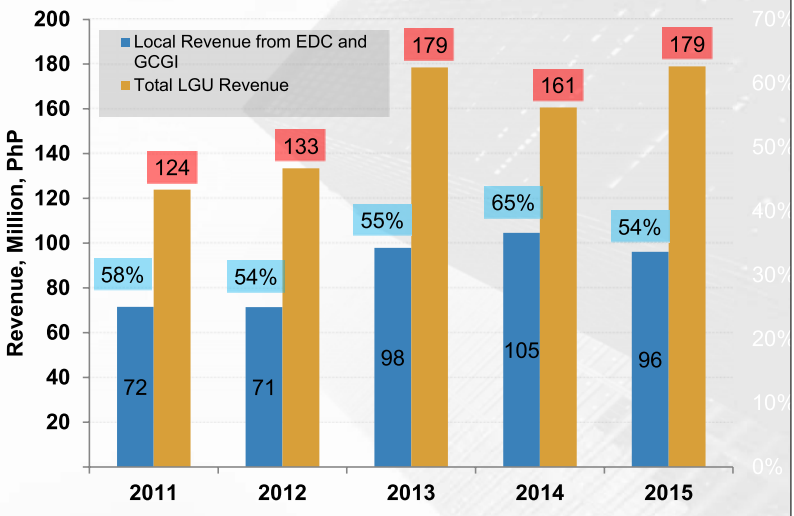


Local Government Revenue and EDC-NIGBU Contribution

Valencia LGU Revenue from Geothermal BU



Valencia LGU Revenue and Contribution of Geothermal BU



For the past years now, Valencia is already classified as a first-class municipality with its annual income flow exceeding one hundred million pesos annually

Welfare Effect of Geothermal Operations

Polychoric PCA Results: Household Welfare in Impact vs Non-Impact Area

- The coefficient on any one variable is related to how much information it provides about the other variables.
- Ownership of an asset may indicate that a household is likely to own only few other assets, then it receives a negative coefficient, which then all point out to low level of welfare of households

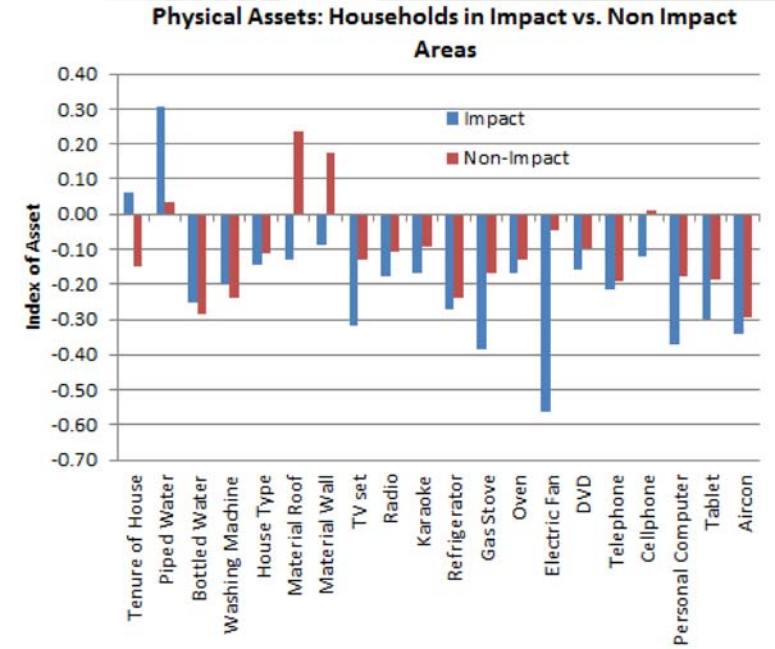
Ownership of Physical Assets

The non-impact area generally has the same welfare condition as the impact area, in so far as the physical capital assets are involved.

All the assets reflected indicate a negative factor score or index except for house tenure and piped water

The negative signs mean the households are likely to own only few other assets which then all point out to low level of welfare of households in the impact area

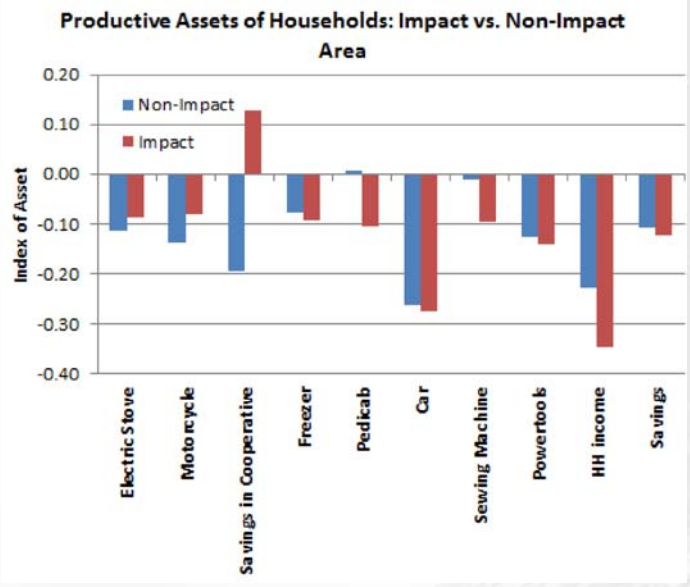
A household with Material Wall (that is not made of strong material) will fall into the lowest categories of other types of assets like roof, house type, even education or human capital asset.



Ownership of Productive Assets

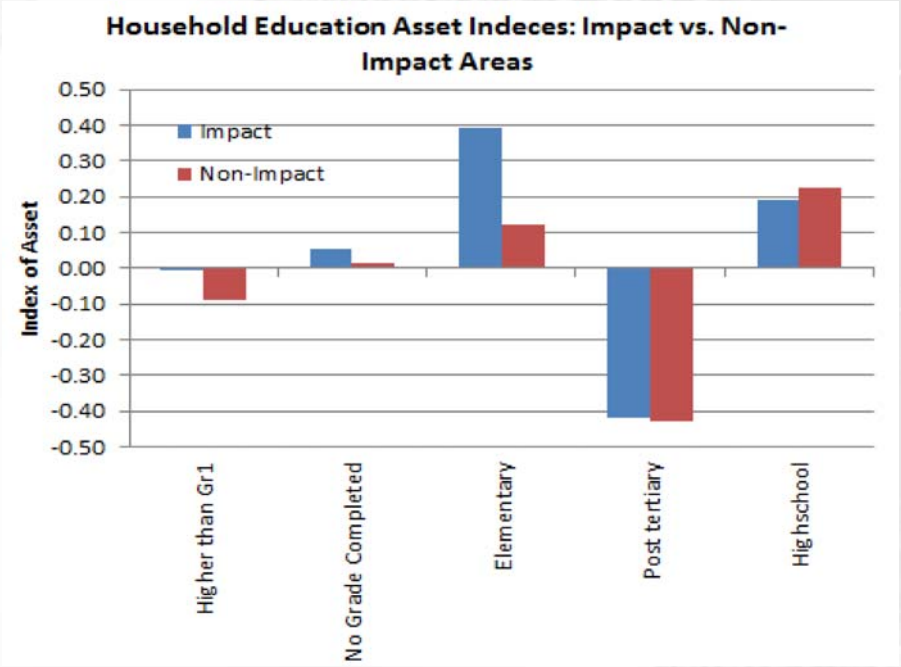
Electric stove, motorcycle, savings in cooperative, freezer, pedicab, car, sewing machine, powertools, HH income and savings.

- Savings in Cooperative uniquely came out with a positive index of .1266 signifying how this asset positively affects welfare of households in the Impact Area.
- The same asset does not give the same effect in the Non-Impact area
- This is mainly due to the different forms of support/assistance given by EDC to various cooperatives in the Impact Area thereby encouraging the locals to be active members of cooperatives.

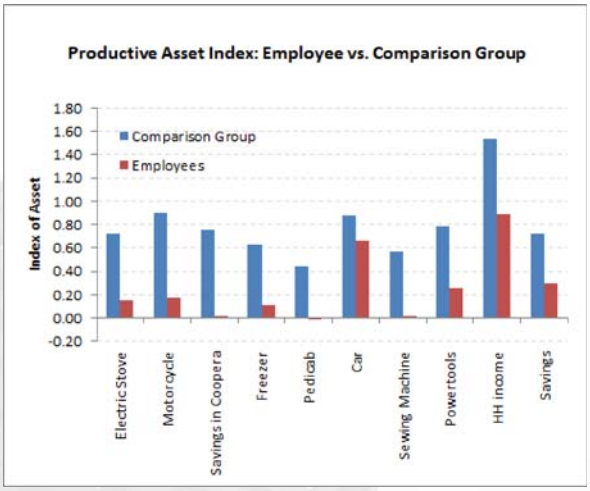


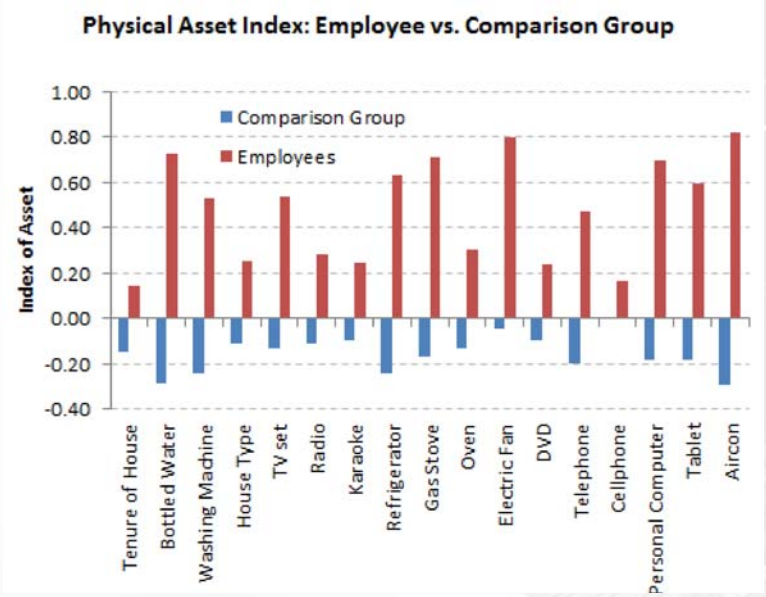
Ownership of Human Capital

- Elementary level generated the highest asset index of .3928 for the Impact group.
- The index for the Impact Group is higher than that of the Non-Impact group at .3928 and .1212, respectively.
- At higher level the scenario changes



Welfare of Geothermal Employee Households vs Comparison Group Households





Conclusion

Economic Impact:

The geothermal operations of NIGBU have impact on whole economy in three key economic aspects brought about the inter-sectoral linkages (backward, and forward linkages), of the steam (IC 176) and electricity generation (IC175) in the entire economy, thereby creating what is labeled as “ripple effects”.

NIGBU, which produces steam and generates electricity, is considered relatively more important as a supplier of inputs to other industries based on the regional model.

At the national model, it may be considered as relatively more important as a purchaser of inputs with respect to the production of steam.

Taxes and royalty collection from EDC/GCGI is the single most important contributor of municipal income. Approximately 60% of Valencia’s annual income is derived from real property tax paid by EDC alone.

Conclusion…cont

Welfare Impact:

Overall, the asset-based wealth indices, which are proxy indicators for welfare improvement of households showed not significant differences of welfare of impact and non-impact area in terms of Physical assets;

On specific assets, ownership of piped water (a component of the physical asset), type of wall material, savings in cooperatives, graduating from elementary, are welfare improving for households in impact area, and showed distinct advantage over non-impact areas, which are indications of positive contribution to welfare of geothermal operations of EDC-NIGBU

Implications for EDC-NIGBU

The multiplier effect implies that investments in geothermal operations will flow back by means of increased final demand for energy. This means increased demand for steam and electricity generation to create an incentive for expansion of geothermal operations.

The scenario analyses carried out by this study indicated that a 6.3% growth in final demand for the two industries (steam generation and electricity production) will result to 0.06% (PhP7.7 B) increase in gross output.

The 60 MW expansion is projected to generate 1,735 additional jobs in the economy in a year. A 5-year projected duration of the expansion project will have 5x that number of jobs created.

The Company can support further cooperative savings by promoting enterprise development from local produce in Valencia, linking small-holder agriculture produce to medium scale manufacturing business, and diversifying its education or capacity development program toward developing enterprise skills for manufacturing and trading.

The company can support the development of project proposal for utilizing its share from natural wealth

Behavioral insights and a new design to enhance new technology adoption among Thai farmers

Phumsith Mahasuweerachai
Steffen Andersen
Siwaporn Fongtong
Uri Gneezy
Katharina Laske
Julie Marx

Prepared for Economic Approaches to Environmental Management in Southeast Asia Seminar
Ho Chi Minh City, January 10-11, 2018

Beginning of the Story

New agricultural technology
- Lower cost
- Higher yield
- Environmental friendly

→

Coping risks
Reduce income fluctuation for poor
Natural resource efficiency

But
Rate of adopting the new technology is still low especially for (relative) poor farmers.

The Main Purpose of the Study

How to increase rate of new technology adoption among poor?

Royal Initiative Discovery Foundation

- Rural development project
- Create water supply storage: 7 million cubic meter of water
- Build small irrigation system

Enough water supply for agriculture during dry season
But not for off-seasonal rice

Off-seasonal rice: Need water 1,200 m^3/ rai/ month
Four times higher than seasonal rice

*1 rai = 1,600 m^2

Beginning of the Study

Extension programs by the Royal Initiative Foundation

Develop combination of new crops

- Supporting inputs
- Available markets
- Higher profits
- Use less water

Classical problem arrives:
Very low rate of adoption for the new crops

Less than 50 farmers joined the program in the first 2 year

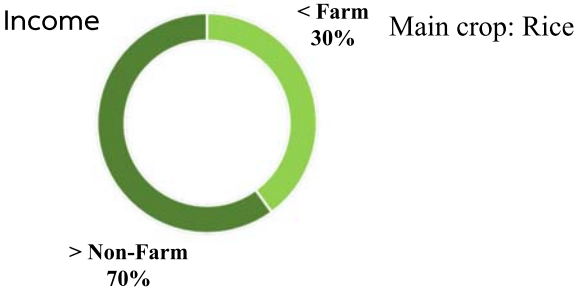
Understanding the Poor: Uncertainty

Annual income $4,570

Annual expenditure $3,715

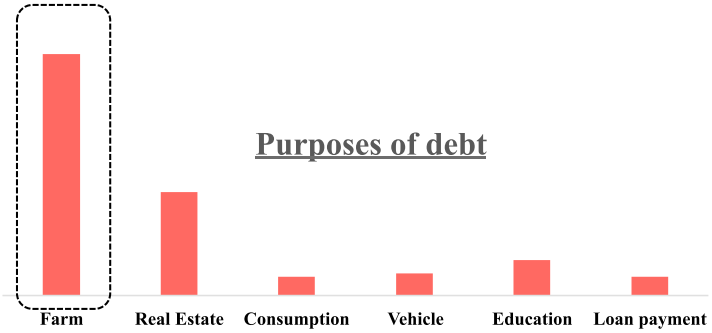
Debt $7,715

Saving $1,000



Main crop: Rice

Cover 70% of debt?



High debt, low saving, and main crop does not provide profit.

Understanding the Poor: Too Risk Averse?

"New crops are good but I have never grow them before. I fear I will do something stupid and will not be able to get any profits."

"I have debt to pay if I lose from new crops I will not be able to pay back debt and I may lose my land."

"Even thought, off-seasonal rice provides lower profit, I am sure I could make some profit from it. However, I am not sure to make any profit as shown in the paper from the new crops."

"My kids are still studying. I want to make sure I have consistent income to support them. Rice and working outside agricultural sector could provide this steaming of income, but I am not sure for the new crops."

The Main Barriers

New Crops: Too Risky
Seasonal Migration and Off-Seasonal Rice: OK

The Main Barriers

Inexperience
Fear of loss

↓

Can be managed in the short-run.

Uncertainty of HH economy

↓

Cannot be managed in the short-run.

Short-run main purpose: To increase rate of adopting new crops

Program to Convince Farmers

1. Pay farmers a monthly of 5,000 Baht ($143) if they participate in the new crops adoption program introduced by the foundation.
   - This payment will last for 4 months; off-seasoning farming period.
   - This payment will be guaranteed as long as the farmers put in enough effort.

2. The foundation will introduce combination of new crops that could make profits at least 20,000 Baht ($570) to cover guaranteed income.

Program to Convince Farmers

3. The foundation will provide inputs to farmers, i.e. seeds, fertilizer.

4. The foundation will provide experts and field experts
   - As supervisor for growing new crops (prevent inexperience problem)
   - As enforcer to prevent moral hazard (whether farmers put enough effort)

5. The foundation will buy all product from farmers with guaranteed price.

6. After harvesting the crops, the revenue will go back to the foundation to cover all costs including monthly payments. Any revenue above all costs will go back to the farmers.
   - If losses occur, farmers do not need to pay back the losses, and can have monthly payment.

Implementation: Risk Transfer

- 38 villages are eligible for the program.
- Participants were recruited in village level during November to the first week of December 2016 .
- The number of households participated in the program was limited to 10 households per village.
- Farmers have three day to make decision to join the program. They also allow to submit the application right after the meeting.

Implementation: Risk Transfer

Before and After Comparison

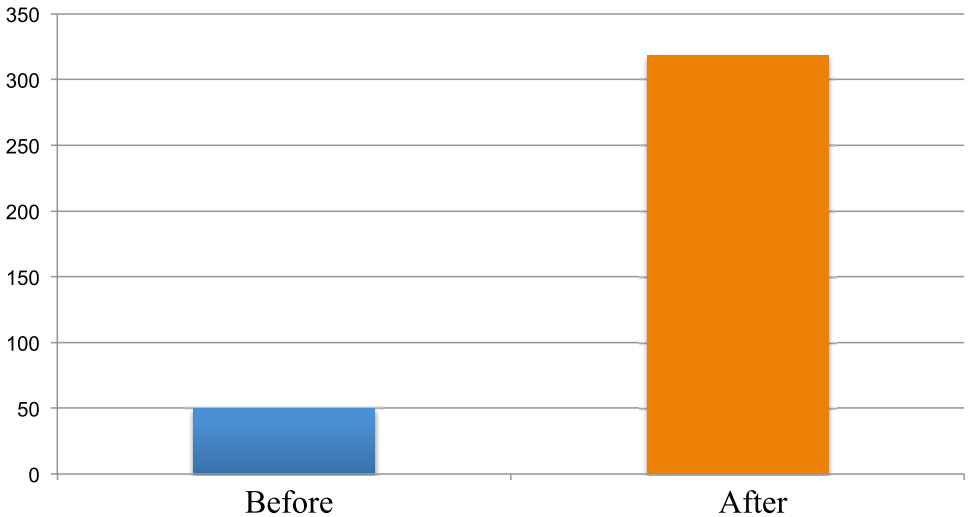
- Before
  - Villagers themselves before the program is implemented.
  - No risk transfer mechanism
  - The number of applicant before introduction of risk transfer program
- After
  - Implement risk transfer mechanism

Outcome: The number of applicant after the risk transfer program is implemented.

The Impacts of the Program: Risk Transfer

- Short-run
  - Transfer risk from farmers to foundation seems to work
  - Solve fear of loss (loss aversion)

318 households applied for the program



Note: No farmer applied for similar program with no risk transfer

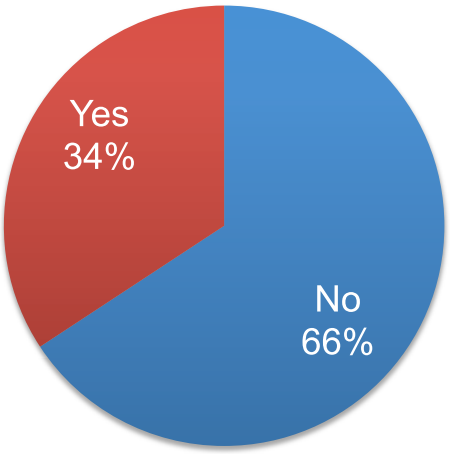
The Impacts of the Program

- Selection process
  - Access to water supply and enough labor
  - Lottery

181 households join the program

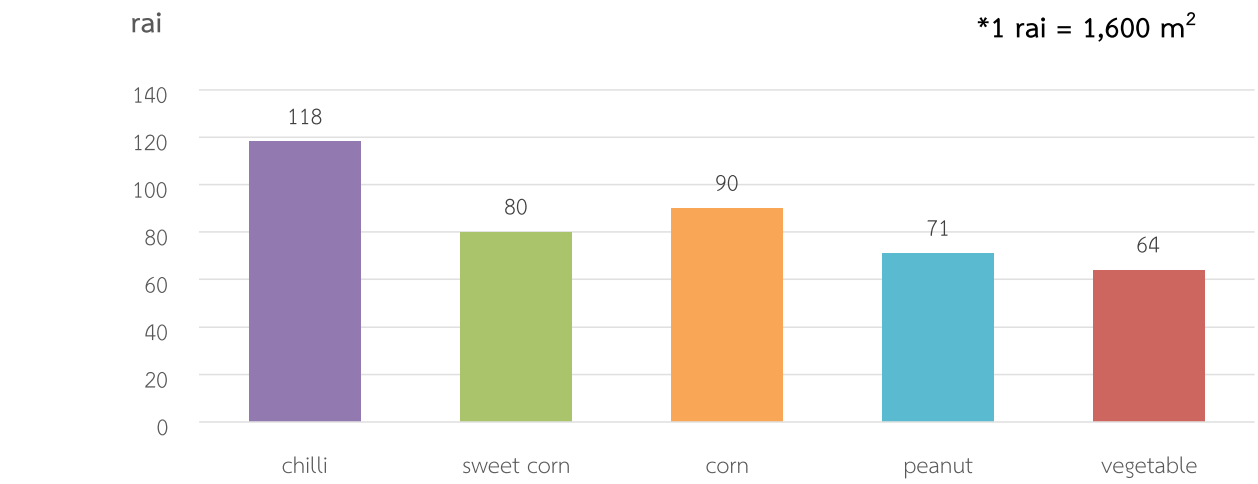
The Impacts of the Program

- Short-run
  - Program seem to attract targeted farmers.
  - Those who have never tried the new crops before.



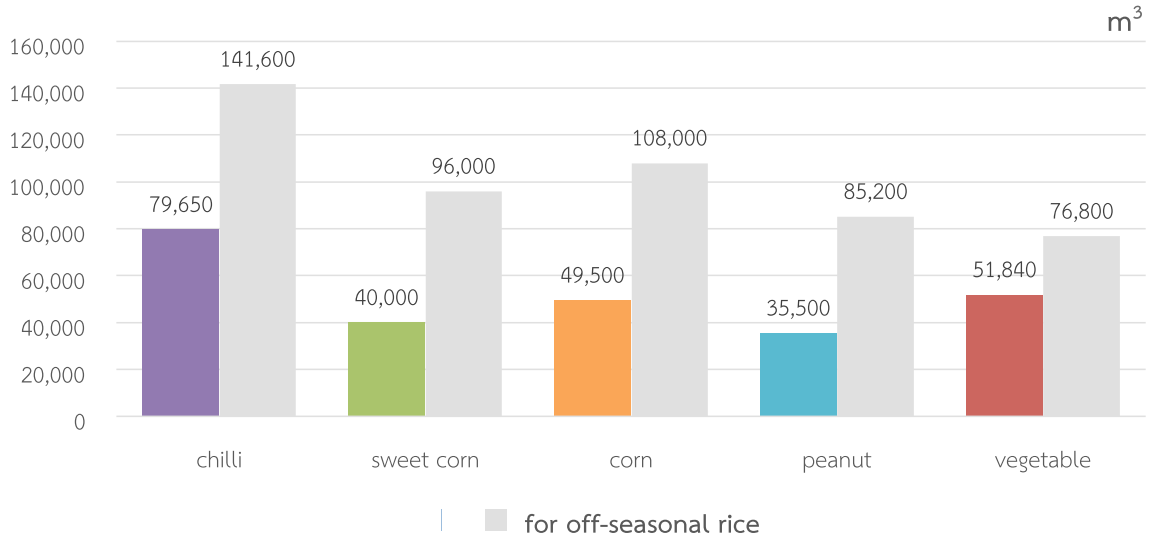
The Impacts of the Program

Total land size for each crop



The Impacts of the Program

The demand for water supply compared to off-seasonal rice

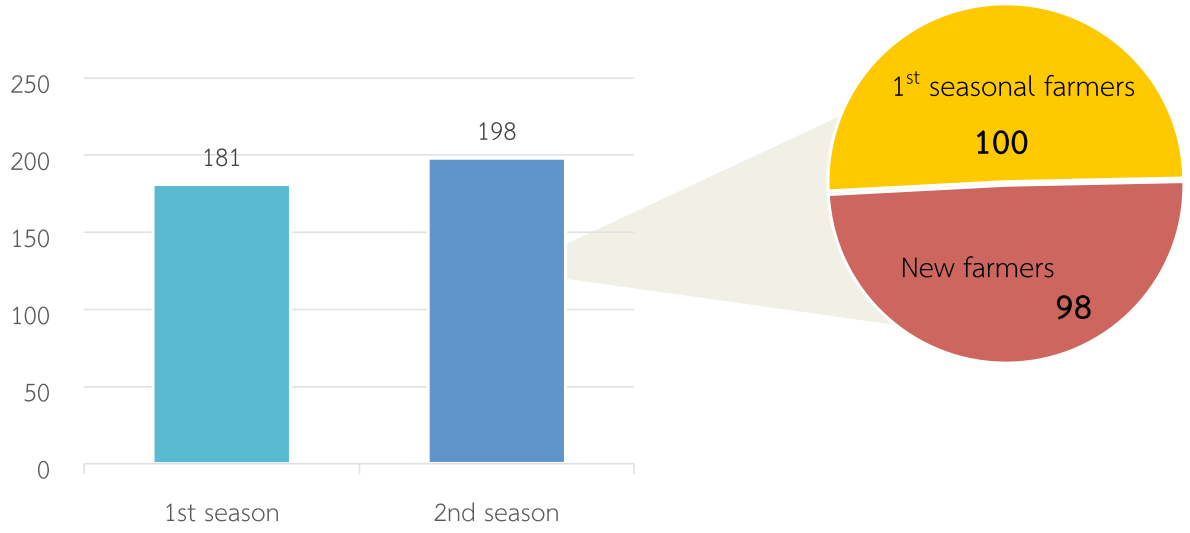


Water saving = 251,110 m^3
50% less water used with higher profits

The Impacts of the Program

2nd season

- Every things the same but
- No income insurance provided



Note: 52 farmers from 1st season wanted to continue but could not do it because their lands were still flooded during registration.

Conclusion (but not the last)

- Loss aversion that leads to risk aversion could be managed.
- Appropriate transfer risk mechanism could be a short-run increase rate of new technology adoption for the poor.

Our View to Help the Poor

Farmers have no burden to access to credit (at least in case of Thailand). Lack of appropriated skills and technology would be the more important issue. So, rather than focusing only on providing them cheap loan, giving them choices of appropriated skills and technology *as well as opportunity to try them* would improve their livelihood.