

Reporting from the Field: Thailand

## Technologies for Rice-based Eco-industrial Clustering in Thailand

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Good afternoon ladies and gentleman. It gives me great pleasure to make this presentation on what we did in Thailand as part of this eco-industrial cluster project. As the title says, our work focused around developing technologies for rice based eco-industrial clustering in Thailand.

Let me start with a short discussion about the country profile. Thailand is around 64 million in terms of population, with a current per-capita GDP around \$8,300. In terms of GDP contribution, agriculture plays relatively a lower role; industries and service sectors play a predominant role. However, it is important to look and check the factor; large percentage of labor force is concentrated around agriculture sector, and if you take specifically in terms of rice, 26% of the world rice export originates from Thailand. So it is a very important sector for Thailand. In terms of pollution, the water pollution originating from organic

pollutions to large extents are linked to agro industries.

Now let me take you to the industrial developments. There are large amounts of foreign direct investments in Thailand for the last 20-30 years. One of the reasons is that Thailand has been looked as a very attractive country for the foreign investments. At the moment, European Union is taking the lead role. The second role is played by the Japanese investors. Japan has been progressively investing on industry and infrastructure.

**Country Profile - Thailand** IGES

- ✓ Population of 64 million in 510,000 km<sup>2</sup>, 76 provinces
- ✓ GDP per capita (PPP): \$8,300
- ✓ GDP composition: agriculture 9.9%, industry 44.1%, services 46%
- ✓ Labor force : agriculture 49%, industry 14%, services 37%
- ✓ World's 2<sup>nd</sup> largest tungsten producer and 3<sup>rd</sup> largest tin producer
- ✓ 26 % of the world's rice exports are from Thailand
- ✓ Top imports from Japan (22%), China (9.4%)
- ✓ Major Environmental Concerns
  - air pollution from vehicle emissions
  - water pollution from organic and factory wastes
  - deforestation
  - soil erosion
  - wildlife populations threatened by illegal hunting

Technologies for Rice based Eco-Industrial Clustering in Thailand  
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Slide ②

**Industrial Development in Thailand** IGES

- ✓ Major FDI in Thailand : Japan, the United States, Europe, Taiwan, Hong Kong, and Singapore
- ✓ Japan has been the largest source of FDI since the late 1970s
- ✓ US overtook in 1999 and Singapore in 2001 but in 2000 and 2001 Japanese FDI bounded back by increasing equity shares in local subsidiaries
- ✓ Investments on infrastructure development
  - Japan Bank for International Cooperation
  - Japan International Cooperation Agency
  - ODA for infrastructure development projects
  - Bangkok International Airport
  - Eastern Seaboard Development Program

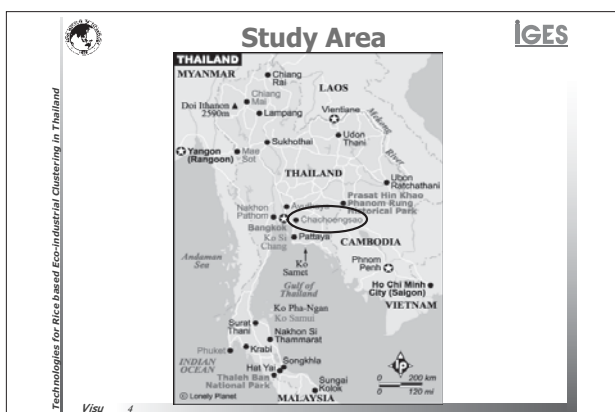
Country	Apr 2006 (million US\$)
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Technologies for Rice based Eco-Industrial Clustering in Thailand  
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Let me take you to a quick look on the map and you can see Thailand. Now you can see it in a closer look and we all know where Bangkok is.

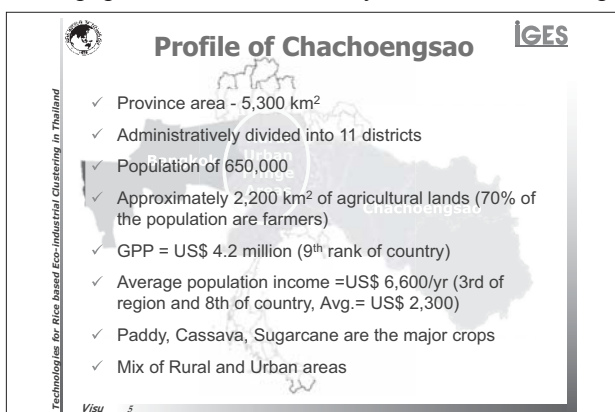
Now I am going to take you to the research study area, a province next to Bangkok, what we call Chachoengsao. Basically we have identified a study area just next to Bangkok and we are trying to look at the urban fringe inter-relations there. Here, you can



Slide ④

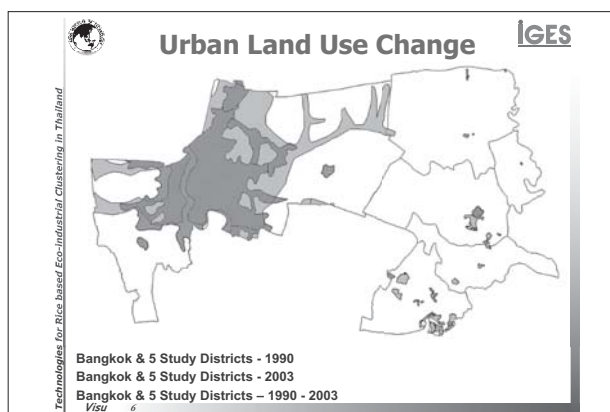
see that very quickly. This is the province we are going to talk about. To another quick look, you can see the red dot is Bangkok, the light pink is the study area we are talking about, and the next province Chachoengsao.

I will just quickly tell you the province we are talking about has 11 districts with a total population of close to half a million. It is very important to understand this province in terms of GPP ranks 9th within the country, so it is a very important province, and it got very good in terms of agriculture major crops - rice, cassava, sugarcane are considered as major crops. In terms of population, it has a mixture of rural and urban population, so I will take you back into the map.



Slide ⑤

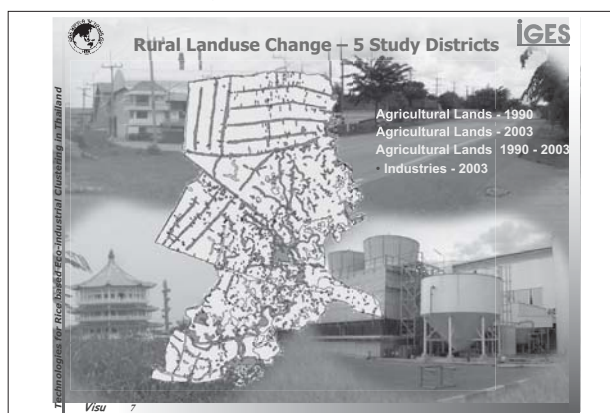
If you look at the combination of Bangkok and the province of Chachoengsao what you see in the dark gray is the Bangkok province in 1990. You can see that over the years the migration or the urban migration has been expanding it, and there you can see that



Slide ⑥

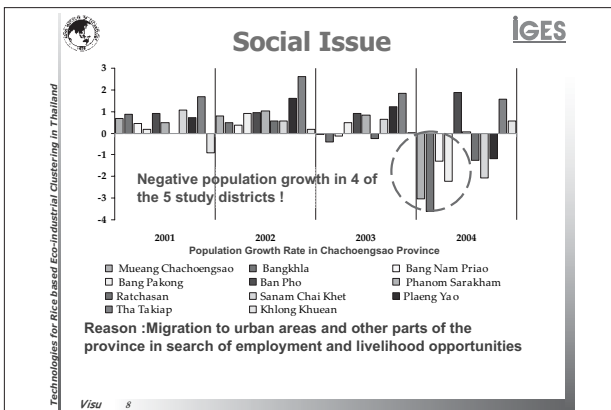
between 1990 to 2003 how the urban migration has taken place.

It is interesting to look at Bangkok and the five provinces between Bangkok and Chachoengsao which we have taken as study areas in urban fringe, and this is what you see in 2003. There are a large number of industries that have come up within the urban-fringe area that is between the Bangkok and the greater province of Chachoengsao.



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It is important to see the next part, how the population growth has taken place with the province. We have the 11 districts and here you can see in the last few years the four out of the five study areas, districts we are looking at which have a negative population growth. One of the reasons is migration to urban areas and other part of the provinces in search of employment and livelihood opportunities. There is a trend that people tend to move towards Bangkok. That gives a very good reason for us to look into the



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study area.

Regarding the environmental status of the study area, the table summarizes the number of complaints related to environment issues, which are brought to the pollution control department. And if you noticed here, the Chachoengsao province has 21 complaints to various issues related to environment, and that is used as an indicator relatively a bad environmental quality. If you look at solid waste, municipal solid wastes are generated, especially in these five urban-fringe districts approximately around 120 tons per day. The wastes are organic in nature, but they do not have proper disposal facilities. In terms of wastewater, organic wastes have been generated mainly from livestock industries, from piggery, pig industries and chicken farms etc. Organic pollution is certainly an issue here.

**Environmental Status**

Technologies for Rice-based Eco-Industrial Clustering in Thailand

IGES

Province	Odor	Noise	Dust/Smoke	Waste water	Solid waste	Hazardous waste	Other	Total
Chonburi	12	4	6	4	1	1	0	28
Rayong	9	2	6	11	0	0	0	28
Chachoengsao	9	2	5	3	0	1	1	21
Phraechinburi	3	2	1	2	1	5	1	15
Chantaburi	0	0	1	1	0	0	0	2
Trat	0	0	0	0	0	0	0	0
Sakaeo	0	0	0	0	0	0	0	0

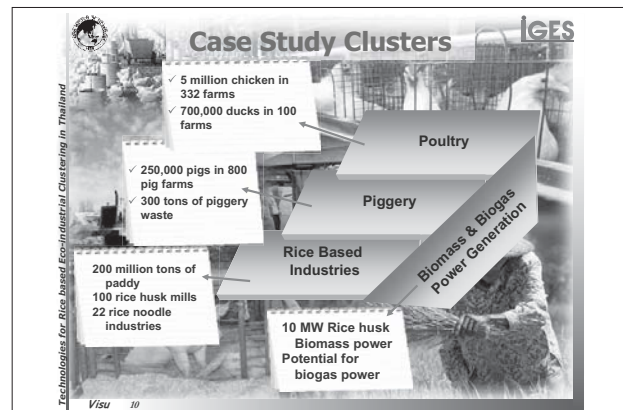
- ✓ Solid Waste
  - About 120 tons/day of MSW (predominantly organic) in 5 study districts
  - Collection efficiency: 85-100%;
  - Pig farms and Poultry: Solid Waste and Excreta
  - Agricultural Residue: Rice husk, Straw
- ✓ Wastewater
  - 250,000 pigs in 800 farms
  - A farm with 200-2,000 pigs generate wastewater at the rate of about 12.5 L/pig/day
  - Average BOD of about 1,412 mg/L and maximum BOD of 4,638 mg/L

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Slide ⑨

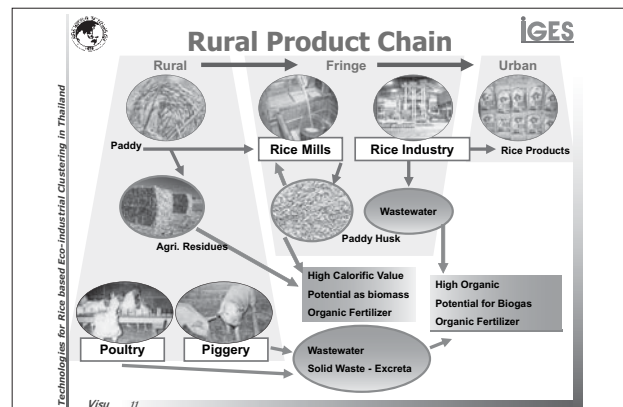
In our study, we looked into these three sectors; first one is the poultry. This particular province has

one of the biggest number of chicken farms, approximately around 5 million chickens, around 0.7 million ducks. These chickens have grown in small farms scattered around different parts of the province. There are around 250,000 pigs spread around 800 farms, and they produce large amount of waste. Regarding the paddy, there are 200 million tons of paddies generated or produced. There are around 100 rice mills, and 22 rice noodle industries, which could be classified into small and medium scale industries. If you just estimate the biomass potential, it is approximately around 10 MW only from the rice husk.



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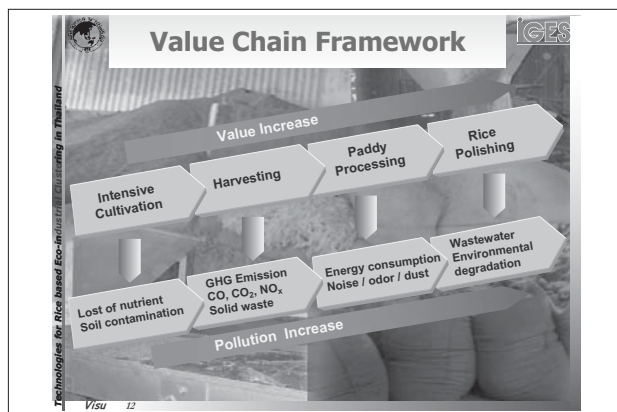
If you look at what happens in this industrial sector, the rural area we have the paddy and that leads to agriculture residues. Poultry and piggeries generate the solid waste and the wastewater. If you go to the urban area on the Bangkok side, you have the fine products, which mean the end product, are converted into value-added products, the final product. But in be-



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tween the fringe areas, there are large numbers of industries. These industries are rice mills, rice-based industries, noodle manufacturing etc., which produce not only waste but also a certain amount of high caloric value compounds like rice chaff or agriculture residues. The wastewater to a large extent contains organic pollution. That is the scenario.

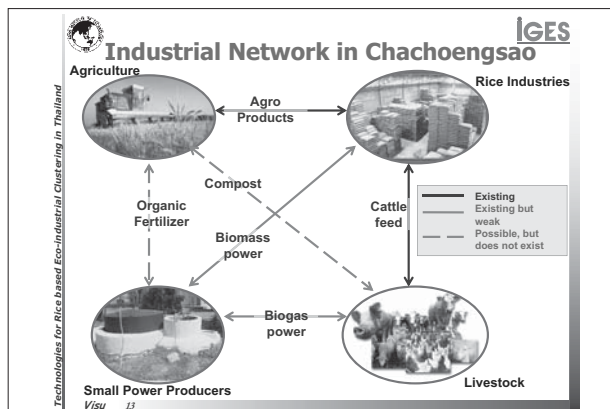
The product movement between the rural and urban, if you take, for example, the rice paddy, the cultivation is done in the rural areas, and it moves passing through the urban fringe to go to the urban area. The value is being added progressively, and the value addition could be from \$1 to \$100 in the end. As the value of the product is added, the amount of pollution generated also keeps increasing. It often comes to the situation where the industries, which are located at the urban areas like in Bangkok, produce a large value added product. But they also produce a large amount of pollution, and they have difficulty in managing that. And what we find is it might be good that some of these value-added products could be transmitted to the urban-fringe areas, where it could be managed properly. That is the focus of our study here.



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In this network, there is agriculture, rice industry. We already have a pretty good network on this part. Then you have a rice industry to the livestock. There are good industrial networks, but what we find missing is converting the waste coming from all of them as creating a small power generation or power producers. There are some power producers, but they

were not linked properly to these three sectors. This is why it might be attractive to look into this case study.



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I will run through the strengths and the weakness of these study cluster area. In the present cluster situation, the raw material and the waste sharing between agriculture and the livestocks are possible and it is taking place. Some of the industries, small and medium scale industries, which we have observed, have a significant potential for cleaner production.



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Second, in terms of weakness, in the current situation there are unscientific methods of livestock farming. The livestock is bred more like in a cottage industry or not properly managed; sometimes it leads to a significant amount of pollutions, which are not managed properly.

If you summarize the strengths of the existing network, there is an availability of paddy residues in quantities suitable for biomass power generation, but

**Weakness**

- ✓ Present Cluster Situation
  - Use of intermediate technology in farming, harvesting and rice processing
  - Unscientific methods in livestock farming
  - Pollution of local water sources from high organic livestock wastes
  - Lack of awareness on technologies and possibilities in resource recovery from agricultural and livestock wastes
  - Excessive Migration of population towards urban Bangkok
  - Indiscriminate disposal of paddy residues and excreta from piggeries and poultry farms
- ✓ Ideal Eco-cluster
  - Increase in inward population migration from additional employment – pressure on local resources
  - Creation of more businesses may exert pressure on natural resources for raw materials

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**Opportunities**

- ✓ Present Cluster Situation
  - Increase employment rate by way of creating new business (e.g. small & medium scale power generation using biomass/biogas)
  - Increase the local income of the Province leading to improved living standards
- ✓ Ideal Eco-cluster
  - Create additional jobs in rice industry, piggery and poultry through new businesses, services and products in Chachoengsao Province
  - Prevent outward population migration, a prevailing social issue in Chachoengsao Province, and sustain rural growth
  - Chachoengsao Province is classified under Zone 2 and hence attract new investments thus increasing the share of the region in the national economy
  - Cluster formations in Chachoengsao Province, will make the economy of scale more attractive

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**Potentials**

- ✓ Present Cluster Situation
  - Biomass power generation from agricultural residues
  - Biogas generation from piggery waste
  - Community level or decentralized power generation
  - Organic farming practices - poultry Litter as organic fertilizer
- ✓ Ideal Eco-cluster
  - Enhance pollution control through biogas systems in piggery
  - Community participation in local industrial and rural development
  - Develop resource conscious agriculture, pig and poultry farming
  - Environmentally friendly business practices in agriculture and livestock waste management

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Slide 17

not all of them have been utilized properly. There is a potential there. That is the strength and a large number of small and medium scale piggeries and chicken farms exist, and there are potential over there. And very interesting, these industries are located very close to the urban-fringe areas, or very close to Bangkok. This is the strength of the system.

Regarding the weakness, maybe at the moment

large amount of waste is disposed as are paddy and agro residues. They are burnt regardless of its biomass potential, and they have not done in a very organized manner where there is a potential if they can bring in together, it could look much better.

During the field visit, we have found that there is a lack of awareness in terms of technology for resource recovery, for example, from biogas generation from piggery industries or poultry industries, or agro industries incorporating solid wastes from municipal solid wastes etc. People do not have good awareness in terms of technological availability. There is an excess migration of population. They tend to always move towards Bangkok because there is a better livelihood which is a typical trend in many of the Asian countries.

Now if you look at the opportunities, they are creating additional jobs. If the industries are being developed better, the links are being developed as an eco-industrial cluster, there is a lot of potential to create additional jobs in this sector. As I said, livestock sector is very important for this country. It also can prevent outward migration of people, and the organic pollution load could be reduced significantly.

As to the potentials, decentralized and small and medium scale power generation is possible and that is one of the current trends of the national policies. Community participation in local natural resource management and small industries development, which means you start developing micro-industries at the ur-

**SWOP – Findings**

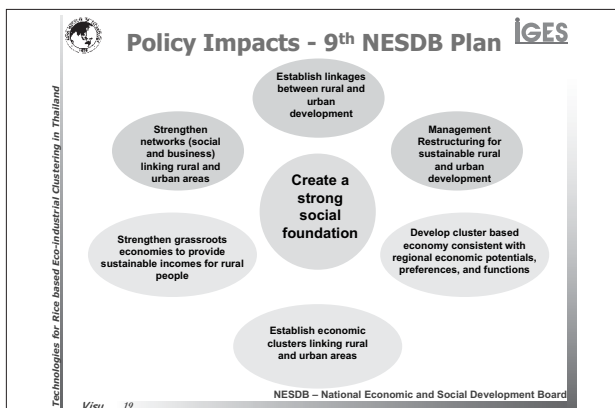
<ul style="list-style-type: none"> <li>• Availability of paddy residues in quantities suitable for biomass power generation</li> <li>• Large number of small and medium scale piggeries and poultry</li> <li>• Proximity to urban Bangkok opens avenues for new markets</li> </ul> <p>Strengths</p>	<ul style="list-style-type: none"> <li>• Create additional jobs in paddy processing, piggery and poultry</li> <li>• Prevent outward population migration from the Province</li> <li>• Enhance pollution reduction through biomass power and biogas systems</li> </ul> <p>Opportunities</p>
<ul style="list-style-type: none"> <li>• Indiscriminate disposal of paddy residues and excreta from piggeries and poultry farms</li> <li>• Lack of awareness on technologies for resource recovery from agricultural and livestock wastes</li> <li>• Excessive migration of population towards urban Bangkok</li> </ul> <p>Weaknesses</p>	<ul style="list-style-type: none"> <li>• Decentralized and small &amp; medium scale power generation systems</li> <li>• Community participation in local natural resource management and small industry development</li> <li>• Organic farming from biomass ash</li> </ul> <p>Potentials</p>

Technologies for Rice based Eco-Industrial Clustering in Thailand  
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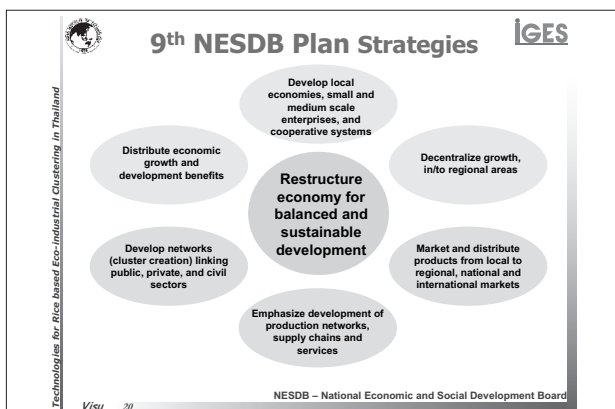
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ban fringe areas which becomes, takes the ownership and the community takes the leadership role. More interesting thing is the organic farming can play an important role.

Then please look at the current 9<sup>th</sup> policy plan developed by the National Economic and Social Development Board (NESDB), it is very interesting to observe. This national plan already clearly and explicitly says, establish the linkage between the rural and urban development that means the policy mechanisms already exist. It also establishes economic clusters linking the rural and urban areas. The higher priority has been already placed on this. The third interesting point in this policy is to strengthen the grassroots economies to provide sustainable income for rural people. It means the national thrust in the policy planning is already towards this direction.



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Slide 20

Now let me talk to you a little bit about the business sense. Regarding the investment potential, the

country has been divided into different zones. In the right, the darkest gray is the Zone 1, which is where Bangkok is located. Our study area is located in the Zone 2, which comes as a part of our potential investment zone. This sector is classified as an investment Zone 2, which generally attracts the foreign investments, the potential investments. Because of this, there are already many industries, which are located in Bangkok, started migrating outside in search of the better investment potentials. I think it is very interesting to note this.

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In terms of incentives for rural industries, at the moment the Board of Investment in Thailand identifies and classifies around 30 agro industries for special incentives. It is very interesting to note again that livestock, slaughtering, meat processing, agro industries etc. have been placed already as priority industries. Thailand wants to become the kitchen of the world, so agro industries or value added agro in-

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dustries have been placed as a priority investment sector. There is a special reference placed on agro processing zones. In terms of policy directions, everything is geared perfectly on that line.

Now it also is interesting as we listened to the previous presentation. In Thailand, a lot of things have been developing, especially in the last three years, especially because of the energy crisis. Thus, lots of developments have taken place in terms of power purchase policy; especially they wanted to promote small power producers. Co-generations or facilities for renewable energy fuels are what the government wants to promote to develop small biomass based anaerobic digesters within the study area. In many cases the policies are designed allowing direct sales to industrial estates. It becomes much easier for independent power producers to produce small scale powers or hook into the system.

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As our work thrives to a large extent on technology impact, I will summarize our finding on this slide. Two kinds of waste are generated from the rice processing or paddy processing. One is agriculture residues, which contain very high-calorific values. It could be linked into small scale biomass power producers and could lead into decentralized power generation systems, efficient use of resources. At the moment we have certain power plants. They are relatively large scale, not in a small or medium scale. What we are looking at is a small or medium scale or decentralized systems larger than the bigger systems.

Next one is pig farms and poultry, both of them produce large amount of organic wastes. They have an excellent potential for small scale biogas generation systems, and the biogas as a fuel for cooking or industrial heat could be generated. The most important thing is not only generating money from energy source, but also prevents the environmental pollution and the thrive should be on that side too.

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This is the existing system, energy producers, piggeries and the poultries, the existing cluster. They could be created into a network by bringing in biomass or biomass power systems. They could be brought into a cluster and that could be classified what you call a green cluster or eco-industrial cluster, and it is very important to see these. These clusters take place in the urban fringe area rather than in the urban area or purely in the rural area.

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I think I will conclude my presentation with the followings. Micro level material flow clearly reveals

presence of inter-firm networks as well as potential for further strengthening. Lack of appropriate technologies prevents full resource recovery and complete reuse between the existing networks. Current national policies are extremely conducive both from agriculture, environment and investment promotion, plus the power generation. Emphasis is already well placed on rural-urban linkage in the national planning. Agro industries in rural-urban fringe areas have gained a very important role in the NESDB plan with already an emphasis on Eco-clusters. Strategies clearly foresee the development of eco-friendly industries. And most interesting within the context of Thailand, agro industrial clusters indirectly contribute to His Majesty, The King's Projects, existing projects such as Rice Bank, Cattle Bank, Land Management and Development projects.

nology transfer certainly will further accelerate the transformation of this region or the urban fringe sector into a model cluster with brilliant inter-firm networks.

I think as a sort of conclusion I would like to use this slide to present. Thailand is experiencing a revolution in self-sufficient local economy through various landmark projects initiated by His Majesty, The King, and that is very important. I have indicated a few examples. What we are looking at is an eco-industrial cluster in urban-rural fringe areas with food crops and livestock as key components, which certainly contribute to His Majesty's vision at large.

Let me finish my statement, regarding policies in Thailand for promotion of eco-industrial clusters, we do have excellent policies to promote eco-industrial clusters, but what we lack are certain types of simple technologies or decentralized technologies related to biogas and a biomass generation. Thank you very much.

### Conclusions

Technologies for Rice based Eco-Industrial Clustering in Thailand

- ✓ Micro level material flows clearly reveal the presence of inter-firm networks as well as potentials for further strengthening
- ✓ Lack of appropriate technologies prevents full resource recovery and complete reuse between the existing network
- ✓ Current national policies are conducive – Environmental, Agricultural, Investment promotion, Power Generation
- ✓ Special emphasis on rural-urban linkages in the NESDB plan
- ✓ Agro industries in rural-urban fringe areas have gained prominence in the NESDB plan with an emphasis on Eco-clusters
- ✓ Strategies clearly foresee development of eco-friendly industries in urban-fringe areas and rural communities as a means of sustainable local development
- ✓ Agro eco-industrial clusters indirectly contribute to His Majesty The Kings Projects on Rice Bank, Cattle Bank and Land Management and Development

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Slide 26

In terms of recommendations, there is a need for technology transfer and inter-firm networking. Tech-

Thailand is experiencing a revolution in self-sufficient local economy through various landmark projects initiated by His Majesty The King.

An eco-industrial cluster in urban-rural fringe areas with food crops and livestock as key components contributes to His Majesty's vision at large.

Technologies for Rice based Eco-Industrial Clustering in Thailand

Thank you.....

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Slide 28

### Recommendations

Technologies for Rice based Eco-Industrial Clustering in Thailand

- ✓ **Technology Transfer**
  - Material flows indicate more opportunities for eco-industrial networking.
  - Cost-effective technologies for Small & Medium -scale, decentralized biomass power and biogas generation is required
- ✓ **Inter-firm networks**
  - Networks in simple nature exist; but are often weak and underutilized.
  - Several other possible linkages yet to be strengthened and fully exploited.

**Technology Transfer will further accelerate the transformation of the region into a model cluster with a brilliant inter-firm network**

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Slide 27





**IGES**

Technologies for Rice based Eco-industrial Clustering in Thailand

【タイからの報告】

## Technologies for Rice-based Eco-industrial Clustering in Thailand

米加工業を中心とした環境調和型産業クラスターネットワークに関する技術政策分析

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Visu 1

Slide ①



**IGES**

Technologies for Rice based Eco-industrial Clustering in Thailand

## Country Profile - Thailand

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Visu 2

Slide ②

Technologies for Rice based Eco-industrial Clustering in Thailand

## Industrial Development in Thailand

- ✓ Major FDI in Thailand : Japan, the United States, Europe, Taiwan, Hong Kong, and Singapore
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3

Slide ③

Technologies for Rice based Eco-industrial Clustering in Thailand


## Study Area

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4

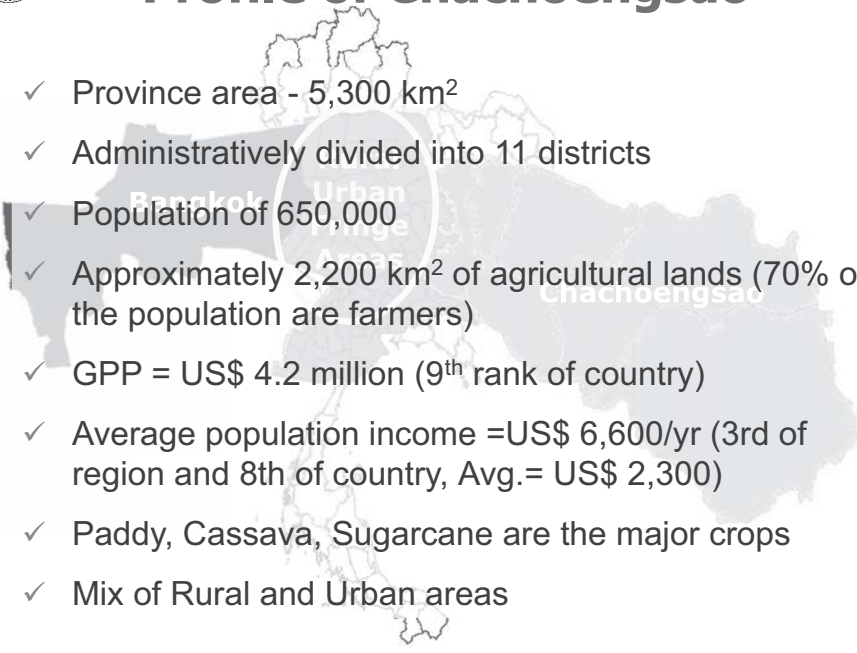
Slide ④

Technologies for Rice based Eco-industrial Clustering in Thailand



## Profile of Chachoengsao






- ✓ Province area - 5,300 km<sup>2</sup>
- ✓ Administratively divided into 11 districts
- ✓ Population of 650,000
- ✓ Approximately 2,200 km<sup>2</sup> of agricultural lands (70% of the population are farmers)
- ✓ GPP = US\$ 4.2 million (9<sup>th</sup> rank of country)
- ✓ Average population income =US\$ 6,600/yr (3rd of region and 8th of country, Avg.= US\$ 2,300)
- ✓ Paddy, Cassava, Sugarcane are the major crops
- ✓ Mix of Rural and Urban areas


Visu 5

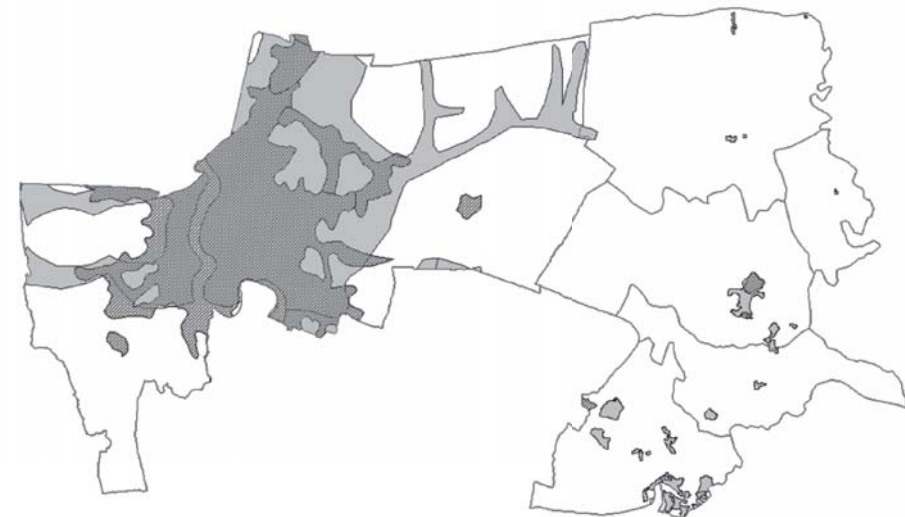
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Technologies for Rice based Eco-industrial Clustering in Thailand



## Urban Land Use Change

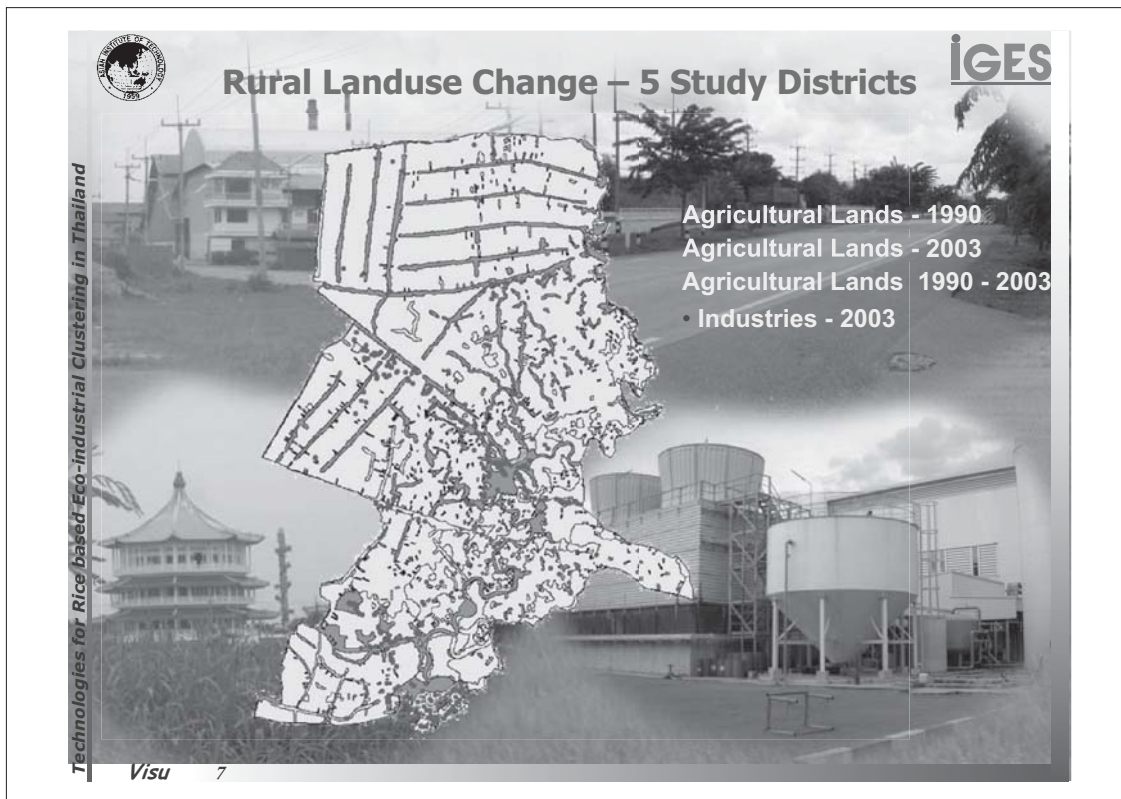




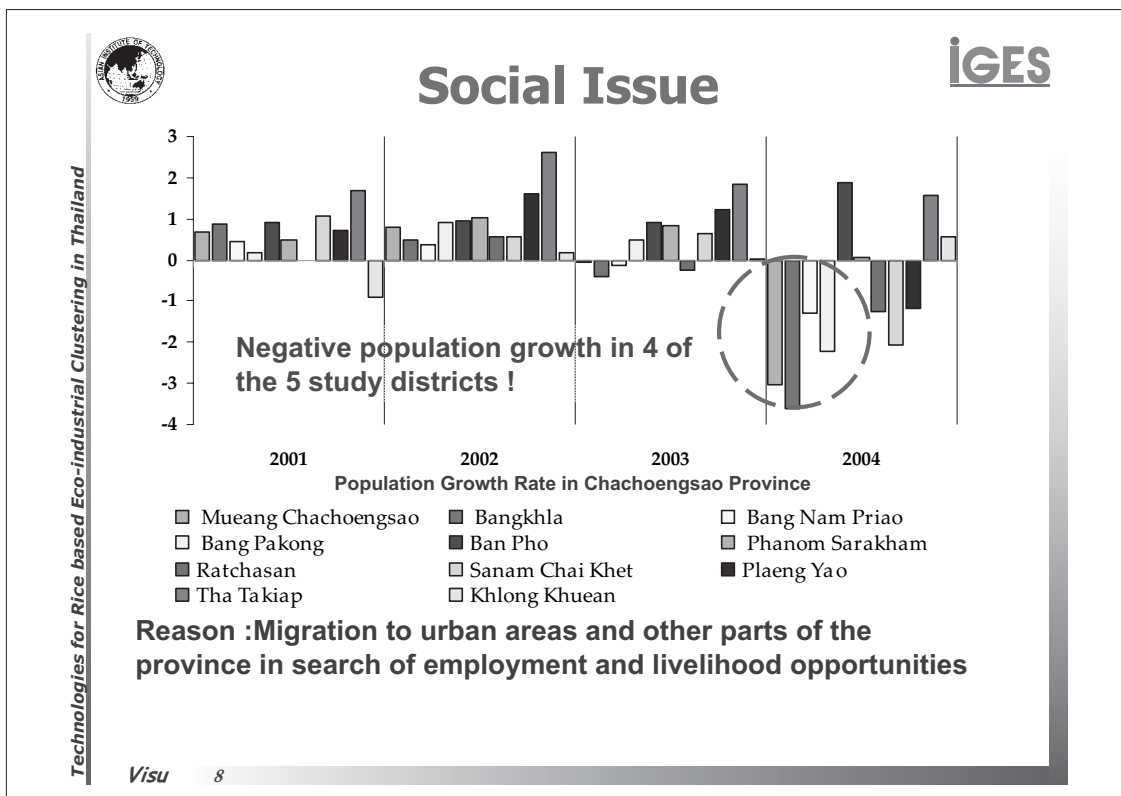
**Bangkok & 5 Study Districts - 1990**  
**Bangkok & 5 Study Districts - 2003**  
**Bangkok & 5 Study Districts - 1990 - 2003**

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Slide ⑦



Slide ⑧

Technologies for Rice based Eco-industrial Clustering in Thailand

## Environmental Status

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Trat	0	0	0	0	0	0	0	0
Sakaeo	0	0	0	0	0	0	0	0

- ✓ **Solid Waste**
  - About 120 tons/day of MSW (predominantly organic) in 5 study districts
  - Collection efficiency:85-100%;
  - Pig farms and Poultries: Solid Waste and Excreta
  - Agricultural Residue: Rice husk, Straw
- ✓ **Wastewater**
  - 250,000 pigs in 800 farms
  - A farm with 200-2,000 pigs generate wastewater at the rate of about 12.5 L/pig/day
  - Average BOD of about 1,412 mg/L and maximum BOD of 4,638 mg/L

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Slide 9

Technologies for Rice based Eco-industrial Clustering in Thailand

## Case Study Clusters

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✓ 5 million chicken in 332 farms

✓ 700,000 ducks in 100 farms

✓ 250,000 pigs in 800 pig farms

✓ 300 tons of piggery waste

200 million tons of paddy

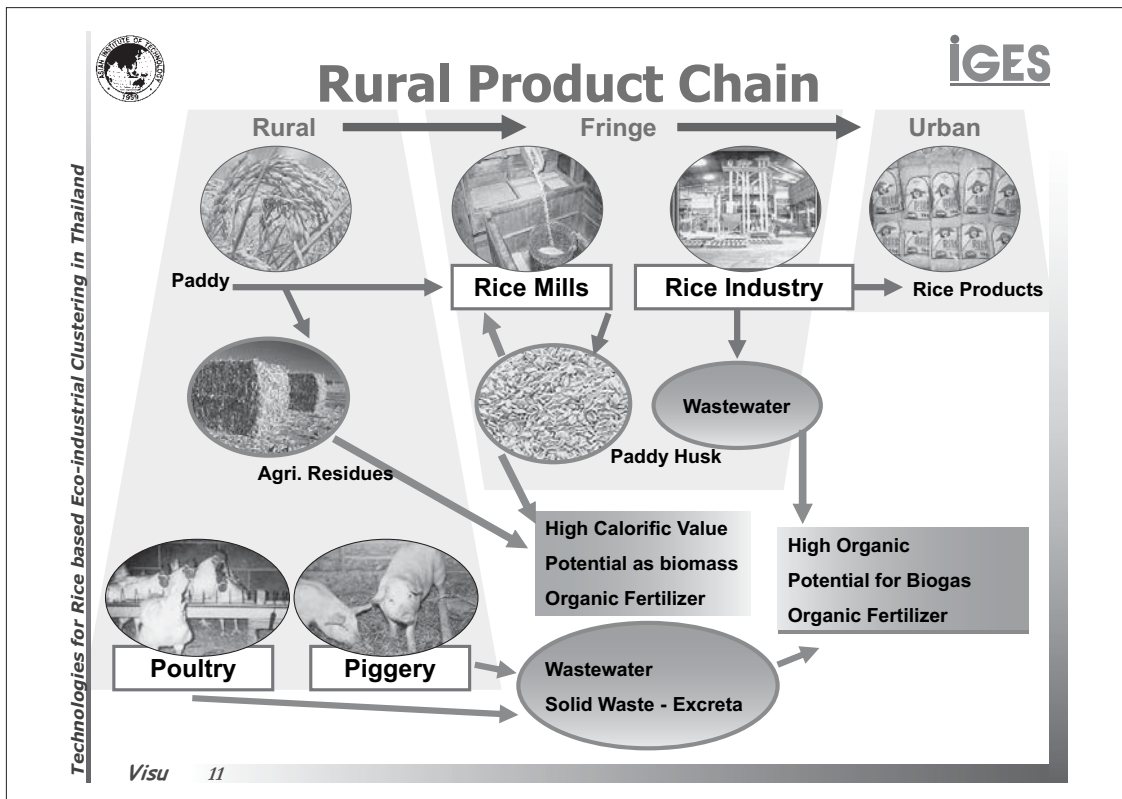
100 rice husk mills

22 rice noodle industries

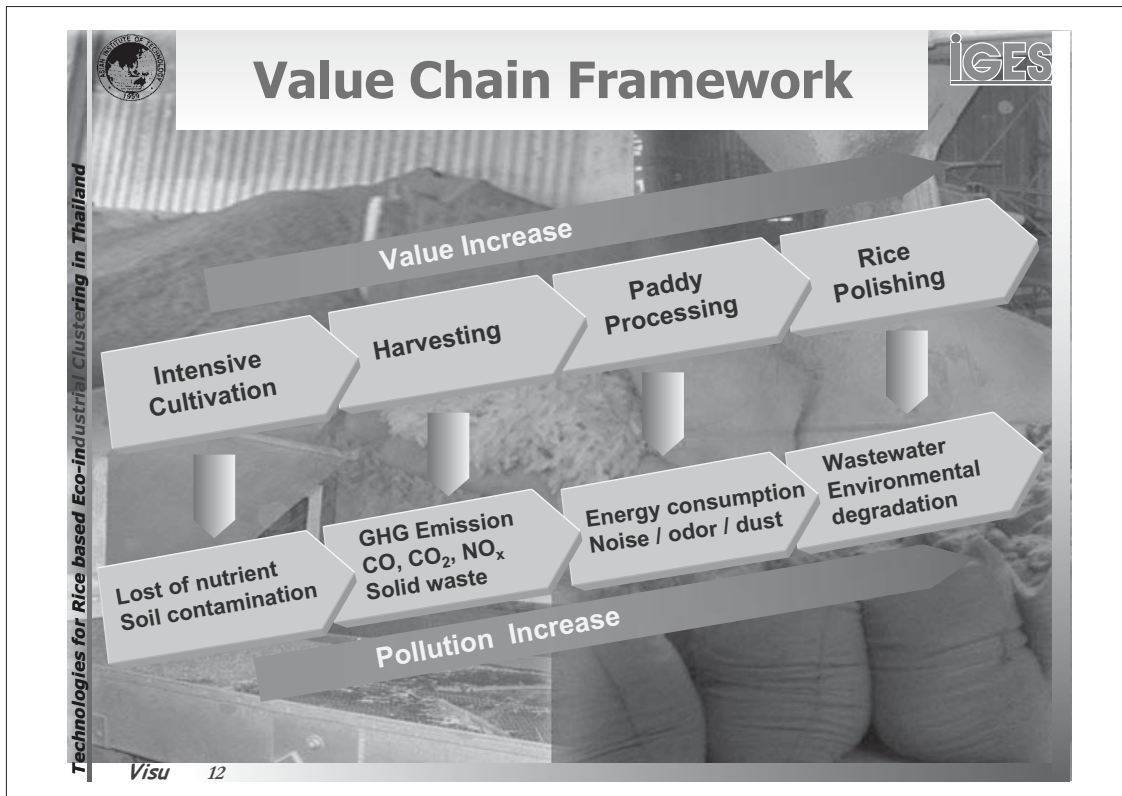
10 MW Rice husk Biomass power

Potential for biogas power

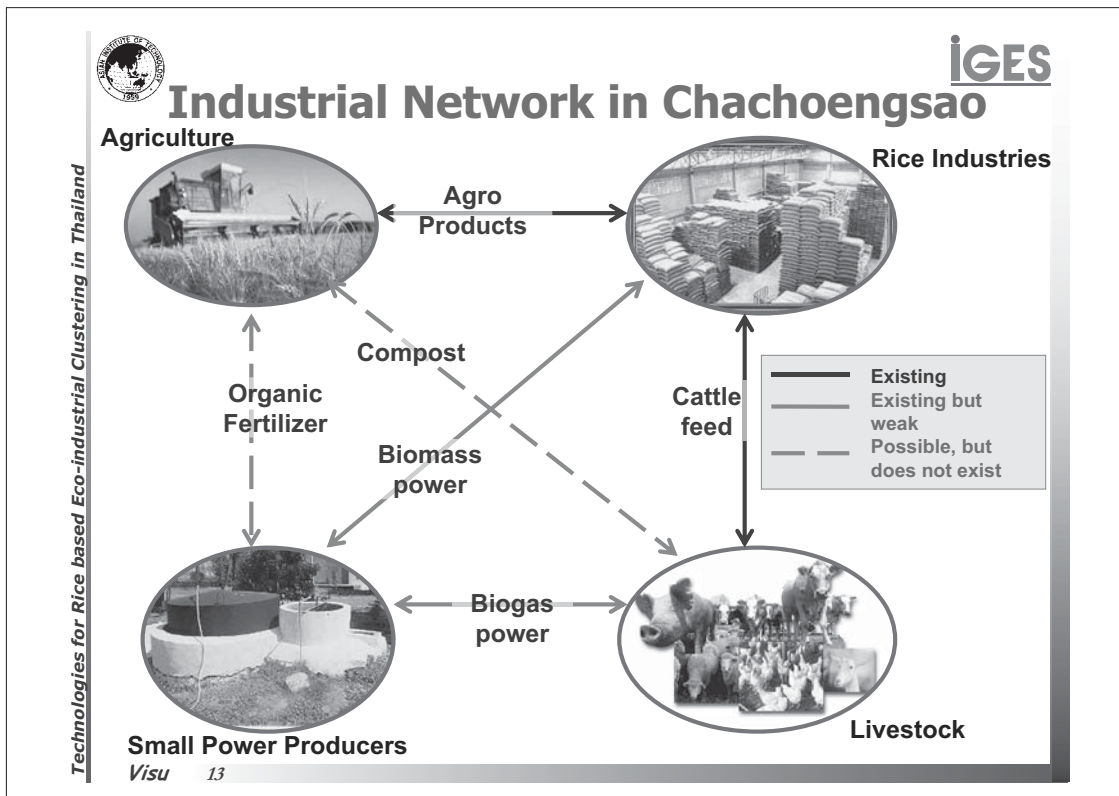
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- Technologies for Rice based Eco-industrial Clustering in Thailand
- ## Strengths
- ✓ **Present Cluster Situation**
    - Raw material and waste sharing between agriculture and livestock
    - Access to Bangkok areas leads to a broad spectrum of markets for agricultural and livestock products
    - Rapidly improving infrastructure facilities such as roads, water supply and electricity in the Province attracts new investments
    - Cleaner Production potential at individual firm level, SMI level (e.g. Rice Noodle Industry)
  - ✓ **Ideal Eco-cluster**
    - Creation of new business that utilize disposed resources as raw materials— rice husk/biomass power generation; piggery waste biogas
    - Increase competitiveness of business by reducing production costs; cost reduction in waste disposal + income generation through resource recovery from waste
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Technologies for Rice based Eco-industrial Clustering in Thailand



## Weakness



- ✓ Present Cluster Situation
  - Use of intermediate technology in farming, harvesting and rice processing
  - Unscientific methods in livestock farming
  - Pollution of local water sources from high organic livestock wastes
  - Lack of awareness on technologies and possibilities in resource recovery from agricultural and livestock wastes
  - Excessive Migration of population towards urban Bangkok
  - Indiscriminate disposal of paddy residues and excreta from piggeries and poultry farms
- ✓ Ideal Eco-cluster
  - Increase in inward population migration from additional employment – pressure on local resources
  - Creation of more businesses may exert pressure on natural resources for raw materials

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Technologies for Rice based Eco-industrial Clustering in Thailand



## Opportunities




- ✓ Present Cluster Situation
  - Increase employment rate by way of creating new business (e.g. small & medium scale power generation using biomass/biogas)
  - Increase the local income of the Province leading to improved living standards
- ✓ Ideal Eco-cluster
  - Create additional jobs in rice industry, piggery and poultry through new businesses, services and products in Chachoengsao Province
  - Prevent outward population migration, a prevailing social issue in Chachoengsao Province, and sustain rural growth
  - Chachoengsao Province is classified under Zone 2 and hence attract new investments thus increasing the share of the region in the national economy
  - Cluster formations in Chachoengsao Province, will make the economy of scale more attractive

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*Technologies for Rice based Eco-industrial Clustering in Thailand*



## Potentials




- ✓ Present Cluster Situation
  - Biomass power generation from agricultural residues
  - Biogas generation from piggery waste
  - Community level or decentralized power generation
  - Organic farming practices - poultry Litter as organic fertilizer
- ✓ Ideal Eco-cluster
  - Enhance pollution control through biogas systems in piggery
  - Community participation in local industrial and rural development
  - Develop resource conscious agriculture, pig and poultry farming
  - Environmentally friendly business practices in agriculture and livestock waste management


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*Technologies for Rice based Eco-industrial Clustering in Thailand*



## SWOP – Findings



<ul style="list-style-type: none"><li>• Availability of paddy residues in quantities suitable for biomass power generation</li><li>• Large number of small and medium scale piggeries and poultries</li><li>• Proximity to urban Bangkok opens avenues for new markets</li></ul> <p style="text-align: center;"><b>Strengths</b></p>	<ul style="list-style-type: none"><li>• Create additional jobs in paddy processing, piggery and poultry</li><li>• Prevent outward population migration from the Province</li><li>• Enhance pollution reduction through biomass power and biogas systems</li></ul> <p style="text-align: center;"><b>Opportunities</b></p>
<p style="text-align: center;"><b>Weaknesses</b></p> <ul style="list-style-type: none"><li>• Indiscriminate disposal of paddy residues and excreta from piggeries and poultry farms</li><li>• Lack of awareness on technologies for resource recovery from agricultural and livestock wastes</li><li>• Excessive migration of population towards urban Bangkok</li></ul>	<p style="text-align: center;"><b>Potentials</b></p> <ul style="list-style-type: none"><li>• Decentralized and small &amp; medium scale power generation systems</li><li>• Community participation in local natural resource management and small industry development</li><li>• Organic farming from biomass ash</li></ul>

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**Policy Impacts - 9<sup>th</sup> NESDB Plan** **IGES**

*Technologies for Rice based Eco-industrial Clustering in Thailand*

**Strengthen networks (social and business) linking rural and urban areas**

**Establish linkages between rural and urban development**

**Management Restructuring for sustainable rural and urban development**

**Develop cluster based economy consistent with regional economic potentials, preferences, and functions**

**Create a strong social foundation**

**Establish economic clusters linking rural and urban areas**

**Strengthen grassroots economies to provide sustainable incomes for rural people**

*Visu* 19 NESDB – National Economic and Social Development Board

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**9<sup>th</sup> NESDB Plan Strategies** **IGES**

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**Develop local economies, small and medium scale enterprises, and cooperative systems**

**Decentralize growth, in/to regional areas**

**Market and distribute products from local to regional, national and international markets**

**Restructure economy for balanced and sustainable development**

**Emphasize development of production networks, supply chains and services**


**Develop networks (cluster creation) linking public, private, and civil sectors**

**Distribute economic growth and development benefits**

*Visu* 20 NESDB – National Economic and Social Development Board

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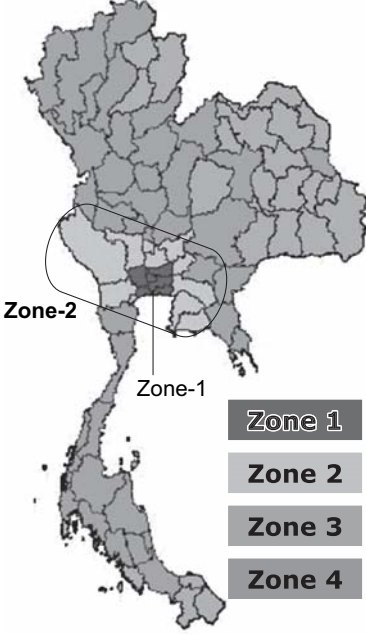
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## Investment Benefits

**IGES**

- ✓ **Chachoengsao is classified under Investment Zone 2**
  - 100% waiver of import duty on machinery for industries in estates
  - 50% waiver for industries outside the estate
  - Corporate income tax exemption – 7 years within industrial estate and 3 years outside
  - Exemption on import duty for raw material for 1 year in both cases
- ✓ **Relocating industries from Zone 1 (Bangkok and surrounding provinces) to Zone 2 also attract benefits**



**Zone 1**  
**Zone 2**  
**Zone 3**  
**Zone 4**

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## Incentives for Rural Industries

**IGES**


- ✓ **Board of Investment, Thailand identified and classified 30 agro industries for special incentives**
  - Livestock, Slaughtering, meat and food processing, animal feed, agriculture products and waste re-processing – identified as priority activities
  - Special reference to Agro processing zones
  - Machinery import duty exemption
  - Corporate income tax exemption for a period of 8 years regardless of zone with no limits
  - Other rights and benefits according to Bol announcement




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## Power Purchase Policy




- ✓ **Small Power Producers**
  - Co-generators or facilities using renewable energy fuels,
  - Sell power to EGAT of not more than 90 MW for each project.
  - Minimum purchase guarantee – not less than 80%
  - Allows direct sale to industrial estates near the power plants
- ✓ **Very Small Power Producers (less than 1 MW)**
  - Agricultural residues and wastes from agro industries (e.g. rice husk)
  - Products converted from agricultural residues, and wastes from agricultural or industrial production processes. (e.g. tapioca wastewater)
  - Municipal waste: RDF, Biomethanation


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## Technology Impacts




- **Paddy Processing**
  - Agricultural Residues; High calorific value
- **Pig farms**
  - Piggery waste; High organic matter
- **Poultry**
  - Poultry Litter; High organic matter

- Small-scale biomass power
- Decentralized power generation systems
- Efficient use of resources





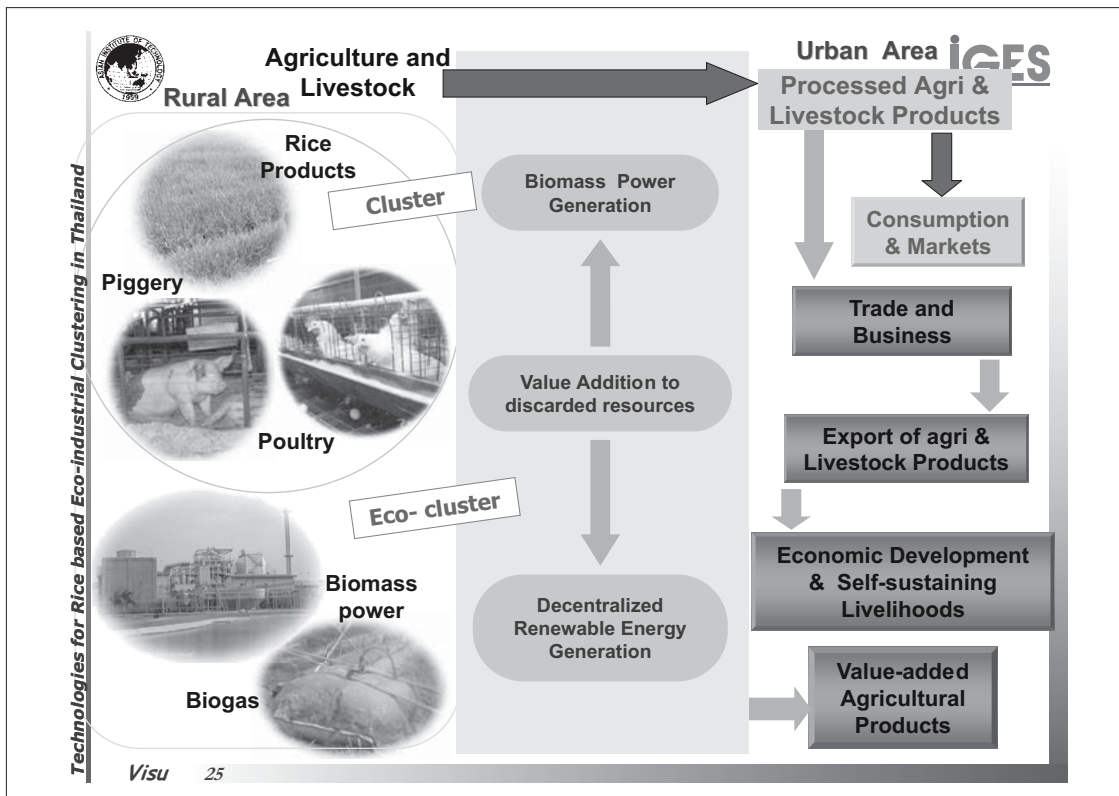


- Small-scale biogas generation systems
- Biogas as fuel for cooking or industrial heat and power generation
- Prevents environmental degradation

- ✓ One Small-scale biomass power generation of 10 MW from rice husk
- ✓ Major portion of agricultural residues is unscientifically disposed without realizing its potentials
- ✓ Poultry and Piggery waste disposed in local water-bodies and barren land - potential to generate biogas is not utilized

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**Technologies for Rice based Eco-industrial Clustering in Thailand**

## Conclusions


**IGES**

- ✓ Micro level material flows clearly reveal the presence of inter-firm networks as well as potentials for further strengthening
- ✓ Lack of appropriate technologies prevents full resource recovery and complete reuse between the existing network
- ✓ Current national policies are conducive – Environmental, Agricultural, Investment promotion, Power Generation
- ✓ Special emphasis on rural-urban linkages in the NESDB plan
- ✓ Agro industries in rural-urban fringe areas have gained prominence in the NESDB plan with an emphasis on Eco- clusters
- ✓ Strategies clearly foresee development of eco-friendly industries in urban-fringe areas and rural communities as a means of sustainable local development
- ✓ Agro eco-industrial clusters indirectly contribute to His Majesty The Kings Projects on Rice Bank, Cattle Bank and Land Management and Development

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## Recommendations





- ✓ **Technology Transfer**
  - Material flows indicate more opportunities for eco-industrial networking.
  - Cost-effective technologies for Small & Medium -scale, decentralized biomass power and biogas generation is required
- ✓ **Inter-firm networks**
  - Networks in simple nature exist; but are often weak and underutilized.
  - Several other possible linkages yet to be strengthened and fully exploited.

Technology Transfer will further accelerate the transformation of the region into a model cluster with a brilliant inter-firm network

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Technologies for Rice based Eco-industrial Clustering in Thailand

Thailand is experiencing a revolution in self-sufficient local economy through various landmark projects initiated by His Majesty The King.

An eco-industrial cluster in urban-rural fringe areas with food crops and livestock as key components contributes to His Majesty's vision at large.



Thank you.....

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