



2<sup>nd</sup> Biomass-Asia Workshop

# **Rice husk potential of Vietnam**

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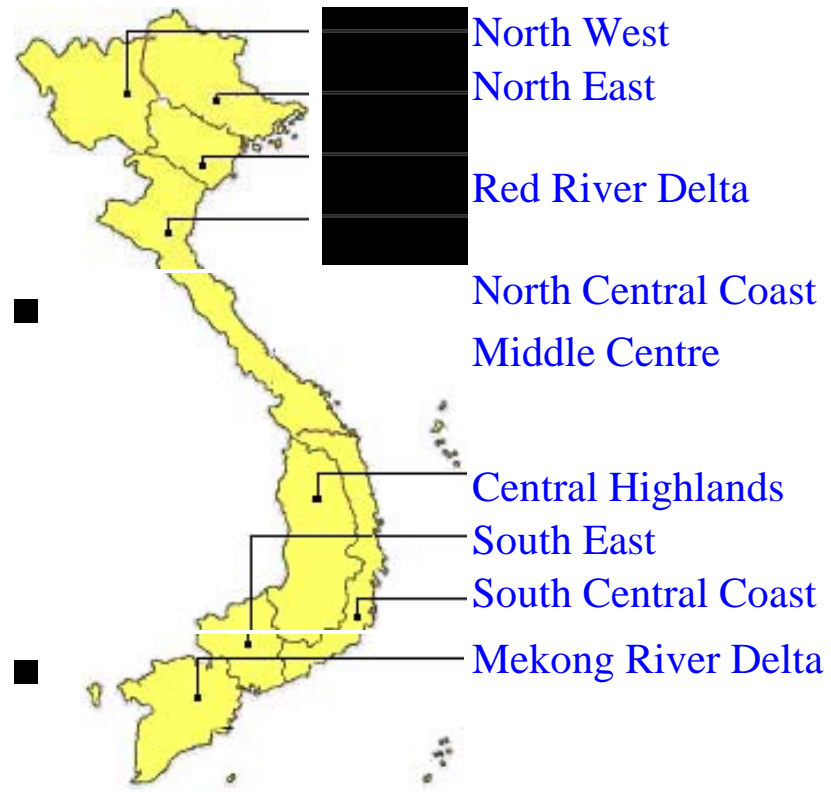
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## Regions and Provinces of Viet Nam





# Rice husk: 1.Area

## Planted area of paddy by regions

No	Region	Thous. ha				
		1995	1999	2000	2001	2002
	<b>Whole country</b>	<b>6765.6</b>	<b>7653.6</b>	<b>7666.3</b>	<b>7492.7</b>	<b>7485.4</b>
<b>1</b>	<b><i>Red river Delta</i></b>	<b>1193</b>	<b>1202.8</b>	<b>1212.6</b>	<b>1202.5</b>	<b>1196.7</b>
<b>2</b>	<b><i>North East</i></b>	<b>522.3</b>	<b>535.2</b>	<b>550.3</b>	<b>558</b>	<b>562.5</b>
<b>3</b>	<b><i>North West</i></b>	<b>134.5</b>	<b>132.9</b>	<b>136.8</b>	<b>139.6</b>	<b>140.8</b>
<b>4</b>	<b><i>North Central Coast</i></b>	<b>682.2</b>	<b>677.9</b>	<b>695</b>	<b>701.2</b>	<b>700.4</b>
<b>5</b>	<b><i>South Central Coast</i></b>	<b>42.5</b>	<b>434.8</b>	<b>422.5</b>	<b>414</b>	<b>399.5</b>
<b>6</b>	<b><i>Central Highlands</i></b>	<b>173.2</b>	<b>166</b>	<b>176.8</b>	<b>180.8</b>	<b>186.1</b>
<b>7</b>	<b><i>South East</i></b>	<b>447.3</b>	<b>518.8</b>	<b>526.5</b>	<b>504.6</b>	<b>485.6</b>
<b>8</b>	<b><i>Mekong River Delta</i></b>	<b>3190.6</b>	<b>3985.2</b>	<b>3945.8</b>	<b>3792</b>	<b>3813.8</b>

# Rice husk: 2. Rice husk output (straw = rice husk)

Rice husk output. 20% of paddy

No	Region	Thous.tons				
		1995	1999	2000	2001	2002
	<b>Whole country</b>	<b>4992.74</b>	<b>6278.76</b>	<b>6505.9</b>	<b>6421.68</b>	<b>6812.7</b>
<b>1</b>	<b><i>Red river Delta</i></b>	<b>1018.08</b>	<b>1276.68</b>	<b>1317.32</b>	<b>1283.88</b>	<b>1337.06</b>
<b>2</b>	<b><i>North East</i></b>	<b>291.52</b>	<b>382.26</b>	<b>413</b>	<b>449.98</b>	<b>465.78</b>
<b>3</b>	<b><i>North West</i></b>	<b>65.78</b>	<b>74.44</b>	<b>80.72</b>	<b>88.14</b>	<b>90.3</b>
<b>4</b>	<b><i>North Central Coast</i></b>	<b>428.16</b>	<b>526.92</b>	<b>564.8</b>	<b>593.38</b>	<b>627.78</b>
<b>5</b>	<b><i>South Central Coast</i></b>	<b>283</b>	<b>340.74</b>	<b>336.32</b>	<b>341.42</b>	<b>341.08</b>
<b>6</b>	<b><i>Central Highlands</i></b>	<b>85.9</b>	<b>102.48</b>	<b>117.36</b>	<b>129.24</b>	<b>121.9</b>
<b>7</b>	<b><i>South East</i></b>	<b>253.96</b>	<b>316.3</b>	<b>335.84</b>	<b>336.14</b>	<b>333.22</b>
<b>8</b>	<b><i>Mekong River Delta</i></b>	<b>2566.34</b>	<b>3258.94</b>	<b>3340.54</b>	<b>3199.5</b>	<b>3495.58</b>

# Rice husk: 3. For power generation

**Potential for electricity generation (30% of rice husk) ( LHV: 3330Kcal/kg, Humidity: 13% )**

No	Region	Thous.tons				
		1995	1999	2000	2001	2002
	<b>Whole country</b>	<b>922.60</b>	<b>1169.18</b>	<b>1188.76</b>	<b>1152.45</b>	<b>1249.17</b>
<b>1</b>	<b><i>Red river Delta</i></b>	<b>152.7</b>	<b>191.5</b>	<b>197.6</b>	<b>192.6</b>	<b>200.5</b>
<b>2</b>	<b><i>North East</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>3</b>	<b><i>North West</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>4</b>	<b><i>North Central Coast</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>5</b>	<b><i>South Central Coast</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>6</b>	<b><i>Central Highlands</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>7</b>	<b><i>South East</i></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>8</b>	<b><i>Mekong River Delta</i></b>	<b>769.90</b>	<b>977.68</b>	<b>1002.16</b>	<b>959.85</b>	<b>1048.67</b>

# Rice husk: 4. Rice mills dispersion

	Province	Number of rice mills available in the list	Province rice production -2002-Thous. tons
1	An Giang	144	2452
2	Bac Lieu	31	699
3	Ben Tre	4	392
4	Binh Duong	11	35
5	Ca Mau	3	418
6	Can Tho	24	2206
7	Ho Chi Minh	10	182
8	Long An	176	1729
9	Phu Yen	21	289
10	Soc Trang	40	1633
11	Tien Giang	13	1281
11	Tay Ninh	57	570
12	Tra Vinh	47	986
13	Others	34	
14	Total	615	



## Current uses of rice husk

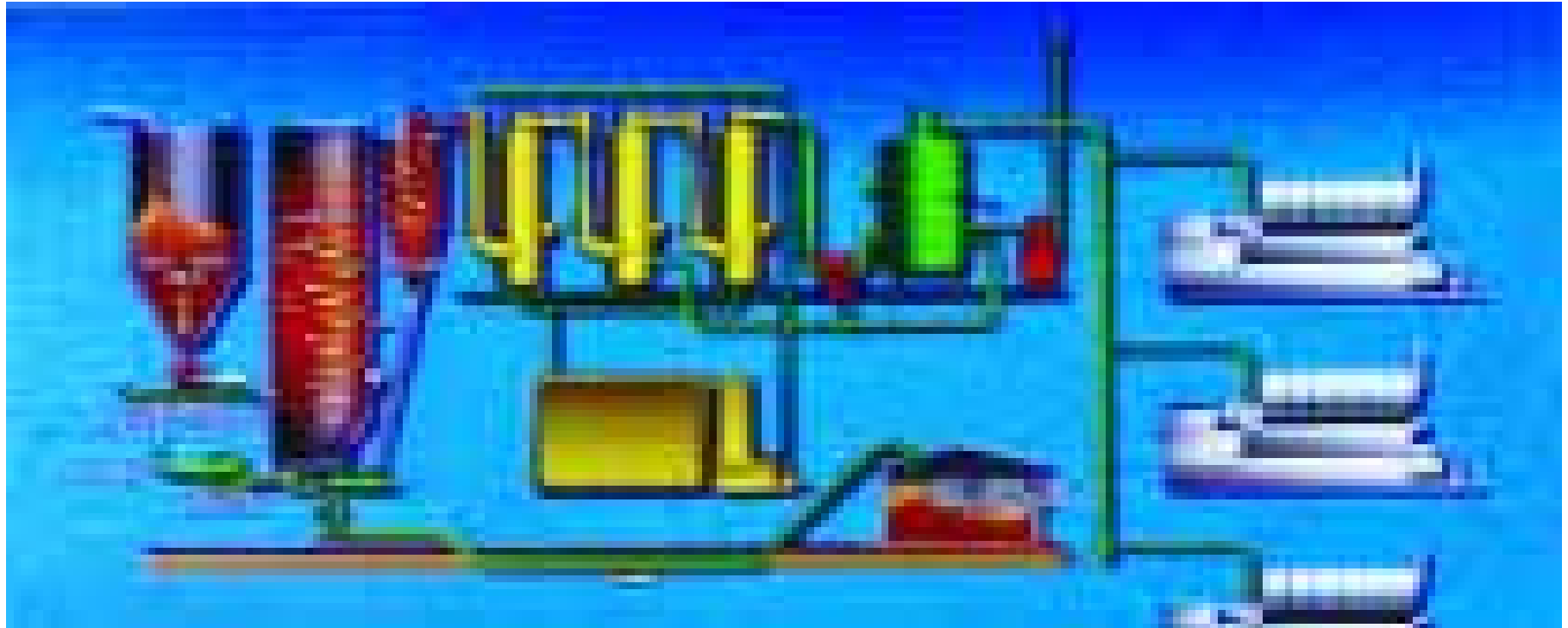
- Fuel for brick, ceramic kilns, open burning, cooking.
- Price: seasonal price, from 5US\$-8US\$/tonne, or 0.36-0.6US\$/GJ.
- Comparison:
  - + Rice husk: 0.36-0.6 US\$/GJ.
  - + Coal( good coal): 1.64 US\$/GJ (50US\$/t)
  - + DO: 11US\$/GJ (retail: 0.5US\$/kg)

# Power generation



- Siting:
  - + Large rice mill >100,000t paddy/year available >20,000t of rice husk or >2MW installed ( 5000hrs)-very few. But rice husk supply, heat and electricity demands are stable.( one site identified by Institute of Energy)
  - + Collection in area of radius 20km, available for 3-5 MW. But rice husk supply, heat and electricity demands are not stable.( one site identified by Peakovinhloi Co. and RCEE)
  - + Need to show, that the use for power generation does not cause the deficit of rice husk for other use.

# Gasification technology



# Gasification technology



2005/12/26

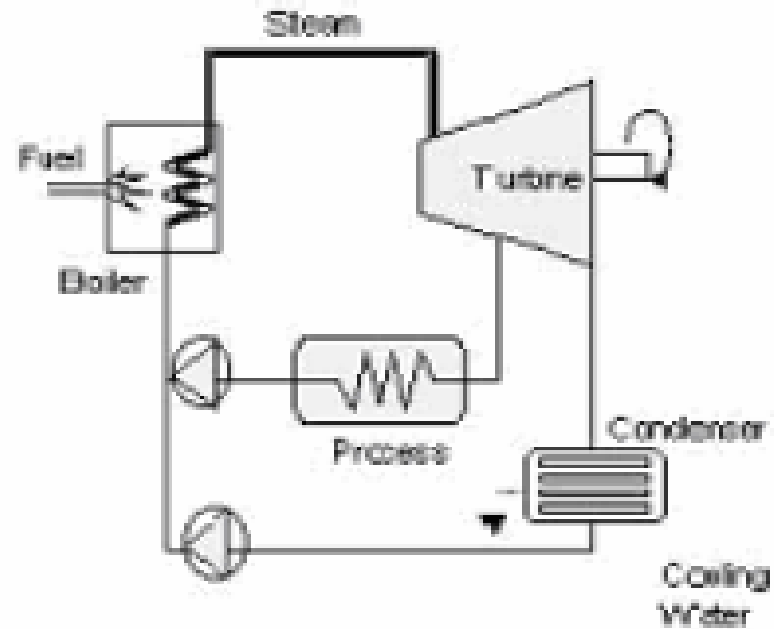
Rice husk-second biomass-Thai

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# Gasification technology

Item	Unit	Value	Remark
Specific investment	MUS\$/MW	0.693	
Discount rate	%	12	
O&M	% of investment	3	
Fuel cost	USD/kg	7.75	
Fuel HV	Kcal/kg	3000	
Installed capacity	MW	3	
Operation time	hrs/year	7000	
Output	MW h	21000	
Fuel consumption	T/MW	2	
Project lifetime	year	20	
Electricity purchase price	US\$/MW h	45.2	
<b>CDM contribution</b>			20 years CO2 purchase
Reduction	tCO2	17902	
CO2 price	US\$/tCO2	4	
CO2 revenue	US\$	71608	
<b>Finance results</b>			
NPV	MUS\$	2.1	
NPV+CDM	MUS\$	2.65	
Payback period	Year	5.2	
Payback period + CDM	Year	4.5	
IRR	%	26.6	
IRR+CDM	%	30.1	

# Steam technology



Extraction-condensing steam turbine



# Steam technology

## PROJECT IDENTIFICATION

Company:	Hoa An Commune- An Giang province	Case: 10 - Power-only mode 2,880 h/yr
Project description:	4 MW Full Condensing Steam Turbine Cogeneration Plant	Cogen mode 2,160 h/yr
Calculation done by:	COGEN 3	Other Identification: Ash sale 30 USD/ton

## SUMMARY FINANCIAL RESULTS

<b>Pre-tax Project IRR</b> <i>Pre-tax project nominal Internal Rate of Return (IRR)</i>	18.1%	
<b>Pre-tax Project NPV</b> <i>Pre-tax Net Present Value (NPV)</i>	38,150,111 ('000) Dong	2,424 ('000) US \$
<b>Post-tax Project IRR</b> <i>Post-tax nominal project Internal Rate of Return (IRR)</i>	17.5%	
<b>Post-tax Project NPV</b> <i>Post-tax Net Present Value (NPV)</i>	32,728,665 ('000) Dong	2,060 ('000) US \$
<b>Post-tax Equity IRR</b> <i>Post-tax nominal equity Internal Rate of Return (IRR)</i>	27.8%	
<b>Discounted payback time</b>	9.8 Years	
<b>Simple payback time</b>	5.7 Years	
<b>Total investment costs (Incl. contingency)</b>	81,549,082 ('000) Dong	5,182 ('000) US \$
<b>Financial project lifetime</b>	20 Years	
<b>Cash flow coverage ratios</b>	<b>Minimum</b>	<b>Average</b>
Pre-tax	of interest	11.81
	of debt service	2.63
Post-tax	of interest	11.41
	of debt service	2.60



# CDM opportunity

- CO2 reduction:
  - + Grid connected: 0.615 kgCO<sub>2</sub>/kWh.
  - + Off grid: DO substitute: 0.8kgCO<sub>2</sub>/kWh ( default value).
- Leakage: Do not reduce rice husk supply for other rice husk use as fuel.
- Problem: Very small scale.



Thank You