



*Hamada*  
BOILER

**HAMADA**  
**COGENERATION**  
IS WHAT YOU **NEED!!!**

ONE WITH **2** ADVANTAGES  
**STEAM & ELECTRICITY IN ONE**

**SAVE DOUBLE  
AND GROW MORE**

9.9 MW Back Pressure Turbine CO-GEN Coal Fired Power Plant with 75 T/h CFBC 100 bar 540 °C installed at AKPC (Asia Kraft Papermill) of Thailand

[www.hamadaboiler.com](http://www.hamadaboiler.com)

# INTRODUCING HAMADA COGENERATION

Hamada Boiler, the pioneer and market leader in small and medium coal-fired process steam boiler in the Philippines, Indonesia and South East Asia, is again introducing another innovation in industrial steam and power generation. After successfully installing again another 10MW Coal-Fired Power Plant in Thailand in the last quarter of 2012, Kazuhiro Hamada, Chairman and CEO of Hamada Group of Companies, announces the launching of another pioneering product line in the market, namely the Hamada Semi-Packaged Cogeneration Coal-Power Plant.

## This Coal-Fired Power Plant comes in two variants

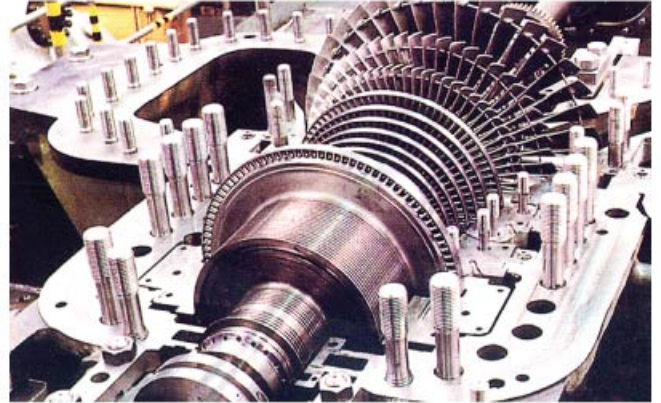
The first uses a 35-ton Bubbling Fluidized Bed Boiler, operating at 25 bar and 400 deg. Centigrade superheated steam and using a back-pressure turbine-generator. This set-up is capable of delivering 35-ton/hr process steam for factory use at 6-8 bar with an extra 1800-2000 kw/hr of electricity.

The second variant also uses the same boiler configuration but now using an extraction type turbine-generator. This set-up will deliver 4,500-5000 kw/hr of electricity and an extra 10-15 ton/hr of process steam.

What is unique in this power plant is that it is semi-packaged and therefore much easier and faster to install and can be made **FULLY OPERATIONAL IN ONE (1) YEAR ONLY.**

But the most interesting feature of this semi-packaged power plant is the huge total savings that it can generate from the combined saving on steam and electricity, which is conservatively placed at around 70%. Hence, with all major components and parts of the power plant priced below the present industry benchmark, payback is estimated **TO BE LESS THAN ONE (1) YEAR ONLY.**

As the many satisfied users of Hamada coal-fired boilers would testify, this new Hamada product is sure to once again help many companies to cushion the impact of high electricity and steam costs on their bottom line.



1800-2000KW Back Pressure Turbine/Generator  
Boiler: 35ton 25bar 400 °C | Back Pressure for Process  
35ton at 6 - 8bar



4500KW Extraction Condensing Turbine/Generator  
Boiler: 35ton 25bar 400°C  
Extraction for Process 15ton at 6 - 8bar



AKPC Asia Kraft Papermill(Thailand)  
Boiler: 75ton 100bar 540°C CFB Boiler | 9.9MW Back Pressure  
Turbine/Generator | Installed in 2013 by Hamada Boiler



Hot Cyclone System of CFB Boiler 75ton 100bar 540°C

# Cost of Energy and Savings, Calculations on Steam Cost for 3 Countries

## INDONESIA

Exchange Rate : as Rp 9600/USD | Cost of Electricity : Rp900/KWH (US\$0.09375/KWH)

COST OF STEAM PER TON							
KIND OF FUEL	HEAT VALUE	UNIT	PRICE	PRICE	CONSUMPTION	COST OF STEAM	SAVINGS %
	<i>KCAL/unit</i>		<i>(RP)</i>	<i>US \$</i>	<i>PER ton of steam</i>	<i>RP./ton STEAM</i>	<i>vs COAL</i>
INDUSTRIAL Diesel	9063/liter	LITER	9500	0.9896	86.9 Liter	825,550	89.35%
GAS	8700/m3	M3	3300	0.3438	90.5 m3	298,650	70.58%
COAL 0-50 MM	5500/kg	KG	550	0.0573	143.2 Kg	78,760	

## PHILIPPINES

Exchange Rate : as PhP 41/USD | Cost of Electricity : PhP12/KWH (US\$0.29268/KWH)

COST OF STEAM PER TON							
KIND OF FUEL	HEAT VALUE	UNIT	PRICE	PRICE	CONSUMPTION	COST OF STEAM	SAVINGS %
	<i>KCAL/unit</i>		<i>(PhP)</i>	<i>US \$</i>	<i>PER TON/HR</i>	<i>PhP./ton STEAM</i>	<i>vs COAL</i>
INDUSTRIAL Diesel	9063/Liter	LITER	41.00	1.0000	86.9 Liter	3,563	79.90%
BUNKER C	9200/KG	KG	32.00	0.7805	85.6 KG	2,739	73.86%
COAL 0-50 MM	5500/kg	KG	5.00	0.1220	143.2 Kg	716	

## THAILAND

Exchange Rate : as THB 30/USD | Cost of Electricity : THB3.20/KWH (US\$0.10666/KWH)

COST OF STEAM PER TON							
KIND OF FUEL	HEAT VALUE	UNIT	PRICE	PRICE	CONSUMPTION	COST OF STEAM	SAVINGS %
	<i>KCAL/unit</i>		<i>(THB)</i>	<i>US \$</i>	<i>PER TON/HR</i>	<i>THB./ton STEAM</i>	<i>vs COAL</i>
INDUSTRIAL Diesel	9063/liter	LITER	35.00	1.1667	86.9 Liter	3,042	86.82%
BUNKER C	9200/KG	KG	26.00	0.8667	85.6 KG	2,226	81.98%
COAL 0-50 MM	5500/kg	KG	2.80	0.0933	143.2 Kg	401	

## SUMMARY

	PER MONTH	4500 KW EXTRACTION-CONDENSING (15T Steam/h)			1800 KW BACK-PRESSURE (35T Steam/h)		
		INDONESIA	PHILIPPINES	THAILAND	INDONESIA	PHILIPPINES	THAILAND
Saving on Steam	VALUE OF STEAM BY OIL AND GAS	Rp3,225,420,000	Php 29,581,200	฿24,040,800.00	Rp7,525,980,000	Php 69,022,800	฿56,095,200.00
		\$ 335,981.25	\$ 721,492.68	\$ 801,360.00	\$ 783,956.25	\$ 1,683,482.93	\$ 1,869,840.00
Saving on Electricity	VALUE OF PRODUCED ELECTRICITY	Rp2,916,000,000	Php 38,880,000	฿10,368,000.00	Rp1,166,400,000	Php 15,552,000	฿ 4,147,200.00
		\$ 303,750.00	\$ 948,292.68	\$ 345,600.00	\$ 121,500.00	\$ 379,317.07	\$ 138,240.00
	TOTAL GAIN (STEAM + ELECTRICITY)	\$ 639,731.25	\$ 1,669,785.37	\$ 1,146,960.00	\$ 905,456.25	\$ 2,062,800.00	\$ 2,008,080.00
	TOTAL OPERATING COST OF POWER PLANT	\$ 255,282.50	\$ 579,931.71	\$ 393,622.40	\$ 255,282.50	\$ 579,931.71	\$ 393,622.40
	NET SAVING OF CO-GEN	\$ 384,448.75	\$ 1,089,853.66	\$ 753,337.60	\$ 650,173.75	\$ 1,482,868.29	\$ 1,614,457.60
OPERATING COST OF HAMADA CO-GENERATION PLANT/MONTH					INDONESIA	PHILIPPINES	THAILAND
1)	COAL CONSUMPTION	143.2 Kg/ton	35 ton/H		\$ 206,745.00	\$ 440,078.05	\$ 336,806.40
2)	STATION LOAD	620 KWH	/Hour		\$ 41,850.00	\$ 130,653.66	\$ 47,616.00
3)	OPERATOR	6 Persons/Shift	3 Shifts		\$ 4,687.50	\$ 7,200.00	\$ 7,200.00
4)	MAINTENANCE		/Month		\$ 2,000.00	\$ 2,000.00	\$ 2,000.00
TOTAL					\$ 255,282.50	\$ 579,931.71	\$ 393,622.40

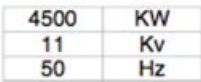
## Fuel Consumption Calculation

Steam Pressure : 25kg/cm<sup>2</sup> 400°C  
 Feed Water Temperature : 104°C (w/ deaerator)  
 Evaporation : 1,000 kg/H  
 Hv: Coal : 5500 kcal/kg (Average Value)  
 hs = Enthalpy at steam 25 kg/cm<sup>2</sup> at 400 °C  
 = 773.5 Kcal/Kg  
 hf = Enthalpy of feed water  
 = 104 Kcal/Kg  
 Boiler Efficiency : 85 %



For One (1) Ton Evaporation of Steam at 25Kg/cm<sup>2</sup> 400 °C ;  
 Coal Consumption =  $\frac{(1,000\text{Kg of Steam/H}) \times (hs-hf)}{\text{Boiler Efficiency} \times Hv}$   
 =  $\frac{1,000 \times (773.5 \text{ kcal/kg} - 104 \text{ kcal/kg})}{0.85 \times 5500 \text{ Kcal/kg}}$   
 =  $\frac{669500}{4675}$   
 = **143.2 Kg of Coal/ton of Steam**

### 4500KW EXTRACTION CONDENSING TURBINE



## 1800KW BACK PRESSURE TURBINE



CASE-1 Extraction condensing (10.2% gain in steam)

CASE-2 Back pressure (10% gain in steam)

## Cooling Water Requirements

	Case-1	Case-2
KW GENERATED	4500 KW	1800 ~ 2000 KW
SYSTEM	Extraction/Condensing	Backpressure
Total Circulating Water	1400 m3/h	300 m3/h
Make-up Water	16.8 m3/h	3.6 m3/h
Cooling Equipments	Condensate Water	N/A
	Air Cooler of Generator	
	Steam Cooler of Seal Steam	
	Oil Cooler of Turbine	



Electric Precipitator



Pneumatic Ash Pump



Ash Silo



Automatic Ash Disposal Valve



High Pressure Feed Water Pump



Ash Cooler System



High Pressure Steam Header



Cooling Tower for Condensate water



Condenser Unit



Coal Feeding System with Injection of Air



Deaerator Unit



Oil System



Diesel Engine Operated Emergency Pump



Oil Pump



PLC with SCADA



Cooling Tower Circulating Pump



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