

WASTE MANAGEMENT IN BRAZIL

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WTERT 2010 Bi-Annual Meeting at Columbia University
NEW YORK CITY, OCTOBER 7 & 8, 2010

WTERT-Brasil homepage → www.wtert.com.br



Conselho de Pesquisa em Tecnologia de Geração de Energia a Partir de Resíduos

Progresso no Gerenciamento Sustentável de Resíduos

Waste-to-Energy Research and Technology Council

Advancing Sustainable Waste Management

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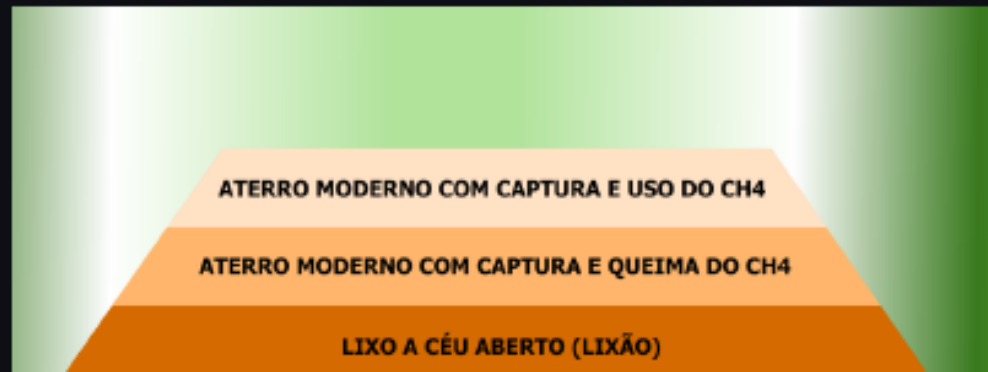
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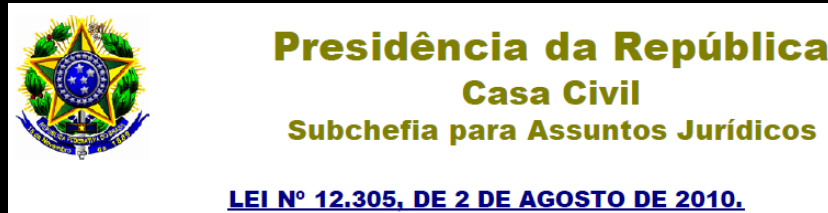


Nos Estados Unidos existem 87 usinas resíduos-energia (REN) ou "waste-to-energy" (WTE) que processam 28 milhões de toneladas de resíduos sólidos urbanos (RSU) gerando cerca de 15 TWh de eletricidade por ano. Na década de 1990 todas estas usinas implementaram novas regulamentações (MACT- Maximum Achievable Control Technology) da Agência de Proteção Ambiental (EPA). [ler mais](#)

Últimas Notícias

- [COPPE e COMLURB fazem parceria para geração de energia a partir do lixo. O acordo firmado hoje em solenidade na UFRJ prevê edital para apresentação de propostas para a Prefeitura do Rio de Janeiro em 60 dias](#) – 17 de agosto de 2010
- [Comissão do Senado vota proposta do senador Marcelo Crivella que obriga o uso do biogás de aterros sanitários para cidades com mais de 200.000 habitantes. Os créditos de carbono pelo MDL \(Mecanismo](#)

BRAZIL APPROVED NEW SOLID WASTE MANAGEMENT LAW AFTER 20 YEARS OF DISCUSSION IN THE CONGRESS.



THE LAW INSTITUTES WM HIERARCHY: REDUCTION, RECYCLING, ENERGY RECOVERY (NOT SPECIFIC), FINAL DISPOSAL.

INSTITUTES THE NATIONAL SOLID WASTE PLANNING PROGRAM TO BE COORDINATED BY THE FEDERAL GOVERNMENT, **UPDATED EVERY 4 YEARS**, TAKING INTO ACCOUNT THE BEST INTERNATIONAL PRACTICES.

THIS PLANNING SHOULD ESTABLISH GOALS FOR RECYCLING AND ENERGY RECOVERY AND CREATE FINANCIAL SOURCES TO IMPROVE WM.

UNFORTUNATELY THE LAW IS VAGUE IN MANY ASPECTS IN SPECIAL NOT DISTINGUISHING BETWEEN INCINERATION AND METHANE RECOVERING FROM LANDFILLS.

DOES NOT INSTITUTE ORGANICS LANDFILL DIVERSION PROGRAM.

SEVERAL CITIES ARE CONSIDERING WTE TO REPLACE LANDFILLS:

CONSIDERING JUST HOUSEHOLD WASTE

1. BELO HORIZONTE (1,500 TPD)
2. RIO DE JANEIRO (4,500 TPD)
3. BRASILIA (2,000 TPD)



IS PROCESSING **60,000** TPD (INCLUDING RIO, SÃO PAULO, BELO HORIZONTE AND OTHERS) – SEVERAL LANDFILL GAS PROJECTS

NEW LANDFILL IN RIO 9,000 TPD WILL TRAVEL 80 KM TO BURY PLASTICS AND GENERATE METHANE TO GET CARBON CREDITS.



Endereço inicial:

Copacabana, Rio de Janeiro - RJ, Brasil

Endereço de destino:

Seropédica - RJ, Brasil

Distância: 78,7 km (aprox. 1 hora 1 minuto)

Dados cartográficos ©2009 MapLink/Tele Atlas

RECENT MEDIA AND EVENTS ON WTE IN RIO DE JANEIRO

ARTICLE PUBLISHED IN OGLOBO
(#1 PAPER IN RIO) ON NOV/2009

"LANDFILL DECEPTION"

1. BRAZIL-JAPAN FORUM (WM)

OCTOBER 5-6 WITH PARTICIPATION
OF WTERT-GREECE (KALOGIROU)
AND WTERT-BRASIL (MYSELF)



2. WASTE: SOURCE OF CLEAN ENERGY (FEDERATION OF INDUSTRIES OF RIO DE JANEIRO- SEP-28)



3. HALF HOUR TV SHOW ("CITIES & SOLUTIONS" – CHANNEL 40) ON WTE → SPECIAL EMPHASIS ON WTERT-BRASIL (OCT 6)

4. ONE HOUR TALK IN SÃO PAULO UNIVERSITY WITH SEVERAL MAYORS ATTENDING – OCT 21





WASTE MANAGEMENT COMPANY (COMLURB) OF RIO DE JANEIRO AND COPPE-UFRJ SIGN AGREEMENT TO DEVELOPE WTE PLANTS (Aug-2010).

LHV → THEMELIS = 8,1 MJ/Kg CONSONNI = 8,6 MJ/Kg

RIO DE JANEIRO - MSW

DIRETORIA TÉCNICA E INDUSTRIAL - DIN
GERÊNCIA DE PESQUISAS APLICADAS - IGP

2009

COMPONENTES (%)	AP 1	AP 2.1	AP 2.2	AP 3.1	AP 3.2	AP 3.3	AP 4	AP 5.1	AP 5.2	AP 5.3	Mp	PESO TOTAL EM Kg POR COMPONENTE
PAPEL	11,04	16,46	12,06	11,56	12,76	11,95	10,53	11,51	9,23	8,01	11,65	1.752,98
PAPELÃO	3,62	3,79	2,78	2,84	3,13	3,01	2,60	2,91	2,43	3,45	3,02	454,46
TETRA PACK	1,29	1,18	1,54	1,48	1,64	1,45	1,36	1,37	1,38	1,35	1,41	211,65
TOTAL (PAPEL)	15,95	21,43	16,38	15,88	17,53	16,40	14,50	15,79	13,04	12,80	16,08	2.419,09
PLÁSTICO DURO	4,37	4,38	3,41	5,43	3,45	3,85	3,66	3,41	3,40	3,63	3,85	579,73
PLÁSTICO FILME	13,08	15,73	15,71	16,83	13,98	14,25	15,27	15,12	14,48	16,42	14,97	2.251,84
PET	1,41	1,74	1,50	1,21	1,26	1,64	1,62	1,41	1,24	1,38	1,49	223,54
TOTAL (PLÁSTICO)	18,86	21,84	20,61	23,47	18,69	19,74	20,55	19,94	19,12	21,42	20,31	3.055,12
VIDRO INCOLOR	1,52	2,11	1,52	1,29	1,57	1,70	1,74	1,43	1,08	1,92	1,62	243,58
VIDRO COLORIDO	1,06	2,78	1,70	1,06	0,59	1,01	1,87	0,97	0,32	0,35	1,22	184,14
TOTAL (VIDRO)	2,58	4,89	3,22	2,34	2,16	2,72	3,61	2,40	1,40	2,28	2,84	427,72
MATERIA ORGANICA PUTRESCIVEL	52,67	41,01	51,54	49,21	52,11	50,62	51,18	52,02	57,54	55,06	51,00	7.673,61
AGREGADO FINO ORGÂNICO	2,79	2,45	2,68	2,70	2,46	2,94	2,96	1,91	2,30	2,44	2,63	394,95
TOTAL (ORGÂNICO)	55,47	43,46	54,21	51,91	54,57	53,56	54,14	53,93	59,84	57,50	53,63	8.068,55
METAL FERROSO	1,19	1,36	1,46	1,31	1,23	1,51	1,11	1,29	1,30	1,28	1,32	198,74
METAL NÃO FERROSO	0,37	0,49	0,43	0,40	0,40	0,32	0,59	0,42	0,39	0,37	0,42	63,02
TOTAL (METAL)	1,56	1,85	1,88	1,71	1,64	1,84	1,70	1,71	1,69	1,65	1,74	261,76
PEDRA	1,22	1,54	1,11	0,30	0,58	0,80	0,96	0,55	0,00	0,42	0,78	117,67
LOUÇA / CERÂMICA	0,33	0,38	0,27	0,44	0,68	0,32	0,29	0,20	0,09	0,03	0,31	46,68
TOTAL (INERTE)	1,56	1,92	1,38	0,75	1,26	1,12	1,25	0,74	0,09	0,45	1,09	164,35
FOLHA / FLORES	0,73	2,09	0,65	0,76	0,55	1,39	1,24	1,50	2,00	1,24	1,26	189,07
MADEIRA	0,41	0,22	0,11	0,58	0,41	0,32	0,36	0,55	0,28	0,21	0,34	51,72
BORRACHA	0,11	0,12	0,03	0,28	0,26	0,22	0,33	0,22	0,24	0,51	0,23	34,68
PANO / TRAPO	1,98	1,75	0,91	1,88	1,94	1,93	1,54	2,48	1,49	1,11	1,75	262,58
COURO	0,41	0,17	0,00	0,23	0,22	0,20	0,18	0,07	0,22	0,15	0,18	27,56
OSSO	0,00	0,01	0,00	0,00	0,00	0,03	0,00	0,00	0,00	0,00	0,01	1,26
COCO	0,21	0,15	0,44	0,13	0,65	0,39	0,49	0,47	0,56	0,43	0,40	60,50
VELA / PARAFINA	0,00	0,00	0,06	0,00	0,01	0,01	0,00	0,02	0,00	0,00	0,01	1,52
ELETROELETRÔNICO	0,18	0,12	0,10	0,09	0,12	0,13	0,13	0,18	0,05	0,24	0,13	19,71
TOTAL (OUTROS)	4,03	4,62	2,31	3,94	4,16	4,62	4,26	5,48	4,83	3,90	4,31	648,60
TOTAL GERAL	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	
TEOR DE UMIDADE (%)	43,63	40,24	32,63	43,74	43,00	38,72	39,10	44,31	36,04	44,95	40,26	
PESO ESPECÍFICO (kg/m³)	123,79	123,53	119,30	117,25	125,21	122,62	122,57	128,13	121,69	139,56	123,96	15.045,19
PESO DA AMOSTRA (kg)	1.039,85	1.393,38	1.145,31	989,70	1.352,30	3.237,42	2.147,39	1.537,62	1.096,89	1.105,33	15.045,19	
CONTAINERS	35	47	40	35	45	110	73	50	38	33	506	

* Valor correspondente ao somatório de lixo amostrado no Município do Rio de Janeiro.

ECONOMIC FEASIBILITY

1. ORIGINAL DISCREPANCY → CAPITAL COST, POWER GENERATION, ETC. ON A PER TON BASIS (COST/TON; MWhe / TON; MWht/ TON; etc....)
2. WHAT IS BURNING?

	DRY FRACTION (C ₆ H ₁₀ O ₄)	MOISTURE	ASHES	LHV (KJ/Kg)
USA	67%	18%	15%	11.000
EUROPE	62%	23%	15%	10.000
BRAZIL	52%	33%	15%	8.000



1 Kg 1,424 Kg 1,808 Kg 0,616 Kg

1 Kg of air = 0,23 Kg of O₂ + 0,77 Kg of N₂ → 1,424 Kg de O₂ = 6,191 Kg of air

NO EXCESS AIR (STOICHIOMETRIC or LAMBDA = 1)

1 Kg MSW USA → 4,15 Kg of air

1 Kg MSW Brazil → 3,22 Kg of air
(22% LESS THAN USA)

HIGHER MOISTURE WASTE **COSTS LESS** TO BURN PER TON (**COST PROPORTIONAL FLUE GAS FLOW**)

	APROX. WASTE COMP			LHV MJ/Kg	Radiabatic = 1,200 C		AIR FUEL RATIO			APC/BOILER COST INDEX	GRATE/ BOILER COST INDEX (C6H10O4+ASHES)
	C6H10O4	H2O	ASHES		Excess Air (lambda)	Stack O2 (Volume)	Ton air/Ton C6H10O4	Ton air/Ton WASTE	Ton FG/Ton WASTE		
BRAZIL	52%	33%	15%	8,0	1.36	4,42%	8.53	4.436	5.29	0.71	0.82
EUROPE	62%	23%	15%	10,0	1.52	6,02%	9.52	5.901	6.75	0.90	0.94
USA	67%	18%	15%	11,0	1.58	6,60%	9.92	6.643	7.49	1.00	1.00

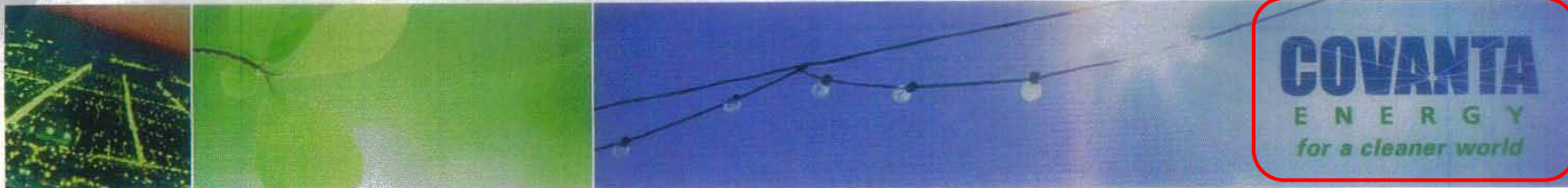
INCLUDES WATER EFFECT

ONE TON OF BRAZILIAN WASTE →

22% LESS DRY FUEL(C6H₁₀O₄) THAN
USA (**NEEDS LESS AIR TO BURN**)

83% MORE WATER THAN USA (**LESS AIR
TO COOL**)

WTE IN BRAZIL / CHINA SHOULD COST LESS 20-30% PER TON
THAN IN USA AND EUROPE



Custos

COVANTA RELEASED THIS DOCUMENT DURING MY VISIT IN 2008 WITH CEMIG EXECUTIVES TO SEAMASS AND HEMPSTEAD

➤ Capital de Investimento:

Capital: **US\$ 200,000** por tonelada instalada por dia de capacidade de processamento

Área de Implantação: 5 - 10 hectares

➤ Custos de Operação e Manutenção (O & M): **US\$ 30** por ton processada, incluindo:

Mão de Obra.

Materiais.

Disposição da Cinza.

Manutenção dos Equipamentos

CAPITAL → USA ~ US\$ 200.000 / (TPD) → BRASIL ~ US\$ 140.000 / (TPD)

792 TPD PLANT → US\$ 110.000.000

TIPPING FEE = US\$ 17/ton ~ US 39/ton

MWhe = US\$ 83

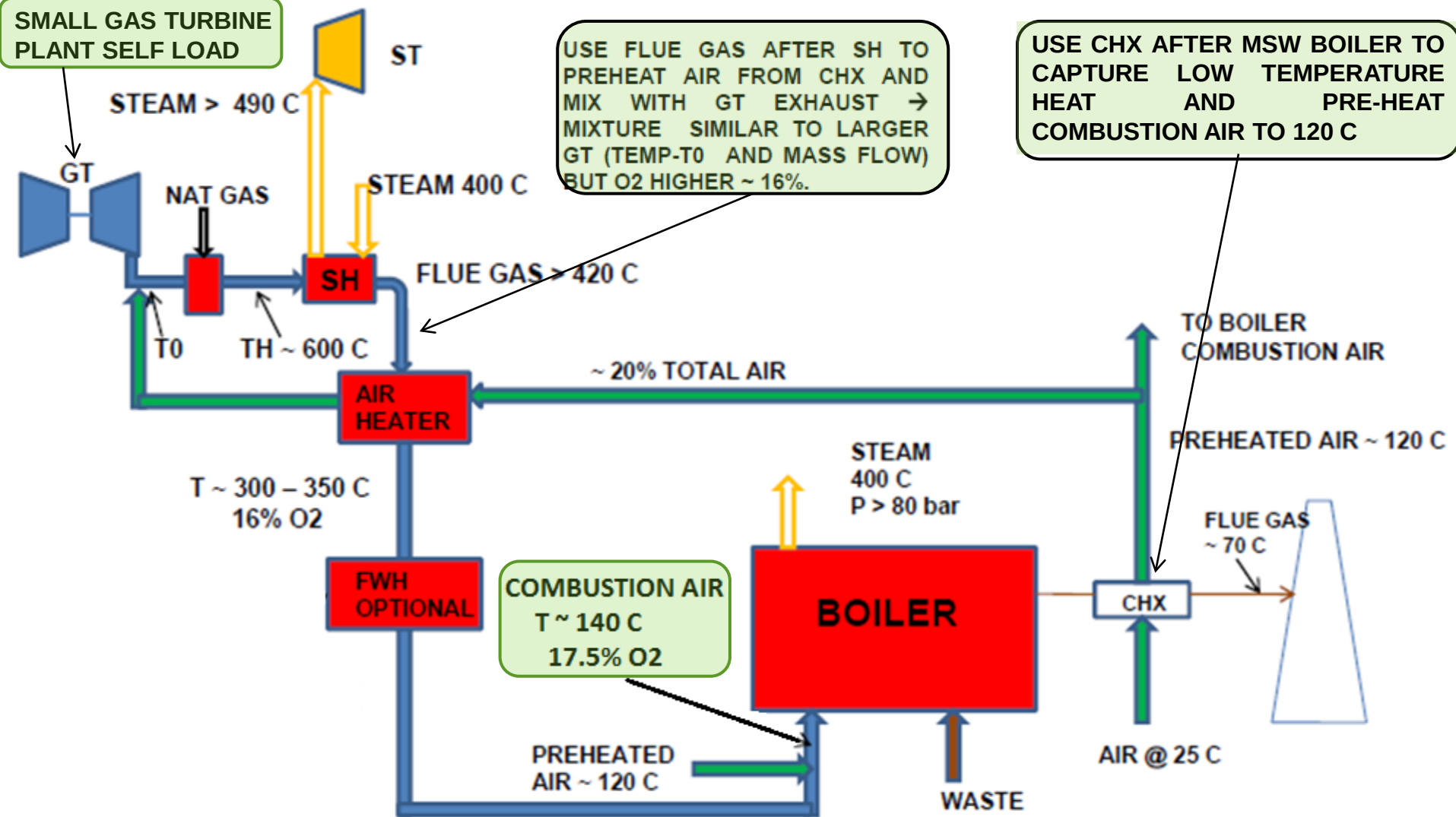
O&M = US\$ 22/ton

FEASIBILITY WILL DEPEND ON IRR, TAXES AND:

EFFICIENCY(MWhe/MWht)

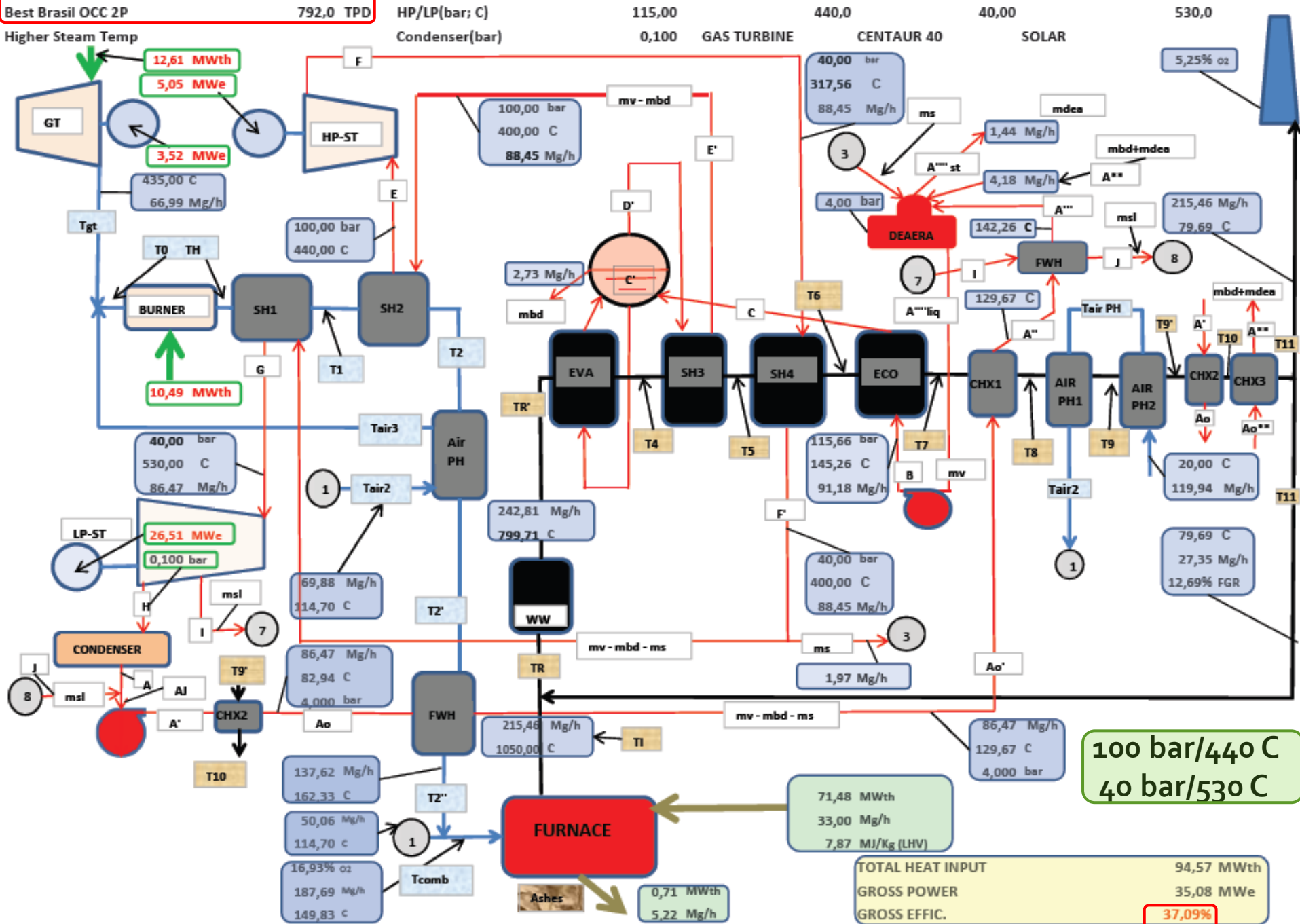
OPTIMIZED COMBINED CYCLE (OCC)

HIGH EFFICIENCY WITH LOW NG CONSUMPTION



CHOICE OF GT X NG COST IS VERY IMPORTANT TO OPTIMUM DESIGN → NEED
DEDICATED SOFTWARE TO INCLUDE FINANCE.

SOFTWARE DEDICADO PARA USINAS COM CICLO COMBINADO OTIMIZADO -CCO



Amsterdam, Netherlands

Status: Summer 2007



2013/9/14

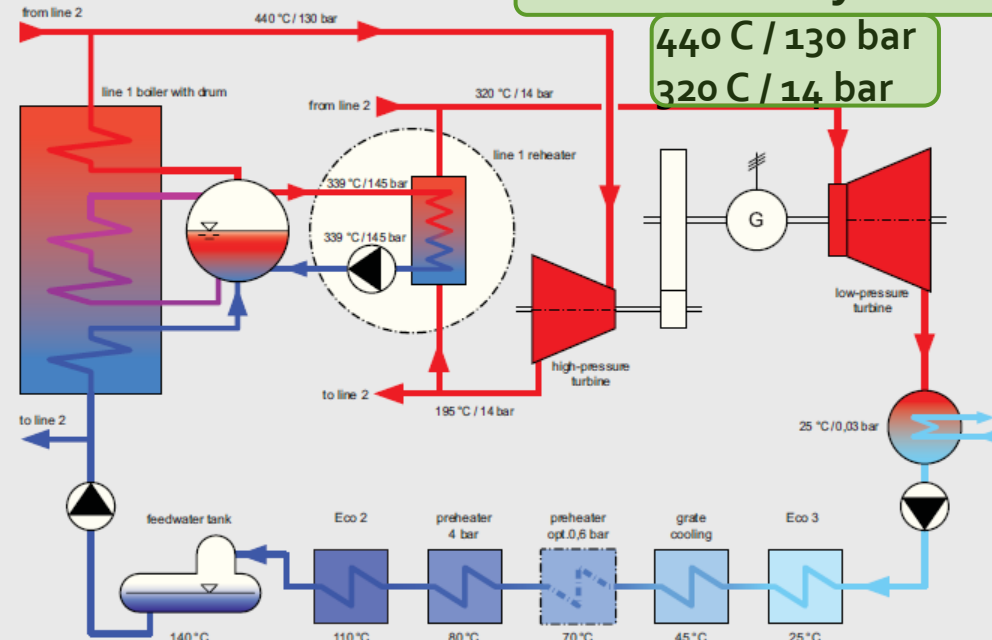
Seminar on Thermal Waste Treatment
JW Marriott Hotel Hong Kong, 7 March 2008

13

Figura 4.2 – Usina WTE de Amsterdam (4.500 ton/dia).

Reheating and water-steam cycle scheme

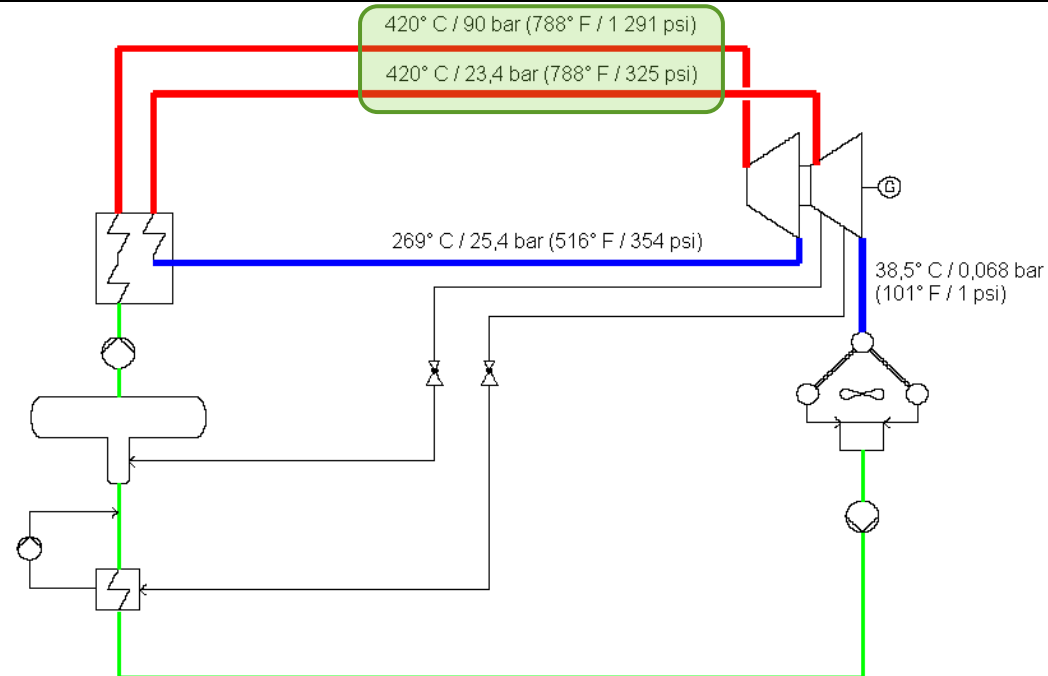
net efficiency 30 %



Waste-to-Energy Plant Germany EBS-IKW Rüdersdorf



boiler efficiency 86,5 %
gross power production 29,9 %



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Novo Energy, LLC

Belo Horizonte,
Brazil

State-of-the-art technology provider for solid fuel based renewable energy projects



NOVO ENERGY TECHNOLOGY
SUPPLY FOR THE BELO HORIZONTE
RESOURCE RECOVERY FACILITY

Prepared by:
Novo Energy, LLC
Submission Date: October 30, 2009

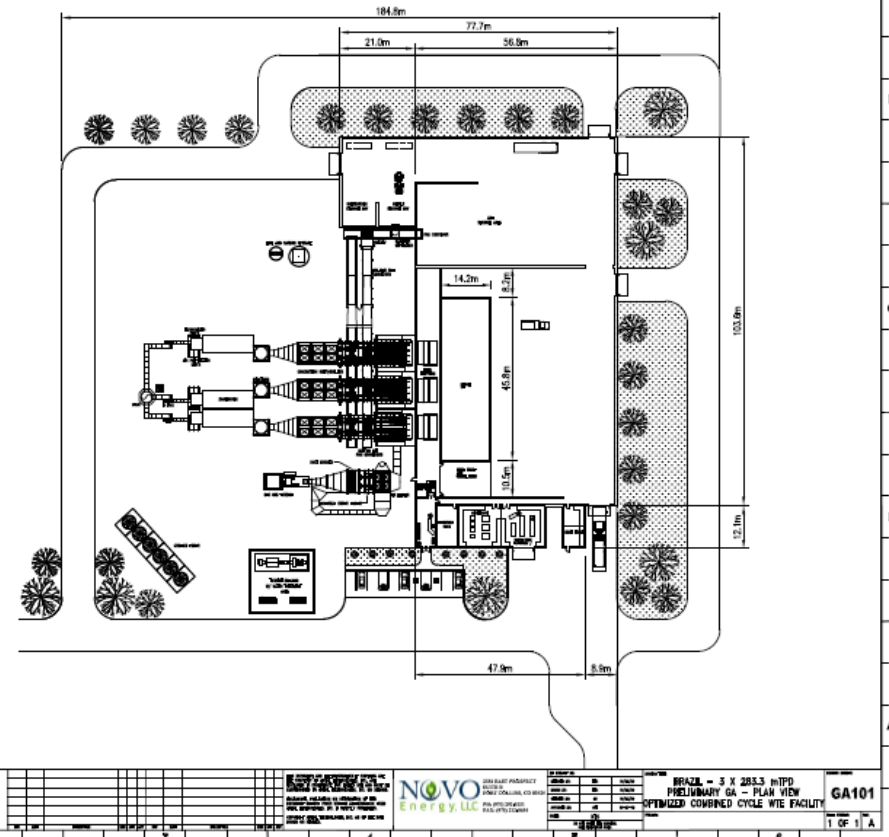
778

PRELIMINARY
NOT FOR CONSTRUCTION

OCC - 792 TPD
WITH 5 MWe
GAS TURBINE



SECOND FLOOR OFFICES



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BRAZIL - 3 X 285.3 MW
PRELIMINARY GA - PLAN VIEW
OPTIMIZED COMBINED CYCLE WTE FACILITY

GA101
1 OF 1 A

THE BRAZILIAN LAW FOR WTE INCENTIVES LIMITS THE ELECTRIC POWER TO
30 MWe.

FOR A LHV OF 8 MJ/Kg AND 22% NET EFFICIENCY → 1,400 TPD

30% NET EFFICIENCY → 1,000 TPD

OCC (75% MSW + 25% NG) → 800 TPD

COMPARISON BETWEEN BILBAO AND OCC – SAME MSW BOILER (792 TPD)

	CASE ₁	CASE ₂	CASE ₃	CASE ₄
	BILBAO PLANT ORIGINAL	OCC BILBAO (STANDARD ST)	OCC BILBAO (HIGH EFF ST)	OCC BILBAO (HIGH EFF ST) no GT
TPD	792	792	792	792
GAS TURBINE(MWe)	LM6000 (46)	GE5 (5.5)	GE5 (5.5)	NA
HP (bar) / T (C) / Isen eff	100 / 540 / NA	100 / 400 / 0.703	100 / 400 / 0.85	100 / 460 / 0.85
LP (bar) / T (C) / Isen eff / Pcond (bar)	30 / 540 / NA / NA	30 / 540 / 0.865 / 0.06	30 / 530 / 0.91 / 0.03	30 / 530 / 0.91 / 0.03
PLANT GROSS POWER(MWe)	100	33,89	36,17	30,05
MSW ENERGY (MWth)	71	71	71	71
Nat Gas CONSUMPTION(MWth)	152	21,84	21,32	12,38
MSW APP EFFICIENCY	31,66%	34,51%	38,04%	36,04%
Nat Gas EFFICIENCY - STANDALONE CC	51,00%	43,00%	43,00%	NA
MSW ACTUAL EFFICIENCY	NA	32,65%	35,48%	36,04%
Nat Gas ACTUAL EFFICIENCY	NA	49,06%	51,51%	36,04%
MSW SHARE	22,48%	72,30%	74,67%	85,15%
OVERALL EFFICIENCY	44,84%	36,50%	39,18%	36,04%

CASE 4 – NO GT – GOOD OPTION FOR USING LANDFILL GAS – NG CONSUMPTION ~ 8% OF BILBAO. CAN ALSO USE ETHANOL OU BIODIESEL (LPP COMBUSTION PROCESS).

CONCLUSIONS

1. HIGH MOISTURE MSW → BOILER AND APC ARE SMALLER PER TON OF WASTE.
2. WTE IN BRAZIL / CHINA SHOULD COST LESS 20-30% PER TON THAN IN EUROPE / USA.
3. LOWER CAPITAL + MORE ENERGY (OCC) = FEASIBILITY.



Lixão - Forma inadequada de disposição
final de resíduos sólidos
foto: André Vilhena

**IN BRAZIL AND OTHER COUNTRIES
WASTE IS STILL DUMPED AWAY AND
PEOPLE TRY TO MAKE A LIVING FROM IT**





Landfill gas utilization

WtERT is strictly against the creation of new landfills, however the methane emitted from current landfills must be used.



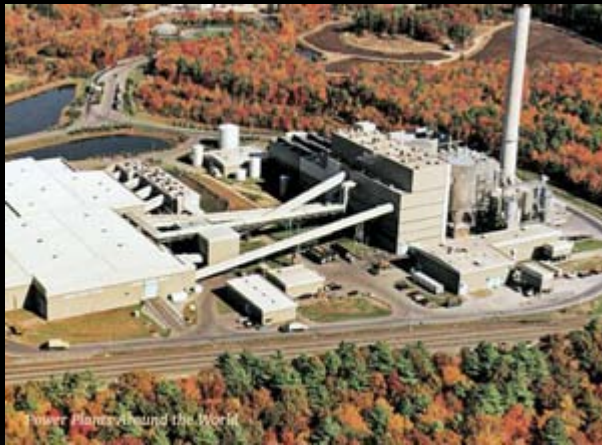
Divulgação

No Centro de Tratamento de Resíduos de Nova Iguaçu, em Adrianópolis, são produzidos 2.000m³ de gás/hora

MODERN LANDFILLS ARE BETTER THAN OPEN DUMPS BUT STILL REPRESENT AN ENVIRONMENTAL IMPACT THAT SHOULD AND COULD BE AVOIDED

WASTE TO ENERGY MUST FIND A WAY TO
BECOME AVAILABLE IN OTHER COUNTRIES
AT REASONABLE COSTS. I BELIEVE W^TE^RT
CAN PLAY AN IMPORTANT ROLE IN THIS
MATTER





THANK YOU

