





# LAWI EtaPlant<sup>®</sup> Boiler Island & Power Plant Systems

Generating power from renewable fuel sources – highest fuel flexibility with the state-of-the-art LAWI EtaPlant Combustion & Boiler technologies

The energy recovery of solid waste utilization in power plants is among the most efficient energy options, helping to reduce  $CO_2$  emissions and save the limited fossil resources. LAWI designs and supplies customized power plants that generate highly efficient electricity, heat and process steam according to the customer's unique plant layout requirements while meeting stringent environmental requirements. From first contact to final commissioning - LAWI is your reliable partner when it comes to sustainable and cost-efficient energy solutions. What all LAWI solutions have in common: the reliability with which our customers achieve their energy goals.

#### Applicable FUELS

All kind of Biomass & Agricultural Waste (bagasse, EFB, rice husk, cassava, e Waste wood Municipal Solid Waste (MSW) Refuse Derived Fuels (RDF) Solid Recovered Fuels (SRF) Industrial Waste (IW) Sewage Sludge ... and many more



**Combustion System** The heart of every biomass and WtE power plants is the combustion – Over the last years of intense R&D we have combined our experience from nearly 30 years of designing multifuel combustion systems & incinerators and created the German patented LAWI EtaComb<sup>®</sup> of today, which was successfully installed in more than 50 projects in different countries across the world.

The LAWI EtaComb<sup>®</sup> hydraulically driven moving step grate system with grate

segments arranged in the form of stairs is especially developed for the operation of different kind of solid wastes of inhomogeneous characteristics. Depending on the lower heating value of the fuel, the grate bars can be cooled using a water-cooling circuit, air cooling, or a combination of both. By selecting the appropriate cooling medium, the thermal and mechanical stress on the grate bars is significantly reduced. Consequently, this improves the plant availability and reduces maintenance costs.









### LAWI Strong Points & Advantages

Outstanding Multi-Fuel Application	Efficiently combusting an outstanding range of fuel characteristics LHV Range of 4,500 – 26,000 kJ/kg Fuel moisture content of up to 65 % Large particle size variation
Highest Efficiency through optimal Combustion	Combustion Efficiency of up to 98% Oxygen Content between 3-4% Very low unburnt content in ash, TOC <3% Overall Boiler Efficiency of more than 90%
Low Emissions	Very low CO and VOC emissions Very low NOx emissions
Low Maintenance & high Availability	sophisticated German engineering state-of-the-art heavy duty industrial design standard
Investment Security	Reliable technology even for the most heterogeneous solid fuels Stable & consistent returns on investment

# **Energizing Biomass & Waste.**

# **Protecting Investment through Reliability.**

# Since 1996.









**Steam Boiler System** The natural circulation steam boiler systems of the *LAWI EtaPlant®* are always designed in Germany and are taylor-made for the specific application. The LAWI boiler are efficient water tube single drum boiler systems with secondary heating surfaces, such as evaporators, super-heaters, economizers and air preheaters that accommodate the requirements of stable process steam supply to the industry as well as high pressure steam (superheated steam) supply for electric generation.

LAWI's long-term experience and expertise in the design of boiler that use flue gases from solid fuels forms the basis for being capable of addressing the high thermal, chemical and mechanical demands even in difficult process conditions (contaminated gases) and thus achieving excellent anti-wear and anti-fouling performances. LAWI boiler are combined with the *LAWI EtaComb®* combustion systems presenting our customers an outstanding performance of efficient and reliable steam generation out of one hand.

#### **LAWI Boiler Benefits**

- ▲ Thermodynamically advanced heating surface design achieving excellent anti-wear and anti-fouling performances
- Project specifically customized boilers for each application designed 100% in Germany but with respect to flexible global supply capabilities
- Highest possible techno-commercially efficiency with low maintenance requirements
- Fabricated with state-of-the-art production and factory testing technologies and quality assurance system









#### Advance Combustion Control & LAWI EtaLogic® Process Optimization

The LAWI advanced combustion and boiler control system is particularly designed by LAWI for efficient and adaptable operation for a fully automatic operation and the result of decades of experience in the design of solid fuel firing and boiler systems.

The LAWI control systems are specially developed for biomass combustions and incineration processes with the purpose of increasing reliability, stability and simplicity of operation of the plant. The control logics are based on advanced MPC adaptive controllers and apply the operators experience into a multidimensional (AI) control concept. Together with the LAWI EtaLogic<sup>®</sup> process optimization system, the entire combustion and boiler process is stabilized at the setpoint values allowing the plants achieve highest level of stable, reliable and efficient operations with minimized need for manual interference even if fuel compositions are not constant.

The LAWI EtaLogic<sup>®</sup> optimization systema can also easily be integrated into existing power plants via direct communication with the existing DCS.







100 % Projects successfully completed







#### LAWI Benefits - Why LAWI?

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#### **Highest Efficiency through optimal Combustion**

The adiabatic LAWI EtaComb<sup>®</sup> Combustion System with recirculation gas operates with maximum process stability on a very low excess air rate, keeping the oxygen content between 3-4% and guaranteeing complete burn-out of the fuel. This results in a combustion efficiency of over 98% and CO emissions and unburned hydrocarbons on unsurpassed low rates. The very low excess air rate further leads to low exhaust gas flow rates and consequently minor heat losses, that can increase the overall boiler efficiency to more than 90%

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#### **Outstanding Multi-Fuel Application**

From the first idea and stretch, the LAWI EtaComb<sup>®</sup> Combustion System has been designed with the focus to efficiently combust an outstanding range of fuel characteristics allowing highest possible operation flexibility.

With the LAWI EtaComb<sup>®</sup>, changes in the fuel characteristics – which are typical for any kind of waste fuels – are compensated by its adiabatic design and sophisticated application of recirculation gas. Thus, allowing stable flue gas flow, temperatures and heat transfer even when

the fuel characteristics such as moisture or LHV are varying. Even hard-to-burn fuels such as high moisture fuels with water content of up to 65 % and a LHV down to 4,500 kJ/kg can be efficiently utilized with the LAWI EtaComb<sup>®</sup> Combustion System.

Last but not least, the extraordinary easiness of fuel flexibility allows potential increases in the fuel market prices to be compensated by switching to substitute fuels and therefore increasing overall investment security.

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#### Low Maintenance and high Availability

LAWI's sophisticated German engineering and state-of-the-art heavy duty industrial design standards keep wear and tear on low levels and availability high.

Our proven process stability significantly reduces the thermal stress of the combustion and boiler equipment to minimum levels and therefore increases the lifetime of the equipment. A lifetime no-erosion guarantee of heat exchangers is made possible by the LAWI EtaComb<sup>®</sup> as well as reduced fly ash design through optimal flue gas velocity and retention time in the post-combustion chamber and boiler radiant chamber.



## Range of Application & Experience of LAWI Boiler Islands

	Biomass-to-Energy	Waste-to-Energy
Firing Capacity	20-120 MWth	10-60 MWth
Boiler Capacity Steam Output	approx. 20 -130 tph	10-65 tph
Power Generation	5-30 MWe	3-15 MWe
Saturated Steam	Yes	Yes
Superheated Steam	up to 515°C, 95 bar(a)	up to 450°C
Combustion Temperature	850-1,100°C	950-1,100°C
Oxygen Content (Flue Gas)	3-6% wet	3-6% wet
LHV Range	4.5-20 MJ/kg	7.5-26 MJ/kg
Fuel Moisture Range	up to 65%	up to 65%





### LAWI EtaPlant® - Selected References

WASTE-TO-ENERGY POWER PLANT -  $7 M W_{\rm e}$ 

LAWI EtaPlant<sup>®</sup> COD: July 2019

Design Fuel: RDF Location: Ayutthaya, Thailand

**TECHNICAL PROJECT DATA** Firing Design Capacity: 30 MW<sub>th</sub> Steam Boiler Design Data: 35 tph 53 bar(a), 450 °C Generator Capacity: 7 MW<sub>el</sub>



**LAWI SCOPE OF SUPPLY:** EPC of LAWI EtaPlant<sup>®</sup> boiler island with LAWI EtaComb<sup>®</sup> 300 incl. ash handling system, TGS interconnecting piping and LAWI EtaLogic<sup>®</sup> optimization unit.



#### **BIOMASS POWER PLANT – 12 MW**<sub>e</sub>

LAWI EtaPlant<sup>®</sup> COD: August 2017

Design Fuel: Multi Fuel with Gliricidia as design fuel Location: Nabou of Viti Levu, Fiji

> **TECHNICAL PROJECT DATA** Firing Design Capacity: 51.2 MW<sub>th</sub> Steam Boiler Design Data: 57 tph 36.3 bar(a), 440 °C Generator Capacity: 12 MW<sub>el</sub>

**LAWI SCOPE OF SUPPLY:** EPC of LAWI EtaPlant<sup>®</sup> boiler island with LAWI EtaComb<sup>®</sup> 500 incl. fuel conveying, ash handling system, flue gas cleaning, TGS interconnecting piping and plant automation system (DCS).

#### **BIOMASS POWER PLANT - 6MW**e

LAWI EtaPlant<sup>®</sup> COD: June 2014

Design Fuel: Multi Fuel with Gliricidia as design fuel Location: Mahiyangana, Sri Lanka

TECHNICAL PROJECT DATA

Firing Design Capacity: 27.5 MW<sub>th</sub> Steam Boiler Design Data: 32.9 tph 68 bar(a), 485 °C Generator Capacity: 6 MW<sub>el</sub>



LAWI SCOPE OF SUPPLY: Overall plant basic engineering, EP of LAWI EtaComb<sup>®</sup> 300 incl. fuel conveying and ash handling system, Owner's technical consultant.



..... to see further successful projects out of our extensive reference list visit www.lawipower.com

#### Consult with us and find out more about:

LAWI's flagship combustion system: the *EtaComb® - Advance* the ultimate multifuel furnace with optimal combustion & emission control. LAWI's air cooled and water-cooled moving grate systems your steps to a complete burn out of almost all high & low calorific solid fuels LAWI's model predictive process optimization: The LAWI EtaLogic<sup>®</sup> getting the world's best operator into your power plant - 24/7. Always assuring stable & efficient operation with minimum manual intervention The LAWI EtaPlant<sup>®</sup> boiler islands German designed solid fuel fired boiler technology. Reliably producing stable & efficient energy outputs with minimum shutdown times LAWI's excellent track record and references We are awaiting you: Come, consult us and visit our refence sites to convince yourself....

#### www.LAWIPOWER.com .....

#### or contact us directly sales@de.lawipower.com



LAWI EtaComb® Firing Systems



LAWI EtaPlant® Boiler Islands



LAWI EtaLogic® Plant Optimization



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