



**"Gheorghe Asachi" Technical University of Iasi, Romania**



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## **ENVIRONMENTAL AND ECONOMIC BENEFIT OF THE STEAM ENERGY FROM A RECYCLED BIOMASS BOILER**

**Sudarat Saelee<sup>1</sup>, Boontham Paweewan<sup>2</sup>, Rungnapa Tongpool<sup>3\*</sup>,  
Thongthai Witoon<sup>2</sup>, Jun-ichi Takada<sup>4</sup>**

<sup>1</sup>TAIST Tokyo Tech, National Science and Technology Development Agency, Pathumthani, 12120, Thailand

<sup>2</sup>Department of Chemical Engineering, Kasetsart University, Bangkok, 10900, Thailand

<sup>3</sup>National Metal and Materials Technology Center (MTEC), Pathumthani, 12120, Thailand

<sup>4</sup>Department of International Development Engineering, Graduate School of Science and Engineering,  
Tokyo Institute of Technology, Tokyo, 152-8550, Japan

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### **Abstract**

The usage of biomass as renewable energy source is increasing around the world as this reduces carbon dioxide (CO<sub>2</sub>) emissions and fossil fuel consumption. Recycled boilers for biomass are relatively cheap and widely used in commercial plants in Thailand. However, their efficiency was relatively low and life time was relatively short, compared to new boilers. This research studied environmental impacts and economic benefits of the new and recycled boilers through their entire lives, using life cycle assessment (LCA) and life cycle costing (LCC) methodology. The impact assessment method of ReCiPe Midpoint (H) was used. The results showed that, in the construction stage, the environmental impacts of the recycled boiler were lower than the new one, due to relatively low consumption of virgin materials. In the operation stage, the recycled boiler having 60% efficiency performed the worst while the recycled boiler having 70% efficiency performed the best. The main impact contributors for the steam energy production were the boiler construction and emissions from wood combustion. The cost of the steam energy produced by the recycled boiler operating at 60 and 70% efficiency was cheaper than the energy obtained from the new one by 0.00084 and 0.00174 US\$/MJ, respectively. The increase of boiler efficiency can reduce both environmental impacts and operation cost.

*Key words:* biomass, boiler, LCA, recycle, steam energy

*Received: January, 2014; Revised final: October, 2014; Accepted: January, 2015*

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\* Author to whom all correspondence should be addressed: e-mail: rungnapatongpool@gmail.com; Phone: +66 25646500; Fax: +66 25646404