

New insights for decentralised waste-to-energy systems in small to medium-scale: Incineration and gasification

Giovanna Andrea Pinilla-De La Cruz

VEBIC – Vaasa Energy Business Innovation Centre
University of Vaasa
Vaasa, Wolffintie 34, Finland
giovanna.pinilla.de.la.cruz@uwasa.fi

Monica Julieth Valencia Botero

VEBIC – Vaasa Energy Business Innovation Centre
University of Vaasa
Vaasa, Wolffintie 34, Finland
monica.valencia.botero@uwasa.fi

Jussi Kantola

School of Technology and Innovations University of Vaasa
Vaasa, Wolffintie 34, Finland
Jussi.kantola@uwasa.fi

Abstract

Decentralised energy systems are crucial migrating towards cleaner systems. The main advantage is the adjustability to energy demand and supply. A key aspect to promote decentralised energy systems is the integration of flexible technologies in terms of scale and capability to process a wide range of materials including Municipal Solid Waste (MSW). The Waste-to-Energy (WtE) technologies are a strategic factor for planning decentralised energy systems. Among thermochemical WtE technologies, incineration appears to be the most mature. On the other hand, gasification is an emerging technology with the potential to convert a broad range of wastes into useful energy products. The purpose of the study is to provide insights for the planning of decentralised WTE energy systems from MSW. Incineration and gasification are compared by a multidimensional analysis through a systematic review. Findings indicate that decentralised WtE energy systems could meet part of energy demand reducing environmental impacts. Although incineration delivers steady energy production, its feasibility depends on the scale. Gasification offers pliability in the scaling-up process and energy storage. Gasification requires being tested on a commercial scale. Decentralised WtE energy systems provide a platform for emerging technologies through public-private partnerships. Critical success factors include adaptability of technologies and business models.

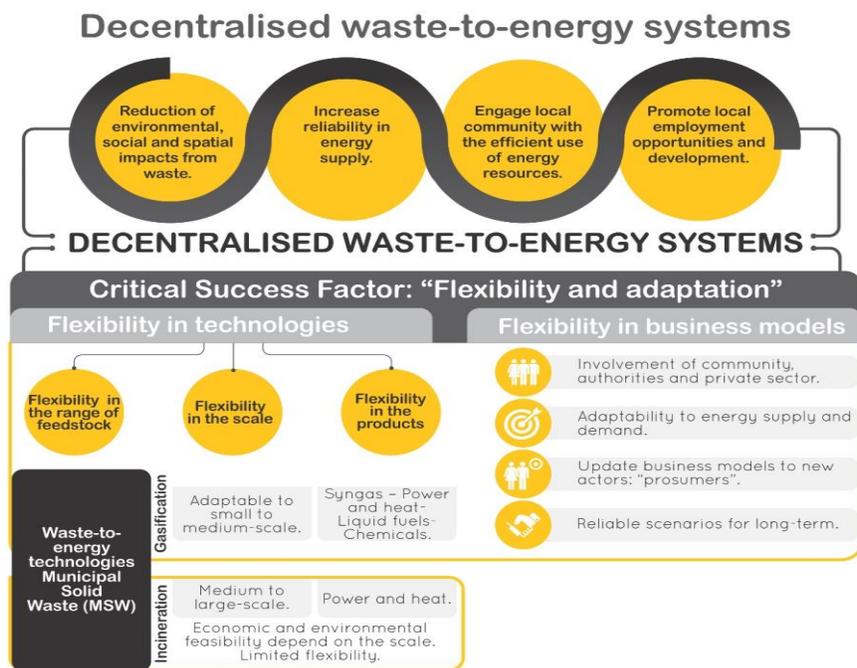


Figure 1. Critical success factors for decentralised WtE energy systems

Keywords

Decentralised energy systems, waste-to-energy, municipal solid waste, gasification, incineration.

Biographies

Giovanna Andrea Pinilla-De La Cruz is a project researcher in Public-Private Partnerships (PPPs) for energy infrastructure development at VEBIC – Vaasa Energy Business Innovation Centre-, the University of Vaasa, Finland. She earned Bachelor in Industrial Engineering from Universidad Santiago de Cali, Colombia. Masters of Science in Engineering, Environmental and Energy Engineering from the University of Sheffield, United Kingdom and she is currently a doctoral student in Technical Sciences in Industrial Management at the University of Vaasa. During 2005-2014, she worked in energy projects in Colombia. Currently, her research is focusing on waste-to-energy technologies for energy infrastructure development in the context of decentralised energy systems through PPPs.

Monica Julieth Valencia Botero is a Project researcher of the Vaasa Energy Business Innovation Centre (VEBIC) in the domain of the assessment of the energy systems, especially bioenergy and renewable energy. She has experience in several aspect of the energy business including technologies, environmental assessment and biofuels and bioenergy. She earned Bachelor in Chemical Engineering and MSc in Engineering – Chemical Engineering from Universidad Nacional de Colombia – Manizales (Colombia). She got the research PhD in Environmental and Energy Engineering Sciences from the University of Udine (Italy).

Jussi Kantola is a professor in the school of technology and innovations at University of Vaasa, Finland. Earlier he was an associate professor in the department of Knowledge Service Engineering at KAIST, Korea. During 2003-2008, he worked in various research roles at Tampere University of Technology and University of Turku, Finland. He has PhD degrees (IE) from University of Louisville, KY, USA, 1998 and Tampere University of Technology, Finland, 2006. During 1999-2002, he worked as an IT and business and process consultant in USA and in Finland. His research interests include resource management, human factor, and product design and development.