Information Management in Solid Wood Fuel Order-Supply Process

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ABSTRACT

The validity and accuracy of information and its fast distribution is significant in effective wood fuel procurement. The authors’ objectives were i) to define the solid wood fuel procurement process of regional power plants, ii) to define a conceptual data model for the wood fuel order-supply process and iii) to create an application for managing the process. They did an interview study for representatives of 38 power plants, their fuel suppliers and subcontractors about wood fuel procurement. They studied further six plants and one major supplier with focus group interviews. It was found that a lot of data is available, but it’s not utilized efficiently. The authors used a methodology of designing information systems architecture and use-case derived methodology to determine the conceptual data model for the order-supply process and to develop an application to control it. Altogether, the hypothesis of the significant and wide-ranging role of information in the order-supply process was confirmed. The study gives a basis to further develop the systems to manage this information.

Keywords: Application, Communication, Data Model, Forest Biomass, Forest Energy, Information Architecture, Power Plant, Procurement Process

1. INTRODUCTION

Monitoring and estimating forest biomass resources, their supply and usage in power plants are the key elements in energy production from wood. Their significance has increased as the use of wood fuel in producing renewable energy for societies has grown. EU’s climate and energy targets for the year 2020 include that of all the energy used 20% should originate from renewable resources (European Parliament and Council 2009). In many countries forest biomass has an important role in achieving this target (Europolitics, 2012; Hakkila, 2006; Routa et al., 2013; Röser, 2011; Wolfsmayr, 2013). Interest for wood based liquid and gaseous fuels and their

DOI: 10.4018/IJGC.2015010102
production facilities is strong and increasing (Jenkins, 2014), but at present use in solid form as wood chips is dominant (Routa et al., 2013).

Efficient order-supply process is crucial for power plants using wood chips (Kanzian et al., 2013; Shabani et al., 2013). An important factor in this is the management of information. Supply chain and usage of wood fuel become more effective with real time information of its heating value and timely pick-ups of energy wood piles: the efficiency of the incineration process increases and the transportations become more profitable when haulages of wood material with high moisture content are avoided (Acuna, 2012; Röser, 2011). Managing information about available solid wood fuel resources, their accessibility and quality, processing of fuel and its incineration is also required.

Advanced measuring technology, different web-based services and geographic positioning systems provide plenty of valuable data for the procurement process (Hultnäs et al., 2012; Ranta, 2005; Zambelli et al., 2012). However, the utilization of this data and its processing into useful form of information is often not very effective, especially among regional power plants.

In the previous studies there have been several approaches in the field of forest biomass resource management. The following perspectives have been proposed in the literature:

- **Sustainable use of forest biomass**: As the forests’ significance as a source for energy increases, there is a risk for excessive exploitation of them. This may cause problems to the forests’ natural growth and welfare, and have negative effects on the biodiversity and the forests’ ability for carbon capture. With advanced management of wood fuel procurement information the prerequisites for sustainable forest management can be fulfilled and the documents and reports required to verify it produced (Verkerk et al., 2011);

- **National or local forest biomass and bioenergy resources, their availability and future scenarios**: Estimations of the resources and their availability and sufficiency at present and in the future have been topical issues in the studies. They evaluate a nations’ or certain areas’ capability to fulfill the demands set for bioenergy. The focus is on utilizing the forest resources in a way which ensures the availability of wood fuel also in future (Dhungana, 2009; Muinonen et al., 2013; Ranta, 2005; Tromborg et al., 2011);

- **Mapping optimal locations for bioenergy plants**: Identifying of possible locations for new bio power plants is a central question in profitable forest biomass use. In the studies focusing on this field the biomass resources, their spatial distribution and accessibility in a certain area are estimated to determine the best locations for the plants. Different decision support systems have been developed by using geographic information systems, databases of biomass resources and multi-criteria optimization (Perpiña et al., 2009; Perpiña et al., 2013; Zambelli et al., 2012);

- **The interaction between social, economic and environmental factors**: Some of the studies concentrate in evaluating the possibilities to implement new bioenergy projects and determining the barriers that hinder them. For example, a decision to establish a new bioenergy plant cannot be made based only on biomass resources, but the dynamic interaction between society, economic and environment has to be considered. Multi-criteria analysis has been found to be an appropriate tool to assist in such complex decision making and stakeholder integration (Buchholz et al., 2009; Peura and Hyttinen, 2011);

- **Forest biomass logistics and management of supply chain network**: The wood fuel’s logistics from forest to power plants and effectiveness of supply networks and their design have been surveyed a lot in various studies especially in the 21st century. Their significance have increased due to the growing need and expanded volumes of wood fuel. The issues studied are about machinery and working methods in the forest tract and road side landing,
Neural Predictive Controller Based Diesel Injection Management System for Emission Minimisation
www.igi-global.com/article/neural-predictive-controller-based-diesel/61376?camid=4v1a