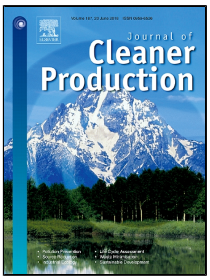
# Accepted Manuscript

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| PII: | S0959-6526(18)31362-3 |
| DOI: | 10.1016/j.jclepro.2018.05.035 |
| Reference: | JCLP 12892 |
| To appear in: | *Journal of Cleaner Production* |
| Received Date: | 17 May 2017 |
| Revised Date: | 13 April 2018 |
| Accepted Date: | 03 May 2018 |

Please cite this article as: Jingxiang Lv, Renzhong Tang, Wangchujun Tang, Shun Jia, Ying Liu, Yanlong Cao, An investigation into methods for predicting material removal energy consumption in turning, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.05.035

# An investigation into methods for predicting material removal energy consumption in turning

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**Abstract:** The wide use of machining processes has imposed a large pressure on environment due to energy consumption and related carbon emissions. The total power required in machining include power consumed by the machine before it starts cutting and power consumed to remove material from workpiece. Accurate prediction of energy consumption in machining is the basis for energy reduction. This paper investigates the prediction accuracy of the material removal power in turning processes, which could vary a lot due to different methods used for prediction. Three methods, namely the specific energy based method, cutting force based method and exponential function based method are considered together with model coefficients obtained from literatures and experiments. The methods have been applied to a cylindrical turning of three types of workpiece materials (carbon steel, aluminum and ductile iron). Methods with model coefficients obtained from experiments could achieve a higher prediction accuracy than those from literatures, which can be explained by the inability of the coefficients from literatures to match the specific machining conditions. When the coefficients are obtained from literatures, the prediction accuracy is largely dependent on the sources of coefficients and there is no definitive dominance of one approach over another. With model coefficients from experiments, the cutting force based model achieves the best accuracy, followed by