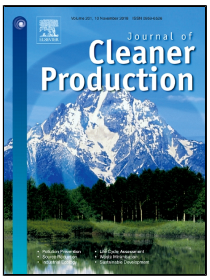
Accepted Manuscript



Renewable energy project performance evaluation using a hybrid multi-criteria decision-making approach: case study in Fujian, China

Lihui Zhang, He Xin, Zhinan Kan

PII:	S0959-6526(18)32773-2
DOI:	10.1016/j.jclepro.2018.09.059
Reference:	JCLP 14194
To appear in:	*Journal of Cleaner Production*
Received Date:	12 June 2018
Accepted Date:	07 September 2018

Please cite this article as: Lihui Zhang, He Xin, Zhinan Kan, Renewable energy project performance evaluation using a hybrid multi-criteria decision-making approach: case study in Fujian, China, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.09.059

Renewable energy project performance evaluation using a hybrid multi-criteria decision-making approach: case study in Fujian, China

Lihui Zhang [a, b], He Xin [a, b*], Zhinan Kan [c]

[a] School of Economics and Management, North China Electric Power University, PCR, Beijing, China

[b] Beijing Key Laboratory of New Energy and Low-Carbon Development (North China Electric Power University), Changping, Beijing, 102206, China

[c] LUNENG NEW ENERGY（GROUP）CO., LTD

Abstract: The evaluation of the best renewable energy project (REP) among many alternatives is a complicated multi-criteria decision-making (MCDM) problem, which usually involves several criteria in economy, technicality, environment and society. To solve this problem, a hybrid approach mixing 2-dimension uncertain linguistic variables (2DULVs), a cloud model and an extended TODIM (an acronym in Portuguese of interactive and multicriteria decision making) together to evaluate REPs efficiently is proposed. Firstly, because of the extra reliability assessment, the 2DULVs are adopted by decision-makers (DMs) to evaluate the performance of alternatives. Secondly, given that the cloud model could vividly depict the fuzziness and randomness, a novel conversion model is proposed to transform the 2DULVs into integrated clouds. Thirdly, the extended TODIM approach is used to evaluate and rank REPs considering DMs' psychological behaviors. Following this, the Fujian case study has been provided to demonstrate to verify the feasibility of the hybrid approach. The results show that the most important criterion is the emission reduction of the greenhouse gases (GHG), and the wind power project is selected as the best alternative, but the later sensitivity analysis shows that the optimal alternative is sensitive to the attenuation factor of losses. Finally, a comparative analysis is conducted to demonstrate the correctness and superiority of the proposed approach. The originality of this work is the first time to put forward the model of transforming 2DULVS into integrated cloud.

Keywords: renewable energy project; performance evaluation; 2-dimension uncertain linguistic variables; cloud model; extended TODIM.

Nomenclature

$\hat{s}$	A 2DULV	w	Weight vector of criteria
$[s_a, s_b]$	I class uncertain linguistic information of $\hat{s}$	D	A finite set of DMs
$[h_c, h_d]$	II class uncertain linguistic information of $\hat{s}$	λ	Weight vector of DMs
S_I	Predefined linguistic set for performance assessment	$[\tilde{\hat{s}}_{ij}^{\,k}]_{m\times n}$	2DULVs decision matrix
H_{II}	Predefined linguistic set for reliability assessment	$[\tilde{y}_{ij}^{\,k}]_{m\times n}$	Integrated clouds decision matrix