

> View all article collections

> View all issues

# About the journal

ISSN  
1364-0321

Copyright  
Copyright © 2021 Elsevier Ltd. All rights reserved

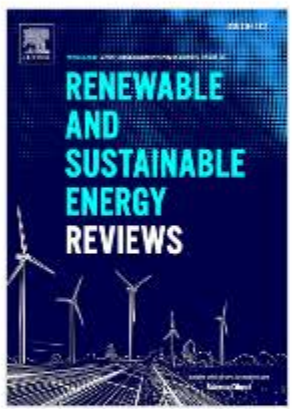
> More journal info



Help improve this page

# Renewable and Sustainable Energy Reviews

Supports open access



25.5

CiteScore

12.11


Impact Factor


Editor-in-Chief: Aoife M. Foley  
View editorial board

> View aims and scope

## Explore journal content

- > Latest issue
- > Article collections
- > All issues

 Sign in to set up alerts

 RSS | open access RSS

## Latest issues

Volume 141  
*In progress* (May 2021)

Volume 140  
April 2021


Volume 139  
April 2021

Volume 138  
March 2021

> View all issues

## Find out more

- > **Submit your article**
- > Guide for authors
- > About the journal
- > Open access options

Help improve this page 



ScienceDirect

# Renewable and Sustainable Energy Reviews

Supports *open access*

25.5  
CiteScore

12.11  
Impact Factor

Menu



Search in this journal

Submit your article ↗

Guide for authors ↗

## About the journal

[Aims and scope](#)

[Editorial board](#)

[Abstracting and indexing](#)

### Editor-in-Chief



Aoife M. Foley

Queen's University Belfast, Belfast, United Kingdom

### Associate Editors

#### Agriculture, Biofuels, and LCA

Catherine Brewer

New Mexico State University, Las Cruces, New Mexico, United States

#### Automotive Engineering Systems



Xiaosong Hu

Chongqing University, Chongqing, China

## Bioenergy, Waste to Energy, Biomass



Abdul-Sattar Nizami

Government College University Lahore, Lahore, Pakistan

## Buildings and Built Environment



Taehoon Hong

Yonsei University Department of Architecture and Architectural Engineering, Seoul, Korea, Republic of

## Materials



Martin Schiemann

Ruhr University Bochum, Bochum, Germany

## Policy, Economics, Biomass, Solar Thermal



Sotirios Karellas

National Technical University Of Athens Laboratory of Steam Boilers and Thermal Plants, Zografou, Greece

## Power Systems



Songyan Wang

Harbin Institute of Technology, Harbin, China

Solar PV, Solar Thermal, Solar Integration, Solar Materials, Solar Heating and Cooling



Yanjun DAI

Shanghai Jiao Tong University, Shanghai, China

Solar Photovoltaics and Solar Energy



Simon Philipps

Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany

Transport



Brian Caulfield

The University of Dublin Trinity College, Dublin, Ireland

Wind Energy



Paul Leahy

University College Cork National University of Ireland, Cork, Ireland

## Assistant Editor



Dlzar Al Kez

Queen's University Belfast, Belfast, United Kingdom

## Editorial Board Members

Air pollution, Greenhouse Gas & Climate Policy



Xi Lu

Tsinghua University, Beijing, China

## Bioenergy



Lise Appels

KU Leuven, Leuven, Belgium



Suani Teixeira Coelho

University of Sao Paulo, São Paulo, Brazil

## Biomass



Purushothaman Abhilash

Banaras Hindu University Institute of Environment & Sustainable Development, Varanasi, India



Shurong Wang

Zhejiang University, Hangzhou, China

## Biomass and Solar

Carbon Fluxes



John D Albertson

Cornell University, Ithaca, New York, United States



Abdul Ghani Olabi

University of Sharjah, Sharjah, United Arab Emirates

## Carbon Materials, and Catalysts



Michela Alfe

Institute for Research on Combustion (IRC), Napoli, Italy

## Buildings, Construction and Architecture



Jian Zuo

The University of Adelaide, Adelaide, Australia

## Buildings and Energy Efficiency

Lola Ben-Alon

Columbia University Graduate School of Architecture Planning and Preservation, New York, New York,  
United States

## Energy Consumer Behaviour



Yael Parag

Interdisciplinary Center Herzliya, Herzliya, Israel

## Energy Economics and Financing



Ilhan Ozturk

Cag University, Tarsus, Turkey

## Energy Modelling, Optimisation, Policy and Markets



Reinhard Haas

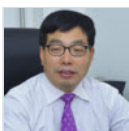
TU Wien University, Wien, Austria



Denis Sidorov, DSc habil.

Hunan University, Changsha, China, and ESI, Russian Academy of Sciences, Irkutsk, Russian Federation  
Russian Federation

## Heat Transfer



Qiuwang Wang

Xi'an Jiaotong University School of Energy and Power Engineering, Xian, China



## Hydrogen Energy



Faik Bilgili

Erciyes University Faculty of Economics and Administrative Sciences, Kayseri, Turkey



Andreas W. Schäfer

University College London, London, United Kingdom

## Hydrogen, Waste to Energy and Sustainable Energy



Yong Sik Ok

Korea University, Korea Biochar Research Center, Chuncheon, Korea, Republic of

## Infrastructure and Society



Lindsay C. Beevers

Heriot-Watt University, Edinburgh, United Kingdom

## Marine Energy



AbuBakr S. Bahaj

University of Southampton, Southampton City, United Kingdom



Barbara Zanuttigh

University of Bologna, Bologna, Italy

## Materials



Chaoying Wan

University of Warwick International Institute for Nanocomposites Manufacturing, Warwick, United Kingdom

## Ocean Atmosphere Interactions and Ocean Energy

### Policy and Assessment



Douglas J. Arent

National Renewable Energy Laboratory, Golden, Colorado, United States



António Franco de Oliveira Falcão

University of Lisbon, Lisbon, Portugal



Mark Jentsch

Bauhaus University Weimar, Weimar, Germany



Kieran O'Driscoll

Queen's University Belfast, Belfast, United Kingdom



Noam Lior

University of Pennsylvania, Philadelphia, Pennsylvania, United States



Wanan Sheng

SW MARE Marine Technology, Cork, Ireland

## Renewable Energy Infrastructure



Leyla Ozgener

Manisa Celal Bayar University, Manisa, Turkey

## Renewable Energy Integration



Gareth Harrison

The University of Edinburgh School of Engineering, Edinburgh, United Kingdom

## Renewable Energy and Power Systems



Xiangjun Li

China Electric Power Research Institute, Energy Storage and Electro-technics Department, Beijing, China



Ju Ping

Hohai University College of Energy and Electrical Engineering, Nanjing, China

## Resource Assessment and Solar



David Renne

Dave Renne Renewables, Boulder, Colorado, United States

## Smart Cities



Diana Reckien

University of Twente, Enschede, Netherlands

## Smart Grids and Power Systems



Liana Cipcigan

Cardiff University Cardiff School of Engineering, Cardiff, United Kingdom



Qinglai Guo

Tsinghua University, Beijing, China



George Kariniotakis

MINES ParisTech - Sophia Antipolis Campus, Sophia Antipolis Cedex, France

## Solar Thermal



Brian Norton

Technological University Dublin, Dublin, Ireland

## Solar Photovoltaics and Solar Energy



Joshua Pearce

Michigan Technological University Department of Materials Science and Engineering, Houghton, Michigan, United States

## Stochastic Optimisation in Energy Systems



Antonino Marvuglia

Luxembourg Institute of Science and Technology, Esch-Sur-Alzette, Luxembourg

## Subsurface Resource, Sustainability, Techno-Socio-Economic Assessment



Ray (Zhenhua) Rui

Massachusetts Institute of Technology Department of Mechanical Engineering, Cambridge, Massachusetts, United States

## Transport



Haifeng Dai

Tongji University, Shanghai, China

## Turbomachinery, Combustion and Renewable Energy



Patrick Hendrick

ULB, Bruxelles, Belgium

## Water, Hydraulics and Hydropower



Li He

Tianjin University, Tianjin, China

## Wind



Robert W. Thresher

National Renewable Energy Laboratory, Golden, Colorado, United States

## Wind Energy and Energy Forecasting



Jethro Browell

University of Strathclyde, Glasgow, Scotland, United Kingdom

All members of the Editorial Board have identified their affiliated institutions or organizations, along with the corresponding country or geographic region. Elsevier remains neutral with regard to any jurisdictional claims.

---

ISSN: 1364-0321

Copyright © 2021 Elsevier Ltd. All rights reserved



Copyright © 2021 Elsevier B.V. or its licensors or contributors.  
ScienceDirect® is a registered trademark of Elsevier B.V.







# Renewable and Sustainable Energy Reviews

Supports *open access*

25.5  
CiteScore

12.11  
Impact Factor

Menu



Search in this journal

Submit your article ↗

Guide for authors ↗

## Volume 59

Pages 1-1688 (June 2016)

[← Previous vol/issue](#)

[Next vol/issue >](#)

Receive an update when the latest issues in this journal are published

[Sign in to set up alerts](#)

Full text access

Editorial Board

Page IFC

[↓ Download PDF](#)

*Regular Articles*

Review article ○ Abstract only

A review of high-efficiency motors: Specification, policy, and technology



Shyi-Min Lu

Pages 1-12

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

Demand response in China: Regulations, pilot projects and recommendations – A review

Jun Dong, Guiyuan Xue, Rong Li

Pages 13-27

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

Exploring the nexus between water saving and energy conservation: Insights from industry sector during the 12th Five-Year Plan period in China

Alun Gu, Fei Teng, Zhiqiang Lv

Pages 28-38

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

Wind energy applications for Taiwan buildings: What are the challenges and strategies for small wind energy systems exploitation?

Shih-Yuan Liu, Yu-Feng Ho

Pages 39-55

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

The role of the discount rates in energy systems optimisation models

Diego García-Gusano, Kari Espegren, Arne Lind, Martin Kirkengen

Pages 56-72

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

Solid desiccant dehumidification and regeneration methods—A review

Kishor S. Rambhad, Pramod V. Walke, D.J. Tidke

Pages 73-83

[↓ Purchase PDF](#)    Article preview [↓](#)

Review article  Abstract only

## Manufacturing metrology for c-Si photovoltaic module reliability and durability, Part I: Feedstock, crystallization and wafering

Hubert Seigneur, Nahid Mohajeri, R. Paul Brooker, Kristopher O. Davis, ... Winston V. Schoenfeld

Pages 84-106

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Solution to sustainable rural electrification in Myanmar

Ramchandra Pode, Gayatri Pode, Boucar Diouf

Pages 107-118

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Evaluation of research on CO<sub>2</sub> trans-critical work recovery expander using multi attribute decision making methods

Simarpreet Singh, MS Dasgupta

Pages 119-129


[Purchase PDF](#) Article preview 

Review article  Abstract only

## Holographic solar energy systems: The role of optical elements

M. Victoria Collados, Daniel Chemisana, Jesús Atencia

Pages 130-140

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Soluble Algal Products (SAPs) in large scale cultivation of microalgae for biomass/bioenergy production: A review

Lin-Lan Zhuang, Yin-Hu Wu, Victor Manuel Deantes Espinosa, Tian-Yuan Zhang, ... Hong-Ying Hu

Pages 141-148

[Purchase PDF](#) Article preview 

Review article  Abstract only

## A review on solar reforming systems

Syed A.M. Said, Mohammed Waseeuddin, David S.A. Simakov

Pages 149-159

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Influence of lipid extraction methods as pre-treatment of microalgal biomass for biogas production

Viviane T. de C. Neves, Emerson Andrade Sales, Louisa W. Perelo

Pages 160-165

[Purchase PDF](#) Article preview 

Review article  Abstract only

## A review of residential demand response of smart grid

Haider Tarish Haider, Ong Hang See, Wilfried Elmenreich

Pages 166-178

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Improvement of anaerobic degradation by white-rot fungi pretreatment of lignocellulosic biomass: A review

E. Rouches, I. Herpoël-Gimbert, J.P. Steyer, H. Carrere

Pages 179-198

[Purchase PDF](#) Article preview 

Review article  Abstract only

## System dynamics, uncertainty and hydrocarbon resources modelling: A systematic review

Saroj Koul, Oluwabunmi A. Falebita, John-Felix K. Akinbami, Joshua B. Akarakiri

Pages 199-205

[Purchase PDF](#) Article preview 

Review article  Abstract only

## A scientific approach with bibliometric analysis related to brick and tile drying: A review

Alptug Yataganbaba, İrfan Kurtbaş

Pages 206-224

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Manufacturing metrology for c-Si module reliability and durability Part II: Cell manufacturing

Kristopher O. Davis, Marianne P. Rodgers, Giuseppe Scardera, R. Paul Brooker, ... Winston V. Schoenfeld  
Pages 225-252

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Prospects of Pakistan–China Energy and Economic Corridor

Faheemullah Shaikh, Qiang Ji, Ying Fan  
Pages 253-263

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Bioenergy from anaerobic digestion in Pakistan: Potential, development and prospects

Abdur Raheem, Mohammad Yusri Hassan, Rabia Shakoor  
Pages 264-275

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Application of factorial analysis to a Brazilian metropolitan region considering the Millennium Development Goals

Herivelto Tiago Marcondes dos Santos, Rubens Alves Dias, José Antônio Perrella Balestieri  
Pages 276-291

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Quantifying environmental performance of biomass energy

G.M. Joselin Herbert, A. Unni Krishnan  
Pages 292-308

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Topologies for large scale photovoltaic power plants

Ana Cabrera-Tobar, Eduard Bullich-Massagué, Mònica Aragüés-Peñalba, Oriol Gomis-Bellmunt  
Pages 309-319

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Recent developments in geometrical configurations of thermal energy storage for concentrating solar power plant

Qianjun Mao

Pages 320-327

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Electricity supply security and the future role of renewable energy sources in Brazil

Rodrigo Corrêa da Silva, Ismael de Marchi Neto, Stephan Silva Seifert

Pages 328-341

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## A survey on residential Demand Side Management architecture, approaches, optimization models and methods

B. Priya Esther, K. Sathish Kumar

Pages 342-351

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article    *Open access*

## Life cycle assessment (LCA) – from analysing methodology development to introducing an LCA framework for marine photovoltaic (PV) systems

J. Ling-Chin, O. Heidrich, A.P. Roskilly

Pages 352-378

[↓ Download PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Effects of district heating networks on optimal energy flow of multi-carrier systems

Amin Shabanpour-Haghighi, Ali Reza Seifi

Pages 379-387

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Techno-economic feasibility study on Integrated Renewable Energy System for an isolated community of India

Anurag Chauhan, R.P. Saini

Pages 388-405

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Blends of pyrolysis oil, petroleum, and other bio-based fuels: A review

Anke Krutof, Kelly Hawboldt

Pages 406-419

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## The status quo review and suggested policies for shale gas development in China

Yanbin Li, Yun Li, Bingqian Wang, Zhuoer Chen, Dan Nie

Pages 420-428

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Assessing the proficiency of adaptive neuro-fuzzy system to estimate wind power density: Case study of Aligoodarz, Iran

Shahaboddin Shamshirband, Afram Keivani, Kasra Mohammadi, Malrey Lee, ... Dalibor Petkovic

Pages 429-435

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Wind energy generation technological paradigm diffusion

Jiuping Xu, Li Li, Bobo Zheng

Pages 436-449

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Contribution of Plug-in Hybrid Electric Vehicles in power system uncertainty management

Jamshid Aghaei, Ali Esmaeel Nezhad, Abdorreza Rabiee, Ehsan Rahimi

Pages 450-458

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Impact assessment of international anti-dumping events on synchronization and comovement of the Chinese photovoltaic stocks

Xuan Huang, Haizhong An, Wei Fang, Xiangyun Gao, ... Xiaoqi Sun

Pages 459-469

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Reviewing the viability of renewable energy in community electrification: The case of remote Western Australian communities

Liam Byrnes, Colin Brown, Liam Wagner, John Foster

Pages 470-481

[Purchase PDF](#) Article preview 

Review article  Abstract only

## A model for valuing new technologies under a pull incentives environment

Glauca Fernandes, Fernanda Finotti Cordeiro Perobelli, Luiz Eduardo T. Brandão

Pages 482-493


[Purchase PDF](#) Article preview 

Review article  Abstract only

## Modeling the benefits of electric cooking in Bhutan: A long term perspective

Dorji Yangka, Mark Diesendorf

Pages 494-503

[Purchase PDF](#) Article preview 

Review article  Abstract only

## A review of renewable energy utilization in islands

Yonghong Kuang, Yongjun Zhang, Bin Zhou, Canbing Li, ... Long Zeng

Pages 504-513

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Tidal range technologies and state of the art in review

Shaun Waters, George Aggidis

Pages 514-529

[Purchase PDF](#) Article preview 

Review article  Abstract only

A review on the inclusion of wind generation in power system studies

Neeraj Gupta

Pages 530-543

[Purchase PDF](#) Article preview 

Review article  Abstract only

Brazilian recycling potential: Energy consumption and Green House Gases reduction

A.V. Colling, L.B. Oliveira, M.M. Reis, N.T. da Cruz, J.D. Hunt

Pages 544-549

[Purchase PDF](#) Article preview 

Review article  Abstract only

Application of TCE-PCM based heat sinks for cooling of electronic components: A review

Santosh Kumar Sahoo, Mihir Kumar Das, Prasenjit Rath

Pages 550-582

[Purchase PDF](#) Article preview 

Review article  Abstract only

Review and multi-criteria assessment of solar energy projects in Chile

M. Grágeda, M. Escudero, W. Alavia, S. Ushak, V. Fthenakis

Pages 583-596

[Purchase PDF](#) Article preview 

Review article  Abstract only

Present status and overview of Chemical Looping Combustion technology

Anirban Nandy, Chanchal Loha, Sai Gu, Pinaki Sarkar, ... Pradip K. Chatterjee

Pages 597-619

[Purchase PDF](#) Article preview 

Review article  Abstract only



## Highly efficient antireflective and self-cleaning coatings that incorporate carbon nanotubes (CNTs) into solar cells: A review

Hengameh Hanaei, M. Khalaji Assadi, R. Saidur

Pages 620-635


[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Territorial analysis of energy consumption of a small remote island: Proposal for classification and highlighting consumption profiles

Fiona Bénard-Sora, Jean Philippe Praene

Pages 636-648

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Chemometric interpretation of different biomass gasification processes based on the syngas quality: Assessment of crude glycerol co-gasification with lignocellulosic biomass

Nataša Đurišić-Mladenović, Biljana D. Škrbić, Anastasia Zabaniotou

Pages 649-661

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Photogalvanics: A sustainable and promising device for solar energy conversion and storage

Amulyacharya Malviya, Prem Prakash Solanki

Pages 662-691

[Purchase PDF](#)    Article preview 

Review article  Abstract only

## Review of the development of pulsating heat pipe for heat dissipation

Xiaohong Han, Xuehui Wang, Haoce Zheng, Xiangguo Xu, Guangming Chen

Pages 692-709


[Purchase PDF](#)    Article preview 

Review article  Abstract only

## A review of the development of Smart Grid technologies

Maria Lorena Tuballa, Michael Lochinvar Abundo

Pages 710-725

[Purchase PDF](#) Article preview 

Review article  Abstract only

Advances in nanostructured thin film materials for solar cell applications

N. Ali, A. Hussain, R. Ahmed, M.K. Wang, ... Y.Q. Fu

Pages 726-737

[Purchase PDF](#) Article preview 

Review article  Abstract only

Evaluation of financial incentives for combined heat and power (CHP) systems in U.S. regions

Jian Zhang, Heejin Cho, Alta Knizley

Pages 738-762

[Purchase PDF](#) Article preview 

Review article  Abstract only

Advances in the valorization of waste and by-product materials as thermal energy storage (TES) materials

Andrea Gutierrez, Laia Miró, Antoni Gil, Javier Rodríguez-Aseguinolaza, ... Luisa F. Cabeza

Pages 763-783

[Purchase PDF](#) Article preview 

Review article  Abstract only

A review of recent developments and technological advancements of variable-air-volume (VAV) air-conditioning systems

Godwine Swere Okochi, Ye Yao

Pages 784-817

[Purchase PDF](#) Article preview 

Review article  Abstract only

*Jatropha curcas* phytotomy and applications: Development as a potential biofuel plant through biotechnological advancements

Praveen Kumar, Vimal Chandra Srivastava, Mithilesh Kumar Jha

Pages 818-838

[Purchase PDF](#) Article preview 

Full text access

### RETRACTED: Solar still with condenser – A detailed review

A.E. Kabeel, Z.M. Omara, F.A. Essa, A.S. Abdullah

Pages 839-857

[Download PDF](#) Article preview 

Review article  Abstract only

### Spain's fulfillment of its Kyoto commitments and its fundamental greenhouse gas (GHG) emission reduction drivers

Itziar Martínez de Alegría, Aitor Basañez, Pablo Díaz de Basurto, Ana Fernández-Sainz

Pages 858-867

[Purchase PDF](#) Article preview 

Review article  Abstract only

### An analysis on the effectiveness of a smart grid test-bed project: The Korean case

Sung Tai Kim, Byung In Lim, Wan Kyu Park, Myoung Kyu Kim, Sung-Yong Son

Pages 868-875

[Purchase PDF](#) Article preview 

Review article  Abstract only

### A booming green business for Taiwan's climate perspective

Wen-Cheng Hu, Jui-Chu Lin, Chien-Te Fan, Chen-An Lien, Shih-Ming Chung

Pages 876-886

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Alumina-supported potassium compounds as heterogeneous catalysts for biodiesel production: A review

João Paulo da Costa Evangelista, Amanda Duarte Gondim, Luiz Di Souza, Antonio Souza Araujo

Pages 887-894


[Purchase PDF](#) Article preview 

Review article  Abstract only

### Thermal comfort in educational buildings: A review article

Zahra Sadat Zomorodian, Mohammad Tahsildoost, Mohammadreza Hafezi

Pages 895-906

[Purchase PDF](#) Article preview 

Review article  Abstract only

Planning for integration of wind power capacity in power generation using stochastic optimization

Yashar Aliari, Ali Haghani

Pages 907-919

[Purchase PDF](#) Article preview 

Review article  Abstract only

A review on well integrity issues for CO<sub>2</sub> geological storage and enhanced gas recovery

Mingxing Bai, Zhichao Zhang, Xiaofei Fu

Pages 920-926

[Purchase PDF](#) Article preview 

Review article  Abstract only

Renewable and sustainable energy reviews solar photovoltaic energy progress in India:

A review

Sarat Kumar Sahoo

Pages 927-939

[Purchase PDF](#) Article preview 

Review article  Abstract only

Analysis and possible geothermal energy utilization in a municipality of Panonian Basin of Serbia

Branka Nakomcic-Smaragdakis, Tijana Dvornic, Zoran Cepic, Natasa Dragutinovic

Pages 940-951

[Purchase PDF](#) Article preview 

Review article  Abstract only

Analysis of energy input and output for honey production in Iran (2012–2013)

Omid Omid-Arjenaki, Rahim Ebrahimi, Davoud Ghanbarian

Pages 952-957

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Review of the security of supply in Turkish energy markets: Lessons from the winter shortages

Seyit Ali Dastan, Orhun Selcuk

Pages 958-971

[Purchase PDF](#) [Article preview](#) 

Review article  Abstract only

## Decentralized control of the hybrid electrical system consumption: A multi-agent approach

Abdoul K. Mbodji, Mamadou L. Ndiaye, Papa A. Ndiaye

Pages 972-978

[Purchase PDF](#) [Article preview](#) 

Review article  Abstract only

## Factor demand, technical change and inter-fuel substitution in Africa

Presley K. Wesseh, Boqiang Lin

Pages 979-991

[Purchase PDF](#) [Article preview](#) 

Review article  Abstract only

## Manufacturing metrology for c-Si module reliability and durability Part III: Module manufacturing

Eric J. Schneller, R. Paul Brooker, Narendra S. Shiradkar, Marianne P. Rodgers, ... Winston V. Schoenfeld

Pages 992-1016


[Purchase PDF](#) [Article preview](#) 

Review article  Abstract only

## Development of the location suitability index for wave energy production by ANN and MCDM techniques

Soumya Ghosh, Tilottama Chakraborty, Satyabrata Saha, Mrinmoy Majumder, Manish Pal

Pages 1017-1028

[Purchase PDF](#) [Article preview](#) 

Review article  Abstract only

## Off-grid renewable energy in remote Arctic areas: An analysis of the Russian Far East

Anatole Boute  
Pages 1029-1037

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Solar photovoltaic water pumping system - A comprehensive review

Vimal Chand Sontake, Vilas R. Kalamkar

Pages 1038-1067

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Measuring resilience in energy systems: Insights from a range of disciplines

Lynette Molyneaux, Colin Brown, Liam Wagner, John Foster

Pages 1068-1079

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Analysis of ripple current, power losses and high efficiency of DC–DC converters for fuel cell power generating systems

M. Venkatesh Naik, Paulson Samuel

Pages 1080-1088

[Purchase PDF](#) Article preview 

Review article  Abstract only

### A review on paddy residue based power generation: Energy, environment and economic perspective

S.M. Shafie

Pages 1089-1100

[Purchase PDF](#) Article preview 

Review article  Abstract only

### An econometric study of the impact of economic growth and energy use on carbon emissions: Panel data evidence from fifty eight countries

Saidi Kais, Hammami Sami

Pages 1101-1110

[Purchase PDF](#) Article preview 

Review article  Abstract only

## Adaptive neuro-fuzzy approach for ducted tidal turbine performance estimation

Obrad Anicic, Srdjan Jovic

Pages 1111-1116

[Purchase PDF](#) Article preview

Review article  Abstract only

## Operation, sizing, and economic evaluation of storage for solar and wind power plants

Asmae Berrada, Khalid Loudiyi

Pages 1117-1129

[Purchase PDF](#) Article preview

Review article  Abstract only

## Distributed generation: A review of factors that can contribute most to achieve a scenario of DG units embedded in the new distribution networks

Antonio Colmenar-Santos, Cipriano Reino-Rio, David Borge-Diez, Eduardo Collado-Fernández

Pages 1130-1148

[Purchase PDF](#) Article preview

Review article  Abstract only

## Optimal sizing for a hybrid power system with wind/energy storage based in stochastic environment

Ahmad Mohamed Abd el Motaleb, Sarah Kazim Bekdache, Lázaro Alvarado Barrios

Pages 1149-1158

[Purchase PDF](#) Article preview

Review article  Abstract only

## Exploring adolescents' knowledge, perceptions and attitudes towards Renewable Energy Sources: A colour choice approach

Kiriaki M. Keramitsoglou

Pages 1159-1169

[Purchase PDF](#) Article preview

Review article  Abstract only

## Mitigating methods of power fluctuation of photovoltaic (PV) sources – A review

S. Shivashankar, Saad Mekhilef, Hazlie Mokhlis, M. Karimi

Pages 1170-1184

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Adoption of green electricity by small- and medium-sized enterprises in Germany

Sebastian Rahbauer, Luisa Menapace, Klaus Menrad, Thomas Decker

Pages 1185-1194

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Energy efficiency assessment of fixed asset investment projects – A case study of a Shenzhen combined-cycle power plant

Li Yingjian, Yousif A. Abakr, Qiu Qi, You Xinkui, Zhou Jiping

Pages 1195-1208

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Integration of 750 MW renewable solar power to national grid of Pakistan – An economic and technical perspective

Tasneem Zafar, Kirn Zafar, Junaid Zafar, Andrew A. P Gibson

Pages 1209-1219

[Purchase PDF](#) Article preview 

Review article  Abstract only

### Nexus of fuel consumption, car features and car prices: Evidence from major institutions in Ibadan

Damilola F. Arawomo, Augustine C. Osigwe

Pages 1220-1228

[Purchase PDF](#) Article preview 

Review article  Abstract only

### How to improve the market efficiency of carbon trading: A perspective of China

Xin-gang Zhao, Gui-wu Jiang, Dan Nie, Hao Chen

Pages 1229-1245

[Purchase PDF](#) Article preview 



Review article  Abstract only

## By-products recycling for syngas cleanup in biomass pyrolysis – An overview

Yafei Shen, Junfeng Wang, Xinlei Ge, Mindong Chen

Pages 1246-1268

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Electrochemical conversion of carbon dioxide into renewable fuel chemicals – The role of nanomaterials and the commercialization

Ibram Ganesh

Pages 1269-1297

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Effects of operation temperature and reactant gas humidity levels on performance of PEM fuel cells

Dilek Nur Ozen, Bora Timurkutluk, Kemal Altinisik

Pages 1298-1306

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article    *Open access*

## Power loss due to soiling on solar panel: A review

Mohammad Reza Maghami, Hashim Hizam, Chandima Gomes, Mohd Amran Radzi, ... Shahrooz Hajighorbani

Pages 1307-1316

[↓ Download PDF](#)    Article preview [✓](#)

Review article  Abstract only

## Greenhouse gas emissions from energy sector in the United Arab Emirates – An overview

A.N. Khondaker, Md. Arif Hasan, Syed Masiur Rahman, Karim Malik, ... Musah A Muhyedeen

Pages 1317-1325

[↓ Purchase PDF](#)    Article preview [✓](#)

Review article  Abstract only

## The contributions of cloud technologies to smart grid

Baling Fang, Xiang Yin, Yi Tan, Canbing Li, ... Jianliang Li  
Pages 1326-1331

[↓ Purchase PDF](#)   Article preview [✓](#)

Review article  Abstract only

### Clean, not green: The effective representation of renewable energy

Kiriaki M. Keramitsoglou, Robert C. Mellon, Maria I. Tsagkaraki, Konstantinos P. Tsagarakis  
Pages 1332-1337

[↓ Purchase PDF](#)   Article preview [✓](#)

Review article  Abstract only

### Effect of nanofluid additives on performances and emissions of emulsified diesel and biodiesel fueled stationary CI engine: A comprehensive review

Vivek W. Khond, V.M. Kriplani  
Pages 1338-1348

[↓ Purchase PDF](#)   Article preview [✓](#)

Review article  Abstract only

### Measuring the readability of Indonesian biomass websites: The ease of understanding biomass energy information on websites in the Indonesian language

Muhammad Kunta Biddinika, Retno Puji Lestari, Bayu Indrawan, Kunio Yoshikawa, ... Fumitake Takahashi  
Pages 1349-1357

[↓ Purchase PDF](#)   Article preview [✓](#)

Review article  Abstract only

### Practice of diesel fuel blends using alternative fuels: A review

Bhupendra Singh Chauhan, Ram Kripal Singh, H.M. Cho, H.C. Lim  
Pages 1358-1368

[↓ Purchase PDF](#)   Article preview [✓](#)

[< Previous vol/issue](#)

[Next vol/issue >](#)

ISSN: 1364-0321

Copyright © 2021 Elsevier Ltd. All rights reserved



Copyright © 2021 Elsevier B.V. or its licensors or contributors.  
ScienceDirect® is a registered trademark of Elsevier B.V.

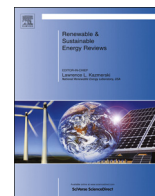
RELX™



ELSEVIER

Contents lists available at ScienceDirect

## Renewable and Sustainable Energy Reviews

journal homepage: [www.elsevier.com/locate/rser](http://www.elsevier.com/locate/rser)

# Measuring the readability of Indonesian biomass websites: The ease of understanding biomass energy information on websites in the Indonesian language



Muhammad Kunta Biddinika<sup>a,\*</sup>, Retno Puji Lestari<sup>b</sup>, Bayu Indrawan<sup>c</sup>, Kunio Yoshikawa<sup>a</sup>, Koji Tokimatsu<sup>a</sup>, Fumitake Takahashi<sup>a</sup>

<sup>a</sup> Department of Environmental Science and Technology, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology, 4259 Nagatsuta-cho, Midori-ku, Yokohama 226-8503, Kanagawa, Japan

<sup>b</sup> Tokyo Indonesian School, 4-6-6 Meguro, Meguro-ku, Tokyo 153-0063, Japan

<sup>c</sup> Surya University, Gd 01 Scientia Business Park, Jl. Boulevard Gading Serpong O/1 Summarecon, Serpong 15810, Indonesia

## ARTICLE INFO

## Article history:

Received 22 November 2014

Received in revised form

26 August 2015

Accepted 13 January 2016

Available online 30 January 2016

## Keywords:

Internet

Indonesia

Biomass information

Website

Energy education

## ABSTRACT

Renewable energy-related information in the Indonesian language (*Bahasa Indonesia*) is nowadays easily accessible on the internet and seeking information from the internet has become the second highest activity of Indonesian netizens. This paper aims to examine the readability of biomass energy-related information that is retrieved from the internet and available in the Indonesian language. By using Google<sup>®</sup> Indonesia's search results of four keywords on biomass renewable energy in the Indonesian language, educational materials on biomass energy were examined. Some inclusion and exclusion criteria have been applied among the search results in order to discriminate the educational materials among the results for further readability assessment by employing four readability standard formulas (SMOG, Gunning Fog, Flesch–Kincaid, and Dwiyanto Djoko Pranowo's). The results showed that information on biomass energy is still difficult to understand by the general public. The results may also become a success indicator of biomass energy campaigns as well as renewable energy education in Indonesia as a key role for its implementation in the near future. This study also contributes to the information quality assessment framework to languages other than English since internet technology has made information in any language accessible.

© 2016 Elsevier Ltd. All rights reserved.

## Contents

1. Introduction . . . . .	1349
1.1. Readability test . . . . .	1351
2. Method and data . . . . .	1352
2.1. Inclusion criteria . . . . .	1352
2.2. Exclusion criteria . . . . .	1352
3. Results and discussion . . . . .	1352
4. Conclusion and recommendation . . . . .	1356
Acknowledgment . . . . .	1356
References . . . . .	1356

## 1. Introduction

The internet has now become one of the most important sources of information. The growing capability of mobile internet connections along with the shrinking size of hardware, from computer desktops to mobile phones – so-called smartphones, the general public nowadays

\* Corresponding author.

E-mail addresses: [mkuntab@gmail.com](mailto:mkuntab@gmail.com),  
[kunta.m.aa@m.titech.ac.jp](mailto:kunta.m.aa@m.titech.ac.jp) (M.K. Biddinika).

can easily seek information from the internet as it is basically at their fingertips.

A wide variety of information regarding renewable energy is now available on the internet; however, studies regarding renewable energy information are still limited. Although some previous studies suggested that information about renewable energy plays an important role in the general public's acceptance of it due to its influence on the general public's knowledge of energy technology [1–6], to the best of the author's knowledge, there is still no study on the ease with which the information can be read and understood, known as the 'readability' of biomass renewable energy information that is available on the internet.

Indonesia, which is said to be one of the wealthiest biomass countries, still has a fairly low-utilization of its biomass potential [7,8]. The biomass potential in Indonesia mainly comes from rice residues (rice husks) and palm oil residues since Indonesia is the world's third largest rice producer as well as rice consumer and the world's largest palm oil producer [7,9]. One of the reasons why the utilization of renewable energy in Indonesia is still low, especially from biomass sources, is because biomass energy information remains sparse. Renewable energy information plays an important role in its successful implementation as it has been reviewed comprehensively in recent literature studies on the social acceptance of renewable energy sources by a contingent valuation method [10]. Some recent studies on renewable energy implementation show that renewable energy information still remains as one of the barriers. In the United States of America, a dearth of high-quality information about renewable electricity technologies was found to be one of the impediments of renewable energy in the USA [11]. In Malaysia, a neighboring country to Indonesia, there is an understanding gap on renewable marine energy information especially between policymakers, investors, and the general public, which has become a barrier to push the technology forward [12]. In India, the adoption of renewable energy still faces some barriers related to its information, such as the lack of a formal information channel on renewable energy for small and medium-scale enterprises, poor access to renewable energy information compared with conventional energy technologies, lack of easy access to information about the latest renewable energy technologies, as well as the general public's preference to take their friends' advice rather than obtain information from experts [13]. In Indonesia, biomass information in the Indonesian language may also be difficult to understand, which, in turn, is influencing the Indonesian people's knowledge on renewable energy.

From the viewpoint of an information source, Indonesians are among the largest users of the internet as an information source in the world and the number of internet users in Indonesia has grown dramatically this decade [14]. The most recent demography of internet users in Indonesia is based on a survey by the Indonesian Internet Service Provider Association (APJII) in 2014 on 2000 internet users located in both rural and urban areas [15]. Most of the internet users in Indonesia are young people with a high-school educational background as shown in Figs. 1 and 2. Almost fifty percent of internet users in Indonesia are aged between 18 and 25 years old who have graduated from senior high-school only. This means that they have not pursued their education to a higher level by attending a college, a vocational school, or a university to obtain a bachelor's degree or as a postgraduate. This education profile of internet users is consistent throughout every province in Indonesia for both rural and urban areas. By daily activities, internet users in Indonesia can be divided into three groups as shown in Fig. 3. The first group is the largest group comprising of employees and those who are self-employed with their own businesses (entrepreneurs), which consists of 55% of the survey sample. The second group is the next largest group comprising of university students and housewives, which consist of 18% and 16% of the sample, respectively. The third group is the smallest group comprising of high school and elementary school students (5%) and the

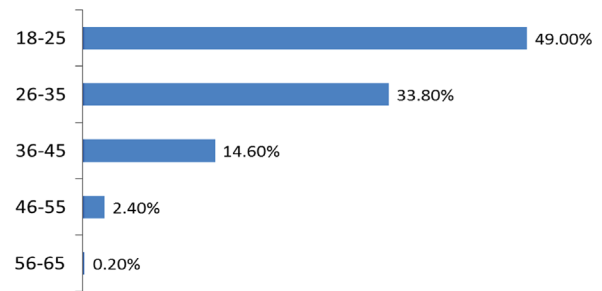


Fig. 1. Profile of internet users in Indonesia by age based on 2014's survey [15].

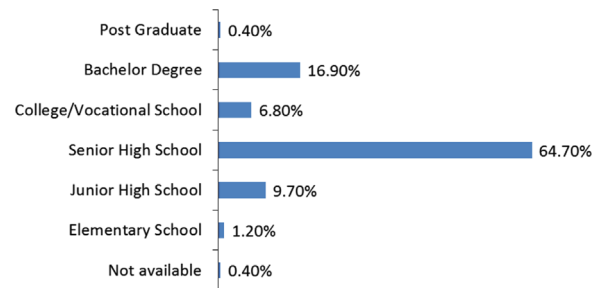


Fig. 2. Profile of internet users in Indonesia by their educational background based on 2014's survey [15].

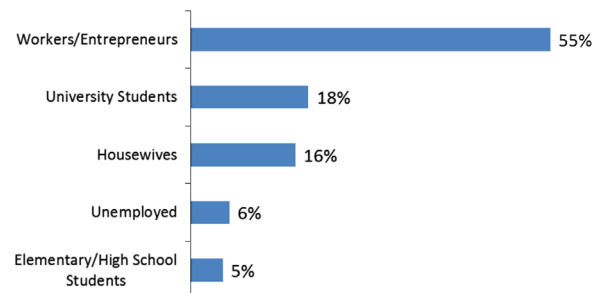


Fig. 3. Profile of internet users in Indonesia by their daily activity based on 2014's survey [15].

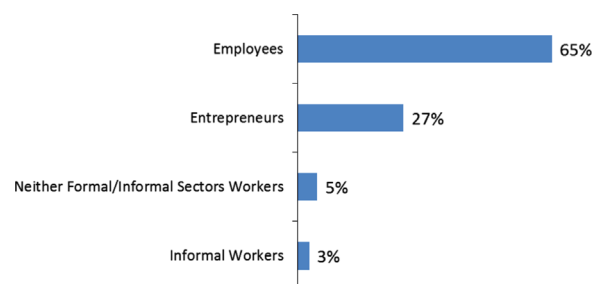


Fig. 4. Profile of internet users in Indonesia by their occupation based on 2014's survey [15].

unemployed (6%). By occupation as shown in Fig. 4, most of the internet users in Indonesia are employees (65%), those who are self-employed or entrepreneurs (27%), a small number of informal workers (3%) and people who are neither formal nor informal sector workers (5%).

In terms of demography, the target readers of renewable energy information should be clarified so that information can be well prepared especially by the ease with which information can be read and understood. Therefore, the term, "general public" used in this study refers to most of the categories shown in the aforementioned internet user profile. To our knowledge, there is still no current study focusing

on biomass energy information in the Indonesian language available on the internet.

The usefulness of the information, including biomass energy-related information, depends upon a person's readability and understandability [8]. Therefore, this study aims to discuss whether the biomass renewable energy information on the Indonesian web-sites is easy or not to understand by using a readability measurement method. Four readability scoring standards have been applied to this study in order to assess how easy it is to understand biomass energy information in the Indonesian language, which is available on the internet.

### 1.1. Readability test

Readability is the starting point for the comprehension of a text [16]. Therefore, the readability tests have all been designed to provide a quantifiable assessment of how easy the information text is to read [17]. If the text is written at a higher level than the reading skills of the target audience, the target audience will most likely not understand the text, and, in turn, the message will not be appropriately conveyed to them [18].

Previous studies have shown that readability measurements are being used for the improvement of communicating health information, such as the supporting information sought by a patient on the internet [19–21], as well as for corporate and investor relations since previous works have found a relationship between the readability of Corporate Social Responsibility (CSR) communications and a company's performance [8], the relationship between the readability of an annual report and a company's performance besides its earning persistence [22], and the adoption and application of occupational health and safety (OHS) by measuring the readability of its guidance documents [16]. An intriguing study involving readability has also been done on the expert–non-expert communications about complex science information, such as DNA evidence reports in the criminal justice system, where forensic experts need to communicate with police, lawyers, prosecutors, and judges from law enforcement agencies who are not always familiar with DNA reports [23]. Readability has also become an issue in the improvement of education by examining learning textbooks in language teaching [24].

Although the readability issue was originally an English-based concern as indicated by most of the aforementioned studies, it has later become universally applicable to non-English languages, such as Finnish, Hungarian, Malaysian, Spanish, possibly Turkish [16] and Indonesian (*Bahasa Indonesia*) [25].

There are at least 10 (ten) readability measurement methods, as Vargas et al. collected, which have then been used for studying the readability of online materials on breast cancer treatment for patients [21]. These ten methods are Coleman–Liau, Flesch–Kincaid, Flesch Reading Ease, FORCAST, Fry Graph, Gunning Fog, New Dale–Chall, New Fog Count, Raygor Estimate, and the Simple Measure of Gobbledygook (SMOG).

This study utilized four readability indicators, three of them are among the aforementioned formulas and have been widely used for English-based texts, and one indicator has been applied to Indonesian text only, namely the Djoko Formula. This study selected only three English-based formulae due to time limitations. Moreover, since the observed texts were in the Indonesian language, the Djoko Formula, as it was specifically designed for the Indonesian language, became the most focused formula in this study. Among the English-based formulae, this study chose SMOG, Gunning–Fog, and Flesch–Kincaid due to the advantage of their simple calculations and interpretations rather than their popularities among the others in the readability study [26]. These three formulae were also found within the most recent literature on readability studies. A search attempt was conducted on Google Scholar using the keyword, “readability” in August, 2015. A hundred search results were collected for references published

since 2011 and sorted by their relevance to the “readability” term. The readability formulae taken from the research methodologies of the references were collected and the results are shown in Table 1. Since the Flesch–Kincaid Formula is very similar to the Flesch Formula, this study chose the Flesch–Kincaid Formula rather than the Flesch Formula as it has been more frequently used in the references. The formula of each of the three English-based indicators in this study is presented in Table 2.

The SMOG (Simple Measure of Gobbledygook) index is a readability formula that estimates the level of education needed to understand a piece of writing. This index is being widely used for checking consumer-oriented healthcare materials.

The Gunning Fog index is a measure of text readability based on a sentence's length and the hard-to-understand words in that sentence. A text with an index of 7–8 is considered an easy-to-understand text, while a text with an index of above 12 is considered too hard to read for most people [20].

The Flesch–Kincaid Grade Level test uses word lengths and sentence lengths. The result is a number that corresponds to a school grade level, which means that a higher score corresponds to a higher level of education that is needed to understand the text. This index is widely used by the United States Army for assessing technical manuals [27].

The Djoko Formula is a readability formula for Indonesian texts that was developed by Professor Dwiyanto Djoko Pranowo of Literature Study at Yogyakarta State University, Indonesia [28]. To the author's knowledge, there is still no other readability formula that has been developed specifically for the Indonesian language except the one developed by Djoko. The Djoko Formula measures whether an Indonesian text is easy to read or not based on 13 (thirteen) indicators, which are the number of paragraphs, the number of sentences in each paragraph, the length of a sentence, complex (compound) sentences, passive sentences, extension sentences, sentences with polysemy words, abstract words, unfamiliar words, loan words, terms, conjunctions, and idioms (phrases) [28]. The indicators of the Djoko Formula and its score are presented in more detail in Table 3 as it is less accessible than other originally English-based formulas.

Each indicator has three quantifiable readability criteria that represent the level of ease to read a certain text. Each indicator is scored based on the criteria compliance so that its contribution to the

**Table 1**  
Number of references using the readability index in a hundred Google Scholar search results.

Readability index	Number of references
Flesch–Kincaid grade level	47
Flesch reading ease	38
Gunning–Fog index	31
SMOG index	29
FORCAST	11
Fry graph	9
New Dale–Chall	8
Coleman–Liau	8
Raygor estimate	7
New Fog count	6

**Table 2**  
Three calculation methods of readability indices used in this study [18].

Index	Formula
SMOG index	$3 + \text{square root of polysyllable}^a \text{ counts per 30 sentences}$
Gunning Fog index	$0.4 \times (\text{average sentence length} + \text{percentage of complex words}^a)$
Flesch–Kincaid Grade level	$(0.39 \times \text{average number of words per sentence}) + (11.8 \times \text{average number of syllables per word}) - 15.59$

<sup>a</sup> Words with three or more syllables.

readability of a certain text can be measured. The score of each indicator is then summarized in order to obtain the Djoko Formula score of a text. The text is considered as easy, medium, and hard to understand if the score ranges from 13–21.7, 21.8–30.5, and 30.6–39, respectively [28].

## 2. Method and data

An internet information search was performed in the second and third week of October, 2014 by using Google<sup>®</sup> Indonesia's search engine for the following terms/keywords in the Indonesian language; *energi biomassa*, *biomassa*, *energi terbarukan biomassa*, *tenaga biomassa*, which can be translated into English as biomass energy, biomass, renewable energy of biomass, and biomass power, respectively.

The first 10 consecutive Google<sup>®</sup> result pages were selected, resulting in a total of 100 websites being obtained from each keyword for further screening since 10 search results appeared from each search result page on Google<sup>®</sup>. The screening of a hundred web-based texts was based on the following criteria:

### 2.1. Inclusion criteria

Texts found on any website containing education materials on renewable biomass energy and written in the Indonesian language for further analysis.

### 2.2. Exclusion criteria

Texts found on any renewable biomass energy websites requiring a subscription or membership, or websites designed for commercial purposes were excluded. Moreover, any texts consisting of less than 200 words on biomass information websites found in the search results were also excluded due to their lack of information. This study also excluded texts found on websites for news outlets, blogs, social media, book chapters available through Google<sup>®</sup> Books, presentations and writings from file-sharing and repository websites, such as slideshare, academia, scribd, and prezi, etc.

The distinction between information or education material on renewable energy of biomass versus material for commercial purposes was made by screening the content of those websites. In addition, the publisher or owner of the website where the measured text located was categorized as follows; universities, community or non-profit organizations, government bodies which were categorized into government agencies as government organizations in general and governmental research and development agencies, businesses, and individual owners or publishers. By this categorization, the information source can be traced down for deeper analysis.

## 3. Results and discussion

From the searching of each keyword, the lowest number of words of a keyword resulted in the most obtained website links of the texts. The keyword *biomassa* generated 8,750,000 search results, while *energi biomassa*, *tenaga biomassa*, and *energi terbarukan biomassa* generated 388,000, 184,000, and 65,700 search results, respectively. The first 100 consecutive results were selected from each keyword resulting in a total of 400 search results. Of these, 381 were excluded from further analysis due to the exclusion criteria, duplication, and language being non-Indonesian. Most of the excluded results were renewable energy news broadcasted by online news portals and reposted by other websites including blogs and social media.

**Table 3**  
Indicators and scores of the Indonesian readability index [28].

Indicator no.	Indicator	Criteria	Score
1	Average number of paragraphs	≤ 5	1
		6	2
		≥ 7	3
2	Average number of sentences per paragraph	6.0–7.1	1
		4.7–5.9	2
		3.6–4.6	3
3	Length of a sentence	7.2–8.5	1
		8.6–9.8	2
		9.9–11	3
4	Percentage of extension sentences	79.0–85.6%	1
		85.7–92.4%	2
		92.3–99%	3
5	Percentage of compound sentences	38–42%	1
		43–46%	2
		47–50%	3
6	Percentage of sentences with polysemy	44.2–56.3%	1
		32.1–44.1%	2
		19.9–32%	3
7	Percentage of passive sentences	11.3–17.7%	1
		17.8–24.1%	2
		24.2–30.5%	3
8	Percentage of unfamiliar words	7.5–11.6%	1
		11.7–15.7%	2
		15.8–19.7%	3
9	Percentage of abstract words	15–20.7%	1
		20.8–26.4%	2
		26.5–32.2%	3
10	Percentage of terms	1.4–4.7%	1
		4.8–8.1%	2
		8.2–11.4%	3
11	Percentage of conjunctions	3–4.4%	1
		4.5–5.9%	2
		6–7.3%	3
12	Percentage of loan words	1.7–2.7%	1
		2.8–4.8%	2
		4.9–7.8%	3
13	Percentage of phrases	2.2–3.1%	1
		3.2–4%	2
		4.1–4.9%	3

Legend: score of indicator; 1=easy, 2=medium, 3=hard.

Therefore, content duplication was frequently found in websites owned by the government and research agencies as well as by universities.

Instead of merely rewriting and then reposting the materials created originally rather than from their work, the government bodies, research agencies, and universities should take a more important role in initiating the dissemination of information on renewable energy technologies because of their duties and functions. Although sharing online information, especially media portal news is becoming an increasingly growing phenomena nowadays, and, as indicated in the

recent studies [29], especially because previous studies have revealed that news sharing may establish social relationships, reputations, and facilitate social interaction and group discussions [30–32]. There needs to be a responsibility to take more of a key role as a content-creator rather than as a content-disseminator on renewable energy socialization.

The dissemination of information, especially renewable energy was crucial for the implementation of renewable energy as some practices in Malaysia, India, and the United States of America found it particularly difficult to obtain information and knowledge on renewable energy technologies so that it contributed to obstacles to renewable energy implementation [10–13]. It is not only how to create a credible and reliable information source, but also how to spread it to the general public, because the information possessed by the general public, that is not limited to some individuals, becomes the foundation of their resulting behavior [10]. The more individuals are reached by the information, the more the information becomes diffused publicly. In the case of India, the lack of reliable information was found to be a barrier to the adoption of renewable energy. Therefore, it is important for scientists and engineers working on renewable energy technologies to engage with the public more frequently for the most effective dissemination of renewable energy information. The information from scientists and engineers is considered to be reliable information about renewable energy technologies.

Although Google<sup>®</sup> Indonesia has been primarily used for searching for text, some aforementioned keywords also generated non-Indonesian language results, namely *energi biomassa* and *biomassa*. This is because *energi* and/or *biomassa* terms can also be found in the Swedish and Finnish languages which are similar languages to one another, as well as in Portuguese, Dutch, and Italian.

The list of websites including its uniform resource locator (URL) containing text, which has been included for further readability analysis is presented in Table 4.

Although nineteen Indonesian texts were measured by each readability formula, the authors found that text number eighteen could not be retrieved all of a sudden due to its removal by the website owner. The owner, Sky Energy Indonesia – a joint venture established in 2008 with Hitachi High Technologies Corporation Japan, chose to update its latest website to English only. At the time of text selection from website links found by Google's search engine at the beginning of this study, the URL of text number eighteen as listed in Table 4 was available. It was the introduction of renewable energy

written in the Indonesian language. Currently, the introduction is only available in English in the new URL (<http://sky-energy.co.id/renewable-energy/>). Its previous Indonesian translation was exactly the same as the text retrieved and measured for this study.

Regarding the website publisher in which the text belongs, text number eighteen was the only text listed in this study to be published by the business sector. Most of the texts listed were published by the community as well as individual owners while only one text had its root URL in a university domain as shown in Table 5. This university specializes in agriculture including the technology involved in that discipline. Only two texts found in the root URL were owned by two different government bodies, the Indonesian Agency for the Assessment and Application of Technology (known as *Badan Pengkajian dan Penerapan Teknologi* (BPPT) in Indonesian) and the Ministry of Energy and Mineral Resources of the Republic of Indonesia (in short ESDM RI).

The results of the readability index for the three originally English-based formulas including the indicators used in the formula are presented in Table 6. For the Djoko Formula result, Table 7 presents it along with the used indicators for the calculation of the formula. Each column in Table 7 represents the indicator of the calculation. The number in parentheses is the score of each text that indicates the level of difficulty of each indicator as shown in Table 3.

All indices indicate that all of the information on biomass renewable energy in *Bahasa Indonesia* is still too difficult to comprehend. Given the SMOG index and the corresponding educational level in the United States' education system as well as some examples of reading material in each SMOG index as mentioned by Taylor [16], all of the information coded in this study can be reached by those who are educated to either a college, or university level, including post-graduates. The same education level was also needed in order to comprehend articles in the Harvard Business Review as well as the USA's Tax Law regulations.

For the Gunning Fog and Flesch–Kincaid measurement on the biomass renewable energy information in *Bahasa Indonesia* available on the internet, the minimum result is still above the highest level of the index range, which represents its difficulty to read. Both the Gunning Fog and Flesch–Kincaid have a score type which is similar to the SMOG index too, which indicates the level of education needed to understand the text. Given the qualities assessed by SMOG, Gunning Fog, and Flesch–Kincaid measurement are word lengths and sentence lengths, the Djoko Formula uses the number of difficult words and sentences as its parameter, which influences whether a text is easy or difficult to comprehend.

**Table 4**

List of website URL containing texts measured for readability.

Text no.	URL
1	<a href="http://web.ipb.ac.id/~tepfeta/elearning/media/Energi%20dan%20Listrik%20Pertanian/MATERI%20WEB%20ELP/Bab%20III%20BIOMASSA/indexBIOMASSA.htm">http://web.ipb.ac.id/~tepfeta/elearning/media/Energi%20dan%20Listrik%20Pertanian/MATERI%20WEB%20ELP/Bab%20III%20BIOMASSA/indexBIOMASSA.htm</a>
2	<a href="http://www.amazine.co/27020/apa-itu-energi-biomassa-definisi-dan-4-contohnya/">http://www.amazine.co/27020/apa-itu-energi-biomassa-definisi-dan-4-contohnya/</a>
3	<a href="http://wiki.openthinklabs.com/science-corner/pengenalan-energi-untuk-anak/sumber-sumber-energi/terbarukan/pengetahuan-dasar-tentang-bio">http://wiki.openthinklabs.com/science-corner/pengenalan-energi-untuk-anak/sumber-sumber-energi/terbarukan/pengetahuan-dasar-tentang-bio</a>
4	<a href="http://www.dw.de/biomassa-sebagai-sumber-energi-terbarukan/a-3057079">http://www.dw.de/biomassa-sebagai-sumber-energi-terbarukan/a-3057079</a>
5	<a href="http://www.aneahira.com/energi-biomassa-kemurgi.htm">http://www.aneahira.com/energi-biomassa-kemurgi.htm</a>
6	<a href="http://www.indoenergi.com/2012/04/pengertian-biomassa.html">http://www.indoenergi.com/2012/04/pengertian-biomassa.html</a>
7	<a href="http://www.indoenergi.com/2012/04/energi-biomassa-dari-limbah-organik.html">http://www.indoenergi.com/2012/04/energi-biomassa-dari-limbah-organik.html</a>
8	<a href="http://iccc-network.net/id/lib/article/leds/270-biomassa-untuk-potensi-energi-terbarukan-indonesia">http://iccc-network.net/id/lib/article/leds/270-biomassa-untuk-potensi-energi-terbarukan-indonesia</a>
9	<a href="http://www.p3tkebt.esdm.go.id/index.php?option=com_content&amp;view=article&amp;id=369&amp;Itemid=491&amp;lang=en">http://www.p3tkebt.esdm.go.id/index.php?option=com_content&amp;view=article&amp;id=369&amp;Itemid=491&amp;lang=en</a>
10	<a href="http://netsains.net/2008/03/energi-alternatif-itu-bernama-biomassa/">http://netsains.net/2008/03/energi-alternatif-itu-bernama-biomassa/</a>
11	<a href="http://b2te.bppt.go.id/index.php/hasil-riset/98-hasil-riset-b2te/93-biogas.html">http://b2te.bppt.go.id/index.php/hasil-riset/98-hasil-riset-b2te/93-biogas.html</a>
12	<a href="http://www.imago.or.id/2013/04/biomassa-sebagai-alternatif-energi.html">http://www.imago.or.id/2013/04/biomassa-sebagai-alternatif-energi.html</a>
13	<a href="http://beranda.miti.or.id/pemanfaatan-limbah-biomassa-cangkang-kakao-sebagai-sumber-energi-terbarukan/">http://beranda.miti.or.id/pemanfaatan-limbah-biomassa-cangkang-kakao-sebagai-sumber-energi-terbarukan/</a>
14	<a href="http://www.nu.or.id/a,public-m,dinamic-s,detail-ids,14-id,47199-lang,id-c,teknologi-t,Teknologi+Gasifikasi+Biomassa+untuk+Kebutuhan+Energi+di+Pesantren-.phpx">http://www.nu.or.id/a,public-m,dinamic-s,detail-ids,14-id,47199-lang,id-c,teknologi-t,Teknologi+Gasifikasi+Biomassa+untuk+Kebutuhan+Energi+di+Pesantren-.phpx</a>
15	<a href="http://id.wikipedia.org/wiki/Energi_terbarukan">http://id.wikipedia.org/wiki/Energi_terbarukan</a>
16	<a href="http://www.indoenergi.com/2012/04/keuntungan-energi-biomassa.html">http://www.indoenergi.com/2012/04/keuntungan-energi-biomassa.html</a>
17	<a href="http://www.kamase.org/?p=1113">http://www.kamase.org/?p=1113</a>
18	<a href="http://www.sky-energy.co.id/renewable-energy-2/">http://www.sky-energy.co.id/renewable-energy-2/</a>
19	<a href="http://budisma.web.id/pengertian-biomassa/">http://budisma.web.id/pengertian-biomassa/</a>



In Table 7, based on the indicator of the average number of paragraphs (column number one), the average score was 2.5 points indicating the average texts observed in this study were in the upper-medium level of difficulty. It designated the level as more than medium, but less than hard. Too much information indicated by the number of paragraphs in the text might also require a higher level of education in order to understand it. From the indicator of average number of sentences per paragraph, the average score was 2.8 indicating that the average texts measured were in the medium level, and almost reached a hard level of reading difficulty. According to the indicator, a text is considered as easy to comprehend if the number of sentences per paragraph are not too small since too few sentences in a paragraph makes it difficult to explain a certain topic being discussed in that paragraph. Given the common stereotypes of engineers and scientists who are perceived as having poor communication skills [33], creating explanatory sentences which are neither too short nor too wordy, but clear for a certain topic within a paragraph was probably not an easy matter. Two indicators mentioned above, which are the average number of paragraphs and the average number of sentences per paragraph were categorized as indicators of a paragraph.

The aforementioned stereotype was also relevant for the indicators of the average number of words per sentence (average

length of a sentence) although the difficulty criterion was opposite to the sentence per paragraph indicator. Based on the criteria of sentence length, a sentence whose words were less was easier to comprehend than a longer one. The average score in this criterion was 3 indicating that all of the texts were difficult to read due to the lengths of the sentences. The challenge in this criterion was how to make simple, concise, non-wordy sentences whose message can be clearly conveyed.

Criterion number four was based on the percentage of sentences containing extension words, which is a word that has an extended meaning besides its definite core meaning. For example, the term “sailing (*berlayar*, in the Indonesian language)” designates any activity that moves across the sea by ship, which is not only a ship with a sail (a sailboat), but also any type of ship although the term initially meant only an activity using a sailboat. The word “sailing” in *Bahasa Indonesia* is then considered to be extended from its initial or original meaning. The more extension sentences found within a text, the more difficult the text was to comprehend. The average score of this criterion was 1 point indicating that all of the text observed was easy to understand based on the percentage of extension sentences.

Criterion number five was based on the percentage of compound sentences in each text. A compound sentence is a sentence

**Table 5**

Website publisher and its category in which texts have been measured for readability.

Text no.	Website publisher	Root URL	Publisher category
1	Bogor Agriculture University	<a href="http://ipb.ac.id">ipb.ac.id</a>	University
2	Amazine – Online Popular Knowledge Portal	<a href="http://amazine.co">amazine.co</a>	Community
3	OpenThink Labs – Online Knowledge Portal	<a href="http://openthinklabs.com">openthinklabs.com</a>	Community
4	Deutsche Welle – in the Indonesian Language	<a href="http://dw.de">dw.de</a>	Government Agency
5	Anne Ahira for Indonesia	<a href="http://anneahira.com">anneahira.com</a>	Individual
6, 7, 16	Indoenergi	<a href="http://indoenergi.com">indoenergi.com</a>	Community
8	Indonesia Climate Change Center	<a href="http://iccc-network.net">iccc-network.net</a>	Government Agency
9	Energy and Mineral Resources R&D Board	<a href="http://p3tkebt.esdm.go.id">p3tkebt.esdm.go.id</a>	Government R & D
10	Netsains – Online Knowledge Portal	<a href="http://netsains.net">netsains.net</a>	Community
11	Energy Technologies Laboratory	<a href="http://b2te.bppt.go.id">b2te.bppt.go.id</a>	Government R & D
12	Bojonegoro Student Association	<a href="http://imago.or.id">imago.or.id</a>	Community
13	Community of Indonesian Scientists	<a href="http://beranda.miti.or.id">beranda.miti.or.id</a>	Community
14	Nahdlatul Ulama	<a href="http://nu.or.id">nu.or.id</a>	Community
15	Wikipedia	<a href="http://id.wikipedia.org">id.wikipedia.org</a>	Community
17	Student Community of Energy Center	<a href="http://kamase.org">kamase.org</a>	Community
18	Sky Energy	<a href="http://sky-energy.co.id">sky-energy.co.id</a>	Business
19	Budisma	<a href="http://budisma-web.id">budisma-web.id</a>	Individual

**Table 6**

Texts and readability indicators for SMOG, Gunning Fog, and Flesch–Kincaid Formulas.

Text no.	Number of			Average number of			SMOG index	Gunning Fog index	Flesch–Kincaid index
	Sentences	Words	Characters	Words/sentences	Syllables/words	Characters/words			
1	75	1274	8037	17	2.7	6.2	16.2	25.2	21.4
2	29	418	2669	14	3	6.4	15.4	24.9	20.8
3	37	565	3285	15	2	5.8	14.7	22	18.6
4	26	337	2062	13	3	6.1	13.8	22.9	19.4
5	57	1011	6250	18	3	6.2	16.2	24.2	21.4
6	14	259	1568	19	3	6.1	16.6	24.7	21.4
7	29	531	3254	18	3	6.1	16.2	24.3	21.1
8	35	549	3333	16	3	6.1	15.2	22.7	20.3
9	16	297	1791	19	3	6	17.5	26.7	21.7
10	57	1005	6309	18	2.7	6.3	16.3	25	21
11	9	211	1333	23	2	6.3	18.4	25.7	22.6
12	37	534	3381	14	3	6.3	15.3	24.6	21
13	43	869	5414	20.5	3	6.3	17.7	25	22.6
14	38	723	4576	19.5	2.5	6.3	17.1	25.1	22
15	22	447	2829	20	3	6.3	17.7	26.7	22.8
16	29	479	2933	17	3	6.3	15.3	23.6	20.7
17	52	973	5917	18.7	2.3	6.1	16.1	23.7	20.9
18	17	435	2565	26	2	5.9	19.2	26.6	23.1
19	27	450	2831	17	3	6.3	16.4	25.2	21.4

**Table 7**  
Readability indicators and the score of each text for the Djoko Formula.

Text no.	Paragraph indicators		Sentence indicators					Word indicators					
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	22 (3)	3.4 (3)	17 (3)	57.3 (1)	94.7 (3)	1.3 (3)	60 (3)	0 (1)	0.2 (1)	12.5 (3)	13.5 (3)	7.9 (3)	2 (1)
2	7 (3)	4.1 (3)	14.4 (3)	62.1 (1)	100 (3)	0 (3)	79.3 (3)	0.24 (1)	4.8 (1)	5.7 (2)	13.6 (3)	2.4 (1)	3.3 (2)
3	7 (3)	5.3 (2)	15.3 (3)	59.5 (1)	81.1 (3)	0 (3)	45.9 (3)	0 (1)	1.1 (1)	4.8 (1)	12.9 (3)	11.5 (3)	2.1 (1)
4	6 (2)	4.3 (3)	13 (3)	26.9 (1)	65.4 (3)	7.7 (3)	57.7 (3)	0 (1)	0.9 (1)	5.6 (2)	10.7 (3)	7.4 (3)	3.3 (2)
5	13 (3)	4.4 (3)	17.7 (3)	43.9 (1)	94.7 (3)	0 (3)	49.1 (3)	0.3 (1)	1.1 (1)	5.7 (2)	10.9 (3)	11.5 (3)	2.4 (1)
6	4 (1)	3.5 (3)	18.5 (3)	57.1 (1)	92.9 (3)	7.1 (3)	64.3 (3)	0 (1)	0 (1)	10.4 (3)	9.3 (3)	9.3 (3)	2.7 (1)
7	10 (3)	2.9 (3)	18.3 (3)	41.4 (1)	93.1 (3)	0 (3)	41.4 (3)	0.4 (1)	0.8 (1)	4.1 (1)	10.9 (3)	10 (3)	3.6 (2)
8	9 (3)	3.9 (3)	15.7 (3)	51.4 (1)	80 (3)	2.9 (3)	54.3 (3)	0.2 (1)	0.5 (1)	6.6 (2)	10.6 (3)	12.2 (3)	4.2 (3)
9	3 (1)	5.3 (2)	18.6 (3)	68.8 (1)	75 (3)	0 (3)	50 (3)	0.3 (1)	1 (1)	13.5 (3)	12.5 (3)	16.8 (3)	2 (1)
10	14 (3)	4.1 (3)	17.6 (3)	54.4 (1)	87.7 (3)	0 (3)	49.1 (3)	0.3 (1)	1.7 (1)	6.7 (2)	12.2 (3)	14 (3)	1.2 (1)
11	5 (1)	1.8 (3)	23.4 (3)	55.6 (1)	100 (3)	0 (3)	55.6 (3)	0 (1)	2.8 (1)	9 (3)	12.3 (3)	16.1 (3)	3.3 (2)
12	6 (2)	6.2 (1)	14.4 (3)	43.2 (1)	70.3 (3)	0 (3)	59.5 (3)	0.4 (1)	2.4 (1)	5.8 (2)	11 (3)	12.9 (3)	1.5 (1)
13	10 (3)	4.3 (3)	20.2 (3)	51.2 (1)	83.7 (3)	0 (3)	81.4 (3)	0.1 (1)	1.8 (1)	6 (2)	11.2 (3)	17.7 (3)	1.7 (1)
14	10 (3)	3.8 (3)	19 (3)	52.6 (1)	97.4 (3)	0 (3)	50 (3)	0.1 (1)	0 (1)	8 (2)	10.8 (3)	10.1 (3)	1.8 (1)
15	8 (3)	2.8 (3)	20.3 (3)	63.6 (1)	100 (3)	0 (3)	63.6 (3)	0 (1)	0.5 (1)	8.1 (2)	15.7 (3)	8.5 (3)	2.7 (1)
16	8 (3)	3.6 (3)	16.5 (3)	37.9 (1)	100 (3)	0 (3)	72.4 (3)	0 (1)	0 (1)	5.8 (2)	12.9 (3)	10.2 (3)	2.3 (1)
17	14 (3)	3.7 (3)	18.7 (3)	46.2 (1)	46.2 (2)	0 (3)	50 (3)	0.2 (1)	3.3 (1)	2.1 (1)	11.8 (3)	10.7 (3)	2.9 (1)
18	4 (1)	4.3 (3)	25.6 (3)	64.7 (1)	94.1 (3)	0 (3)	94.1 (3)	0.2 (1)	1.4 (1)	2.5 (1)	8.5 (3)	13.3 (3)	3.9 (2)
19	7 (3)	3.9 (3)	16.7 (3)	33.3 (1)	88.9 (3)	0 (3)	55.6 (3)	0 (1)	0.2 (1)	8.9 (3)	14.7 (3)	15.3 (3)	1.6 (1)

with more than one subject or predicate. The average score of this criterion was 2.9 points indicating that the entire text observed was hard to understand. This criterion challenged an author of renewable energy information on the internet to consider creating expressions simply by using one subject and one predicate within a sentence so that the sentence would be more understandable.

Criterion number six was based on the percentage of sentences with polysemy in each text. Polysemy is a word with more than one meaning. This criterion contributes 3 points on average of the whole text observed. From the percentage of passive sentence criterion, the average score was 3 points indicating that all of the text was difficult to understand due to the high-portion of passive sentences within a text.

Based on the indicator of words, which consists of the percentage of unfamiliar words, abstract words, terms, conjunctions, loan words, and phrases, the average scores of each indicator showed that the texts were relatively easy to understand compared with that of paragraph indicators as well as sentence indicators. The criteria of both unfamiliar words and abstract words contributed to 1 point of the average readability score indicating that all of the text was easy to understand regardless of the percentage of unfamiliar and abstract words contained in the text. Although the percentage of phrases contributed to more than 1 point of the average readability score, it was less than 2 points, which indicated that the texts were still considered as easy to understand based on the percentage of phrases used in a text. Both criteria on the percentage of loan words and terms indicated that the observed texts were at the medium level of readability represented by 2.9 points and 2.1 points, respectively of the average readability scores. The average score on the loan words criteria was a bit higher compared with the other criteria among the word indicators. The use of loan words was unavoidable in order to explain biomass renewable energy because of the original scientific terms. However, the lower the usage of loan words made a text easier to comprehend. The only difficulty in the word criteria point of view was contributed by the percentage of conjunctions found in a text. The percentage contributed 3 points of the average score indicating the overall text was difficult to comprehend based on how many conjunctions were used in a text.

This study has limitations since an analysis solely based on readability indices cannot fully justify whether or not information readability requires a certain level of education due to the differences in ways of explanation in the Indonesian language from that in English.

However, as DuBay mentioned in his comprehensive review on readability studies [34] that due to the limitations of readability formulae, readability researchers have recommended that formulae are best used in conjunction with other methods. Basically, readability can be determined by using two methods; the readability formula and reader responses [35]. Readability formulae are instruments to predict the difficulty in reading a text while reader responses are a set of tests on the ability to read a text. Therefore, this readability study emphasizes the prediction of difficulty in reading renewable energy information. By predicting how difficult a text is that explains renewable energy issues, the issues then could be relatively well prepared in terms of their readability before their interaction with the general public.

Given the nature of academics and scientists, industries, and policy makers on renewable energy who are not specialists in linguistics, performing both readability formulae and reader response methods would take an extremely long time. This nature may create more separation between the general public and academics/scientists as well as industries and policy makers on renewable energy. This bold line may be dealt with by middle actors such as communicator specialists, who serve as consultants in the implementation of technology including renewable energy. The utilization of readability formulae by academics and scientists, industries, and policy makers would not only attract them to engage with the general public as a key to the successful implementation of technology, but also then make them communicators, although less specialized, who are also experts in renewable energy technologies. As the available formulae are ready to use, the less specialized persons who are not necessarily linguists might be able to measure the readability of texts. As far as he/she has basic linguistic skills, which are the ability to distinguish characters in words, syllables in words, words in sentences, and sentences in paragraphs, he/she can measure the readability of texts. However, this is especially applicable for English-based formulae due to their aforementioned readability indicators. For Indonesian-based formulae, a little training is needed since its indicators are more than that of those which are English-based as shown in Table 3.

The limitations due to the different ways of explanation in the Indonesian language from those in English, have also been implicitly mentioned in DuBay's review [34]. DuBay highlighted the discrepancy between the scores of different readability formulae, which have long been confusing. This discrepancy has been caused by different variables, which are used by different formulae and consequently by

different criteria for measuring the readability. The review gave an example; a formula uses 75% of correct answers to predict a certain level of a readability score while another formula uses 50% of correct answers to predict the same level of a readability score. The other formula may predict the same level of readability by only answering 65% correctly. DuBay finally mentioned clearly in the review that the range of readability scores or levels resulting from different readability formulae “remind us that they are not perfect predictors. They provide probability statements, or, rather, rough estimates of text difficulty. That means the readability formulae account for 50–84 percent of the variance in the text difficulty as measured by comprehension tests”. (Page 56).

Therefore, different corresponding vocabularies between English and Indonesian as aforementioned that leads to different score of indices is in line with the explanation above. For the information, DuBay noted that an English-based readability formula has been utilized for 12 languages including the Malay language, which is virtually identical to the Indonesian language [16].

#### 4. Conclusion and recommendation

This study has brought to light the utilization of readability measurements in the improvement of the general public's understanding of renewable energy especially biomass energy technology. Among ten of the most well known English-based readability measurement methods, this study selected Flesch–Kincaid, Gunning–Fog, and SMOG indices since they are mostly found in the most recent literature on readability studies. Since the measured texts were in the Indonesian language, this study also chose the Djoko Formula as an original readability method for the Indonesian language (Bahasa Indonesia). Compared to English-based readability methods, to the author's knowledge, the Djoko Formula is the only readability formula that has been specifically developed for the Indonesian language. Different with that of English-based methods whose readability variables are only characters, syllables, words, sentences, and paragraphs, the Djoko Formula has thirteen indicators for measuring readability.

It was found that the word indicators did not really contribute to the difficulty of biomass energy reading comprehension in *Bahasa Indonesia* on the internet in spite of the origin of the technologies' terms coming from another language. Many English technical terms were unavoidable when addressing renewable energy technology from biomass. Therefore, it is also important for scientists and engineers working on biomass energy technology to engage with the general public more frequently in order to disseminate biomass energy information more effectively. By improving the general public's engagement in the work of the scientists and engineers who specialize in biomass energy, the reliability of information on biomass technology can be maintained. This needs to be conducted so as to avoid any misunderstandings of the technology that, in turn, would lead to barriers in the implementation of biomass technology.

A study on the readability of biomass information using the readability formulae includes a weakness. Since the formulae depend on the number of paragraphs, sentences, words, and syllables including their comparison with their parameters, they may not accurately reflect the understandability of the reading. Therefore, measuring the readability level does not depend only on the readability formula, but also on the readers' responses. Since this study used only readability formulae, it emphasized the prediction of difficulty in reading biomass energy information. Furthermore, given the nature of academics and scientists, including industries and policy makers on biomass energy technologies who are not specialists in linguistics, performing both the readability formula and reader responses methods would be time and money consuming.

According to the website search results, this study found that biomass energy information which is reliable, high-quality, as well as

easy to read is still quite limited. Therefore, more biomass renewable energy information in *Bahasa Indonesia* should be created and published on the internet by carefully considering the readability indicators in order to make the information easy to comprehend. This consequently means that universities and research agencies as well as government bodies should play more of a key role in the dissemination of biomass renewable energy information that is available on the internet.

#### Acknowledgment

This study was supported financially by JSPS KAKENHI Grant number 15H05228. The authors greatly appreciate the support.

#### References

- [1] Liu W, Wang C, Mol APJ. Rural public acceptance of renewable energy deployment: the case of Shandong in China. *Appl Energy* 2013;102:1187–96.
- [2] Sovacool BK, Ratan P Lakshmi. Conceptualizing the acceptance of wind and solar electricity. *Renew Sustain Energy Rev* 2012;16(7):5268–79.
- [3] Molin E. Causal analysis of hydrogen acceptance. *Jan. Transp Res Rec* 2005;1941(1):115–21.
- [4] Achterberg P, Houtman D, van Bohemen S, Manevska K. Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in The Netherlands Jun. *Int J Hydrog Energy* 2010;35(12):6075–83.
- [5] O'Garra T, Mourato S, Pearson P. Investigating attitudes to hydrogen refuelling facilities and the social cost to local residents. *Jun. Energy Policy* 2008;36(6):2074–85.
- [6] Duan H. The public perspective of carbon capture and storage for CO<sub>2</sub> emission reductions in China. *Sep. Energy Policy* 2010;38(9):5281–9.
- [7] Hasan MH, Mahlia TMI, Nur H. A review on energy scenario and sustainable energy in Indonesia. *May. Renew Sustain Energy Rev* 2012;16(4):2316–28.
- [8] Abu Bakar AS, Ameer R. Readability of corporate social responsibility communication in Malaysia. *Jan. Corp Soc Responsib Environ Manag* 2011;18(1):50–60.
- [9] FAOSTAT. [Online]. Available: <<http://faostat3.fao.org/>>; [accessed 23.09.14].
- [10] Stigka EK, Paravantis J a, Mihalakakou GK. Social acceptance of renewable energy sources: a review of contingent valuation applications. *Renew Sustain Energy Rev* 2014;32:100–6.
- [11] Sovacool BK. Rejecting renewables: the socio-technical impediments to renewable electricity in the United States. *Nov. Energy Policy* 2009;37(11):4500–13.
- [12] Le Lim X, Lam WH. Public acceptance of marine renewable energy in Malaysia. *Energy Policy* 2014;65:16–26.
- [13] Luthra S, Kumar S, Garg D, Haleem A. Barriers to renewable/sustainable energy technologies adoption: indian perspective. *Renew Sustain Energy Rev* 2015;41:762–76.
- [14] Indonesia Internet Users-Internet Live Stats. [Online]. Available: <<http://www.internetlivestats.com/internet-users/indonesia/>>; [accessed 16.08.15].
- [15] A.P.J.I. Indonesia, Indonesia internet user profile 2014 (in Indonesian). [Online]. Available: <<http://www.apjii.or.id/v2/upload/statistik/Survey APJII 2014 v3.pdf>>; 2015 [accessed 05.08.15].
- [16] Taylor G. Readability of OHS documents – a comparison of surface characteristics of OHS text between some languages. *Aug. Saf Sci* 2012;50(7):1627–35.
- [17] Shepperd S, Charnock D, Gann B. Helping patients access high quality health information. *Oct. BMJ* 1999;319(7212):764–6.
- [18] Jayaratne YSN, Anderson NK, Zwahlen RA. Readability of websites containing information on dental implants. *Oct. Clin Oral Implants Res* 2013.
- [19] Hendrick PA, Ahmed OH, Bankier SS, Chan TJ, Crawford SA, Ryder CR, Welsh LJ, Schneiders AG. Acute low back pain information online: an evaluation of quality, content accuracy and readability of related websites. *Man Ther* 2012;17(4):318–24.
- [20] Grewal P, Alagaratnam S. The quality and readability of colorectal cancer information on the internet. *Int J Surg* 2013;11(5):410–3.
- [21] Vargas CR, Chuang DJ, Ganor O, Lee BT. Readability of online patient resources for the operative treatment of breast cancer. *Aug. Surgery* 2014;156(2):311–8.
- [22] Li F. Annual report readability, current earnings, and earnings persistence. *Aug. J Account Econ* 2008;45(no. 2–3):221–47.
- [23] Howes LM, Julian R, Kelty SF, Kemp N, Kirkbride KP. The readability of expert reports for non-scientist report-users: reports of DNA analysis. *Apr. Forensic Sci Int* 2014;237:7–18.
- [24] Mavasoglu M, Dincer S. Readability and french language teaching texts: an analysis of french language teaching websites and textbooks. *Feb. Procedia-Soc Behav Sci* 2014;116:256–9.
- [25] Putra RMS. Fog index dan keterbacaan berita utama (Headline) suara merdeka 03 Mei 2013. *J Ilmu Komun* 2013;10(1):41–8.

- [26] Dempsey SJ, Harrison DM, Luchtenberg KF, Seiler MJ. Financial opacity and firm performance: the readability of REIT annual reports. *J Real Estate Financ Econ* 2012;45(2):450–70.
- [27] Free readability formulas : free readability tools : readability software. [Online]. Available: (<http://readabilityformulas.com/>); 2014 [accessed 30.03.14].
- [28] Pranowo DD. Alat ukur keterbacaan teks berbahasa Indonesia. (thesis in Indonesian). Yogyakarta State University; 1998 <http://staff.uny.ac.id/sites/default/files/131764502/Artikel%20TESIS%20S2%20JOKO.pdf>.
- [29] Lee CS, Ma L. News sharing in social media: the effect of gratifications and prior experience. *Mar. Comput Human Behav* 2012;28(2):331–9.
- [30] Hsu C-L, Lin JC-C. Acceptance of blog usage: the roles of technology acceptance, social influence and knowledge sharing motivation. *Jan. Inf Manag* 2008;45(1):65–74.
- [31] Dunne Á, Lawlor M, Rowley J. Young people's use of online social networking sites – a uses and gratifications perspective. *J Res Interact Mark* 2010;4:46–58.
- [32] Park N, Kee KF, Valenzuela S. Being immersed in social networking environment: facebook groups, uses and gratifications, and social outcomes. *Dec. Cyberpsychol Behav* 2009;12(6):729–33.
- [33] Hankins N. Communication skills for engineers and scientists. ISBN: 0 85295 455 7. In: Venables John, editor. *Process Safety and Environmental Protection*, 80. IChemE; 2002. p. 2002 <http://www.sciencedirect.com/science/article/pii/S0957582002710495>, <http://dx.doi.org/10.1205/095758202762277650>.
- [34] DuBay WH. *The principles of readability*. 2004.
- [35] Singer H, Donlan D. Active comprehension: problem-solving schema with question generation for comprehension of complex short stories. *Read Res Q* 1982;17(2):166–86.