

This book discusses investigation on induction motor energy saving strategy particularly applied in the small and medium scale industry. A walk-through motor energy audit is carried out in a typical type of industry in Indonesia to collect some important data. Three induction motor energy saving strategies, by which energy efficient motor, variable speed drive, and capacitor bank are considered with respect to five criteria thought to influence the decision making in selecting suitable energy saving strategy for motor. Besides, motor energy saving is assessed using technical approach considering annual energy saving obtained from energy efficient motor, variable speed drive, and capacitor bank. In addition, assessments are carried out to find energy efficiency indicator such as specific energy consumption and energy intensity, as well as assessment on carbon dioxide emission and mitigation.



Yusak Tanoto

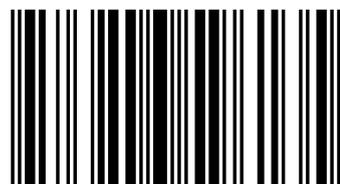


Yusak Tanoto

He has received M.Eng. degree in Energy with specialization on Electric Power System Management from Asian Institute of Technology Thailand in 2010. He is currently faculty member at Electrical Engineering Department Petra Christian University, Indonesia. His research interest include macro and micro energy management, policy and planning.

Adaptive Electricity Energy Saving Strategy for Industrial Motors

A hybrid approach for mitigating environment impact: A case of Indonesian small and medium scale industry



978-3-8465-9613-5

 **LAMBERT**
Academic Publishing

Yusak Tanoto

Adaptive Electricity Energy Saving Strategy for Industrial Motors

**A hybrid approach for mitigating environment
impact: A case of Indonesian small and medium
scale industry**

Impressum/Imprint (nur für Deutschland/only for Germany)

Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

Alle in diesem Buch genannten Marken und Produktnamen unterliegen warenzeichen-, marken- oder patentrechtlichem Schutz bzw. sind Warenzeichen oder eingetragene Warenzeichen der jeweiligen Inhaber. Die Wiedergabe von Marken, Produktnamen, Gebrauchsnamen, Handelsnamen, Warenbezeichnungen u.s.w. in diesem Werk berechtigt auch ohne besondere Kennzeichnung nicht zu der Annahme, dass solche Namen im Sinne der Warenzeichen- und Markenschutzgesetzgebung als frei zu betrachten wären und daher von jedermann benutzt werden dürften.

Coverbild: www.ingimage.com

Verlag: LAP LAMBERT Academic Publishing GmbH & Co. KG
Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Deutschland
Telefon +49 681 3720-310, Telefax +49 681 3720-3109
Email: info@lap-publishing.com

Herstellung in Deutschland:
Schaltungsdienst Lange o.H.G., Berlin
Books on Demand GmbH, Norderstedt
Reha GmbH, Saarbrücken
Amazon Distribution GmbH, Leipzig
ISBN: 978-3-8465-9613-5

Imprint (only for USA, GB)

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

Any brand names and product names mentioned in this book are subject to trademark, brand or patent protection and are trademarks or registered trademarks of their respective holders. The use of brand names, product names, common names, trade names, product descriptions etc. even without a particular marking in this works is in no way to be construed to mean that such names may be regarded as unrestricted in respect of trademark and brand protection legislation and could thus be used by anyone.

Cover image: www.ingimage.com

Publisher: LAP LAMBERT Academic Publishing GmbH & Co. KG
Heinrich-Böcking-Str. 6-8, 66121 Saarbrücken, Germany
Phone +49 681 3720-310, Fax +49 681 3720-3109
Email: info@lap-publishing.com

Printed in the U.S.A.
Printed in the U.K. by (see last page)
ISBN: 978-3-8465-9613-5

Copyright © 2011 by the author and LAP LAMBERT Academic Publishing GmbH & Co. KG and licensors
All rights reserved. Saarbrücken 2011

LIST OF CONTENT

Executive Summary	ii
Chapter 1: Introduction	1
Chapter 2: Literature Review	4
2.1. Small and medium scale industry in Indonesia	4
2.2. Induction motor	6
2.3. The walk-through energy audit	10
2.4. Energy efficiency opportunities for induction motor	12
2.5. Energy and CO ₂ emission analysis	17
2.6. Analytic Hierarchy Process	18
Chapter 3: Objectives and Benefit	23
Chapter 4: Research Methodology	25
4.1. Motor energy utilization audit	25
4.2. Energy saving using Variable Speed Drive	26
4.3. Energy loss reduction using capacitors	26
4.4. Selection of appropriate measures	27
4.4.1. Decision making based on ranking of energy saving criteria using Analytic Hierarchy Process	28
4.4.2. Establishment of specific energy consumption and energy intensity	28
4.4.3. Carbon dioxide emission analysis	29
Chapter 5: Result and Analysis	31
5.1. Observation site and walk-through audit	31
5.2. Assessment on motor energy saving strategies	37
5.2.1. Energy Efficient Motor	38
5.2.2. Power factor compensation using capacitor	41
5.2.3. Assessment on Variable Speed Drive option	42
5.3. Decision making using Analytic Hierarchy Process	44
5.4. Assessment on energy efficiency indicator	47
5.5. Assessment on carbon dioxide emission and mitigation	49
Conclusion and Recommendation	51
Acknowledgement	52
References	53
Appendix	56

Executive Summary

This report presents investigation on induction motor energy saving strategy particularly applied in the small and medium scale industry. A walk-through motor energy audit is carried out in a typical type of industry in Indonesia to collect some important data. During the research, three induction motor energy saving strategies, by which energy efficient motor, variable speed drive, and capacitor bank are considered with respect to five criteria thought to influence the decision making in selecting suitable energy saving strategy for motor. Besides, motor energy saving is assessed using technical approach considering annual energy saving obtained from energy efficient motor, variable speed drive, and capacitor bank. In addition, assessments are carried out to find energy efficiency indicator such as specific energy consumption and energy intensity, as well as assessment on CO₂ emission and mitigation.

With the support of economic as well as technical data required for each strategy, combination of assessment method involving technical and multi criteria evaluation using analytic hierarchy process offers feasible solution corresponds to the industry's inherent characteristic. It is revealed that capacitor bank is the most suitable saving strategy to the case of small and medium scale industry in this research and thus suggested to be provisioned at the first priority, followed by variable speed drive and energy efficient motor, consecutively. It is revealed that the combination on selected motor saving strategy may lead to reduce electricity energy by around 10%, equal to around 38% CO₂ emission mitigation, or threefold. Hence applying motor energy saving should not be only seen as a chance to get cost saving, but also as an opportunity to mitigate environmental emission significantly.