further developed to improve the quality of coal with a calorific value below 3,500 cal/g considering the price of brown coal with that quality that is much lower than the feedstock which is used in this study, 4,000 cal/g. Therefore, cooperation and commitment that has been constructed together by the Indonesian Ministry of Energy and Mineral Resources (MEMR) and Kobe Steel Ltd have to be developed better in the future.

IV. CONCLUSIONS

UBC product use can reduce feed consumption by 50% compared to the use of brown coal. Furthermore, when compared with the greenhouse gas emission potential (GEP) which occurs between the two scenarios is the importance of the number 1,512,943.215.00 kg CO_2-eq as saving and CO_2-eq kg 1,140,674,415.29 as net saving. The Government of Indonesia should pay attention to the mining sector and UBC process development sector to support the Energy Mix Target by 2025. Only by the reduction in feedstock price, improvement in the UBC product conversion and also the prevention direct sales of brown coal, then UBC process will be further developed. Indonesia may also get a bigger profit for a long time from that process.

ACKNOWLEDGMENT

Gratitude addressed to PT. Bukit Asam, PT. Upgraded Brown Coal Indonesia/Kobe Steel Ltd. Representative office, and Research and Development Center for Mineral and Coal Technology/RDCMCT (*TekMira*) which are facilitated the data collection in order to complete this research.

REFERENCES

[1] President of Indonesia, *Indonesian Government Regulation no.79/2014 on National Energy Policy*. Jakarta, Indonesia, 2014.

[2] National Energy Council, *Indonesia Energy Outlook 2016*. Jakarta, Indonesia, 2016.

[3] International Energy Agency (IEA), *World Energy Outlook 2012*. Paris, France, 2012.

[4] B. Daulay, "Research and Development on Clean Coal Technology in Indonesia", in *Clean Fossil Energy Technical and Policy Seminar*. Incheon, Korea, 2009.

[5] A. Saptoro, Huo K C, "Influences of Indonesian coals on the performance of a coal-fired power plant with an integrated post combustion CO_2 removal system: A comparative simulation study," *Energy Conversion and Management*, vol 68 pp. 235–243, 2013.

[6] Q. Zhu, *Update on Lignite Firing*, CCC/201. London, United Kingdom (UK): International Energy Agency Clean Coal Centre (IEA CCC), 2012.

[7] B. D. Afrah, B. Sajjakulnukit, M. D. Bustan, "Lyfe Cycle Cost Analysis of Upgrading Brown Coal (UBC) Process in Indonesia," *International Journal of Chemical and Environmental Engineering*, vol 5 (3) pp.153 – 157, June. 2014

[8] S. Kinoshita, S. Yamamoto, T. Deguchi, T. Shigehisa, "Demonstration of Upgraded Brown Coal (UBC) Process by 600 tonnes/day Plant." Kobelco, Technology review No. 29, 2010.

[9] *Clean Coal Technologies in Japan - Technological Innovation in The Coal* Industry, The New Energy and Industrial Technology Development Organization (NEDO) and the Japan Coal Energy Center (JCOAL). Kawasaki, Japan, 2006

[10] A. Sieminski, *International Energy Outlook 2016*. Washington DC, United States: U.S Energy Information Administration, 2016.

[11] Buttigieg J. Hessami M A, "Power Generation in Australia: Green House Gas Emissions and CO_2 Abatement Strategies," in *Proc 2nd International Green Energy Conference*. Oshawa, Canada: University of Ontario Institute of Technology, 2006.

[12] A. M. Carpenter, *Switching to Cheaper Coals for Power Generation*, CCC01. London, United Kingdom (UK): International Energy Agency Clean Coal Centre (IEA CCC), 1998.

[13] J. L, Vernon, *Sustainable Development in The Production and Use of Coal*, CCC/79. London, United Kingdom (UK): International Energy Agency Clean Coal Centre (IEA CCC), 2004

[14] Indonesian Coal Mining Association. "Indonesia Coal Industry Update 2016" in *JOGMEC Coal Investment Seminar*. Tokyo, Japan, 2006.

[15] T. K. Hariadi, P. J. Prahara, S. B. Lesmana, R. Saidi, "Energy Efficiency and Policy Analysis for Household in DI Yogyakarta (Yogyakarta Special Region) Indonesia," *International Journal on Advanced Science Engineering Information Technology*, vol. 6 pp 329 – 333, 2015

[16] R. Indrayuda, "Indonesia's Coal Policy toward 2020: prospect and implementation" in *APEC Clean Fossil Energy Technical and Policy Seminar*. Cebu, Philippines, 2006

[17] Ministry of Energy and Mineral Resources Republic Republic of Indonesia. *Handbook of Energy and Econonomic Statistic of Indonesia*.
Jakarta, Indonesia. 2016.

[18] Jozto, Frank, *Brown Coal Exit: a Market Mechanism for Regulated Closure of Highly Emissions Intensive Power Stations*, Australian National University, Australia: Centre for Climate Economic & Policy (CCEP), 2015.

[19] M. R. Othman, Martunus, R. Zakaria and WJN. Fernando, "Strategic planning on carbon capture from coal fired plants in Malaysia and Indonesia: a review." *Energy Policy 2009*; 37:1718–35. 2009.

[20] Regulation of President of *Republic of Indonesia No. 4/2009 about mineral and coal mining*. Jakarta, Indonesia, 2009.

[21] Regulation of President of *Republic of Indonesia No. 1/2014 about guidelines for general plan of national energy*. Jakarta, Indonesia, 2014.