ANALYSIS ON THE RELATIONSHIP BETWEEN SECTORAL ELECTRICITY CONSUMPTION, ECONOMIC PERFORMANCE AND ELECTRICITY PRICE IN MALAYSIA

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ABSTRACT

Electricity is one of the important sources of energy and is vital for the process of the country's economic growth. The issues of growing electricity consumption and heavy electricity subsidies have raised the attention of the government. However, the majority of the previous studies that specialize on the demand side of electricity were focused on total electricity consumption. Thus, this paper aims to provide the background analysis of electricity consumption trends with the focus on the four main economic sectors in Malaysia such as the industrial, commercial, mining and agricultural. The purposes were to examine the relationship between electricity consumption, Gross Domestic Product (GDP) and price of electricity based on panel data for the period 2002 to 2012. The sectoral electricity consumption model was tested using econometric techniques such as Panel Cointegration, Panel Fully Modified Ordinary Least Square (FMOLS) and Panel Granger Causality tests. The Panel Cointegration Test confirmed an existence of a stable long run relationship among the variables. The results from the panel FMOLS estimation revealed that the electricity consumption in industrial, commercial and mining sectors was positively responsive to GDP changes. In the agricultural sector, GDP had a negative effect on electricity consumption. Moreover, the higher electricity price tended to increase and decrease electricity consumption in the industrial sector and commercial sector respectively. Nonetheless, the results of the electricity price were not significant in the mining and agricultural sectors. For all the sectors, an increase in GDP had a positive effect on electricity consumption. Finally, the Panel Granger Causality Test detected a relationship running from economic growth to electricity consumption. The results obtained indicated that policy maker must be careful in the formulation of energy policy, thus suggesting that the policy should be focused on the electricity consumption in each sector.

ABSTRAK

Elektrik merupakan salah satu sumber tenaga yang penting dan memainkan peranan dalam proses pertumbuhan ekonomi negara. Isu-isu mengenai peningkatan jumlah penggunaan tenaga elektrik dan subsidi elektrik yang tinggi telah mendapat perhatian serius Kerajaan. Bagaimanapun, kebanyakan kajian terdahulu yang mengkhususkan pada sudut permintaan elektrik lebih terarah kepada penggunaan elektrik secara menyeluruh. Maka, kertas kajian ini akan memberi tumpuan kepada analisa corak penggunaan elektrik dengan fokus diberikan kepada empat sektor ekonomi utama di Malaysia iaitu perindustrian, komersial, perlombongan dan pertanian. Tujuannya adalah untuk mengkaji hubungan di antara penggunaan elektrik, Keluaran Dalam Negara Kasar (KDNK) dan harga elektrik berdasarkan pada data panel bagi tahun 2002 hingga 2012. Model penggunaan elektrik oleh sektor-sektor terbabit dijalankan menggunakan teknik-teknik ekonometrik seperti Panel Kointegrasi, Panel Pengubahsuain Penuh Kaedah Kuasa Dua Terkecil (FMOLS) dan Panel Penyebab Granger. Hasil ujian Panel Kointegrasi mengesahkan bahawa terdapatnya hubungan jangka panjang antara pembolehubah-pembolehubah tersebut. Keputusan daripada Panel FMOLS menunjukkan bahawa penggunaan elektrik di sektor perindustrian, komersial dan perlombongan adalah responsif secara positif terhadap perubahan KDNK. Di sektor pertanian, KDNK memberi kesan negatif ke atas penggunaan elektrik. Selain itu, kenaikan harga elektrik cenderung untuk meningkatkan dan mengurangkan penggunaan elektrik masing-masing di sektor perindustrian dan komersial. Walau bagaimanapun, hasil keputusan tersebut adalah tidak signifikan ke atas sektor perlombongan dan pertanian. Untuk semua sektor pula, peningkatan KDNK memberi kesan positif ke atas penggunaan elektrik. Akhir sekali, ujian Panel Penyebab Granger mengesan terdapatnya hubungan daripada pertumbuhan ekonomi kepada penggunaan elektrik. Keputusan yang diperolehi ini menunjukkan bahawa pembuat dasar haruslah berhati-hati dalam menggubal dasar tenaga, sekaligus mencadangkan supaya dasar yang dibuat perlulah bersandarkan kepada penggunaan elektrik oleh setiap sektor.

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Mohd Hafiz Aswad bin Nadzri

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ADF	Augmented Dickey-Fuller
ASEAN	Association of South-East Asian Nations
Sen/kWh	Sen per kilowatts hour
CI	Capital Investment
CONS	Number of Consumers
CPI	Consumer Price Index
EC	Electricity Consumption
ECM	Error Correction Model
ECT	Error Correction Term
EMP	Employment
FMOLS	Fully Modified Ordinary Least Square
GDP	Gross Domestic Product
GW	Gigawatts
GWh	Gigawatts per hour
IEA	International Energy Agency
IPP	Independent Power Producer
kWh	kilowatts per hour
LLC	Levin, Lin and Chu
MIEEIP	Malaysian Industrial Energy Efficiency Improvement Project
MW	Megawatts
OLS	Ordinary Least Square
PE	Price of Electricity
RE	Renewable Energy
SEB	Sarawak Energy Berhad
SESB	Sabah Electricity Sdn Bhd

SUR	Seemingly Unrelated Regression
TNB	Tenaga Nasional Berhad
TWh	Terawatts per hour
UK	United Kingdom
US	United States

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Electricity is a man-made source of energy. As it is non-durable, electricity compliments durable goods like electrical appliances or electrical machinery (Rebensteiner, 2013). It helps directly by running consumer durables in terms of services and running machines which help directly or indirectly to produce consumer goods. Electricity is an exceptional energy because the consumption of electricity has to be simultaneous once it is been generated, thus electricity cannot be economically stored. Furthermore, electricity has a unique position among other different types of energy because electricity is clean energy, is easy to transfer and can be transformed into other kinds of energy. The demand of electricity varies hourly, daily, weekly and across the seasons (Ranci & Cervigni, 2013). It cannot be fully controlled and it is practically impossible to prevent market participants from consuming more or less electricity.

Electricity plays an important role in the process of economic growth and is required for both commercial and non-commercial usage. Commercial usage of electricity refers to the use of electric power in the industrial, commercial, mining and agricultural sectors. For non-commercial, the principal use of electricity energy is for public lighting and by residential consumer. Winkler, Simoes, Rovere, Rahman & Mwakasonda (2011) stated that electricity is a vital input together with machinery,

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REFERENCES

Abbas, F. & Choudhury, N. (2013). Electricity consumption-economic growth Nexus: An aggregated and disaggregated causality analysis in India and Pakistan. *Journal of Policy Modeling*, 35, 538-553.

Abdullah, H., Bakar, N.A. & Hassan, S. (2014). Analysis of FDI inflows into China from ASEAN-5 countries: A panel cointegration approach. *Journal of Economic Cooperation and Development*, 35(3), 1-28.

Acaravci, A. & I. Ozturk (2010). Electricity consumption-growth nexus: Evidence from panel data for transition countries. *Energy Economics*, 32(3), 604-608.

Ahmed, J. U., Saidur, R., Masjuki, H. H., Mekhilef, S., Ali, M. B. and Furqon, M. H. (2011). An application of energy and exergy analysis in agricultural sector of Malaysia. *Energy Policy*, 39(12), 7922-7929.

Al-Faris, A. R. F. (2002). The demand for electricity in the GCC countries. *Energy Policy*, 30(2), 117-124.

Al-Ghandoor, A., Al-Hinti, I., Jaber, J. O. & Sawalha, S. A, (2008). Electricity consumption and associated GHG emissions of the Jordanian industrial sector: Empirical analysis and future projection. *Energy Policy*, 36(1), 258-267.

Alter, N. & Syed S. H. (2011). An empirical analysis of electricity demand in Pakistan. *International Journal Of Energy Economics And Policy*, 1(4), 116-139.

Altinay, G. & Karagol, E. (2005). Electricity consumption and economic growth: Evidence from Turkey. *Energy Economics*, 27(6), 849-856.

Amarawickrama, H. A. & Hunt, L. C. (2007). Electricity demand for Sri Lanka: A time series analysis. Surrey Energy Economics Centre. *Surrey Energy Economics Discussion Paper Series*, 118.

Anderson, K. P. (1973). Residential demand for electricity: econometric estimates for California and the United States. *The Journal of Business*, 46(4), 526-553.

Apergis, N. & J. E. Payne (2010). Energy consumption and growth in South America: Evidence from a panel error correction model. *Energy Economics*, 32(6), 1421-1426.

Arbuesa, F., Garcia-Valinasb, M. A. & Martinez-Espineira, R. (2003). Estimation of residential water demand: a state-of-the-art review. *The Journal of Socio-Economics*, (1), 81-102.

Arif, M. (2011, July 18). Energy efficient the way forward. BERNAMA. Retrieved from http://www.web6.bernama.com.

Asafu-Adjaye, J. (2000). The relationship between energy consumption, energy prices and economic growth: Time series evidence from Asian developing countries. *Energy Economics*, 22, 615-625.

Athukorala, W. & Wilson, C. (2009). Estimating short and long-term residential demand for electricity: New evidence from Sri Lanka. *Energy Economics*, 1-7.

Bank Negara Malaysia, *The Malaysia Economy in* 2006. Retrieved from http://www.bnm.gov.my/files/publication/ar/en/2006

Beenstock, M., Goldin, E. & Nabot, D. (1999). The demand for electricity in Israel. *Energy Economics*, 21, 168-183.

Bekhet, H. A. & Abdullah. A. (2010). Energy use in agriculture sector: Input-output analysis. *International Business Research*, 3(3), 111-121.

Bekhet, H. A. & Othman, N. S. (2011). Assessing the elasticities of electricity consumption for rural and urban areas in Malaysia: A non-linear approach. *International Journal of Economics and Finance*, 3(1).

Chandran, V. G. R., Madhavan, K. & Sharma, S. (2010). Electricity consumption-growth nexus: The case of Malaysia. *Energy Policy*, 38(1), 606-612.

Chen, S.-T., Kuo, H.-I. & Chen, C.-C. (2007). The relationship between GDP and electricity consumption in 10 Asian countries. *Energy Policy*, 35(4), 2611-2621.

Chouaibi, N. & Abdessalem T. (2011). Causality between electricity consumption and economic growth in Tunisia: Policy implications. *International Journal of Economic Policy in Emerging Economies*, 4(3), 211-226.

Cooper, J. C. B. (2003). Price Elasticity of Demand for Crude Oil: Estimates for 23 Countries. *OPEC Review*, 27: 1-8.

Department of Statistics Malaysia. www.statistics.gov.my

Dergiades, T. & Tsoulfidis, L. (2008). Estimating residential demand for electricity in the United States, 1965–2006. *Energy Economics* 30(5), 2722-2730.

De-Vita, G., Endresen, K. & Hunt, L. C. (2005). An Empirical Analysis of Energy Demand in Namibia. *Surrey Energy Economics Discussion Paper Series*, 110.

Dias-Bandaranaike, R. & Munasinghe M. (1983). The demand for electricity services and the quality of supply. *The Energy Journal*, 4(2), 49-71.

Dilaver, Z. & Hunt, L. C. (2010). Industrial electricity demand for Turkey: A structural time series analysis. *Surrey Energy Economics Discussion Paper Series*, 129.

Dilaver, Z. & Hunt, L. C. (2011). Turkish aggregate electricity demand: An outlook to 2020." *Surrey Energy Economics Discussion Paper Series*. 132.

Donatos, G. S. & G. J. Mergos (1991). Residential demand for electricity: The case of Greece. *Energy Economics*, 13(1), 41-47.

Energy Commission of Malaysia. (n.d). *Electricity supply industry in Malaysia: Peformance and statistical information, 2002-2009*. Retrieved from http://www.st.gov.my

Energy Commission of Malaysia. (March 1, 2012). *Electricity supply industry in Malaysia: Peformance and statistical information* 2010. Retrieved from http://www.st.gov.my

Energy Commission of Malaysia. (July 7, 2013). *Electricity supply industry in Malaysia: Peformance and statistical information* 2011. Retrieved from http://www.st.gov.my

Energy Commission of Malaysia. (March 1,2014). *National Energy Balance* 2012. Retrieved from http://meih.st.gov.my/documents

Energy Commission of Malaysia. (June 11,2014). *Malaysia Energy Statistics Handbook* 2014. Retrieved from http://www.meih.st.gov.my

Energy Commission of Malaysia. (August 8,2014). *Electricity supply industry in Malaysia: Peformance and statistical information* 2012. Retrieved from http://www.st.gov.my

Economic Planning Unit (EPU). *Tenth Malaysia Plan.* Retrieved from http://www.epu.gov.my

Egelioglu, F., Mohamad, A. A. & Guven, H. (2001). Economic variables and electricity consumption in Northern Cyprus. *Energy* 26(4), 355-362.

Ekpo, U. N., Chuku, C. A. & Effiong, E. L. (2011). The dynamics of electricity demand and consumption in Nigeria: Application of the bounds testing approach. *Current Research Journal of Economic Theory*, 3(2), 43-52.

Engle, R. F. & Granger, C. W. J. 1987. Cointegration and error correction: representation, estimation, and testing. *Econometrica*, 55 (2), 251-276.

Espey, J. A. & Espay M. (2004). Turning on the lights: A meta-analysis of residential electricity demand elasticities. *Journal of Agricultural and Applied Economics*, 36(1), 65-81.

Estrada, J. & O. Fugleberg (1989). Price elasticities on natural gas demand in France and West Germany. *The Energy Journal*, 10(3), 77-90.

Evans, J. & L. C. Hunt. (2009). Energy demand theory. In Medlock III, K. B., *International handbook on the economics of energy*. (pp. 89-111). Retrieved from http://www.emrg.sfu.ca

Filippini, M. (1999). Swiss residential demand for electricity. *Applied Economics Letters*, 6(8), 533-538

Fisher, F. M. & Kaysen C. (1962). A study in econometrics: The demand for electricity in the United States. The *American Economic Review*, 52(4), 885-887

Ghader, S. F., Azadeh, M. A. & Mohammadzadeh, S. (2006). Modeling and forecasting the electricity demand for major economic sectors in Iran. *Information Technology Journal*, 5(2), 260-266.

Ghosh, S. (2009). Electricity supply, employment and real GDP in India: Evidence from cointegration and Granger-causality tests. *Energy Policy*, 37(8), 2926-2929.

Granger, C. W. & Newbold P. (1974). Spurios regression in econometrics. *Journal of Econometrics*, 2, 111-120.

Granger, C. W. (1988). Causality, cointegration and control. *Journal of Economic Dynamics and Control*, 12, 551-559.

Gujarati, D. N. (2003). *Basic econometrics, (4^{th} Ed)*. Boston: McGraw Hill.

Halvorsen, R. (1975). Residential demand for electric energy. *The Review of Economics and Statistics*, 57(1), 12-18.

Halvorsen, R. (1976). Demand for electric energy in the United States. *Southern Economic Journal*, 42(4), 610-625.

Helden, G. J. V., Leeflang, P. S. H. & Sterken, E. (1987). Estimation of the demand for electricity. *Applied Economics*, 19(1), 69-82.

Holthedahl, P. & Joutz, F. L. (2004). Residential electricity demand in Taiwan. *Energy Economics* 26(2), 201-224.

Houthakker, H. S. (1951). Some calculations on electricity consumption in Great Britain. *Journal of the Royal Statistical Society*, 114(3), 359-371.

Inglesi, R. (2010). Aggregate electricity demand in South Africa: Conditional forecasts to 2030. *Applied Energy*, 87, 197-204.

Inglesi-Lotz, R. & Blignaut, J. (2011). Estimating the price elasticity for demand for electricity by sector in South Africa. *South African Journal of Economic and Management Sciences*, 14(4).

International Energy Agency. (2013, September) *Southeast Asia energy outlook: World energy outlook special report*. Retrieved from http://www.iea.org/.../southeastasiaenergyoutlook

Ivy-Yap, L. L. & Bekhet, H. A. (2014). Modeling residential electricity consumption function in Malaysia: Time series approach.*World Academy of Sciences, Engineering and Technology*, 8(3).

Jamil, F. & Ahmad, E. (2011). Income and price elasticities of electricity demand: Aggregate and sector-wise analyses. *Energy Policy* 39(9), 5519-5527.

Javid, M. & Qayyum, A. (2014). Electricity consumption-GDP nexus in Pakistan: A structural time series analysis. *Energy*, 64, 811-817.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamic and Control*, 12, 231-254.

Johansen, S. and K. Juselius (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Jumbe, C. B. L. (2004). Cointegration and causality between electricity consumption and GDP: Empirical evidence from Malawi. *Energy Economics*, 26, 61-68.

Kanagawa, M. & Nakata T. (2008). Assessment of access to electricity and the socio-economic impacts in rural areas of developing countries. *Energy Policy*, 36(6), 2016-2929.

Kargi, B. (2014). Electricity consumption and economic growth: A long term cointegrated analysis for Turkey. *International Journal of Economic and Finance*, 6(4), 285-293.

Khan, M. A. & Qayyum, A. (2009). The demand for electricity in Pakistan. *OPEC Energy Review*, 33(1), 70-96.

Kinuthia, B. K. (2011). Markets vs. Government. Foreign direct investment and industrialization in Malaysia. *Economia Mexicana*, 20(2), 409-443.

Kraft, J. & Kraft, A. (1978). On the relationship between energy and GDP. *Journal of Energy and Development*, 3, 401-403.

Lakhani, H. G. & Bumb, B. (1978). Forecasting demand for electricity in Maryland: An econometric approach. *Technological Forecasting and Social Change*, 11(3), 237-259.

Lau, E., Chye X-H. & Choong, C-H. (2011). Energy-growth causality: Asian countries revisited. *International Journal of Energy Economics and Policy*, 1(4), 140-149.

Lean, H. H. & Smyth, R. (2010). On the dynamics of aggregate output, electricity consumption and exports in Malaysia: Evidence from multivariate Granger causality tests. *Applied Energy*, 87(6), 1963-1971.

Levin, A., Lin, C-F. & Chu, C-S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1-24.

Madlener, R., Bernstein, R. & Gonzalez, M. A. A. (2011). Econometric estimation of energy demand elasticities. *E. ON Energy Research Center Series*, 3(8).

Mozumder, P. & Marathe, A. (2007). Causality relationship between electricity consumption and GDP in Bangladesh. *Energy Policy*, 35(1), 395-402.

Narayan, P. K. & Smyth, R. (2005). The residential demand for electricity in Australia: an application of the bounds testing approach to cointegration. *Energy Policy*, 33(4), 467-474.

Narayan, P. K., Nielsen, I. & Smyth, R. (2008). Panel data, cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces. *China Economic Review*, 19(2), 297-307.

Narayan, P. K., Smyth, R. & Prasad, A. (2007). Electricity consumption in G7 countries: A panel cointegration analysis of residential demand elasticities. *Energy Policy*, 35(9), 4485-4494.

Nathan, T. M., Liew, V. K. & Al-Mamun, A. (2013). Effect of primary energy consumption towards disagregated sectoral outputs of India. *Asian Journal of Research in Business Economics and Management*, 3(11), 260-268.

Odhiambo, N. M. (2009). Electricity consumption and economic growth in South Africa: A trivariate causality test. *Energy Economics*, 31(5), 635-640.

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61, 653-670

Pedroni, P. (2000). Fully modified OLS for heterogeneous cointegrated panels. *Advanced in Econometrics*, 15, 93-130.

Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis: new results. *Econometric Theory*, 20, 597-627.

Performance Management and Delivery Unit. (2013). Chapter 6: *Powering the Malaysian economy with oil, gas and energy, A roadmap for Malaysia*. Retrieved from etp.pemandu.gov.my

Pesaran, M. H., Shin, Y., Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Applied Econometrics*, 16(3), 289-326.

Polemis, M. L. (2007). Modeling industrial energy demand in Greece using cointegration techniques. *Energy Policy*, 35(8), 4039-4050.

Ponniran, A., Mamat, N. A. & Joret, A. (2013). Electricity profile study for domestic and commercial sectors. *International Journal of Integrated Engineering*, 4(3), 8-12.

Pourazam, E. (2012). Electricity demand analysis in different sectors: A case study of Iran (Doctor of Philosophy thesis, School of Economics, University of Wollongong). Retreived from http://www.ro.uow.edu.au/theses/3786.

Pouris, A. (1987). The price elasticity of electricity demand in South Africa. *Applied Econometrics,* 19, 1269-1277.

Quedraogo, I. M. (2010). Electricity consumption and economic growth in Burkina Faso: A cointegration analysis. *Energy Economics*, 32(3), 524-531.

Rabensteiner, P. (2013). Multi-dimensional risk and investment return in the energy sector: The case of electric transmission networks. Switzerland, Haupt Verlag AG.

Ranci, P. and Cervigni, G. (2013). The economics of electricity markets, theory and policy: The Loyola De Palacio series on european energy policy. UK, Edward Elgar Publishing Limited.

Rumsey, P. and Flanigan T. (1995). Asian energy efficiency success stories. United States of America, International Institute for Energy Conservation.

Sabir, M., Ahmad, N., Bashir, M. K. (2013). Demand function of electricity in industrial sector of Pakistan. *World Applied Sciences Journal*, 21(4), 641-645.

Saidur, R., Hasanuzzaman, M., Sattar, M. A., Masjuki, H. H., Anjum, M., Mohiuddin, A.K.M. (2007). An analysis of energy use, energy intensity and emissions at the industrial sector of Malaysia. *International Journal of Mechanical and Materias Engineering*, 2(1), 84-92.

Selen, M. and Aysegul, B. (2012). Co-integration analyses of price and income elasticities of electricity power consumption in Turkey. *European Journal of Social Sciences*, 30(4), 523-534.

Shaari, M. S., Hussain, N. E., Abdullah, H. and Kamil, S. (2014).Relationship among foreign direct investment, economic growth and CO2 emission: A panel data analysis. *International Journal of Energy Economics and Policy*, 4(4), 706-715.

Shiu, A. and Lam, P.-L. (2004). Electricity consumption and economic growth in China. *Energy Policy*, 32(1), 47-54.

Silk, J. I. and Joutz, F. L. (1997). Short and long-run elasticities in US residential electricity demand: A co-integration approach. *Energy Economics*, 19(4), 493-513.

Tang, C. F. (2008). A re-examination of the relationship between electricity consumption and economic growth in Malaysia. *Energy Policy*, 36(8), 3077-3085.

Tang, C. F. (2009). Electricity consumption, income, foreign direct investment, and population in Malaysia: New evidence from multivariate framework analysis. *Journal of Economic Studies*, 36(4), 371-382.

Theodoros, Z. and Pashourtidou, N. (2007). An empirical analysis of electricity consumption in Cyprus. *Energy Economics*, 29(2), 183-198.

Tishler, A. (1983). The industrial and commercial demand for electricity under time-of-use pricing. *Journal of Econometrics*, 23(3), 369-384.

Ubani, O. J., Umeh, L. and Ugwu, L. N. (2013). Analysis of the Electricity Consumption in South-East Geopolitical Region of Nigeria. *Journal of Energy Technologies and Policy*, 3(1).

United Nations Development Programme. (2008). Report of the final evaluation on the Malaysian Industrial Energy Efficiency Improvement Project. Retrieved from http://www.erc.undp.org

Waide, P., Lebot, B., Hinnells, M. (1997). Appliance energy standards in Europe. *Energy and Buil*.

Wilson, J. W. (1971). Residential demand for electricity. *Quarterly Reviews of Economics and Business* 11, 7-22.

Winkler, H., Simoes, A. F., Rovere, E. L., Alam, M., Rahman, A., Mwakasonda, S. (2011). Access and affordability of electricity in developing countries. *World Development*, 39(6), 1037-1050.

Wolde-Rufael, Y. (2006). Electricity consumption and economic growth: A time series experience for 17 African countries. *Energy Policy*, 34(10), 1106-1114.

Worldbank. www.data.worldbank.org

Worthington, A. C. (2010). Commercial and industrial water demand estimation: Theoretical and methodological guidelines for applied economics research. *Estudios de Economía Aplicada* 28(2), 237-258.

Yuan, J.-H., Kang, J.-G., Zhao, C.-H., Hu, Z.-G. (2008). Energy consumption and economic growth: Evidence from China at both aggregated and disaggregated levels. *Energy Economics*, 30(6), 3077-3094.

Ziramba, E. (2008). The demand for residential electricity in South Africa. *Energy Policy*, 36(9), 3460-3466.