

**LAPORAN AKHIR
PENELITIAN SKEMA PENELITIAN DASAR**



**INVESTIGASI PENGARUH PRODUKSI LISTRIK TERHADAP KUALITAS
LINGKUNGAN DAN PERTUMBUHAN EKONOMI DI INDONESIA**

Dyah Titis Kusuma Wardani, S.E., MDEC., Ph.D. (0529088304)
Romi Bhakti Hartarto, S.E., M.Ec., Ph.D. (0510099201)
Gigih Ganang Asyraf R. (20180430160)
Mohammed Shameem P

UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Dibiayai Oleh Lembaga Riset dan Inovasi (LRI)
Universitas Muhammadiyah Yogyakarta
Tahun Anggaran 2022/2023



UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Kampus terpadu: Jl. Brawijaya, Geblagan, Tamantirto, Bantul, Daerah Istimewa
Yogyakarta 55183

Telp. (0274) 387656 (hunting) Fax. (0274) 387646

PROTEKSI ISI LAPORAN AKHIR PENELITIAN

Dilarang menyalin, menyimpan, memperbanyak sebagian atau seluruh isi laporan ini dalam bentuk apapun kecuali oleh peneliti dan pengelola administrasi penelitian.

LAPORAN AKHIR PENELITIAN

Informasi Data Usulan Penelitian

1. IDENTITAS PENELITIAN

A. JUDUL PENELITIAN

Investigasi Pengaruh Produksi Listrik terhadap Kualitas Lingkungan dan Pertumbuhan Ekonomi di Indonesia

B. SKEMA, BIDANG, TEMA, DAN TOPIK PENELITIAN

Skema Penelitian	Bidang Fokus Penelitian	Tema Penelitian	Topik Penelitian
Penelitian Dasar	Energi - Energi Baru dan Terbarukan	Teknologi konservasi energi	Teknologi hybrid dalam pemanfaatan sumber energi terbarukan.

C. KOLABORASI DAN RUMPUN ILMU PENELITIAN

Jenis Kolaborasi Penelitian	Rumpun Ilmu 1	Rumpun Ilmu 2	Rumpun Ilmu 3
Kolaboratif Luar Negeri	ILMU EKONOMI	ILMU EKONOMI	Ekonomi Pembangunan

D. WAKTU PELAKSANAAN

Tahun Usulan	Tahun Pelaksanaan	Lama Penelitian
2022	2023	1

E. ANCOR RESEARCH

Anchor Research	Topik Anchor
Imamudin Yuliadi, Prof. Dr., S.E., M.Si.	Economic Development & Monetary Policy

2. IDENTITAS PENELITIAN

Nama	Peran	Tugas
Dyah Titis Kusuma Wardani, S.E., MDEC., Ph.D.	Ketua Pengusul	
Romi Bhakti Hartarto, S.E., M.Ec., Ph.D.	Anggota Pengusul	Menyusun manuskrip publikasi
Gigih Ganang Asyraf R.	Mahasiswa Bimbingan	Citing & referencing

3. MITRA KERJASAMA PENELITIAN (JIKA ADA)

Pelaksanaan penelitian dapat melibatkan mitra kerjasama, yaitu mitra kerjasama dalam melaksanakan penelitian, mitra sebagai calon pengguna hasil penelitian, atau mitra investor

Mitra	Nama Mitra	Kepakaran
-------	------------	-----------

4. KOLABORASI PENELITIAN (JIKA ADA)

Mitra	NIDN/NIK	Instansi
Mohammed Shameem P	N/A	University of Hyderabad

5. LUARAN DAN TARGET CAPAIAN

Luaran Wajib

Tahun	Jenis Luaran
1	Publikasi Jurnal Internasional terindeks SCOPUS,

Luaran Tambahan

Tahun	Jenis Luaran
1	Naskah Akademik

6. KLUSTER

Kluster	Sub Kluster	Group Riset	Mata kuliah
			--

7. ANGGARAN

Rencana anggaran biaya penelitian mengacu pada PMK yang berlaku dengan besaran minimum dan maksimum sebagaimana diatur pada buku Panduan Penelitian dan Pengabdian kepada Masyarakat.

Total Keseluruhan RAB Rp. 18,000,000

Tahun 1 Total Rp. 18,000,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Harga Satuan	Total
PELAPORAN, LUARAN WAJIB, DAN LUARAN TAMBAHAN	Biaya Seminar Nasional	acara	Paket	2000000	Rp. 1	Rp. 2,000,000
PELAPORAN, LUARAN WAJIB, DAN LUARAN TAMBAHAN	Biaya Seminar Internasional	acara	Paket	5000000	Rp. 1	Rp. 5,000,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Harga Satuan	Total
PENGUMPULAN DATA	Biaya Konsumsi Harian	hari	OH	100000	Rp. 5	Rp. 500,000
PENGUMPULAN DATA	Transportasi/BBM	hari	OK(Kali)	100000	Rp. 5	Rp. 500,000
ANALISIS DATA	Honorarium Pengolah Data	bulan	Per Penelitian	2	Rp. 2,000,000	Rp. 4,000,000
ANALISIS DATA	Honorarium Analisis Data	orang	OK(Kali)	2	Rp. 2,500,000	Rp. 5,000,000
PENGUMPULAN DATA	Honorarium Asisten Lapangan	orang	OJ	2	Rp. 250,000	Rp. 500,000
PENGUMPULAN DATA	Uang Harian	hari	OH	5	Rp. 100,000	Rp. 500,000

8. LEMBAR PENGESAHAN

HALAMAN PENGESAHAN LAPORAN AKHIR PENELITIAN SKEMA:

Judul : Investigasi Pengaruh Produksi Listrik terhadap Kualitas Lingkungan dan Pertumbuhan Ekonomi di Indonesia
 Peneliti/Pelaksana : Dyah Titis Kusuma Wardani, S.E., MDEC., Ph.D.
 NIDN : 0529088304
 Jabatan Fungsional : Asisten Ahli
 Program Studi/Fakultas : Ekonomi
 Nomor HP : 08112638191
 Alamat surel (e-mail) : dyah.wardani@umy.ac.id

Anggota

Nama : Romi Bhakti Hartarto, S.E., M.Ec., Ph.D.
 NIDN : 0510099201
 Jabatan Fungsional : Asisten Ahli
 Program Studi/Fakultas : Ekonomi

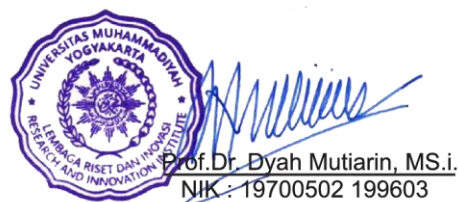
Nama : Gigih Ganang Asyraf R.
 NIM : 20180430160
 Prodi : S1 Ekonomi

Nama : Mohammed Shameem P
 NIK : N/A
 Institusi : University of Hyderabad

Biaya : Rp. 18,000,000

Yogyakarta, 16 Agustus 2023

Mengetahui,
Kepala LRI,



Prof. Dr. Dyah Mutiarin, MS.i.
NIK : 19700502 199603

9. RINGKASAN

Introduction/Main Objectives: This study identifies the various sources of electricity generation used and assesses how these relate to economic growth and environmental quality in six selected ASEAN countries (Indonesia, Malaysia, Filipina, Thailand, Vietnam, and Myanmar) from 1994 to 2014. **Background Problems:** Economic growth is essential for a country to maintain social welfare for all levels of society. Thus, massive electricity production is required to achieve the desired economic growth. **Novelty:** The trade-off between different sources of power generation, economic growth, and environmental quality cannot be denied in the literature. Thus, to reduce carbon emissions and sustain decent economic growth, there is a need to reduce electricity production based on fossil fuels, namely coal, oil, and natural gas. In addition, to increase total electricity production, it is necessary to increase the use of renewable sources of electricity generation, such as hydro. **Research Methods:** This study uses static panel data analysis with random effects model. **Finding/Results:** Economic growth in six selected ASEAN countries is enhanced by electricity generation from all sources, while the contribution of electricity production from hydroelectricity remains the largest and strongest. There is little environmental impact of electricity production from hydroelectric, whereas fossil fuel-based electricity production emits carbon dioxide with coal sources being the largest contributor. **Conclusion:** Based on the results, this study promotes several policy recommendations. First, these six ASEAN countries should invest more in hydropower projects, such as through the effective use of unused water resources. Second, there is a need to reduce the coal mix in power generation since it is a dirty fuel, for example, through subsidies and tax incentives for other fuels like hydroelectric. Besides, clean coal technology in these countries needs to be promoted to improve economic efficiency and environmental sustainability. Finally, to have higher economic growth and better environmental quality, implementing the above measures could help these countries achieve sustainable development goals.

10. KEYWORDS

electricity, energy, environment, economic growth, ASEAN

11. HASIL PELAKSANAAN PENELITIAN

Table 1 provides an overview of the statistical information pertaining to all variables within this study, encompassing the period from 1994 to 2014 in six ASEAN countries. Indonesia encountered its most significant economic contraction on record in 1998 with a staggering -13.13% growth rate. This downturn followed the Asian Financial Crisis. Concurrently, Thailand, Malaysia, and the Philippines also underwent negative economic growth during the same year. Conversely, Myanmar achieved the highest growth rate of 13.70% in 2004, marking a notable economic accomplishment. Notably, Myanmar sustained a double-digit growth trajectory between 2000 and 2010. Regarding carbon dioxide emissions, Malaysia set a peak record at 57.70% in 2011, whereas Vietnam posted the lowest emissions in 1994, recording a figure of 15.89%.

Table 1. Summary Statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
GDP	126	5.82	3.76	-13.13	13.70
CO ₂	126	38.37	8.24	15.89	57.70
hydroelectric	126	22.07	21.41	3.18	76.19
gas	126	39.55	21.97	0.03	74.82
oil	126	11.76	11.89	0.32	56.84
coal	126	21.72	12.94	0	52.45

Source: Authors' calculations

In 2011, Myanmar stood out for having the highest proportion of hydropower plants, accounting for 76.19%. In contrast, Indonesia held the least percentage, with just 3.18% in 1999, a value that always remained below 6% thereafter. In 1997, the Philippines displayed the slightest dependence on natural gas for their power generation, standing at a mere 0.03%. However, by 2002, the country embarked on a trajectory of natural gas-oriented power plant development. On the other hand, Thailand emerged as a notable example of country with the largest share of hydropower plants, reaching 74.82% in 2010. With only a marginal 0.32% of power generation stemming from oil-based plants in 2012, Vietnam ranked as a country with the least reliance on this energy source. This stands in stark juxtaposition to the Philippines, where a significant 56.84% of hydropower plants are based on oil.

Myanmar emerged as the only country with no reliance on coal as an energy source between 1995 and 2001. However, a gradual increment in coal usage was observed thereafter, albeit not in significant measure. This contrasts with Indonesia, which exhibits the most pronounced dependence on coal for energy. Notably, over 50% of Indonesia's power generation derives from coal-based plants in 2014. Furthermore, Table 2 presents the correlation matrix, illustrating the interrelationships between various variables within the model. The correlation coefficients indicate low associations among the independent variables, indicating the absence of significant multicollinearity concerns.

Table 2. Correlation Matrix

	hydroelectric	gas	oil	Coal
hydroelectric	1			
gas	-0.386	1		
oil	-0.289	-0.518	1	
coal	-0.548	-0.282	0.146	1

Source: Authors' calculations

The primary objective of this research is to investigate the diverse array of electricity generation sources and their corresponding associations with both economic growth and environmental quality. The outcomes of the Ordinary Least Squares (OLS), Fixed Effect Model (FEM), and Random Effect Model (REM) estimations are detailed in Table 3. The results from these three approaches exhibit consistency between the random effect and fixed effect models, with a slight variance observed within the OLS method concerning statistical significance. However, our primary emphasis is directed towards the random effect estimation due to its favorable attributes as indicated by the Hausman test. The Hausman test statistics for Model 1 and Model 2 are 3.00 and 8.72, respectively. The chi-square probabilities of these statistics are greater than the 0.1 and 0.05 significance level, respectively, thereby leading to no rejection of the null hypothesis and affirming the presence of a random effect within both models.

Table 3. Panel Data Estimation

Regressors	Model 1 Dependent variable: GDP			Model 2 Dependent variable: CO ₂		
	Common Effect	Fixed Effect	Random Effect	Common Effect	Fixed Effect	Random Effect
Coal	0.055 (0.074)	0.379** (0.168)	0.215* (0.118)	0.056 (0.096)	0.703*** (0.139)	0.638** (0.127)
Hydro	0.127** (0.060)	0.386** (0.173)	0.238** (0.104)	-0.301*** (0.078)	0.261* (0.142)	0.188 (0.126)
Gas	0.054 (0.057)	0.355** (0.170)	0.190* (0.105)	0.032 (0.073)	0.494*** (0.140)	0.427*** (0.124)
Oil	0.043 (0.077)	0.365** (0.174)	0.197* (0.119)	-0.234** (0.100)	0.347** (0.144)	0.281** (0.130)
Constant	-0.827 (5.934)	-29.24* (16.06)	-13.91 (10.24)	45.29*** (7.69)	-6.29 (13.27)	0.167 (11.97)
Hausman chi2 Prob>chi2		3.00 0.559			8.72 0.069	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations

It is evident from Table 3 that electricity production from coal sources contributes to higher economic growth, but it also leads to a significant increase in pollution due to carbon dioxide emissions in six ASEAN countries. This finding poses a challenge to the environmental sustainability of these nations during their development progress aimed at achieving economic growth. Similar trends are observed for natural gas and oil as fossil fuel-based sources. A scenario in which economic growth coincides with CO₂ emissions within an economy could potentially trigger environmental deterioration, which consequently affects economic progress by giving rise to human health issues.

Conversely, hydroelectricity generation, a potential renewable energy source, considerably enhances economic growth without negatively impacting environmental quality in these countries. This finding corroborates with previous studies in various countries (Ziramba 2013; Xiaosan et al., 2021; Villanthenkodath and Shameem, 2023). The environmental implications of electricity production from hydroelectric sources appear promising, as it has minimal effect on carbon dioxide emissions while maintaining its position as the primary and most influential contributor to economic growth. Moreover, the adverse impact of hydroelectricity production on environmental pollution aligns with the notion that hydropower serves as an eco-friendly energy solution capable of enhancing environmental well-being. The result of analysis within the environmental quality model further substantiates the concept that hydroelectricity stands as a viable and sustainable energy source.

12. KESIMPULAN PENELITIAN

The research findings presented in the remarks highlight the importance of electricity generation in driving economic growth in six selected ASEAN countries. It also emphasizes the significant role of hydroelectricity in contributing to economic growth compared to other sources of electricity generation. Additionally, the study points out the environmental impact of different electricity production methods, with hydroelectric power showing little impact, while fossil fuel-based electricity production, particularly from coal, is a major contributor to carbon dioxide emissions.

Based on these findings, the study proposes several policy recommendations to promote sustainable development in these ASEAN countries. Given the significant positive impact of electricity production from hydroelectricity on economic growth, the countries should prioritize investments in hydropower projects. This can be achieved by effectively utilizing untapped water resources to generate electricity. Since fossil fuel-based electricity production, especially from coal, has a detrimental environmental impact, countries should take measures to reduce the reliance on coal in their power generation mix. This can be accomplished through the implementation of subsidies and tax incentives for cleaner alternatives, such as hydroelectric power. For countries that heavily depend on coal for electricity production, promoting and investing in clean coal technology is crucial. This technology aims to improve economic efficiency while minimizing the environmental impact associated with coal-based power generation.

By implementing the above policy measures, these countries can work towards achieving both higher economic growth and better environmental quality, thus contributing to their overall sustainable development goals. However, it is important to note that these policy recommendations are based on the specific context of the research findings and the six ASEAN countries studied. Before implementing these policies, careful consideration of local factors, economic feasibility, and environmental impacts should be undertaken. Policymakers should also collaborate with experts and stakeholders to ensure effective implementation and monitoring of these measures to achieve the desired outcomes.

13. STATUS LUARAN WAJIB

Luaran sudah submit ke jurnal Journal of Environmental Economics and Policy (Scopus Q2)

14. DOKUMEN LUARAN WAJIB

Terlampir di SIMLITABMAS

15. LINK LUARAN WAJIB

N/A

16. STATUS LUARAN TAMBAHAN

N/A

17. DOKUMEN LUARAN TAMBAHAN

Terlampir di SIMLITABMAS

18. LINK LUARAN TAMBAHAN

N/A

19. PERAN MITRA (JIKA ADA)

Mitra menulis bagian introduction dan literature review untuk publikasi jurnal.

20. DAFTAR PUSTAKA

Villanthenkodath, M. A., & Shameem P, M. (2023). Examining the impact of electricity production on economic growth and environmental quality in Japan: A disaggregated level analysis. *Environmental Science and Pollution Research*, 30(1), 849–868.

Xiaosan, Z., Qingquan, J., Iqbal, K.S, Manzoor, A., & Ur R.Z. (2021). Achieving sustainability and energy efficiency goals: assessing the impact of hydroelectric and renewable electricity generation on carbon dioxide emission in China. *Energy Policy*, 155:112332.

Ziramba, E. (2013). Hydroelectricity consumption and economic growth nexus: time series experience of three African countries. *European Journal of Scientific Research*, 9(1), 85-96.

21. LAMPIRAN-LAMPIRAN

N/A