

A REVIEW ON SUSTAINABLE DEVELOPMENT: THE RELATIONSHIP BETWEEN ENERGY CONSUMPTION AND ENVIRONMENTAL DEGRADATION

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ABSTRACT

The aim of this concept paper is to present some of the existing knowledge on the impact of population growth, economic growth, energy intensity growth and urbanization growth on environmental degradation. The paper will emphasise the important concept regarding the sustainable development and identify simultaneously the effect of population growth, urbanization, energy consumption and environmental degradation on the sustainable economic growth as well. To ensure the sustainable development of the economy environmental degradation should not increase with time but be reduced or at least remain constant. If it increases, we will move further away for sustainability, while if it decreases, we will move closer towards it. This paper is meant to support and stimulate the objective of achieving sustainable development which allow higher standard of living through changing of the nation's pattern lifestyle towards the energy efficiency consumption and production.

Keywords: sustainable development, energy consumption, economic growth and environmental degradation.

1. Introduction

Energy certainly plays a vital role in economic development. Rapid urbanization and population growth has raised the demand for energy in most of the countries in the world. Since the 1997 economic crisis, there has been a steady rise in demand for energy. The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) stated that the energy demands in developing countries are projected to growth for around 87 percent by 2030 (UNEP, 2011). Much of this growth in energy demand will occur in Asia which is witnessing rising population, high economic growth and rapid urbanization. Many countries are averse to the notion of energy conservation and efficiency and consider it their priority to first ensure economic growth and deal with energy saving later.

The fact that more energy is required to be generated is placing increasing pressure on upstream energy resources such as crude oil, coal and natural gas, the reserves of which are being depleted. With the increasing issues of overdependence on fossil fuels especially on oil on the one hand, the energy sector also has to be responsible toward the effect of greenhouse gases (GHGs), global warming and climate change on the other challenges. The synergy between environment and economy are more pronounced now than ever before. Energy, environment and climate change are closely intertwined. A holistic and multi-disciplinary

approach is, however, needed to understand the complex linkages between them. Human activities was induced environmental degradation is the most complexity issues facing the world as a whole. A well-conceived energy efficiency strategy will not only allow them to achieve their goal with much lower energy consumption but also enable them to improve the living standards and quality of life, while making human and financial resources available for other aspects of societal development such as education and healthcare.

Hence many studies have attempted to test for causality between energy and economic growth and environmental degradation. This paper, therefore, will present some of the overviews of the existing knowledge on the impact of energy consumption and economic growth toward the environment.

2. Understanding Sustainable Development

The idea of sustainable development were widely recognised by the world leaders in the twenty-first century and the problem of global sustainability has become a common topic of discussion by journalists, scientist and citizens in many part of the world. In the subsequent decades, mainstream sustainable developing thinking was progressively developed through the World Conservation Strategy (1980), the Brundtland Commission or the World Commission on Environment and Development (WCED, 1987) and the United Nations Conference on Environment and Development in Rio (1992). Refer to the Brundtland Report, sustainable development defined as *“development which meets the needs of current generations without compromising the ability of future generations to meet their own needs”* (Brundtland, 1987). There is however no general consensus on an operational definition of sustainability. This is partly because sustainable development is seen as a dynamic process and not a static condition that can be clearly described. Thus World Bank suggest that sustainable development as the development that balance between the needs of economic, social and environment (Table 1).

Table 1: Sustainable Development Components (World Bank, 2005)

Economic	Social	Environment
Service Household needs Industrial growth Agricultural growth Efficient use of labour	Equity Participation Empowerment Social mobility Cultural preservation	Biodiversity Natural resources Carrying capacity Ecosystem integrity Clean air and water

Many of these objectives may seem to conflict with each other in the short term. For example, industrial growth might conflict with preserving natural resources. Yet, in the long term, responsible use of natural resources now will help ensure that there are resources available for sustained industrial growth far into the future. At the world summit 2005, sustainability was redefined as a reconciliation of environmental protection, social progress and economic growth. These three dimensions is best illustrated using the interlocking circles

		SREP (small renewal energy power program)
2002	Johannesburg Earth Summit, Rio	
2004		Ministry of Natural Resources and Environment
2005		National Physical Plan
2006		Malaysia Ninth Malaysia Plan – 4 th thrust (Improve Standard and Sustainability of Quality of Life) Renewal Energy – from waste to energy National urbanization Policy
2007	Bali roadmap toward international agreement on climate change	
2009	COP 15 - Copenhagen Accord	Ministry of Energy, Green technology and Water National Technology Policy 10 th Malaysia Plan

4. Sustainable Energy Sector in Malaysia

Over the years, government has formulated several policies and action plans to address Malaysia energy issues. The development of Energy policies in Malaysia started since 1970s with the introduction of National Petroleum Policy in 1975. This is then followed by the formulation of National Energy Policy of Malaysia in 1979 with the three main objectives of ensuring sufficient and reliable supply of energy, promoting efficient utilization of energy and reducing the negative impact of energy production on the environment. The latest National Policy on Climate Change launched in 2009 also highlights the Energy Efficiency in the supply and demand sector. Table 3 summarizes various key energy policies and acts over the last three decades.

Table 3: Energy-associated government policies and plans (Sin, Suhaida, & Peng, 2011)

Policy/act	Key emphasis
National Petroleum Policy (1975)	- Introduced to ensure optimal use of petroleum resources and regulation of ownership, management and operation, and economic, social, and environmental safeguards in the exploitation of petroleum due to fast growing petroleum industry in Malaysia
National Energy Policy (1979)	- Formulated with broad guidelines on long-term energy objectives and strategies to ensure efficient, secure and environmentally sustainable supplies of energy. It has Three main objectives: - Supply objective: To ensure the provision of adequate, secure, and cost-effective energy supplies through developing indigenous energy resources both non-renewable and renewable energy resources using the least cost options and diversification of supply sources both from within and outside the country - Utilization objective: To promote the efficient utilization of energy and to discourage wasteful and non-productive patterns of energy consumption - Environment objective: To minimize the negative impacts of energy production, transportation, conversion, utilization and consumption on the environment
National Depletion Policy (1980)	- Introduced to safeguard against over exploitation of oil and gas reserves. Thus, it is production control policy
Four Fuel Diversification Policy (1981)	- Fuel diversification was designed to avoid over-dependence on oil as main energy supply and aimed at placing increased emphasis on gas, hydro and coal in the energy mix
Electricity Supply Act (1990)	- Regulates the licensing of electricity generation, transmission and distribution

Gas Supply Act (1993)	<ul style="list-style-type: none"> - Regulates the licensing of the supply of gas to consumers through pipelines, prices, the control of gas supply pipelines, installations and appliances as well as safety
Five Fuel Diversification Policy (2001)	<ul style="list-style-type: none"> - Introduced in recognition of the potential of biomass, biogas, municipal waste, solar and mini hydro as potential renewable energy resources for electricity generation, SREP
Energy Commission Act (2001)	<ul style="list-style-type: none"> - The Energy Commission (or Suruhanjaya Tenaga) was established to provide technical and performance regulation for the electricity and piped gas supply industries, as the safety regulator for electricity and piped gas and to advise the government on matters relating to electricity and piped gas supply including energy efficiency and renewable energy issues. - The Electricity Supply Act 1990 and Gas Supply Act 1993 have both been amended to allow the Energy Commission to take over these responsibilities
National Biofuel Policy (2006)	<ul style="list-style-type: none"> - Supports the five fuels diversification policy. Aimed at reducing the country's dependence on depleting fossil fuels, - Promoting the demand for palm oil. Five key thrusts: transport, industry, technologies, export and cleaner environment.
The National Green Technology Policy (2009)	<ul style="list-style-type: none"> - Intensification of Green Technology research and innovation towards commercialization. Strong promotion and public awareness of Green Technology. Promotion of Green Building Index - Promotion of application of RE in commercial and residential buildings such as PV, rainwater harvesting, phasing out of incandescent lights
National Policy on Climate Change (2009)	<ul style="list-style-type: none"> - ST5-P2: Consolidate the energy policy incorporating management practices that enhances renewable energy (RE) and energy efficiency (EE). - KA19 - ST5 : Promote RE and EE for power generation through: - Burden sharing between government and power producers; - Establishment of EE and RE targets/standards; - - - Inclusion of RE in generation mix by power producers; and - Promotion of RE generation by small and independent developers including local communities.

5. Relationship between Energy Consumption and Environmental Degradation

The linkages between changes in economic activity and environmental degradation are complex and not easily predicted. Economic activity promotes wealth creation but has negative effects on the environment. The current production systems that used in industrialized countries have been generating vast quantities of waste and contamination, causing degradation to natural resources. These impacts are more severe when complemented by increasing on the number of population and lead to increases in energy consumption. Consequently, the later impacts are the greater atmospheric pollution.

A number of researchers have recently considered demographic factors in order to explain the sources of air pollution. The studies based on cross-sectional data by Cramer (1998, 2002) and Cramer and Cheney (2000) was evaluated the effects of population growth on air pollution in California and found a positive relation with the emissions level. Study in 2003 by York, Rosa, and Dietz found a direct relationship between population growth and carbon dioxide emissions and energy use. This result is constant to the study done by Dietz and Rosa (1997) which indicate that the elasticity of CO₂ emissions and energy use with respect to population are close to unity. A similar result was obtained by Shi (2003) and Cole and Neumayer (2004). These authors considered 86 countries during the period 1975–1998 and they found a positive link between CO₂ emissions and a set of explanatory variables including population, urbanization rate, energy intensity and smaller household sizes.

Several studies have discussed the presence of an environmental Kuznets curve (EKC) where the relationship between pollution and income is considered to have an inverted U-shape. These models frequently take emissions per capita for different pollutants as an endogenous variable, assuming implicitly that the elasticity emission–population is unitary. A few of them considered population density as an additional explanatory variable (e.g. Cole, Rayner, & Bates, 1997; Panayotou, 2000). A number of studies utilized total energy use as a proxy for total environmental impact. In this case, energy use per capita found significantly increases with income per capita (Cole et al.(1997) and Suri & Chapman (1998)). However, when energy intensity is considered as the dependent variable, it declines with rising income or even shows a U-shaped curve (Galli, 1998).

The relationship between energy use and income is a widely studied topic in the field of energy economics. Study among 30 OECD and 78 non-OECD countries shows the results indicate that causality from GDP to energy consumption is more prevalent in the OECD or developed countries than the non-OECD or developing countries (Chontanawat, Hunt, & Pierse, 2006). These results implying that a policy to reduce energy consumption aimed at reducing emissions is likely to have greater impact on the GDP of the developed rather than the developing world. Study in Pakistan found evidence that there exists bidirectional causality between energy consumption and economic growth in Pakistan. The rate of urbanization and its attendant impacts differ in regions across the globe (Alam and Butt, 2002). Reddy (2004) in his study stated that the origins of many global environmental problems related to air and water pollution are located in cities and this is called as the urbanization–pollution linkage. Asia’s urban population is expected to double in less than 20 years. Urbanizations reflect more than demographic change. As these countries urbanize, energy demand increases, food and other materials consumed in urban areas must be transported across greater distances. Urban manufacturing and industry also require more energy than traditional agriculture. In addition, the provision of infrastructure and services to new urban residents requires energy that is not typically consumed in rural settlements.

4. Conclusion

Energy use is already high in industrialized countries and is increasing rapidly in developing countries as they industrialize. But energy can be an instrument for sustainable development with an emphasis on more efficient use of energy, and an increased use of renewable energy sources. The need for energy efficiency (EE) solutions through renewable energy sources is now much emphasised. The “green growth” and “green economy” are likely to be achieved through green energy initiatives and green energy technologies development. These aim at increasing EE and achieving a low-carbon development, which in turn, can achieve an eco-efficiency. The “brown” versus “green” energy development debate draws much of the world attention today in the face of climate change. Energy conservation has been accepted as an important means towards the achieving target of sustainable development. Malaysia has formulated strategies and is implementing a number of programmes to promote energy efficiency (EE) and renewable energy in the country. The government will introduce energy

efficiency master plan for effective implementation of energy efficiency initiatives. The initiative will have to be market and commercial driven. Some policies may receive resistance at the beginning but in the long run it will create energy prudent and reaches to the target toward sustainable energy and development as a whole.

References

- Alam, S., & Butt, M. S. (2002). *Causality between energy and economic growth in Pakistan: An application of co-integration and error correction modeling techniques*. Pacific and Asia Journal of Energy, 12(2), 151–165.
- Brundtland, Report of the World Commission on Environment and Development: *Our Common Future*, World Commission on Environment and Development, 1987. Published as Annex to General Assembly document A/42/427,
- Chontanawat, J., Hunt, L. C., & Pierse, R. (2006). *Discussion paper Series Causality between Energy Consumption and GDP: Evidence from 30 OECD and 78 Non-OECD Countries*.
- Cole, M. A., & Neumayer, E. (2004). *Examining the impact of demographic factors on air pollution*. Population and Development Review, 26(1), 5–21.
- Cole, M. A., Rayner, A. J., & Bates, J. M. (1997). *The environmental Kuznets curve: An empirical analysis*. Environment and Development Economics, 2(Part 4), 401–416.
- Cramer, C. J. (1998). *Population growth and air quality in California*. Demography, 35(1), 45–56. Cramer, C. J. (2002).
- Cramer, J. C., & Cheney, R. P. (2000). *Lost in the ozone: Population growth and ozone in California*. Population and Environment, 21(3), 315–337
- Dietz, T., & Rosa, E. A. (1997). *Effects of population and affluence on CO2 emissions*. Proceedings of the National Academy of Sciences USA, 94, 175–179.
- EPU, Economic Planning Unit (2007). *Seventh National Plan*, Kuala Lumpur.
- EPU, Economic Planning Unit (2011). *Sustainable Development: An Overview. Advancing the Sustainable Development Agenda through aligning Malaysia Plans & Policies*. National Consultation Workshop United Nations Conference on Sustainable Development 2012
- Panayotou, T. (2000). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (Working Paper WP238, Technology and Employment Programme). Geneva: International Labour Office.
- Reddy, A. K. N. (2004). *Energy and Social Issue*. In T. B. Johansson & J. Goldemberg (Eds.), *Energy and the challenge of sustainability*. New York: UNDP, UNDESA and WEC.

- Shi, A. (2003). *The impact of population pressure on global carbon dioxide emissions, 1975–1996: Evidence from pooled cross-country data*. *Ecological Economics*, 44, 29–42.
- Sin, T. C., Suhaida, M. S., & Peng, L. Y. (2011). *Sustainability Development through Energy Efficiency Initiatives in Malaysia. ST-4: Green & Energy Management*, 4–5.
- UNEP, U. N. E. P. (2011). *Towards a green economy: Pathways to sustainable development and poverty eradication; A synthesis for policy makers*.
- World Bank. (2005). *World development indicators (WDI) 2005*. Washington.
- W.M.Adams and D.H.L.Thomas (2006). *Mainstream sustainable development: The challenge of putting theory into practice*. *Journal of International Development*. Vol.5, Issue 6, Page 591-604. Doi:10.1002/jid.3380050604
- York, R., Rosa, E. A., & Dietz, t. (2003). STIRPAT, IPAT and IMPACT: *Analytic tools for unpacking the driving forces of environmental impacts*. *Ecological Economics*, 46(3), 351–365.