INTERNATIONAL JOURNAL OF
ENERGY AND ENVIRONMENT

Volume 1, Issue 4, 2010 pp.705-714

Journal homepage: www.IJEE.IEEFoundation.org

Towards energy sustainability in the world: the implications of energy subsidy for developing countries

Joseph Iwaro, Abraham Mwasha

University of West Indies, W. Department of Civil and Environmental Engineering, St.Augustine Campus, Trinidad and Tobago.

Abstract
Energy subsidies are widespread around the world but they vary greatly in importance and type of fuel and country. The fossil fuel consumption rate is growing every year and in about 50 years we will have depleted most of our fossil fuel reserves, so it is necessary to find alternative sources of energy before that happens. However, the only solution to this challenge is through investment on energy conservation programmes and renewable energy source. In line with this challenge and confusion on fund appropriate for energy. This paper is aimed at examining the effect of energy subsidy on energy conservation and renewable energy in developing countries. The study intends to quantify and analysis a case study of Trinidad and Tobago energy subsidy and its implications for developing countries and energy sustainability in the world. Findings show that huge amount investments and government intervention were being expended on energy subsidy in order to lower the price of energy products for consumers. The study further identified implication of this growing subsidy for developing countries and that the funds could be used for creating renewable energy technology and energy conservation programmes.

Keywords: Sustainability, Energy, Consumption, Subsidy, Conservation.

1. Introduction

Experiences in developing countries show that energy consumption continues to increase rapidly due to economic growth and development. The price of fossil fuels is getting higher every year. As a result of that if the current consumption rate remains the same, proven oil reserves will last about 40 years. As for gas, it will be available for another 65 years if there are no interruptions in the supplies found in the Middle East and Russia, the world's largest gas and oil suppliers. Also, according to Bionomic fuel [1] proven coal reserves should last another 155 years, but if we run out of gas and oil before then, we might have to use more coal to substitute energy sources. Going by these facts, the fossil fuel consumption rate is growing every year so we have even less time before the energy starvation begins. This is because while energy demand is growing, fossil fuel reserves are being depleted. In about 50 years we will have depleted most of our fossil fuel reserves, so it is necessary to find alternative sources of energy before that happens.

Currently, the rate of fossil fuel consumption will continue to increase in most developing countries while their governments are spending fund on fuel subsidize to ensure sustainability. However, the only solution to this challenge is through investment on energy conservation programmes and renewable energy source. The existing renewable energy policy and energy conservation policy is not effective or

do not work [1]. As a result, renewable energy financing can be difficult, especially in the current economy, because finance is not widely available. Any conservation and renewable energy policy intended to put in place needs to address the differences in the way energy conservation, renewable energy and fossil fuels are treated by the government. In line with this challenge and confusion on fund appropriate for energy. This paper is aimed at examined the effect of energy subsidy on energy conservation and renewable energy in developing countries. The study intends to quantify and analysis a case study of Trinidad and Tobago energy subsidy and implications for developing countries and energy sustainability in the world. Thereby propose the need to subsidise energy conservation and renewable energy programmes rather than fossil fuel.

1.1 Energy subsidy and economy

Subsidies and price distortions take many forms and can be difficult to measure with precision. The most obvious are on- budget payments by governments to producers or consumers of energy. It is noted that many subsidies are off-budget, and therefore harder to detect and calculate. As such, Oil- and gas producing countries often sell these fuels to consumers at a price below their economic value as can be seen in most developing countries [2]. The forgone revenue or opportunity cost constitutes a subsidy to buyers. Similarly, electricity is sometimes sold to consumers below the short run marginal cost, and often below the long- run marginal cost. Therefore, assessing these implicit subsidies requires accurate estimation of the economic values involved. There can also be direct capital subsidies or tax benefits for energy producers [2]. In Egypt in 2006, for instance, energy subsidies were about 12 percent of GDP- a bit more than half on budget, the remainder consisting of implicit opportunity costs. Energy subsidies are among the largest social expenditures in government budgets. According to World Bank [2], they compared fuel subsidies from a recent IMF survey to public spending on health. Subsidies are 2 to 7.5 times as large as public spending on health in Bangladesh, Ecuador, Egypt, India, Morocco, Pakistan, Turkmenistan, Venezuela, and Yemen. Other sources point to additional countries with high subsidy to GDP ratios. Carey [18], using IMF reports for 2006, lists Algeria (7.5 percent), Syria (12.2 percent), Nigeria (2.0 percent), Trinidad and Tobago (0.8 percent) and Libya (15 percent). Indonesia's subsidies were $12 billion in 2005, and have since risen with fuel prices.

However, removal of fuel subsidy is expected to increase economy efficiency in the long run but in the short run people have limited options to react to price changes, especially where energy is rationed [2]. Some analysts also assert that demand is insensitive to price in the long run [3] while evidence shows that higher energy prices induce substantially lower energy demand. Dahl and Roman [4] reviewed 191 studies of energy demand since 1991confirmed that energy demand reduces by 7 percent, on average as a result of higher energy price.

1.2 Quantifying energy subsidies

Energy consumption subsidies are government measures that result in an end user price that is below the price that would prevail in a truly competitive market including all the costs of supply. Energy is most commonly subsidized through price controls, often through state owned companies. Consumption subsidies have been largely eliminated in the OECD, but remain large in some non-OECD countries. Energy subsidies in OECD countries are mainly directed to production and do not necessarily to reduce end-user prices below market levels [5]. According to analysis carried out in IEA Outlook [5] confirmed the prevalence of consumption subsidies in non-OECD countries. Total subsidies (net of taxes on each fuel) in the 20 countries assessed, which collectively make up 81% of total non-OECD primary energy use, amount to around $220 billion per year, according to 2005 data. On the assumption, that subsidies per unit of energy consumed are of the same magnitude in other non-OECD countries, world subsidies might amount to well over $250 billion per year. That is equal to all the investment needed in the power sector every year on average in non-OECD countries in the reference Scenario. Total subsidies to oil products amount to over $90 billion. Also, in the IEA energy subsidy analysis, the results of which were reported in [6], puts total OECD energy production subsidies at $20-30 billion per year. Furthermore, IEA [8] discussed price-gap approach and practical issues relating to its use in calculating subsidies and their effects. Energy subsidies were calculated using a price-gap approach, which compared final consumer prices with reference prices that correspond to the full cost of supply, the international market price, adjusted for the costs of transportation and distribution. This approach captures all subsidies that reduce final prices below those that would prevail in a competitive market. Such subsidies can take the form of direct financial interventions by government, such as grants, tax rebates or deductions and soft

loans, and indirect interventions, such as price ceilings and free provision of energy infrastructure and services. Simple as the approach may be conceptually, calculating the size of subsidies in practice requires a considerable effort in compiling price data for different fuels and consumer categories and computing reference prices. In the case of Russia, it has the largest subsidies in dollar terms, amounting to about $40 billion per year and most of these subsidies go to natural gas and the rest to electricity (which includes the under pricing of gas delivered to power stations). Subsidies of $25 billion per year to final consumption of gas are alone more than twice the annual investment projected for the entire Russian gas industry. Similarly, Iranian energy subsidies are almost as large, at an estimated $37 billion per year. Six other countries – China, Saudi Arabia, India, Indonesia, Ukraine and Egypt – have subsidies in excess of $10 billion per year each. In terms of fuels, the biggest subsidies overall go to oil products. Most of the countries included in this analysis were found to subsidize at least one oil product, notably gasoline, automotive diesel, kerosene and liquefied petroleum gas and other forms of energy product.

2. Research methodology

In order to examine the effect of energy subsidy on energy conservation and renewable energy in developing countries, a case study of Trinidad and Tobago energy subsidy will be analysed and quantified with the view to promote energy subsidy implications for developing countries. Trinidad and Tobago is a significant hydrocarbon producer with large reserves of crude oil, producing 165,000 barrels per day (bbl/d), of which 131,600 (bbl/d) is crude oil. Oil production has risen in the past several years with increasing rate of consumption per GDP and per capital due to increasing revenue from oil and gas. In 2007, Trinidad and Tobago consumed an estimated 29,000 bbl/d of oil, allowing it to export a sizable amount of its production EIA [9]. In recent years, the country's oil Production has begun to decline which has led to upward review of energy product prices and more allocation for energy subsidy.

3. Energy subsidy analyses and discussion

3.1 Analysis of energy demand and consumption in Trinidad and Tobago

The growth in energy consumption at the rate of 20 percent in year 2000 continues with increase in population; increase in per capital income and GDP. As a result, the country's oil reserves could be exhausted in less than a decade, unless significant new reserves are discovered. Besides, rising GDP and capital will continue to increase the demand for energy in different proportions [7] as further confirmed by EIA [9] energy consumption information on Trinidad and Tobago. Trinidad and Tobago is the Caribbean's largest producer of oil and gas. In 2002, oil production averaged about 141,500 barrels per day (bbl/d), of which 121,833 bbl/d was crude oil. Crude oil reserves, at an estimated 716 million barrels, are expected to last only another decade unless new reserves are found [10]. The energy consumption continues to increase without proportionate production while crude oil reserve has been declined since year 2007. In contrast, the country's natural gas reserves are expected to increase significantly in coming years. Proven natural gas reserves currently stand at 23.5 trillion cubic feet (Tcf). In 2001, the country produced 536 billion cubic feet (Bcf) of natural gas [10]. Trinidad and Tobago has become one of the major natural gas development centers in the world. Natural gas is expected to surpass oil as the main revenue earner for the country in the near future. According to the Trinidad and Tobago Ministry of Energy and Energy Industries, about 36% of its natural gas was exported in 2002 as liquefied natural gas (LNG), while the rest was used domestically [10].

3.2 Natural gas consumption in Trinidad and Tobago

Natural gas is used most extensively in Trinidad and Tobago, where natural gas-intensive industries, such as steel, fertilizer, and petrochemicals are important to the country's economy. Puerto Rico and the Dominican Republic import liquefied natural gas (LNG) from Trinidad and Tobago for power generation. In 2006, the country produced 1.3 trillion cubic feet (Tcf) of natural gas, up 25 percent and the country has benefited from a large amount of foreign investment into the sector, with BP Trinidad and Tobago (BPTT) leading these efforts. Other important players in the natural gas sector include British Gas (BG) and Chevron. Trinidad and Tobago is the largest supplier of LNG to the United States and one of the largest LNG exporters in the world [9]. However, there was a significant decrease in the natural gas reserve between 2006 and 2008. This scenario is expected to continue in the coming years due to increase rate of consumption of energy by different sectors of the economy such building sector, industrial, Transportation sector etc. Thus, shows the need for energy conservation programme and renewable programmes in the country with particular focus on building sector energy demand [11].

As a result of the above energy situation in Trinidad and Tobago, their economy is completely depends on the revenue from oil and natural gas exportation. The current short fall in natural gas reserve and decline in oil production has direct impact on the current price of energy products in the country. In an effort to ensure affordability of energy products for the citizens and ensure energy sustainability, the government has been subsidizing energy product for years with particular attention on gasoline and diesel oil. Subsidies are one of the palliative measures countries around the world employ to stabilize the effect of local prices of crude on the masses of their citizens. Globally, around $300bn (N35.3 trillion) is being spent on energy subsidies per year. It often comes in form of money mapped out by governments in their budgetary guidelines to shield citizens from paying the true price of petroleum products as obtainable in the international market [12]. This idea of subsidy is polarized such that developed economies are of the view that subsidies should be removed and the money so saved channelled into other development projects such energy conservation and renewable energy projects. Their reasons are that the poor who are meant to benefit from the subsidy do not do so; rather, it is the rich who feed fat on the subsidy. They argue that countries that subsidise fuel cause demand to continually rise steeply, threatening to outstrip the growth in global supplies. However, concern in the global oil market these days may be how much longer countries can keep paying the high cost of subsidizing energy products. If enough countries start passing on the true cost of oil to their citizens, it will invariably help to bring the oil market into better balance and lower prices.

Be that as it may, the emerging economies believe in the idea of protecting their citizens from the volatility of the international market. Fuel subsidies are common in oil-rich countries, like Venezuela, with her vast oil reserves. Others with subsidized fuel include Iran, Saudi Arabia, Egypt, Burma, Malaysia, Kuwait, China, Taiwan, South Korea, Trinidad and Tobago, Brunei, Nigeria, and the Australian state of Queensland. For this reason, the amount budgeted for a subsidy is peculiar to each nation. Historically, subsidies keep growing by each passing year as dictated by the price of crude oil at the international market. In some countries, it is insignificant, while in others a chunk of its annual budget goes into it. Some governments have met with stiff opposition from citizens. As the gap widens between soaring international prices and fixed domestic prices, developed economies rather than subsidizing the fuel, often place a tax on every litre of petrol sold, to discourage over-consumption while encouraging alterative energy source and energy conservation. All petroleum fuel products in Trinidad and Tobago are heavily subsidised as a deliberate policy of the government since 1974 with the passing of the Petroleum Production Levy and Subsidy Act. The legislation sets up a mechanism for the collection of a levy from oil producing companies and the payment of a subsidy to wholesaler National Petroleum (NP), a state operated company, to compensate for selling products to consumers at the fixed retail prices. Over the period 1996-2005 the petroleum subsidy amounted to US$655 million, or an average of US$65 million per year. The subsidy is also tax deductible for oil producing companies, so government also incurs additional opportunity cost in revenues foregone. A change in the tax regime limited the production levy to 3.0 per cent of the gross income from crude production but the cap was increased to 4.0 per cent in 2004, with the exception of companies producing less than 3,500 barrels per day (bpd). However, the introduction of the cap means that government bears the part of the cost not covered by the levy. Critics opposing the reduction of the gas subsidy say removing it will lead to an increase in inflation, but those who are for it say it could force Trinidadians to start conserving on energy usage and thinking of renewable energy source. Also, business operators were not satisfied with the former position, saying higher pump prices would put additional burden on consumers already battling high food prices. "It will impact very heavily on the cost of living. The cost of transportation will go up and there will be a drastic increase in the cost of goods and services"[13].

3.3 Analysis and quantification of energy subsidy in Trinidad and Tobago

The following table shows the different types of government interventions as well as the way these interventions work in order to establish subsidies on prices. Energy subsidies are any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers. Table 1 Shows government actions aiming at lowering energy product price to the consumer and also to lower the cost of production through direct financial transfer, direct and indirect taxation, and direct energy related services and energy regulation. The regulation is to ensure price control through lowering or raising the cost of production. In addition to this measure, government put in place legislation to set up a mechanism for the collection of levies from oil producing companies and the payment of a subsidy to wholesaler National

Petroleum (NP), a state operated company, to compensate for selling products to consumers at the fixed retail prices. The energy subsidy is also tax deductible for oil producing companies, so that government can also incurs additional opportunity cost in revenues foregone. The government action through taxation involved exemption on royalties, duties, and producer levies, tariffs, tax credit and depreciation allowances on energy supply equipment. Other forms of measures can be seen in the table 1. Below such as grants to oil producers, grants to consumers, lowering of interest rate and preferential loans to energy product producers and multinational oil retail companies.

Table1. Major works of energy subsidy in Trinidad and Tobago

Government Subsidy	Categories of Subsidy	Roles
Direct financial transfer	Grants to producers Grants to consumers Low interest Preferential loans to producers	Lowers cost of production Lowers price to consumers
Taxation	Rebates or exemptions on royalties, duties, producer levies and tariffs Tax credit Depreciation allowances on energy supply equipment	Lowers cost of production
Energy related services provided directly by government at less than full cost	Direct investment in energy infrastructure Public research and development	Lowers cost of production
Energy regulation	Price controls	Raises cost of production

This study analyses the specific case of subsidies for petroleum products such as: Liquefied petroleum gas (LPG), gasoline, diesel oil and fuel oil because these are tradable goods at the international level that count with international reference prices and because the subsidies aimed at these products are higher than the rest of energy sectors[14]. Energy subsidies in Trinidad and Tobago are mainly expended on Gasoline and Diesel Oil. This can be seen in table 2 where most of the government energy subsidies in 2005 to 2009 went for gasoline and diesel oil. This allocation policy can be attributed to the number of populace using gasoline and diesel oil. About 84% of populace uses these two energy products for domestic use, factory, industrial use, transportation, electric purpose etc. In table 2,the percentage of subsidy for gasoline increased from 23.8% in 2005 to 26% in 2009 and amount to a total subsidy of US$320million 2009. Over the period 1996-2005 the petroleum subsidy amounted to US$655 million, or an average of US$65 million per year. Also, the subsidy for diesel oil increased from US$81.35million in 2005 to US$236.8million in2009 with 48% increase over the previous years. This shows the huge amount investments and government interventions going for energy subsidy aiming at lowering the price of energy product for consumers.

Table 2. Energy product subsidies in Trinidad and Tobago

Liquefied Gas (MUS$)	Gasoline (MUS$)	Diesel Oil (MUS$)	Fuel Oil (MUS$)	Total/yr (MUS$)	
-	25.46	81.35	-	106.81	2005
	83.2	236.8		320.00	2009
	23.8%	76.2%		100%	2005
	26%	74%		100%	2009

Table 3. Energy subsidies based on share of GDP

Annual Subsides MUS$	Share of GDP to Subsidies %	
106.81	0.66	2005
288.06	0.8	2008
320.00	1.9	2009

The share of energy GDP to subsidies increases from 0.66% in 2005 to 1.9% 2009 which shows a total increase of 1.24% over the period of 4 years as shown in table 3. .Also, the annual subsidies increase from MUS$106.81 in 2005 to MUS$320.00 with an increase of MUS$213.19 over same period. According to World Bank statistic [14] the average of GDP's share to subsidies approaches 2.25% in Latin America Caribbean (LAC) countries. Among the sub regions, the Caribbean is the region with the highest share of GDP to subsidies, with an average of 2.8% of GDP. In South America, the average subsidy is 2.31% of GDP and in Central America, 0.7% of GDP. Also, Mexico with 0.6% of GDP to energy subsidy and Costa Rica 0.23 % [14]. More importantly, the average percentage of GDP assigned to energy subsidy in Trinidad and Tobago was 1.2% but, according to statistics of UNESCO 11, the average percentages assigned to education are between 5% to 2% of GDP while the shares of GDP aimed at subsidies for petroleum products reach 8.7% of GDP and have an average of 2.25% in other developing countries of the region.

Table 4. Targeting Subsidies on Diesel by sector

Sector	Million US$/yr
Ground Transport	172.9
National Marine use	18.9
Industry	23.7
Electric sector	14.2
Personal use	7.1
Total	236.8

Table 5. Targeting Subsidies on Gasoline by Sector

Sector	Million US$/yr
Ground Transport	79
Personal use	4.2
Total	83.2

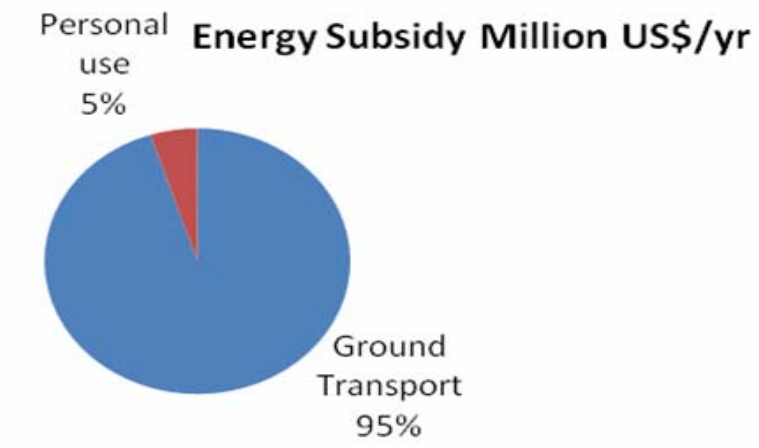

Figure 1. Targeting subsidies on Gasoline by sector

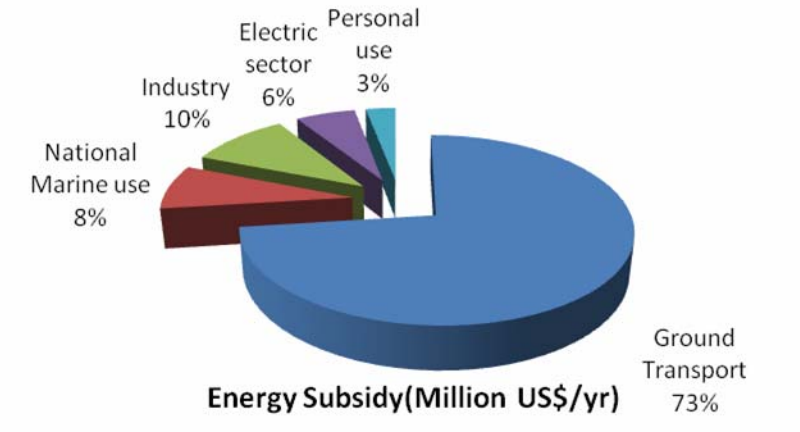

Figure 2. Targeting subsidies on Diesel by sector

The above figures show the subsidy destinations for gasoline and diesel by sectors. Under Diesel, 73% of the subsidies went for ground transportation sector which involved buses, trailers, trucks, mobile construction equipment and some cars. Closely followed was industrial sector with 10% energy subsidies, this was to cater for industrial machines and equipment in order to increase the production output of industrial products such building material, blocks, cement, roofing sheet and goods at a cheaper rate for consumers. Also, National Marine which involves big ships, boats received 8% of energy service aiming to provide services at lower rate while electric sector and personal use accounted for a total of 9% of the subsidies. Likewise, 95% of energy subsidy on gasoline went on ground transportation which involves taxis, buses, cars while 5% went from personal domestic use for small machines. This is aimed at lowering the retail price for premium and super which currently stand at average of 0.64US$cent per litre for premium and super (TT$4/L, premium and TT$2.70/L for Super).

According to this analysis, these statistics do not allow establishing the number of vehicles for private use and for public services (taxis, buses and other transportation vehicles), which hinders the identification of target beneficiaries of the subsidy. However, with low gasoline and diesel prices (subsidy), there is an incentive to buy vehicles for personal use and consume sumptuary goods. This should not be the goal of the subsidy and it is just a short benefit with long negative implications. In this sense, by subsidizing diesel and gasoline, there is an indirect subsidy on basic consumption goods. Therefore, an increase in fuel prices will lead to increase the cost of goods of the basic food basket, affecting the most deprived social groups [14]. This will lead to increase in the number of vehicles on the road and increase in national energy consumption. For this reason, the rate of energy demand will increase going by this analysis in figure 1 and figure 2 where about 84% of the energy subsidies for both gasoline and diesel oil went for ground transportation. This can be seen in table 4 and table 5, where ground transport received 172.9million US$ subsidies on diesel while ground transport under gasoline also received 79million US$ subsidies. This effort is aimed at making life affordable for the consumer and increases their disposable income. On the other hand, there will be an increase in purchasing power of the consumers and thereby increase the number vehicles on the road. The positive effects are the short time benefits while the negative effects are the long time consequences such as: increase in energy demand, fall in energy reserve, increase cost of living and lack of sustainable energy. In the long run, cost of living will increase while available fossils energy will be depleted. From this analysis, it is inferred that targeting diesel and gasoline subsidies in Trinidad and Tobago is a very complex process. However, this study has indicated the need to redirect energy subsidies to long run benefits such as energy conservation and renewable energy programmes instead of pursuing the current short time benefits. This approach will ensure energy sustainability and in the long run lower the cost of energy products for the consumers. More importantly, it will bring about complete elimination of energy subsidies which will make fund available to other important sectors of the economy.

4. Implications of energy subsidy for developing countries and energy sustainability in the world

4.1 Energy policy implications

Higher energy prices have important implications for energy policy. They reinforce the economic and energy-security benefits of diversifying away from imported oil and gas – a major policy objective of

IEA member countries as well as other oil-importing countries [3]. This can be achieved through efforts to stimulate alternative sources of energy, such as biofuels, other renewable energy technologies and nuclear power, as well as through energy efficiency measures. Market and regulatory reform can contribute to lowering supply costs, thereby offsetting at least part of the effect of higher primary energy prices. Most countries are considering a new stronger policies and measures to reduce oil-import intensity for economic, security and/or climate-change reasons. Such policies are of particular importance to countries with relatively high oil-import intensities. There is a large potential to improve the efficiency of energy use in developing regions, given the relatively inefficient energy capital stock currently deployed and the extent of the new investment in energy which is required there. Faster deployment of the most efficient technologies will be needed for this potential to be realized. All oil-importing countries would benefit from reduced imports in developing countries, as this would relieve upward pressure on international oil prices. The economic benefits from reduced oil-import intensity could be substantial in the longer term. In the Alternative Policy Scenario, new energy policies aimed at reducing energy import dependence and greenhouse-gas emissions will reduce the annual oil-import bill by $0.9 trillion for OECD countries and $1 trillion for developing Asian countries by 2030. China alone would save $0.5 trillion and India (OECD] [15].

4.2 Implication for developing countries and energy sustainability in the world

Many developing countries, especially in Asia and Africa, continue to subsidize implicitly or explicitly the consumption of energy services. In many cases, price controls prevent the full cost of higher imported energy from being passed through to end users. As a result, consumption does not respond to increases in the prices of imported fuels, so import costs remain unnecessarily high] 5]. This imported cost can also place a heavy direct burden on government finances and weaken the potential for economic growth. In addition, by encouraging higher consumption and waste, subsidies exacerbate the harmful effects of energy use on the environment. They also impede the development of more environmentally benign energy technologies. Although usually meant to help the poor, subsidies often benefit better-off households. Targeted and transparent social welfare programmes are a more efficient and effective way of compensating the poor for higher fuel prices. They could be funded by the budget savings from lower energy subsidies [16]. Energy subsidies are expensive, damage the climate, and disproportionately benefit the well-off. Their reduction can encourage energy efficiency, energy conservation and increase the attractiveness of renewable energy, and allow more resources to flow to poor people and to investments in cleaner power. Though subsidy reduction is never easy, the Bank has a record of accomplishment in this area, especially in the transition countries. About a quarter of Bank energy projects included attention to price reform. Improvements in the design and implementation of social safety nets can help to rationalize energy prices while protecting the poor [2].

Moreover, providing for global energy sustainability and security will require many vigorous actions at national levels, and considerable international cooperation. These actions and cooperative steps will need to be based on wide- spread public support, especially in exploring venues for increased efficiency of energy use. Also, it will be necessary to develop and deploy new sources and systems for energy supply, including clean use of coal and unconventional fossil resources, advanced nuclear systems, and renewable energy. Diversification of engine fuels, increased use of low-emissions technologies in personal transport, and greater emphasis in deployment of urban mass transit would introduce much-needed flexibility and economy in a rapidly urbanizing world [17]. Achieving an acceptable level of global energy sustainability and security will therefore require sustained governmental focus and international cooperation on identifying strategic energy policy priorities, and the sustained implementation of corresponding policies, actions, and national investments [17]. It will also be critical to involve the public and industry leadership in setting and achieving the key priorities, if we are to collectively deal with threats to energy sustainability and security in time to avoid major economic, environmental, and political damage. The common strategic priorities should include:

- Promotion of energy efficiency, including improving the energy efficiency and economic effectiveness of the energy system in a holistic way
- Diversification of energy supply and demand, as diversity of energy mix, sources, markets, transportation routes and means of transportation decrease vulnerability related to single or predominant sources and systems
- Development of global energy infrastructure with attention to its resilience

- Promotion of clean and affordable energy sources and systems, including advanced nuclear technologies and renewable systems
- Decentralization of energy production through development of local energy resources and systems

5. Conclusion

In this study, a case study of Trinidad and Tobago energy subsidy was analysed with the view to quantify the fund invested on subsidies by the government and promote energy subsidy implications for developing countries. Based on study conducted, the percentage of subsidy for gasoline increased from 23.8% in 2005 to 26% in 2009 and amounted to a total subsidy of US$320million in 2009. Over the period 1996-2005 the petroleum subsidy amounted to US$655 million, or an average of US$65 million per year. Also, the subsidy for diesel oil increased from US$81.35million in 2005 to US$236.8million in2009 with 48% increase over the previous years. Moreover, 84% of the energy subsidies for both gasoline and diesel oil went for ground transportation. Hence, the findings show that huge amount investments and government interventions were being expended on energy subsidy in order to lower the price of energy products for consumers. The study further identified implications of these growing subsidies for developing countries. It was found that, in the long run, these measures will bring about increase in energy demand, increase in cost of living, fall in energy reserve, uncertainty in energy sustainability and reduction in world energy market competiveness. Thus, suggests the need for alternative energy sources such as energy conservation and renewable energy programmes.

Acknowledgement

The author acknowledges the contribution of Latin America Energy Organisation (OLADE) and Climate Change and the World Bank Group whom their reports have served as a major reference in this study.

Reference

[1] Bionomic fuel: Fossil Fuel Reserve Will Not Last Long http://www.bionomicfuel.com/fossil-fuels-reserve-will-not-last-long / cited 2009

[2] World Bank: Climate Change and the World Bank Group-Subsides and Energy Pricing http:siteresources.worldbank.org/EXTCLICHA/Resources/climate_ESweb.pdf/cited 2009

[3] IEA (International Energy Agency). IEA, Paris. OECD/IEA, 2007

[4] Dahl C and C. Roman. “Energy Demand Elasticity— Fact or Fiction? A Survey Update.” In Energy, Environment and Economics in a New Era, 24th USAEE/IAEE North American Conference, Washington, DC, July 8–10, 2004. Cleveland, OH: IAEE

[5] World Energy Outlook. Paris: OECD/IEA, 2006

[6] Von Moltke A, McKee C. and Morgan T. Energy Subsidies, Greenleaf/United Nations Environment Programme, Sheffield, United Kingdom; 2003

[7] Saidur R. Energy Consumption, Energy Savings, and Emission Analysis in Malaysian Office Buildings. Energy Policy 2009; 37:4104-4113

[8] World Energy Outlook: Looking at Energy Subsidies: Getting the Prices Right. Paris: OECD/IEA, 1999

[9] Energy Information Administration (EIA): Trinidad and Caribbean Energy Information http://www.eia.doe.gov/emeu/cabs/caribbean/pdf /cited 2009

[10] Global Energy Network Institute (Geni): National Energy Grid http://www.geni.org/globalenergy/library/national_energy_grid.shtml /cited 2009

[11] Caribbean Information Platform On Renewable Energy (CIPORE): A Preliminary examination of Primary Energy Consumption. http://www.cipore.org /cited 2009.

[12] All Africa: Petroleum Subsidy and its Global Phenomenon http://allafrica.com/stories/200908250153.html/ cited 2009

[13] Jamaica Gleaner: Trinidad debates costly gas subsidy - Proposes cut in TT$2b support package http://www.jamaica-gleaner.com/gleaner/20080208/business/business6.html /cited 2009

[14] OLADE: Targeting Fuel Subsidies in Latin America and the Caribbean http://www.olade.org.ec/documentos2/subsidios_ENG.pdf ?cited 2009

[15] International Energy Agency (IEA)/United Nations Environment Programme (UNEP).Reforming Energy Subsidies, UNEP/OECD, 2002, Paris. Available at http://www.iea.org/textbase/papers/2002/reforming.pdf /cited 2009

[16] World Energy Outlook. Paris: OECD/IEA, 2007.
[17] InterAcademic Council (IAC): Energy Sustainability http://www.interacademycouncil.net/?id=10855 /cited 2009
[18] Carey, K. "Energy Subsidies in MENA." World Bank Regional Energy Brief. http://siteresources.worldbank.org/INTMNAREGTOPENERGY/Resources/ENERGYENG2008AM.Pdf/cited /cited 2009

Joseph Iwaro received his B.Eng in Mechanical Engineering from University of Ado-Ekiti, Ekiti Sate, Nigeria in 2004. He received MSc Construction Management from University of West Indies, Trinidad and Tobago in 2010. He is currently pursuing Ph.D degree at University of West Indies. He current research interest include: Integration of sustainable envelope for sustainable energy efficient design in building, modeling of envelope sustainable performance assessment tool and reducing building energy consumption through energy efficient building design.
Email address: iwaroayoola@yahoo.com

Abraham Mwasha obtained his PhD in Wolverhampton, England, Construction Management certificate at Ardhi/Rotterdam Institute of housing studies, Msc in Civil and Industrial construction in KIIKC, Air traffic controllers' certificate at Wilson Airport. His research interests include Problematic soils (expansive, collapsible, soft soils), Applications of sustainable materials in construction industry, waste management and renewable energy. He has published more than 10 research papers and also was first prize winner of the BIZCOM social enterprise award, organized by the MERCIA Institute of Enterprise for the idea of "NOVEL AND SUSTAINABLE TECHNOLOGY", recipient of competitive Trinidad and Tobago Government research grant and many other research grants. He is presently a lecturer in Department of Civil and Environmental Engineering, at the University of the West Indies, Trinidad and Tobago.
Email address: : amwasha@eng.uwi.tt.

