

R.I. Danabayeva

«ACHIEVING ENERGY SECURITY IN DEVELOPING COUNTRIES»

In recent years, the issue of energy security has topped the agendas of governments around the world. However the term 'energy security' can mean many things. From a developed-world perspective, policies to improve energy security normally focus on the means to secure low cost and reliable supplies of fossil-fuels for electricity generation and transport. For most OECD countries that are increasingly reliant on imported oil, natural gas, and coal, the key question is how to diversify these supplies of imported energy in order to reduce the risk of shortage [1].

While this is also a concern for many developing countries, energy security is also about meeting basic human needs at the household level, where per-capita consumption levels and the quality of energy supplies are often far lower than in OECD countries. As such, this policy briefing focuses on the connections between energy security at the household and national levels, from the perspective developing countries. Key policy recommendations focus on the need to expand the supply of renewable energy, while seeking to manage demand growth through energy efficiency measures.

Energy production and transformations significantly influence poverty, prosperity, women's work and lifestyles, and are affected by demand from urbanization and the population. Sustainable energy development attempts to provide energy services to satisfy basic human needs without compromising future generations or the environment. In Africa, per capita energy use is one-tenth of North America's and has not grown significantly in twenty-five years. Sustainable energy development also overlaps with energy security-the need for a reliable and adequate supply of energy.

At the national-level, seven out of the eight countries studied by GNESD are major net energy importers. In fact, energy import dependency (net energy imports as a percentage of total energy consumption) is over 40% in Senegal, Thailand and Tunisia, whereas in India, Kenya and South Africa, it is around 20%. In addition, the amount of energy imported in absolute terms has increased in all the countries during last few years. At the same time, most of the low income developing countries with high import dependency also show a high vulnerability to energy price volatility. For example, Kenya and Senegal spend more than half of their export earnings for importing energy, while India spends over 45%. In terms of final energy consumption, the share of the transportation sector in total oil consumption exceeds 40% in all the countries in the study, except India.

However, an overriding concern for energy policy makers in developing countries is the need to secure affordable, clean and reliable energy sources at the household level. In fact, domestic energy consumption tends to make up a far larger proportion of total energy demand in developing countries than in OECD nations. For example, 45% of India's total primary energy consumption takes place at the household level. However, households in many developing countries face the threat of insecure energy supplies due to a lack of access to electricity and clean cooking fuels [2]. For example, less than 8% of the Kenyan population has access to electricity, with 42% and 56% in Senegal and India respectively.

Even in areas where households are connected to the grid, supply interruptions are a common occurrence in many developing countries. The cost of energy also imposes a heavy financial burden on the majority of low-income households in developing countries. In Kenya, low income families spend more than 20% of their total income on energy commodities. In Brazil higher income households that depend entirely on electricity typically spend 3-5% of their income on energy, whereas low income households spend 10-20% of their income on energy. As such, rising international petroleum prices have a disproportionate impact on the poorest households in low income countries, and pose a challenge for countries aiming to increase access to cleaner modern fuels for low-income households, such as liquid petroleum gas (LPG). Indeed, there is already evidence of rising fossil fuel price having forced households down the energy ladder in

Senegal and Brazil, thus highlighting the direct connection between macro and micro-level energy security in many developing countries. If rising imported fuel prices are not managed then there is a risk that lower-income households will be forced into using more biomass sources, which in turn increases the risk of health problems and local environmental stress. Where these economic impacts are successfully managed, many developing countries face the challenge of ensuring sufficient and reliable energy supplies, especially of electricity, given that per-capita consumption is often very low but rapidly rising.

The quality of the energy supply is also an issue [3]. Most countries face problems of frequent energy supply disruptions and/or peak time electricity supply shortages. Interruptions of varying frequencies in the electricity sector are mostly due to a heavy reliance on a single resource (e.g., hydro in Kenya and Brazil), inadequate supply capacity and the lack of investment in infrastructure development to meet increasing demand (e.g., inadequate installed capacity in India and South Africa, insufficient oil refining and storage facilities in Senegal).

Policies and programs to address the energy security challenge In order to enhance energy security it is necessary to consider policies that reduce risks from both the supply and demand side. To this end, governments of developing countries are advised to diversify their sources of imported energy, while seeking to reduce a reliance on imported energy (especially oil) over the longer term. On the demand side, policies aimed at increasing energy efficiency are often the easiest and lowest-cost means to achieve greater energy security.

This is particularly the case in countries with diminishing marginal reserve capacities in the electricity generation sectors, where short term demand-side management is often quicker and cheaper than building new supply capacity.

The importance of renewable energy. In countries that have high net energy imports, there is a greater need and justification for expanding the role of domestic renewable energy sources. The barriers to expanding the supply of renewable energy are often the same across countries, principally a lack of financial subsidisation or incentives and limited access to appropriate technologies. In order to encourage large scale and sustained private investment in renewable energy, a combination of R&D-push and demand-pull measures are crucial in order to achieve cost competitiveness.

Examples from the GNESD country studies show that it is desirable for governments to establish dedicated and authorised agencies responsible for promoting, initiating and financing renewable energy projects and programs. Clearly set government targets are fundamental in giving confidence to private investors seeking to develop renewable energy projects. The success of the Brazilian bio-fuel programme was mainly due to clear and consistent policies and targets, as well as government subsidies, set at an early stage. initiatives, which can make use of renewable energy at peak periods (when prices are highest), are recommended since countries can operate with a lower capacity margin at peak hours, which would otherwise adversely affect the quality of energy and possible load shedding.

Small-scale biogas technologies are being promoted, with some success, in India and Kenya, as well as solar cookers in India, Argentina and Kenya and solar water heater program in Argentina, Brazil, Kenya, South Africa and Tunisia. Increasing access to electricity and other grid-based energy networks is recommended wherever possible. Several countries have initiated a number of programs to expand energy access, especially among rural and low income groups.

South Africa, India and Brazil have initiated programs aimed at providing universal access to modern energy services, mainly through electrification which opens the door to an array of grid-connected renewable energy technologies, from large-scale wind farms to household level solar-PV.

Affordability of sustainable energy is a major concern, especially among low income households, in developing countries. As indicated, low income households spend a significantly higher share of their total expenditure on energy (about 18% in Argentina and Thailand, and over 20% in Kenya) than their higher income counterparts. They are therefore particularly vulnerable to increases in energy prices, underlining the need for properly designed

energy subsidies – at least in the early stages of introducing cleaner fuels. Here, it is crucial that subsidies should be properly targeted to cover only the poor. Subsidised natural gas in Argentina and LPG in India provided benefits which were too often received by higher-income households [4]. However, if successful, subsidies should be removed at an appropriate time, such as during a period of low energy prices, or, ideally, when income levels have increased among the target households. What about biomass?

With regard to fuels for cooking and heating, households in developing countries continue to depend heavily on biomass, thus occupying a position at the bottom of the energy. Key policies for promoting renewable energy technologies and markets. Tried and tested means to promote investment in renewable energy include the introduction of feed-in tariffs, net-metering, and tax credits, while governments must lead efforts to support necessary R&D. The ‘adder’ program, which was introduced to small-scale power producers in Thailand, has also been successful. This is where the price of electricity generated from renewable energy is decided by a public competitive bidding system, with the government providing additional revenue to energy suppliers depending on the energy source.

After a renewable technology becomes mature, it is left to compete on the open market. The promotion of solar cookers in India is an example of a renewable energy technology that was initially promoted through several incentives, including government subsidies, but which later became competitive in the open market. Thus, governments can intervene with market creation policies at an early stage of technology development, without having to commit to long-term subsidies. Similarly, in the Brazilian bio-fuel program the government offered a variety of incentives including low-interest loans to build distilleries, ethanol purchase guarantees and favourable pricing relative to gasoline, as well as retail tax breaks until biofuels were able to compete without subsidies in 2005.

In Thailand, ‘conventional’ policies such as financial incentives and tax exemptions have also attracted private sector investment in bio-fuel development programs. However the government actively promotes the consumption of bio-fuels through mandatory consumption policies and attractive pricing structures. Renewable energy at the household level. The household sector can also benefit from the renewable energy projects and the development of infrastructure facilities such as extended grid networks and storage facilities, so that the citizens can access improved energy services. Following positive experiences in Brazil and Tunisia, it is evident that the promotion of renewable energy technologies at the household level, such as solar hot water systems, can help in reducing peak demand in the national grid [5].

The heavy dependence on biomass energy is due to either a lack of access to clean energy sources or the inability to pay for them where they exist, reflecting a need to address wider development goals. However, energy security at the household level can be achieved by promoting the efficient use of biomass energy on one hand, and increasing its availability and its substitutes on the other hand. Here, a number of insights can be gained from the GNESD studies. Technologies such as efficient cook stoves can radically reduce indoor air pollution and the heavy burden on forest resources. India provides the best example of promoting energy efficient cook stoves: 35 million household units were installed between 1987 and 2003, saving an estimated 10 million tons of fuel wood per year [6]. Renewable energy sources can also substitute biomass as a cooking fuel. In India the government provided initial support for the market in household solar cookers which now competes with conventional technologies.

Energy efficiency: the other side of the coin. The introduction of demand management programs can help to reduce total energy demand growth, and thus help achieve energy security at both the national and household level. Key policies include energy consumption reduction targets, taxation, flexible financing mechanisms, energy labelling, performance standards, and awareness raising campaigns. Among the GNESD country studies, Argentina, India, South Africa, Thailand and Tunisia are promoting compact fluorescent lamps, while India and Kenya are also promoting improved cook stoves at the household sector. One of the best examples of government commitment to improving energy efficiency is the Thai government’s support through the

ENCON fund, which is generated from a tax imposed on petroleum products. The ENCON fund provides low interest loans to private investors to finance energy efficient installations and programs. Elsewhere, experience suggests that consumer awareness campaigns can make a significant impact in improving energy efficiency, at a low cost.

Economic growth has always entailed an increasing demand for energy, of which electricity constitutes a major part. As a matter of fact, since 1970, each increase of 1% in GDP has been accompanied by a 0.64% rise in energy consumption (IEA WEO, 2000) [7]. Even though United Nations forecasts estimate that the world population will stabilize around 2075 due to ongoing demographic transition, economic growth itself and the demand for rising living standards in developing and transition countries will still form a considerable force propelling the need for ever increasing energy sources. According to the IEA World Energy Outlook 2004, energy demand will be rising by 60% between 2002 and 2030.

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Бұл мақалада ұлттық нанотехнология мен наноөндіріс ұйымдарымының дамуымен айқындалған алдағы уақыттағы әлемдік энергетикасындағы өзгерістер баяндалады. Әсіресе, жеке мемлекеттерге «энергетикалық кедейшілік» мәселесіне көп көңіл аударылып, қорытынды даму нәтижелеріне талдау жасалып, мәселелер суреттелінеді.

В статье рассматриваются перспективные изменения в мировой энергетике, обусловленные развитием национальных нанотехнологических инициатив и организацией наноиндустрии. Дается характеристика современного состояния энергетики: мировых ресурсов нефти и газа и развития атомных энергетических станций. Особое внимание уделено проблеме «энергетической бедности» отдельных стран и итогам деятельности «Группы восьми» по вопросам глобальной энергетической безопасности.