

ENERGY SECURITY: EVALUATING NATIONAL CONDITIONS IN THE GLOBAL CONTEXT

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OVERVIEW

This paper presents the methodology and early findings of the analysis of national energy security conditions in the world conducted for the Global Energy Assessment [1]. In contrast to other studies which rely on aggregated metrics to compare national energy security conditions, we develop and apply a national energy security assessment framework (Fig. 1) to identify and assess vulnerabilities specific for each national energy system. Our framework uses a contextualized assessment of national energy systems taking into account their the propagation of potential vulnerabilities between their elements: supply, infrastructure and demand. Rather than comparing aggregated energy security metrics the framework identifies specific vulnerabilities which differ from one country to another. We also seek to map the resulting generic condition of energy insecurity which can be compared across countries.

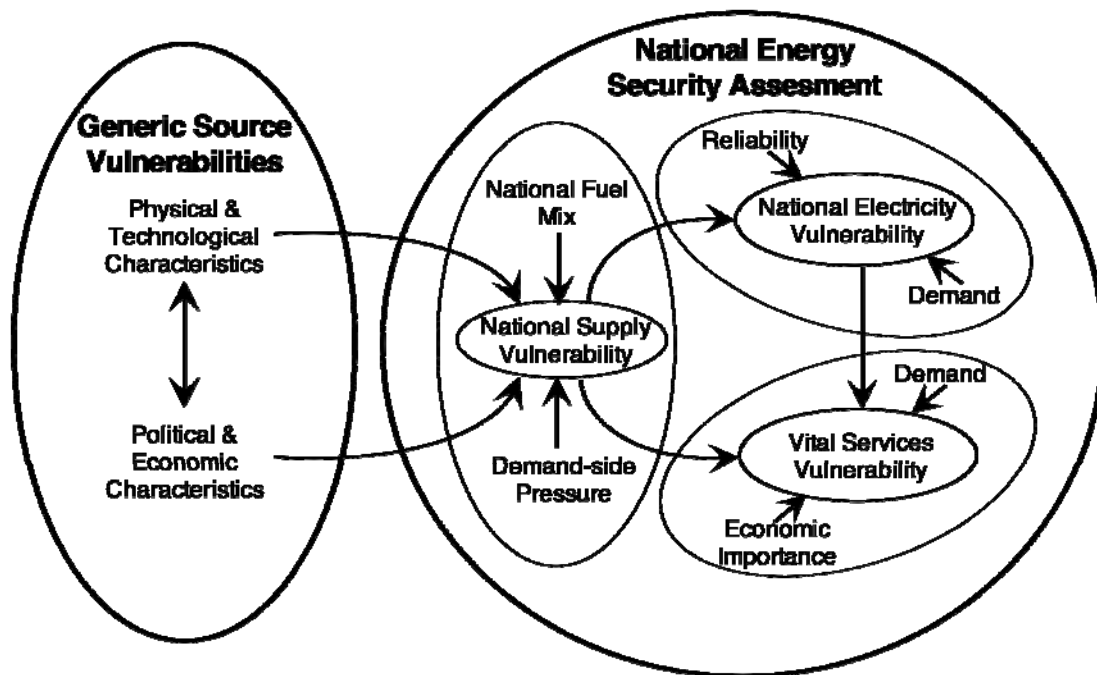


Fig. 1. National energy security assessment framework used in Global Energy Assessment [1]

METHODS

The framework is applied in five consecutive steps focusing on vulnerabilities of primary energy sources, electricity production and end-uses as well as cross-sectoral vulnerabilities. By including energy exports as an “energy end-use” the study makes it possible to apply the same method of analysis to both energy importing and energy exporting countries. At the final end of the analysis we use 23 indicators for 135 countries [2] to map energy security challenges.

RESULTS

The most prominent energy security concerns relate to the oil sector. Over 3 bln people live in 83 countries importing over 75% of their oil consumption. An additional 1.7 bln people live in countries with oil reserves-to-consumption ratio under 15 years. Insecurities of oil supply affect primarily the transport sector. The situation is especially grave in 17 countries (1.7 bln people) where transport energy consumption has grown for more than 8% per year over the last decade.

Oil is not the only energy source causing widespread energy security concerns. Almost 650 mln people live in 32 countries which import over 75% of their gas needs. In addition, 12 countries (780 mln people) have their reserves/consumption ratio of natural gas under 16 years.

Insecurities also affect those countries which rely on nuclear power for their electricity supply. Twenty-one countries (1.3 mln people) with existing nuclear power programs have not started constructing a new reactor in the last 20 years and 19 countries (1.4 bln people) have an average age of their nuclear power plants over 25 years. The nuclear power programs in these countries would need to be either “re-launched” or phased out.

These vulnerabilities of energy sources affect the security of national electricity systems. In 39 countries (600 mln people), over 50% of electricity production is based on imported fuels. Some 4.2 billion people live in 53 countries which will need to massively expand the capacity of their electricity systems in the near future because they either have less than 60% access to electricity or an average demand growth of over 6% over the last decade.

In the residential sector, 39 countries rely on imported fuels for over 50% of energy consumption. In addition, 25 countries use traditional biomass for over 80% of their residential energy.

Some 15-20 national economies significantly rely on revenues from energy (primarily oil) exports. In the majority of these oil-exporting countries the revenues are not expected to last for more than one generation and in several cases they are likely to cease in less than a decade. In addition, poor energy-exporting nations are at a high risk of the ‘resource curse’: economic and political instability eventually affecting human development and security.

Forty-six countries (700 mln people) have a total energy import dependency over 50%. Fifty-eight countries (1 bln people) rely on just one or two PES for most of their energy supply. Costs of energy imports exceed 20% of export earnings in 35 countries (2.5 bln people) and exceed 10% of GDP in 15 countries (200 mln people). In 18 countries (1.8 billion people) the energy consumption has grown over 6% for the last decade signaling a strain on their energy system.

CONCLUSIONS

Very few, if any, countries can currently be considered energy secure. Moreover, the number of such countries is likely to decline in the next decade or two. Whereas the primary energy security concern of most industrialized countries is import dependency and aging infrastructure, many emerging economies have additional vulnerabilities such as insufficient capacity, high energy intensity and rapid demand growth. In most low income countries, supply and demand vulnerabilities overlap making them especially insecure.

REFERENCES

1. IIASA. 2010 Global energy assessment. www.globalenergyassessment.org
2. IEA. International Energy Agency: Statistics. 2009.