Title: Assessment of Asian Energy Security Index in the Context of Global CO_2 Mitigation

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Overview:

Asian countries are currently facing growing energy demand and energy security issues. In addition, they have to link energy policy and climate policy under global pressure of CO_2 emission mitigations. This paper is focusing on "energy security index" to answer the following questions:

- How will energy security index change in Asian countries in Baseline scenario?
- How will it change in CO_2 Mitigation scenario?
- What is the relation between mitigation and energy security? Is it synergy or trade-off?
- Are there any differences by region?
- If any, what are the factors for the regional differences?

Methods:

We evaluate energy security index by country by using results of an energy systems model, which we called DNE21+.

1) Energy security index

In this paper, we evaluate "energy security index" by region up to 2050 by using results of DNE21+. The concept of energy security depends on time factor, geographical dimension and overall context. Individual specialists could focus difference risk factors and end points. The variety of individual views also affects the energy security concept.

We simply formulate "energy security index" to represent the energy insecurity and to conduct better communications. The concept of formulation in this paper is similar to IEA (2007); however, we make some minor changes. The formulation is focusing on dependency of imported oil and gas and these fuel's geographical concentrations.

2) Energy systems model: DNE21+

DNE21+ is used for evaluation of fuels trade matrix. The model is an optimization type model, minimizing the total world energy system costs over all the assessment period. The world is divided into 77 regions including in-country divisions (e.g., Akimoto et al., 2010). The model analysis includes the following CO_2 emission scenarios:

- Baseline scenario (scenario without additional CO_2 mitigation policy)
- 50/50 scenario (halving global CO_2 emission in 2050 relative to 2005)

Expected Results:

1) In 2005, the evaluated energy security indices show that Asian countries, such as China and India, are relatively vulnerable.
2) In Baseline scenario, the results indicate that energy security indices in Asian countries become more vulnerable in 2050. This is because they concentrate imported oil and gas on few regions (Middle East and/or Russia).
3) In 50/50 scenario, the energy security indices in Asian countries become more and more vulnerable in 2050. This is because i) they have less CO_2 storage potentials compared to the expected huge energy demands, and ii) imported gas becomes a major substitute for domestic coal.
4) In contrast, the indices of Western Europe and North America are stable in both scenarios. Geographical condition makes it economical activity to diversify their oil and gas imports.
5) For Asian countries, it would be difficult to achieve both targets: i) improvements of energy insecurity situations and ii) CO_2 mitigations. This is quite different from the results in Western Europe and North America.
6) More regional-specific discussion is required.

References:

Akimoto, K., F. Sano, T. Homma, J. Oda, M. Nagashima and M. Kii, 2010. Estimates of GHG emission reduction potential by country, sector, and cost, Energy Policy, Vol.38, Issue 7, pp.3384-3393.

IEA, 2007. Energy Security and Climate Policy, Energy Policy, Assessing Interactions, OECD/IEA, Paris.