29 June 2017
Issue 491
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Source: García-Gusano, D., Iribarren, D. & Garraín, D. (2017). Prospective analysis of energy security: A practical life-cycle approach focused on renewable power generation and oriented towards policy-makers. *Applied Energy*, 190: 891–901. DOI: 10.1016/j.apenergy.2017.01.011.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

European Commission

Science for Environment Policy

Renewable energy's role in national energy security rated by new index

Researchers have developed a new indicator for policymakers, which shows the strength of renewable-energy technologies for electricity production in a country's energy security. They compare their Renewable Energy Security Index (RESI) to the carbon footprint, in that it is easy to report and practical to use in energy policy.

Energy security, defined by the International Energy Agency as 'the uninterrupted availability of energy sources at an affordable price', is affected by a wide range of economic and technical factors. These include dependence on imports, accessibility, social acceptability, infrastructure and governance.

This new index, RESI, takes account of a number of these factors to help policymakers give a score to their country's energy security, based on the share of renewable technologies within the national electricity production mix. Although it does not take account of all possible influencing factors on energy security or cross-border flows of renewable power, the researchers behind its development say that it provides the right balance of comprehensiveness and practicality. Akin to the carbon footprint, it is an easy-to-report measure for energy policymakers, which can be used to assess both current and future energy security.

To calculate a RESI score, the values of two key factors are summed up, using an equation which also considers the availability rate of energy from the transmission grid. The two factors are:

- **Electricity Demand Satisfaction (EDS)** Broadly speaking, this considers whether national demand can be optimally met through all available power-generating technologies. It covers a number of technical and economic factors which determine an optimal energy system, including set-up and operating costs.
- **National Renewability Factor (NRF)** This considers how much energy used to power each energy technology itself can come from domestic renewable sources (as opposed to imported and/or fossil-fuel sources, for instance, which reduce energy security), which is calculated through life-cycle assessment. For example, the researchers give hydropower a very high NRF value of around 98–99%, whereas fossil and nuclear sources, which use non-renewable resources, have an NRF value of 0%.

A RESI score is typically expected to be below 1, and the researchers suggest that it would be 'sensible' for policymakers to aim for a score of 0.8. Countries which already have a high score could develop policies to maintain that score, they also suggest.

Using Eurostat data, they calculate that the average RESI score for the EU-28 was 0.25 in 2014. However, this score varies greatly by country: Austria has the highest score, approaching 0.7, followed by Sweden at 0.6, and Portugal and Croatia, which both have scores above 0.5.

The researchers also demonstrate the index's use in detail with two case-study countries, Spain and Norway. Currently, 60% of Spain's electricity comes from fossil and nuclear sources, but this share could drop to 23% by 2050 with a corresponding rise in renewable sources (assuming 'business-as-usual' energy policy, with no new emissions targets). The RESI score would, in this case, rise from 0.36 to 0.65.

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However, with an 80% CO_2 emissions reduction target in place, Spain could achieve a RESI score of 0.86 in 2050 due to near-100% renewable supplies. This score could be higher but is kept down because of the NRF values of the renewable technologies in use, and some dependence on energy imports.

Norway is calculated to have a fairly consistent RESI score of around 1 between 2014 and 2050, even under business-as-usual policy — nearly 100% of its energy sources for electricity production are renewable, and it is an exporter, rather than importer, of electricity.

The researchers encourage energy policymakers to use the index as part of the transition from fossil-based to renewable-based power-generation technologies, as it promotes a sustainable model of electricity supply using domestic resources which are both available and affordable. Their Norwegian and Spanish case studies prove it is feasible, they add.

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