

Renewable Energy Market Competence Index part 1: The methodology

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ABSTRACT

A methodology for quantitative and objective Renewable Energy Market Competence Index is developed. The proposed index includes 18 different quantitative indicators; among them 13 are general indicators covering the political, economical situation of the country, and the energy sector, and 5 are technology specific that change from a renewable energy technology to another. In this part of the work, data are collected for the 13 general indicators for 8 Arab countries and 10 benchmark countries. In addition, the methodology of calculating the final index is presented.

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1. Introduction

With the world energy crisis intensifying year after year with the depletion of fossil fuel, especially oil, governments, investors, and research institutions are moving fast to exploit the available potential of renewable energy resources worldwide. It becomes of interest to governments that have large renewable energy potential, and have the need to exploit them to show the huge market they have to attract investors. Equally important, governments would like also to show – if exist – that they have very good industrial base, qualified personnel, and good incentives for renewable energy projects which all make the renewable energy market of the country very competent relative to other countries. On the other hand, it is also of interest to investors to be able to identify countries that have large renewable energy potential with very open and attractive business conditions. All of these demands by these different players can be met with the existence of an index that can *quantitatively* measure the competence of renewable energy market in different countries.

While there are many indices in literature developed by international institutions, organizations, international consulting firms, and by many researchers, few exist for the energy sector. In 2007, Volkan Ş. Ediger et al. developed the Fossil Fuel Sustainability Index to measure the sustainability of oil, natural gas, and coal of different countries [1]. On the other hand, since 2003, Ernst & Young, a leading international consulting firm in business development, is publishing its Renewable Energy Country Attractiveness Indices on quarterly basis [2]. While the later index now includes more than 40 countries and covers all types of renewable energy technologies, the index is partially objective and partially subjective. The subjectivity component of this index arises from the fact that a good part of the information collected is based on open essay questionnaire that are evaluated based on the experience of the operating team. The aim of this work – that is presented in 2 consecutive papers – is to develop an index that is exclusively objective and thus independent of the experience of the evaluator.

In this first part of the work, the full hierarchy of the proposed index is presented along with description of all involved 18 indicators, where only general indicators will be calculated. This paper is organized as follows; Section 2 sets the assumptions in countries' governments that are needed to properly interpret the values of indicators. Section 3 shows the overall hierarchy of the proposed index. Section 4 introduces the list of countries, the data sources, the index type, and score range of the final index. Section 5 discusses 3

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indicators covering the political and economic situation of the country. Section 6 discusses 8 indicators that map the energy sector of the country, followed by Section 7 that covers financial and environmental issues. Section 8 is dedicated to discuss the 5 technology specific indicators where no data is provided for these indicators as they will be applied to the Concentrated Solar Power (CSP) technology in a separate paper as a second part of this work. After describing all 18 indicators, Section 9 illustrates the methodology to calculate the proposed Renewable Energy Market Competence Index followed by conclusion in Section 10. In part 2, this methodology will be applied to CSP technology and thus the final index score and rank will be calculated and determined respectively.

2. Assumptions in countries' governments

When developing an indicator, first a *value* for the indicator is calculated which relates to physical parameters, then this value is transformed into a *score* that matches the min/max range, and the objective of creating an index that represents the competence of this market to RE business. Thus, it becomes important to set a criterion by which this value should relate to the final index. While in some cases these criteria are self-explanatory, in many of the proposed indicators these criteria relay on how the government reads these values and thus how they are going to react to them. Accordingly, some properties had to be assumed in the governments of the countries that are included in the index in order to direct the indicator score to point towards the designed direction of the final index. These assumptions are:

1. *Good governance*: Each country's government acts for the benefit of its citizens. Thus, its choices, and plans are made to meet the energy needs of the country to fulfill the required economic growth and prosperity of its citizens.
2. *Knowledge-based decisions*: Each country's government is well informed about fossil fuel depletion (especially oil and natural gas), the hazardous effects associated with the waste of nuclear fuel and thus switching to RE resources is an unavoidable decision.
3. *Environmentally friendly government*: Each country's government actively and responsibly tries to reduce its CO₂ emission in order to avoid global warming effect.

3. Renewable Energy Market Competence Index hierarchy

A country's market competence towards RE projects involves many factors. Some of these factors are common to all types of RE technologies and others are technology specific. Accordingly, and as shown in Fig. 1, the proposed index is made of a number of indicators that are categorized into two groups, a *general indicators* group and *technology specific indicators* group. The former group is common to all RE technologies and is divided into three subgroups:

1. Political and economic indicator (3 indicators).
2. Energy sector indicator (8 indicators).
3. Financial and environmental indicators (2 indicators).

When calculating Market Competence Index for a certain technology, the technology specific indicators shall be calculated amounting to only 5 indicators. At the end, the final RE Market Competence Index shall be calculated based on the weighted index of each specific technology index as their share in the world market.

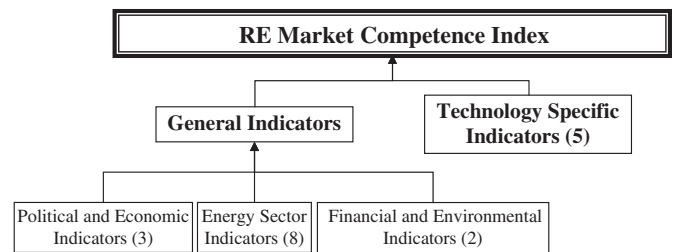


Fig. 1. The hierarchy of the Renewable Energy Market Competence Index.

4. Countries, data source, index type, and score range

Since a great deal of this research work was carried out when the leading author was residence at the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), all 13 member states in the RCREEE center were originally considered. Unfortunately, due to data limitation, 13 indicators – out of total 18 – were missing for *Palestine*, 3 indicators for *Bahrain, Iraq, and Sudan*, and 1 indicator for *Yemen*. Thus, the final list of countries excluded these 5 member states. In addition, another 10 benchmark countries covering all continents, with various economical and energy situation, potential, and policies were added as well. Thus the addressed countries are:

8 *RCREEE countries*: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Syria, and Tunisia.

10 *benchmark countries*: Brazil, Turkey, Spain, Greece, South Africa, Malaysia, India, China, USA, and Germany.

The data needed are collected from different sources. 6 indicators' data are collected from the International Energy Agency (IEA), 3 indicators from REN21-2011 global status report, 2 indicators from Central Intelligence Agency (CIA) World Fact Book, and 1 indicator from each of the following: DLR, World Bank, World Economic Forum, Economic Intelligence Unit, Transparency International, and Springer publisher.

As for the most famous indices, the proposed RE Market Competence Index is designed to be a backward index. With standardization to 100 points, the final index ranges from 0 meaning least competent, up to 100, meaning most competent. Accordingly, all indicators that constitute the whole index are also designed to have the same range and meaning.

5. Political and economic indicators

Since the general political and economical situation of the country shape the whole business environment and thus affect the investment activities in all sectors including the RE one, it is important to include some indicators in the final index to incorporate these effects. Three existing indices that quantitatively measure these effects are included in the proposed index; namely:

- Global competitive index
- Political instability index
- Corruption perception index

These 3 indices are annually published by the World Economic Forum, The Economist magazine, and Transparency International respectively. In order to fulfill the index scoring rule, the original reported scores are linearly mapped to the proposed range. Since low scores for both global competitive index and corruption perception index mean low competitiveness and high corruption respectively, thus their mapping to the proposed index takes the form:

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