COST EFFICIENCY ASSESSMENT OF EUROPEAN RES SUPPORT SCHEMES

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Overview

EU regulation requires EU Member States (MSs) to switch from administratively determined Feed-in Tariff (FIT) or Feed-in Premium (FIP) schemes to competitively determined FIP or Green Certificate (GC) support schemes for new RES-E installations from 2017. There are some exemptions to this rule, demonstration projects and small sized ones can still receive administrative FIT or FIP. This new regulation brings to the end the long era of the administrative RES support schemes in most EU countries. Although administrative support schemes (when the regulator, or responsible ministries determine the support level to RES generators) were effective, as they increased significantly RES investments, EU competition regulation asks national regulators and ministries to introduce competitive pricing of RES support in order to increase cost efficiency of such support.

CEER (Council of European Energy Regulators) come out with its latest Status Review on RES support schemes in the spring 2017 (CEER 2017), which provides a unique database for RES-E generation. The data is unique, as it provides information on the supported RES-E, so the part of RES-E generation that does not receive support (mainly large hydro) is excluded. Second, as the source of information are National Regulatory Authorities (NRAs), it provides a verified, reliable and harmonised source of information on the support level of the various MSs. The focus of this paper is on wind and PV based renewable generation, as these were the less mature technologies (with higher technological learning potential) in contrast to the conventional hydro and biomass based generation. In addition these two technologies (wind and PV) give the bulk of new RES-E investments, as 91% of new RES-E investments in 2016 belong to these two technologies [1]. Folowing the stoctaking of physical deployment of various RES sources and the related CEER investment figures, the paper also gives an overview of the different economic analyses on the effectiveness of RES support schemes in Europe [2-5].

Methods

We have built a cost efficiency indicator (CEI) calculated for the EU member states (plus Norway) separately for the PV and wind technologies for 2015 based on the CEER data and utilising additional information on consumption. The indicator is calculated as follows:

$$CEI_{2015,country} = \frac{Q_{tech,country} \times (Cost_{tech,country,2015} - P_{country,2015})}{Cons_{country,2015}}$$

, where

$Q_{tech,\ country}$: Supported quantity in a given technology in a given country
$Cost_{tech,\ country,\ 2015}$: Supported amount in a given technology in a given country
$P_{country,\ 2015}$: Wholesale price in a given country in 2015
$Cons_{country,\ 2015}$: Electricity consumption in a given country in 2015

This indicator is than used in a Data Envelope Analysis (DEA). DEA is a well established methodology to measure technical and economic efficiencies of observed units, generally called Decision Making Units (DMUs) characterised by more inputs and/or outputs in their transformation processes. Since applied by Charnes [6] to operational research, users of the methodology applied it to measure production efficiency of DMUs (see DEA applications for RES [6-7]). A second widespread area of application is to use it for benchmarking the DMUs in any processes characterised by multiple inputs and outputs, e.g. in management science or in operation research. In our case we apply a benchmarking DEA method, using output oriented CCR model.

Results

Two DEA models were executed, one with both inputs applied, while in the second case only CEI is contrasted with the renewable shares of the assessed countries, while the LCOE (Levelized Cost of Electricity) is disregarded. This allows for decomposing the LCOE effect (reflecting financing conditions and utilisation rates of RES in a given country) from the support level.

Wind generation: The results indicates that four countries: DK, IE, NO and SE have cost efficient support schemes, so Nordic countries perform quite well in the DEA assessment. A second group of countries, DE, EE, LT, LU, PT, and RO are above 0.5 score (average of 0.68), so these countries compose a second group with better than average performance, while the rest of the countries are performing quite poorly in this DEA assessment, showing that high level of inefficiencies exists in their overall support schemes (average of 0.28). The decomposition of the financing effect (switching off LCOE from the DEA inputs) results in high reduction in DEA scores for DE, DK, IE, UK, PT and RO. This indicates that in case of the first four countries probably the very advantageous financial conditions (low level of WACC) make the support schemes better performing in the reference case, while in the latter two countries (PT, RO) the utilisation rates are the main reason behind the deteriorating performance.

PV generation: The DEA results show a very different picture of the cost-efficiency of PV support schemes in Europe compared to wind generation. It indicates that four countries: CY, IT, MT and RO have cost efficient support schemes, but three additional countries: DE, ES and GR perform quite close to the leading group (average score of 0.9). So countries having high utilisation performance (Southern European countries) as well as Germany with its very advantageous financial environment perform well in the reference DEA model. Interestingly DK and BE also perform quite well in the PV assessment, with efficiency scores above 0.6. When looking at the DEA model without the LCOE impacts, however, BE, CY, DE, GR, IT and MT lose their good performance, underlying the fact, that both the financial environment as well as the utilisation rates are even more determining factors than in the case of wind generation. In this sensitivity case Romania remains the unique country with cost-efficient support scheme and only DK and MT remains over the 0.5 DEA score, while for the rest of the countries the gap toward RO further widens, and situates below the 0.3 DEA score.

Conclusions

The results indicate, that wind and PV support schemes work quite differently when cost-efficiencies are measured in the EU countries. While in most countries we can observe significant cost-efficiency improvement in PV, wind generation support schemes show deteriorating trends concerning cost efficiencies in most countries. This is probaly due to lower learning rates, and the site effect of wind : best performing sites occupied first. However unit support of wind generation is still more efficient than for PV in general. Only few countries reach parity in the CEI indicator, e.g. Romania.

Early mover countries (such as Germany, Spain, Czech Republic – countries starting investment earlier) in the PV technology have worse performance in the CEI indicator, but many of them manged to improve their performance in the second part of the assessed period (2011-2015). This is not the case for wind generation support schemes, where Germany, Austria, Italy and France show deteriorated cost-efficiency in support.

References

[1] CEER: Status Review of Renewable Support Schemes in Europe, 2017

[2] R Haas, C Panzer, G Resch, M Ragwitz, G Reece, A Held: A historical review of promotion strategies for electricity from renewable energy sources in EU countries, Renewable and Sustainable Energy Reviews, Volume 15, Issue 2, 2011, Pages 1003-1034

[3] R Haas, G Resch, C Panzer, S Busch, M Ragwitz, A Held: Efficiency and effectiveness of promotion systems for electricity generation from renewable energy sources – Lessons from EU countries, Energy, Volume 36, Issue 4, 2011, Pages 2186-2193

[4] S.Szabó, A.Jaeger Waldau, M.Szabó, F. Monforti-Ferrario, L.Szabó, H.Ossenbrink: European renewable government policies versus model predictions, Energy Strategy Reviews, Volume 2, Issues 3–4, 2014, Pages 257-264

[5] C.G.Dong: Feed-in tariff vs. renewable portfolio standard: An empirical test of their relative effectiveness in promoting wind capacity development, Energy Policy, Volume 42, 2012, Pages 476-485

[6] Charnes A, Cooper, WW, Rhodes E 1987: Measuring the efficiency of decision making units, Operational research 2(6), 429-444

[7] T Sueyoshi, M Goto: Photovoltaic power stations in Germany and the United States: A comparative study by data envelopment analysis, Energy Economics, 42 (2014) 271–28[8] San Cristóbal J R: A multi criteria data envelopment analysis model to evaluate the efficiency of the Renewable Energy technologies Renewable Energy, Volume 36, Issue 10, 2011, Pages 2742-2746