Ulrike Lehr and Barbara Breitschopf

WHO BENEFITS FROM RENEWABLES? – ECONOMIC IMPACTS OF RENEWABLE ENERGY ALONG THE VALUE CHAIN

Ulrike LEHR, GWS mbH, Heinrichstr. 30, 49080 Osnabrück,
+49-541-409-33-280, lehr@gws-os.com , www.gws-os.de
Barbara Breitschopf Fraunhofer ISI, Competence Center
Energy Policy and Energy Markets, Fraunhofer Institute for
Systems and Innovation Research ISI, Breslauer Str. 48, 76139
Karlsruhe, Germany, Phone: +49 (0)721 6809 356

Overview

The discussion on renewable energy technology (RET) deployment has recently shifted from "why" to "how". Renewables contribute an estimated 22% of global electricity production and comprise more than half of net total additions to global electricity capacity in 2012 (REN21, 2013). Economic aspects have primarily entered the debate from the cost side and have resulted in the creation of different financing mechanisms and suggestions on how to allocate the additional costs of RET. Though the cost debate is important, other economic aspects remain to be addressed, especially since RET prices are falling rapidly. More and more governments are interested in capturing additional economic benefits of RET deployment in terms of establishing competitive industries, creating value added and stimulating employment.

The challenges for turning RET *deployment successes* (measured in terms of capacity installed, electricity produced etc.) into socio-*economic successes* (measured in terms of jobs or value-added) are manifold. The initial experience in industrialized countries was that RET industries developed in parallel with deployment, and thus deployment success equaled economic success. However, recent market development seems to indicate that this strong tie might be broken. New competitive players in the field, notably from China, have entered the market and had some economic success before strong domestic deployment plans were put in place.

This paper /builds on the results of a study commissioned by IEA-RETD, which considers the whole value chain of renewable energy technologies – mainly solar and wind – and identifies the economic impacts in each phase of the value chain. In a second step, policies recommendations are developed from the experience of countries with a mature RE industry and from success and failures of other industries to enhance value creation from renewables. It turns out that there is no single "one-stone-one-bird" solution, but the support along the value chain requires a policy mix. Details of this policy mix are presented for clusters of countries according to their respective degree of RETD and industrial development.

Methods

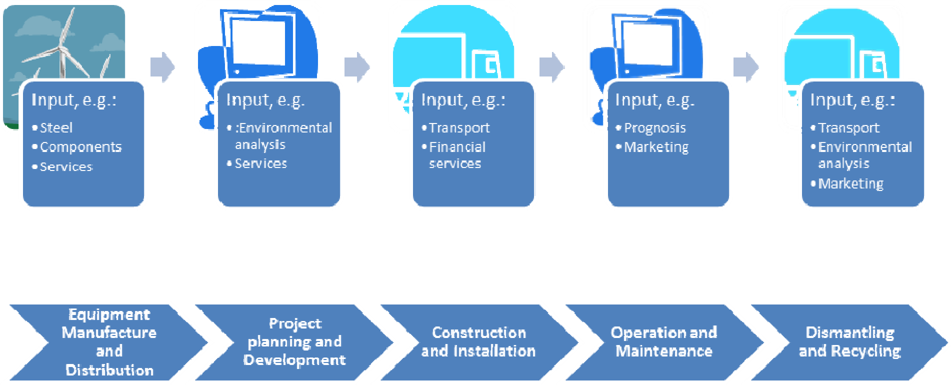
To illustrate the full economic impact of renewable energy technology deployment (RETD) the analysis in this paper includes direct and indirect economic effects. Direct economic effects stem from the technology producers themselves, for instance from the production of wind turbines or solar modules. Indirect effects originate in the production of intermediate inputs for these producers. THE economic tool to analyze direct and indirect effects is input-output analysis. IO tables contain the production technology of any economic sector. They denote the delivery of inputs to other sectors and the demand for inputs from other sectors. Within this systematic, several countries and regions have developed IO vectors for the renewable energy technologies, which are produced in the respective countries. For Germany, this research was supported since 2004 and has yielded the third update of renewable energy IO vectors in 2013 (O'Sullivan et al 2013). Similar approaches led to RE vectors in the MED-Impact project led by DG Energy and Climate (DGEC), the French Development Agency (AFD) and the Treasury Department., the US (Garret Peltier 2009) and Greece (Markaki et al. 2013).

Application of the IO approach provides the quantitative background for the identification of the relevant sectors for first order effects and second order effects. Additionally, results from case studies on the experience of more mature RE industries and other more mature economic sector help to identify niches for countries who want not only participate in the environmental benefits of RETD, but also increase the domestic economic benefits from entries in the RE value chain. The policy mix analysis applied in this study is a bottom-up analysis that identifies the main actors and inputs needed to generate value from RETD. Furthermore, it is complemented by a system-analytic approach that includes the potential of resources, economic activities and the use of RET. The supporting policies fall into demand side policies, supply side policies as well as crosscutting policies in different areas.

Results

Value creation from renewable energy deployment along the value chain differs largely in scale, location, temporal duration as well as challenges for the labor force in terms of qualification. First round effects occur at each step along the value chain (bottom of fig 1.) and second round effects from the production of intermediate inputs, raw materials, components etc.

Figure 1: Value chain in RET



RE technologies differ among themselves regarding the value-added share on the first round, and therefore also regarding the share of material inputs needed and the value creation in other sectors. The paper provides details about the input structure (material and imports) as well as the structure of material inputs for wind and PV industry. The data a calibrated against the results of bi-annual industry survey in Germany. The figure shows that up half of the economic impact of RET deployment goes to second round effects, 15% to imports of inputs and 35% goes to first round domestic value added (numbers are given for PV, slightly different for the wind industry). The result shows how the wider economy can benefit from RET deployment AND how countries can capture value from RET deployment and from RET production without necessarily going into first round production.
The policy analysis in the paper answers the question, how countries can identify their respective niche in the value chain, considering first and second round effects.

Table 1: Success factors along the value chain

Relevant factors:	Domestic industry structure		Sectoral structure	Human resources
	Proximity to existing production	Cluster quality	Integration along the value chain	Skilled workforce
Metals	++	+	+	++
Machinery	+++	+++	+	+++
Electrical devices	++	+	++	++
Electronic parts	+++	++	++	+++
Process and controls	++	++	+	++
Construction preparation	+			+
Installation, construction	++		+++	+
Trade, whole sale		+	++	+
Banks			++	+
Insurance			+	+
Industrial services	++	++	+++	+++

+++ high importance, ++ medium importance, + low importance, blank: not relevant, own compilation.

Conclusions

One **central lesson** that emerges from this study is that a mix of policies from different policy areas such as financing, fiscal, education, R&D policy - addressing RET demand (market), suppliers (firm or sectors) as well as main input factors, in particular human resources and capital – is necessary to successfully generate value creation from RET deployment. This mix will be very country specific and no general applicable “one for all policy set” can be recommended. However, the lessons learnt for the appropriate RE value creation policy mix can be structured with the following questions:

- What is the domestic RET deployment status, RET industry structure and knowledge and R&D intensity?
- What is the expected local, regional and global market development?

- How strong is global competition?

The questions can guide policy makers to localize their current status and to prioritize value creation policies. Depending on the status of RET deployment (solar and wind) and industry, knowledge and R&D intensity countries can be roughly grouped into four cases:

Case 1: Countries which have large levels of RET deployment, strong RET industry as well as R&D intensive industries (e.g. Germany, Spain, Denmark, Japan, China, and the US, to a lesser extent Italy, and Brazil).

Case 2: Countries which have some levels of RET deployment, but weak RET industry, little R&D intensive industry e.g. (Morocco, Tunisia, India, Turkey, South Africa, and Mexico).

Case 3: Countries which have neither large RET deployment nor RET (PV or wind) industry but strong knowledge and R&D intensive industries (e.g. Netherlands, UK, Russia, Canada, France[1]).

Case 4: Countries which have no (or very low) RET deployment, no RET industry, no R&D intensive industries (e.g. most African sub-Sahara countries, Gulf Cooperation Countries, Middle East).

References

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[1] Ignoring here hydro power or biomass.