**Cross-Border Cost Reductions from PV Capacity in Germany**

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## Overview

The Energiewende in Germany is unique in how far the transformation in the energy system will go. It is also unique in its contribution to growth in electricity generation from renewable energy sources. For example, in the early years of the new millennium more than fifty percent of global capacity additions in solar power came online in Germany. At the same time, the costs of solar power, both in terms of capacity (US$/Megawatt) as well as per unit of energy (levelised costs of electricity generation, US$/Megawatthour), decreased significantly.

The literature (an overview can be found in Rubin et al., 2015) mostly agrees that installing capacity leads to cost reductions. This is described as “learning”, “learning rates” are defined as the reduction in electricity generation costs per doubling of installed capacity. This paper brings together the German Energiewende with cost reductions in renewable energies.

## Methods

Firstly, we look at module prices for PV installations. We use module price data from 2000 until 2015. Secondly, we analyse how much solar power was built in Germany. As we feel it will be interesting for the participants of the USAEE 2017 conference, our work also gives a brief quantitative assessment of the German Energiewende’s costs and a qualitative overview of potential associated benefits. Thirdly, we will analyse the share of the German capacity additions with respect to global PV expansion, i.e. what share of total solar electricity generation capacity was built in Germany. Lastly, we calculate how much the German share contributed to global learning, i.e. cost reductions for solar power. This is done following Rubin et al.’s statement that “„[…] by far the most common model used in the energy literature to forecast changes in technology cost is the ‘*one-factor learning curve*’ (or ‘experience curve’).” Hence, we assume cost reductions are exclusively caused by building capacity.

## Results

Resutlts show that Germany contributed to cost reductions in particular in the first decade of the new millennium. At the end of 2009, PV prices had declined from 11,242 USD/kWh in the year 2000 to 8,406 USD/kWh . Based on a one-factor learning model, Germany contributed around 46 % to that decline. Even at the end of 2015, Germany still had contributed around 1/3 to total cost reductions (see following figure).



## Conclusions

An analysis of how much investment in one country causes cost reductions in other countries is of importance beyond the specific case of German because it adds advantages to renewable energy promotion which are often neglected when cost-benefit-analysis are discussed. Furthermore, by showing that “spill-over” effects to other countries are significant, the results can have implications for setting up optimal renewable promotion schemes worldwide.

## References

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