COULD A REAL LEVEL-PLAYING FIELD IN MIDDLE EUROPEAN ELECTRICITY MARKETS BY A FULL INTERNALIZATION OF ENVIRONMENTAL COSTS TRIGGER THE REQUIRED ENERGY TRANSITION?

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Overview

Many instruments have been tried out or proposed to enable an energy transition to significantly reduce energy-related carbon dioxide (CO2) emissions. In the middle- European electricity market these are mainly feed-in-tariffs (partly with a market premium) for renewables with the goal of pushing more renewables into the electricity system. The backlash of todays middle-European electricity market occurs in two parts: first, the increase in costs for households and (partly) industries through the feed-in reallocation charge; and second, the negative CO2-effects due to the low coal price leading to an increase in the use of coal for power generation. Additionally economists criticize the market distortion accompanied with this feed-in-tariff-system. In fact the market distortion is two-fold. On the one side, environmental costs are almost not included in electricity generation costs, on the other hand renewables are artificially subsidized. This paper analyzes how a real level-playing field in the middle-European electricity market would look like - one which is fair and not distorted as environmental costs are not transferred to society and to future generations, but are internalized into electricity generation costs enabling the energy transition to bring Germany and Austria on a sustainable track.

Methods

The paper starts with a literature review to assign realistic costs to main environmental effects of all types of electricity production. Based on these costs, the change in the order of levelized cost of energy (LCOE) for existing types of power generation given the full internalization of environmental costs is calculated for today and for 2030 based on expected cost developments for the middle-European electricity market. The effects of a changed LCOE order on average wholesale prices are simulated with the new ECIM(Environmental Cost Internalization Model)-tool based on guiding scenarios for the electricity market of the German Ministry of environment (Pregger 2013). The resulting energy system is compared with possible low-carbon energy systems to qualify the ability of a real-level-playing field electricity market with full internalization of environmental costs to enable a sustainable energy transition. Based on these results, a refined electricity tax and duty model is proposed for Germany and Austria to keep retail power prices in the same range as with todays market set up. The net tax effect for the two countries based on additional tax income by an environmental internalization tax and reduced standard electricity tax income is calculated. This enables an overall comparison of the proposed real-level-playing field electricity market with full internalization of environmental costs and today's two-fold distorted middle-European electricity market in regard to the advantages and disadvantages for all power generation types, private households, state budget and future generations.

Results

The levelized costs of energy in the middle European electricity market today are in ascending order hydro-nuclear-coal-oil-gas-wind-PV-biomass-biogas with an average wholesale price on the EEX Leipzig of 5 Cent/kWh (Pregger 2013, Heuskel 2013). The German Federal Environmental Agency publishes official environmental cost rates of all types of energy taking into account direct (during energy production) and indirect (plant build up, etc) emissions, especially greenhouse gas emissions as well as air pollution effects. The environmental costs for electricity generation (based on environmental damage costs of 80 Euro per tonne of emitted CO2) are for different types of coal 8.9-10.8 Euro Cent per kWh, natural gas 4.8, oil 8.1(UBA 2013). Renewables also have environmental costs attributed with hydro 0.18 Euro Cent, wind 0.26, PV 1.18 and biomass 3.8 Euro Cent per kWh. Internalising these environmental costs through an environmental cost tax results in a new, fundamentally different LCOE order (hydro-wind-gas-PV-oil-coal-biomass-biogas) with 4-8 Euro Cent/kWh for hydro and wind, 11-12 Euro Cent/kWh for natural gas and PV and 15+ Euro Cent/kWh for

coal, oil, biomass and biogas. Environmental costs of nuclear power have an enormous bandwidth and there are no undisputed numbers today. In our study for the German and Austrian electricity market nuclear can be neglected for the new ascending LCOE order as its phasing out is planned for political reasons (only existing capacities and no new power plants are taken into account in this study).

What is the effect of a full internalization of environmental costs on wholesale prices? Based on the guiding scenarios for the German electricity market of the German Ministry of environment (Pregger 2013) as well as our own calculations with the ECIM-tool, the new average wholesale price based on the new merit order would more than double reaching 11-12 Cent/kWh. As (small) hydro, wind and PV are now within the average wholesale price no (standard) subsidies are needed for these renewable technologies. The same applies to natural gas where investments would make sense again. Investments in new coal- and oil-fired plants are not economically reasonable in an electricity market with full internalization of environmental costs leading to the continuous decarbonisation of electricity generation. Biogas, biomass and existing coal-fired plants could take over their role to additionally balance intermittent renewables triggered by an additional reserve energy market. The resulting electricity mix fits well to what most energy experts describe as the mid-term electricity mix for a sustainable, low-carbon but nuclear-free electricity system with no new coal-fired plants, but additional natural gas-fired plants (plus 10 GW in 2030) required (Pregger 2013). The "bridging" system with hydro, wind, PV and natural gas enables a sustainable path from today to 2030 after which natural gas should be replaced by renewable power hydrogen, renewable power methane or similar carbon-neutral storable energy types in order to finally arrive in an almost carbon-free electricity system in 2050 (Sterner 2009, Pregger 2013).

What is the effect of a full internalization of environmental costs on final customer prices? The German retail power price in 2013 of 28 Euro Cent entails a feed-in-surcharge of 6.2 and further fees and taxes of 4.5 Euro Cent not including value-added taxes. The feed-in-surcharge would decrease drastically for two reasons: first, as the average wholesale price doubles the difference to the feed-in-tariffs is reduced cutting the feed-in-surcharge instantly, second (almost) no new subsidies are required for future renewable investments which will let the feed-in-surcharge disappear in some years. As the environmental cost tax creates an additional income for the State, the State could easily reduce other fees and taxes on electricity. This could be used together with the inherent disappearance of the feed-in-surcharge to keep the final customer price on the same level as today. More details including a proposal for a refined electricity tax and duty model for Germany and Austria will follow in the final version of the paper. Altogether the result could be a middle-European electricity market with retail power prices (for private households) on the same level as today based on a refined electricity tax system, with market forces driving the full utilization of renewable capacities wind, hydro and PV, but also enabling the usage of natural gas as the main bridging technology replacing coal, oil and nuclear.

Conclusions

Internalizing environmental costs, which are today transferred to society or even future generations, into electricity production costs would bring a shift in the electricity markets towards environmentally-friendly energy sources and at the same time would enable a true level-playing field for all electricity producers. Today this level-playing field is distorted two-fold: on one hand, environmental costs of fossil fuels and nuclear power are not attributed to the ones who bring them into the system but to the (future) society. On the other hand, renewables are subsidized to enable them to enter the electricity markets. This two-fold distortion should be removed resulting in a new electricity production merit order. Ecological absurdities like replacing natural gas power plants with coal power plants are almost impossible in a market which fully incorporates ecological costs. The proposed real level-playing field electricity market with internalization of environmental costs is much better suited to enable the energy transition towards environmentally-friendly energy resources as compared to todays market design. In this alternative system no general subsidizing of renewables is necessary, large investments in renewables as well as fossil bridging technologies can be done based on stable boundary conditions. Private households and the state are neither winners nor losers based on a budget-neutral tax reform accompanying the level-playing field electricity market. In fact, the winners will be future generations who would have to carry the main burden if today's energy system was not transformed along a sustainable path.

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