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ON INTEGRATING LARGE SHARES OF RENEWABLES IN ELECTRICITY MARKETS

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ABSTRACT

In recent years increasing shares of renewable energy sources (RES) have changed the usual pattern of electricity markets especially in Western Europe remarkably. Due to this, currently, the development of electricity markets respectively the whole electricity system is at a crucial crossing. On the one hand, the way to a sustainable electricity system based mainly on RES could be paved in the next years. In this context we emphasize especially the considerable price decreases of PV which has brought this technology close to cost-effectiveness on household level.

On the other hand, there are forces which try to retain the old centralized fossil and nuclear-based generation planned economies. Among these is ironically also England

The core objective of this paper is to discuss the relevance and the effects of such a system and the alternatives.

Our core objective is to show how to cope with these shortcomings. Most important is to include a broad portfolio of flexibility options which already exists today but is not fully harvested due to low economic incentives. In this paper we show in detail how for specific load profiles and generation patterns a portfolio of flexibility options can bring about a virtually carbon-free electricity system. The most important options to balance variations in residual load are:

- short-term and long-term storages – batteries, hydro storages, or chemical storages like hydrogen or methane;
- technical demand-side management measures conducted by utilities like cycling, Load Management, e.g. of cooling systems)
- Demand response due to price signals mainly from large customers to price changes, time-of-use pricing time-of-use pricing
- Transmission grid extension leads in principle to flatter load and flatter generation profiles;
- Smart grids: They allow variations in frequency (upwards and downwards regulation) and switch of voltage levels and contribute in this context to a load balancing
- More flexibility in the organization of the market is required;
- In addition, to harvest the full potential of the links have to be extended to transport and heat.

However, currently the market does not yet provide the proper price signals to trigger this flexibility options. Today we have actually a very flat and low price curve over a year.

Straightforward, the major conclusion is that these flexibility options will only then be harvested when sufficiently high price signals from the electricity market trigger these options, when “the exploration principle in the markets work”.