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Analysis of different flexible technologies in the Spain NECP for 2030

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Abstract-

This paper proposes three dimensions relevant to the flexibility assessment: power gradient (i.e., ramps), power during critical hours, and energy available at different timescales. A two-phase procedure analyzes an electric system’s flexibility to cope with renewables’ integration. The first step determines the margin on the three flexibility metrics. The second one runs a cost-based operation model to determine how these dimensions are covered. The ramp margin computed shows that a critical net demand ramp happens when solar power reduces its generation, but the projected Spanish system in 2030 can still cope with this upward ramp. Different flexible technologies cover the weekly energy variation of the net demand (demand minus non-dispatchable generation). This shows the high contribution of storage hydro and open-loop pumped-hydro storage to this variation. Flexible technologies supply upward and downward ramps of the net demand. Batteries and new closed-loop pumped-hydro storage are the storage technologies that contribute the most to these net-demand ramps. We also show that existing and new closed-loop pump-hydro storage generate more in the critical net-demand hours, having a high capacity factor, almost double the batteries.

Index Terms- flexibility assessment, flexibility margin analysis, firmness, ramps, net demand

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