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Trade-offs between Energy Efficiency improvements and additional Renewable Energy supply: A review of international experiences

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Energy is a commodity used worldwide, representing a vital input for social and economic development. Due to continuous growth, energy demand has increased. Solutions have been proposed in order to satisfy the increase in demand, often implying the increase of capacity of the power mix. Meanwhile, current issues concerning climate change and fossil fuels depletion has moved attention towards cleaner ways to produce energy. This trend facilitated the breakthrough of renewable technologies. Since then, support policies have promoted the large deployment of renewables, without considering enough improvements made in the energy saving field. Indeed, less attention has been paid to implement energy efficiency measures in energy systems modeling, which has resulted in scenarios where expedients for a wise use of energy (e.g. energy savings and renewables' share) are unbalanced and cost-savings opportunities are missed. The aim of this paper is to review and evaluate international experiences on finding the optimal trade-off between efficiency improvements and additional renewable energy supply. A critical review of each technique, focusing on purposes, methodology and outcomes, is provided along with a review of models adopted for the analyses. The models are categorized and presented according to their main characteristics (e.g. bottom-up/top-down model, regional/national analysis, partial/general equilibrium, static/dynamic model).

The results of this paper provide, to the decision-makers, informations useful for identify a suitable analysis for investigate on the optimal trade-off between renewables and energy efficiency measures in energy-systems under different objectives.