International Requirements for Large Integration of Renewable Energy Sources

Most European countries have concerns about the integration of large amounts of renewable energy sources (RES) into electric power systems, and this is currently a topic of growing interest. In January 2008, the European Commission published the 2020 package, which proposes committing the European Union to a 20% reduction in greenhouse gas emissions, to achieve a target of deriving 20% of the European Union's final energy consumption from renewable sources, and to achieve 20% improvement in energy efficiency both by the year 2020 [1]. Member states have different individual goals to meet these overall objectives, and they each need to provide a detailed roadmap describing how they will meet these legally binding targets [2]. At this time, RES are an indispensable part of the global energy mix, which has been partially motivated by the continuous increases in hydropower as well as the rapid expansion of wind and solar photovoltaic (PV). The International Energy Agency's 2012 edition of the World Energy Outlook stated that the rapid increases in RES integration are underpinned by falling technology costs as well as rising fossilfuel prices and carbon pricing, but RES integration is also encouraged by continued subsidies: from $88 billion globally in 2011 (compared to $523 billion in fossil-fuel subsidies in 2012 [3], with a share of $131 billion for electricity generation) to an estimated $240 billion in 2035 [4]. According to [3], in 2015 RES accounted for 22% of electricity generation, which was approximately the same level as gas and about one-half the level of coal.