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Vulnerability assessment of climate change impact on natural hazards in energy systems

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In Austria, one sector vulnerable to natural hazards is the energy sector, where a sustainable supply relies on a functioning grid system. Reports on the consequences of natural hazards on the energy system are well known. Over the past years climate change has been one of the most studied environmental issues and it is now accepted that the climate change impacts have to be considered in any natural hazard risk management procedure at any scale (local to international). Not long ago many planners and decision makers felt that the scientific knowledge about future climate was too uncertain to have the confidence to act on. Especially in the field of natural hazards detailed analysis is still limited and therefore a formal risk framework has not yet been developed. One reason is that there are uncertainties about climate change, the impacts on natural hazard processes and the economical losses. This presentation is part of the project RIMES (Climate Change and Risk Management in Energy Systems) funded by the Austrian Climate Research Program (ACRP) dealing with an integrated assessment of climate, energy and economy. In an earlier step we focused on the determination of regional climate models and the influence of climate change on natural hazards. Here we would like to introduce an approach to distinguish between acceptable/non-acceptable risks for critical infrastructures in hydro power systems. This will lead to the identification of needs of action in order to meet a defined protection goal for today and in a changing climate.
A basic element of risk based planning using cost effectiveness criteria is the clear definition of protection goals or in other words to distinguish between an acceptable and non-acceptable risk. In a first step the most critical objects (risk elements) in hydro power systems were identified by consulting experts. Considered were dams, reservoirs, river catchment intakes and diversions, above ground pipelines, outdoor substations, energy production buildings as well as roads and trails. Subsequently, the selected objects were clustered into three vulnerability categories according to their importance in the operational management of the hydro power production system and are directly related to the further depth of analysis. In this project we solely deal with economical losses and therefore the importance of the object depends on possible primary losses (destruction of objects) and possible secondary losses (due to a disruption of the energy production). The possible losses are estimated by engineers and energy experts.
The next step in an integrated risk management procedure is the determination of whether an element at risk is considered safe enough (acceptable risk) or not (non-acceptable risk). Consequently it is necessary to define clear protection goals for 1. Single elements at risk (e.g. in form of return periods or monetary quantifications) and 2. Collective risks (applying cost effectiveness criteria in). In the case that an object is considered safe enough (though comprising a residual risk) one can proceed in applying management procedures such as emergency planning, contract insurances, communicate risk (awareness raising) and monitor the development of factors influencing risks (e.g. due to climate change, change of use, change in technical state of protection measures). However, if the risk is considered as not acceptable there is need for action (e.g. constructing permanent avalanche safety measures) and a thorough cost effectiveness analysis is required. The financial means used for protection purposes have to lead to an acceptable risk reduction. Here we introduce a method to assess the need for action in regard to natural hazard protection, in a formal way for today and for the future based on different climate scenarios.