

DEE-24136 Distributed Energy Resources in Electricity Networks

Exam 11.12.2013

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Use of own programmable calculator is allowed in this exam.

Answer to five questions.

1. Describe one possible scenario of future distribution network including different kind of distributed energy resources. Describe the primary reasons of distributed energy resources, owners of the resources and what kind of impact they have in the distribution network level.
2. Describe what kind of impacts distributed generation has for the protection of distribution network. Explain by using the theory of fault analysis why distributed generation has the described impacts.
3. Describe the impacts of distributed generation connected in medium voltage network for voltage quality. Consider all kind of generation technologies.
4. Provide a detailed explanation why distributed generation will raise voltage in radial distribution network. Draw necessary figures to explain the theory behind the voltage rise effect.
5. Compare traditional distribution network reliability enhancement options and intended island operation consisting of backup and distributed generation units. Consider both the technical and the economical aspects of different solutions. Describe also the basic requirements, the possible benefits/drawbacks, and the possible applications (examples) of reliability enhancement options.
6. Describe the mechanisms of wind power smoothing from single wind turbine level up to Nordic power system level. Describe also what are the most relevant consequences of wind power variation in distribution and transmission network levels and how wind power smoothing is affecting on those.
7. Describe with your own words the concept of active distribution network. Don't describe the details of technology required for active distribution network, but explain why distribution network should be more active and how it might become more active.