This is the accepted version of a paper presented at *ELKRAFT Conference*.

**Citation for the original published paper:**

Stankovic, S., Söder, L. (2017)
Cable Impact on Integration of Wind and Solar Power.
In: Goteborg, Sweden

N.B. When citing this work, cite the original published paper.

**Permanent link to this version:**
http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-219934
Cable Impact on Integration of Wind and Solar Power

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Problems and Aims

Future development of power systems:
• Replacing conventional power sources with renewables
• Moving production from transmission to distribution level
• Cable penetration in grids increases

Challenges:
• Local grid:
  • Overvoltages
  • Increased active power losses (when using reactive power support)
• Overlying grid:
  • Reverse active power flows
  • Injection of reactive power at the point of common coupling (PCC) towards overlaying grid

Test cases

Section [1-2-5-6-7-20-22-23-24-26-27-28]:
• Case 1: Overhead lines (R/X = 0.5 – 1.2)
• Case 2: Cables (R/X = 1.5 – 6.4)

Length of the lines and intersection stays the same in both test cases

Voltage profiles

Overhead lines case

Without reactive support from DG

With reactive support from DG

Cables case

Without reactive support from DG

With reactive support from DG

Test grid (10kV)

PCC

Q12

P12

Q12

Conclusions

• Cables inject reactive power into the grid increasing the overall grid’s voltage
• Reactive support from DG can be used to increase penetration of DG and/or tailor the voltage profile
• Cables provide reactive power decreasing the need of importing it from the overlaying grid in the times of high production of DG
• Cables R/X ratios allow transfer of reactive power to longer distances
• Higher penetration of cables increases grid’s overall capability to exchange reactive power with overlaying grid