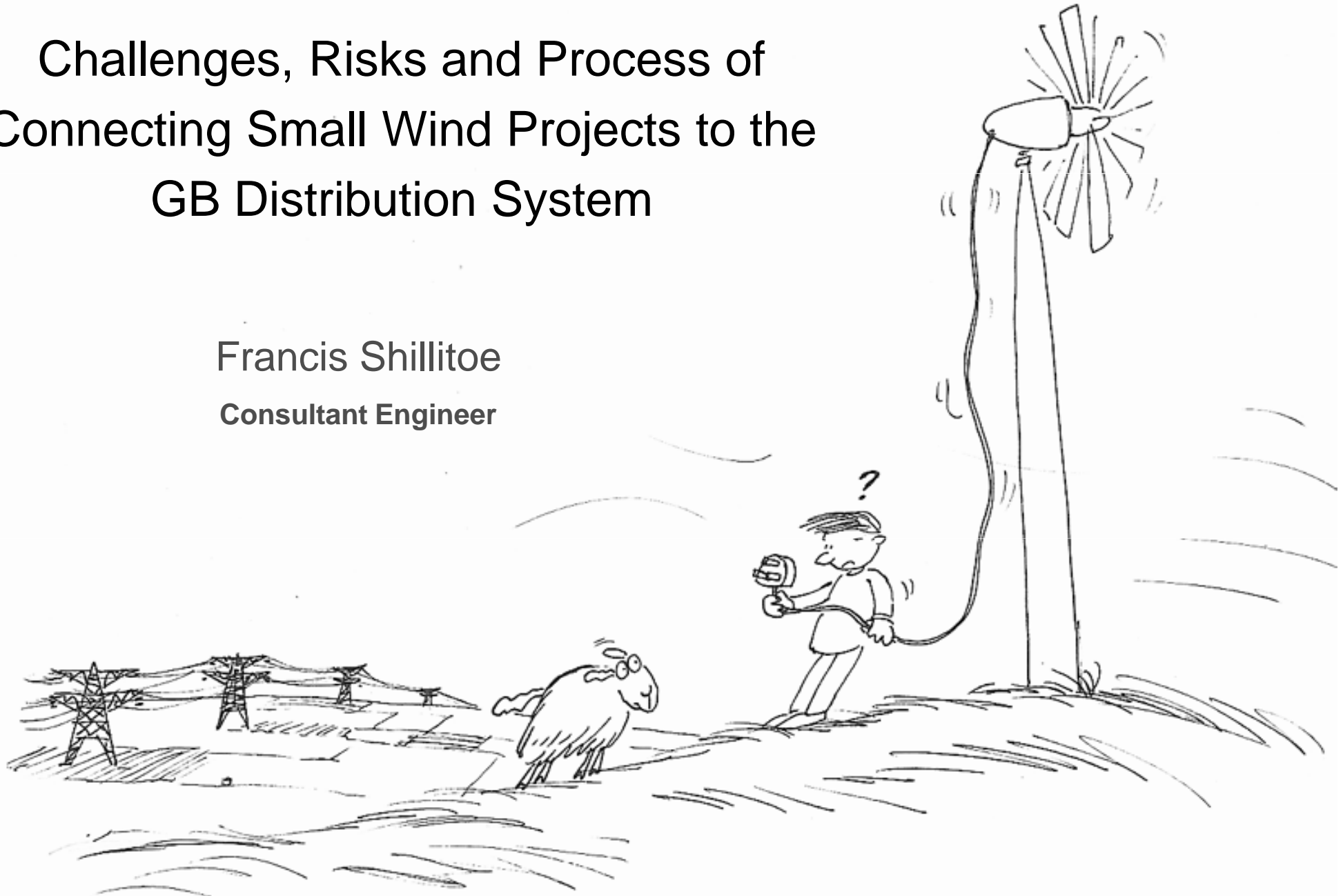


Challenges, Risks and Process of Connecting Small Wind Projects to the GB Distribution System

Francis Shillitoe
Consultant Engineer

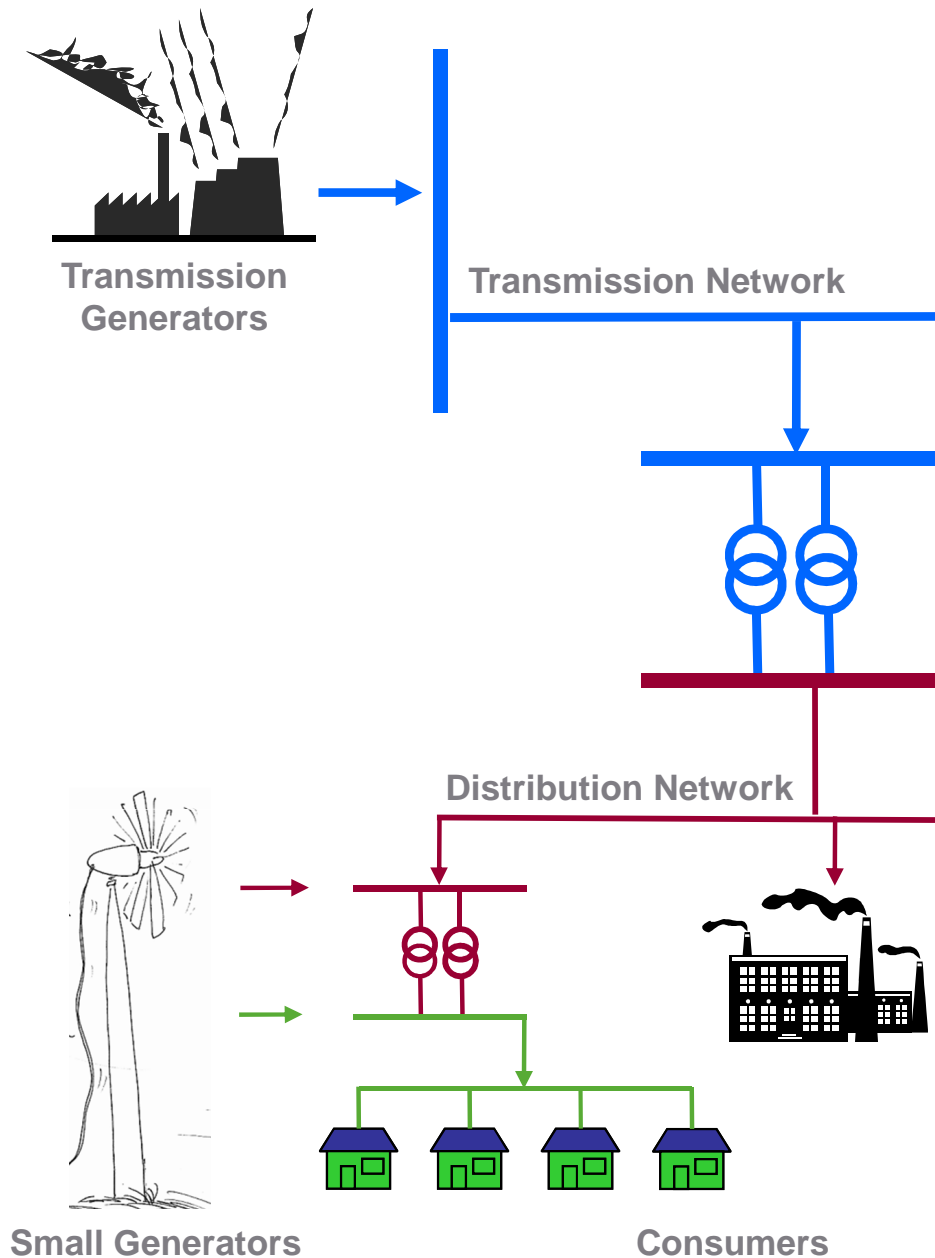


- Established as Econnect 1995, now part of Senergy group
- Grid connection of all renewable generation technologies
- Early feasibility assessments through to commissioning

- Some of our clients



System Overview



33kV medium generation < ~30MW

G59/2

11kV medium/small generation < ~5MW

Low Voltage small generation > 11kW

Low Voltage micro generation < 11kW

G83/1

Overhead Lines



Low voltage

400V three phase
230V single phase



Single phase 11kV



Three phase 11kV line with
single phase 11kV/low voltage
transformer

| | | |
|---|----------------|--------------------|
| Single low voltage micro generator <3.7kW single phase or <11kW three phase | Fit and Inform | G83/1-1 Stage 1 |
| Multiple low voltage micro generators <3.7kW single phase or <11kW three phase each | Inform and Fit | G83/1-1 Stage 2 |
| Small generators and everything larger | Inform and Fit | G59/2 |

- Carry out preliminary site design
- Obtain Budget Estimate
(optional)
- Submit Connection Application (no charge)
(now a standard ENA form for all DNOs)
- Await connection offer
(this will contain the Connection Charge)
- Only way to secure grid capacity is to accept connection offer and
make initial connection charge payment
(as detailed in DNO's statement of methodology and charges)

| Service | Turnaround |
|----------------------------|-----------------|
| Budget Estimate (<1MVA) | 10 Working Days |
| Budget Estimate (>1MVA) | 20 Working Days |
| Connection Offer (LV ≤1kV) | 45 Working Days |
| Connection Offer (HV) | 65 Working Days |

- New timescales came into force October 2010
- Guidance issued by OFGEM on 15/2/2011:
Distributed Generation Standards Direction Guidance Document
- Voluntary compensation for late turnaround of offers:
 - £50 per day for LV generation connections
 - £100 per day for HV generators connections

Main problems for small wind:

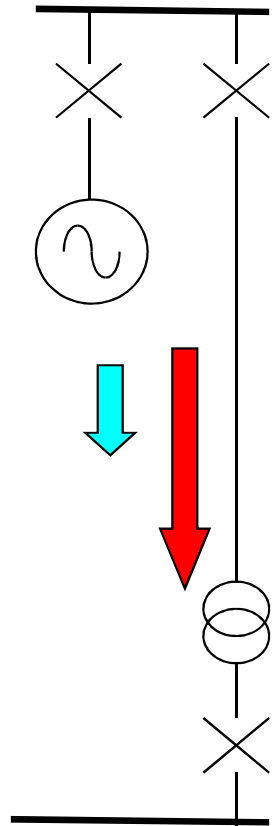
- Voltage Unbalance
(Single phase connections)
- Voltage rise
- Thermal capacity

Other problems:

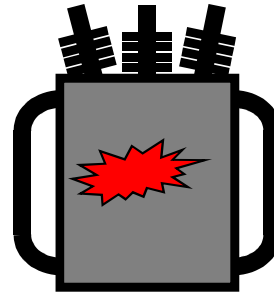
- Fault levels
- Harmonics
- Voltage Flicker



If you cause technical problems, your connection will take **longer to complete** and be **more expensive**.



Transformers



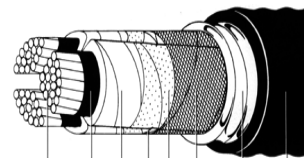
- Overheating leads to insulation failure
- Reverse power flow capability?

Switchgear



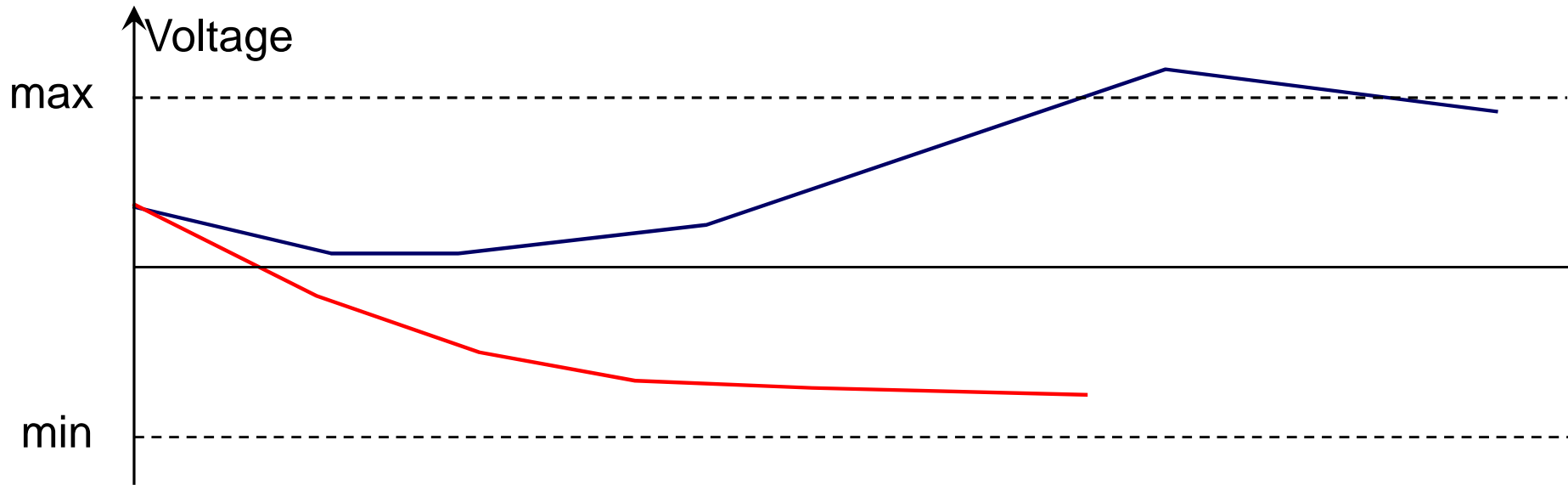
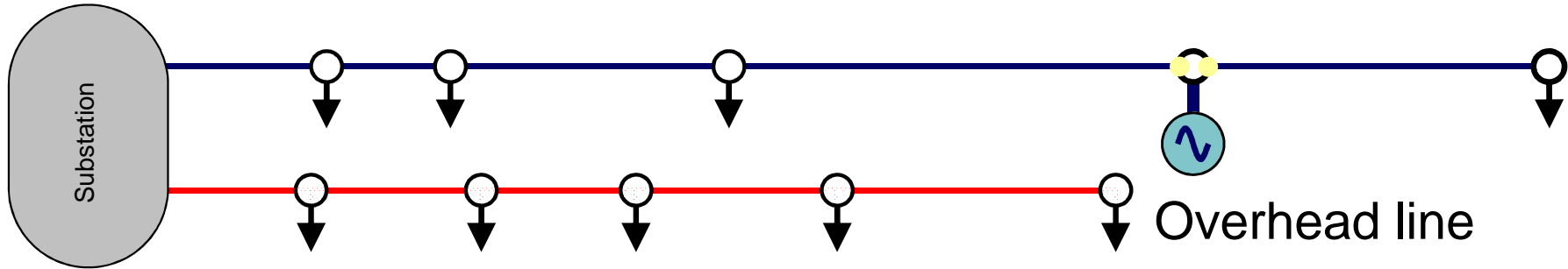
- Overheating leads to insulation failure

Cables

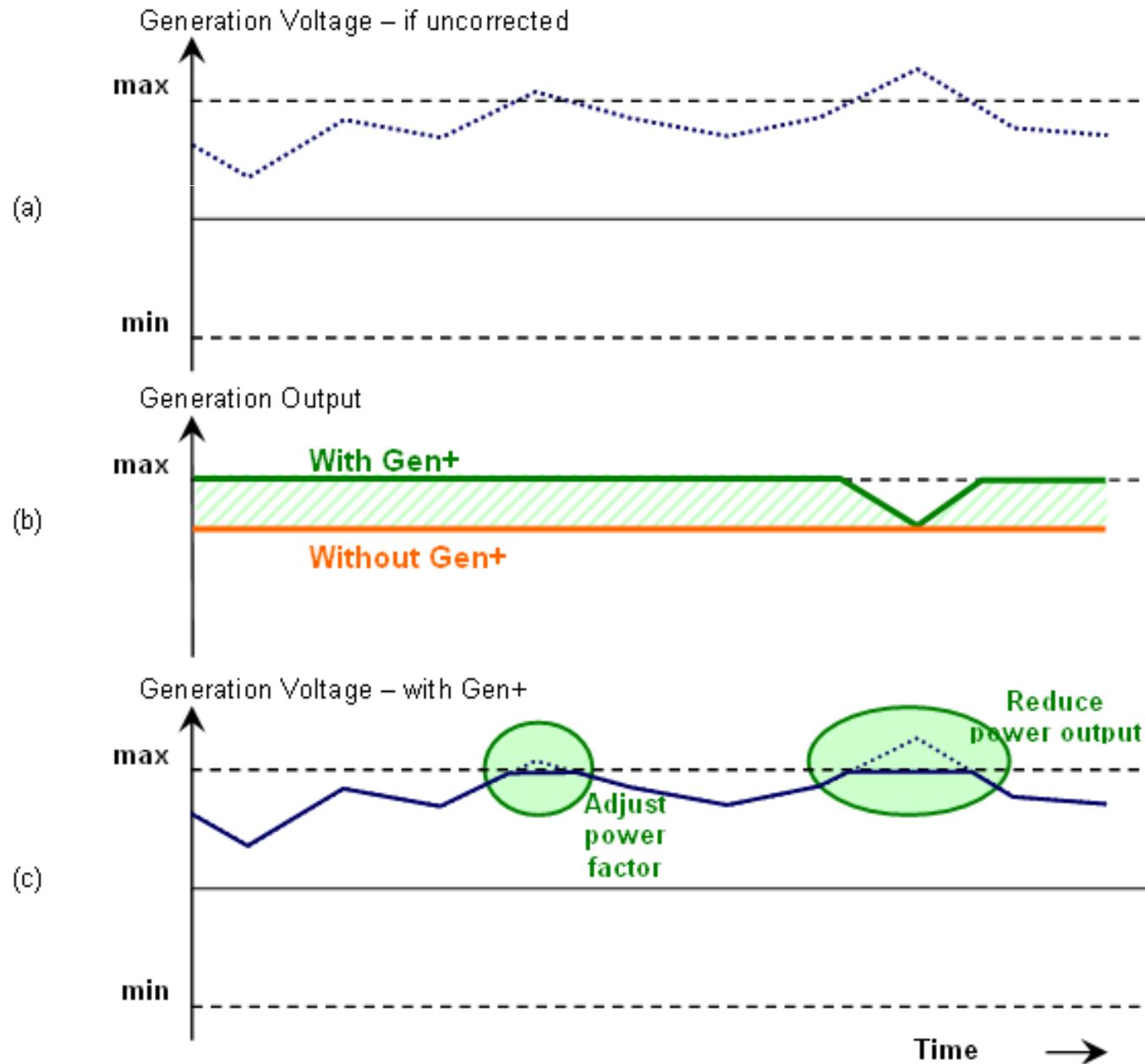


- Overheating leads to insulation failure

Voltage Rise



Smarter ways to manage voltage rise



Connection application forms and guidance:

<http://2010.energynetworks.org/link-to-engineering-documents/>

Connection offer DNO timescales and fines:

<http://www.ofgem.gov.uk/Networks/ElecDist/QualofServ/GuarStandds/Documents1/Distributed%20Generation%20Standards%20Direction%20Guidance%20Document.pdf>

RIIO:

<http://www.ofgem.gov.uk/Media/FactSheets/Documents1/re-wiringbritainfs.pdf>

Thank You

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