



CIGRE WG A3-06
Reliability of HV Equipment

Gas Insulated Switchgear Reliability

TB Part 5

Gas Insulated Switchgear Practices

TB Part 6

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SC A3, Technical Tutorial, September 2011, Vienna

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GIS – Previous surveys

- **1st survey: service experience till 31.12.1990**
70411 (users), 199 473 (manufacturers) CB-bay-years,
690 MaF, MaF frequency : 0,98 MaF/100CB.bay.years
CIGRE papers in Electra and Sessions in 1992 to 1994
- **2nd survey: service experience till 31.12.1995**
113435 (users) CB-bay-years
596 MaF, MaF frequency : 0,52 MaF/100CB.bay.years
CIGRE TB 150, 2000

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3rd GIS survey

Data collection 2004-2007

24 countries, 55 utilities

Ø annual reported population 22240 CB-bays

Evaluation made for 2 datasets:

Reported data (Complete data)	Service experience [CB-bay-years]	Number of major failures MaF	Number of minor failures MiF
All data	88971 (88948)	358 (326)	1505
Without count. 14 and 23	7181 (7158)	105 (102)	970

Two dominant countries (14 & 23) : 64 & 28% of collected data
All MaF frequencies for 3-phase arrangements

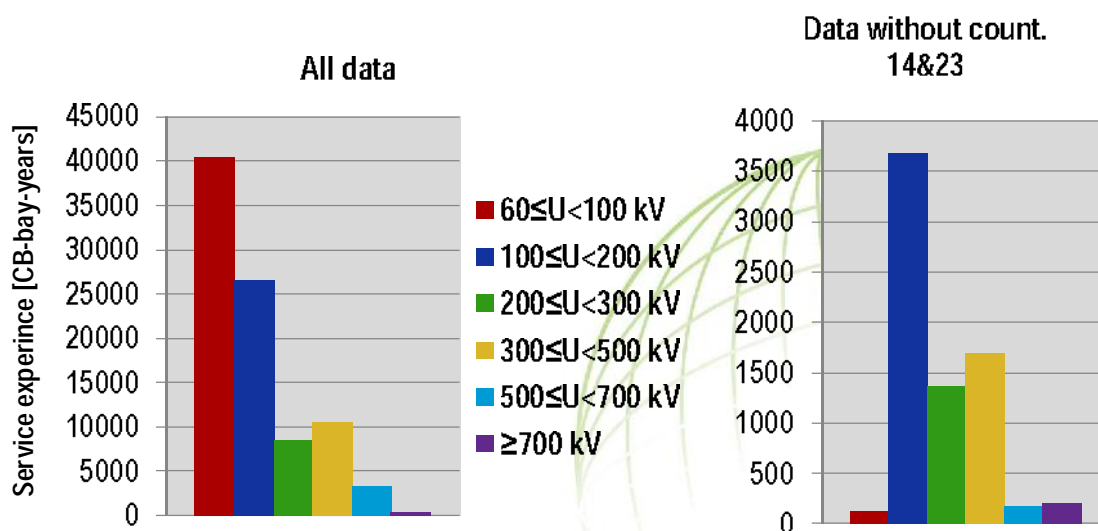
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Service Experience

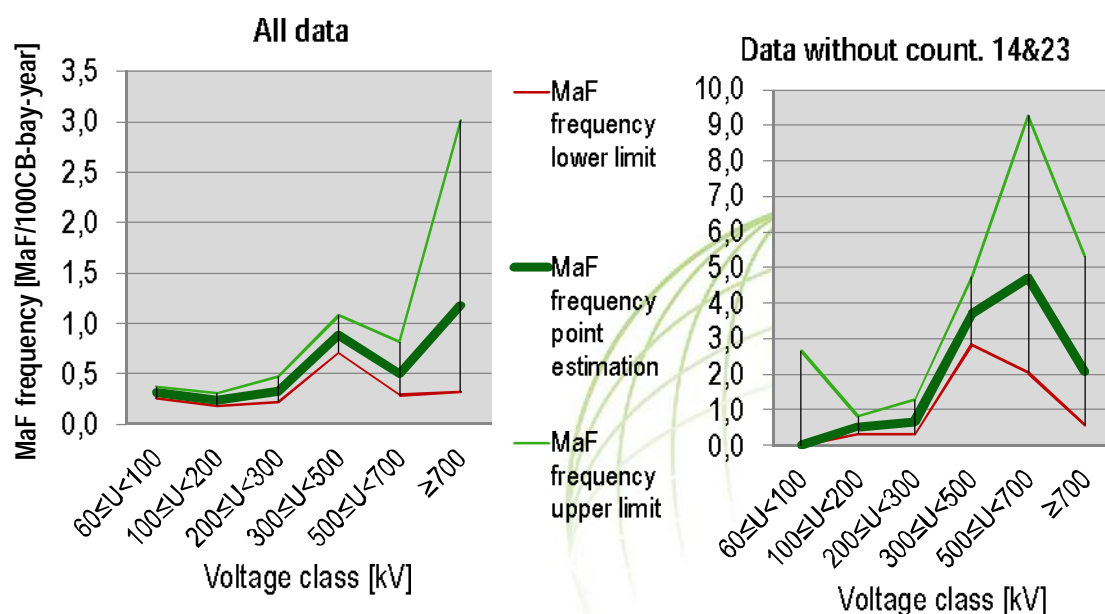
Population - voltage classes distribution



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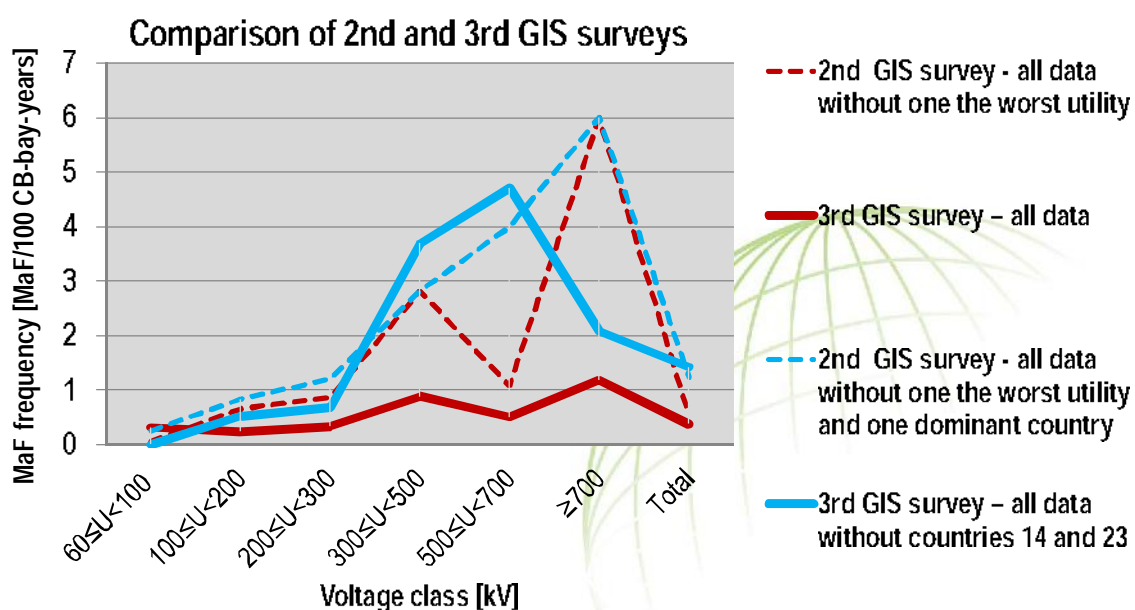
MaF Frequencies



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MaF Frequencies



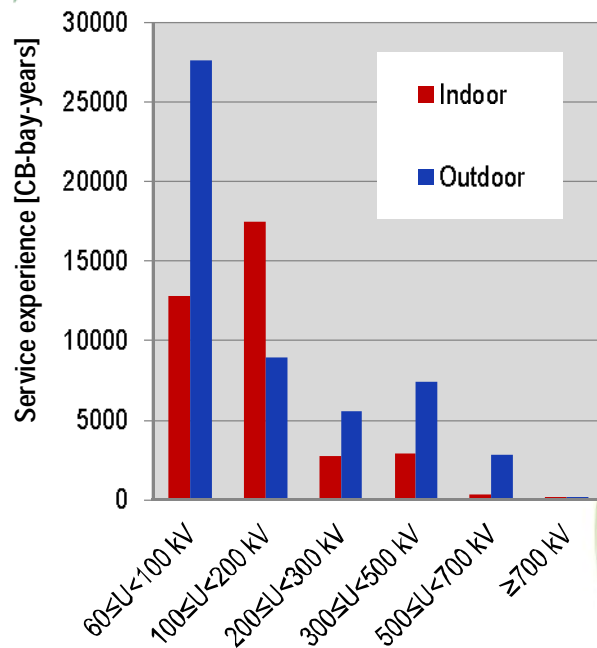
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Further slides for all data and for point estimation values only

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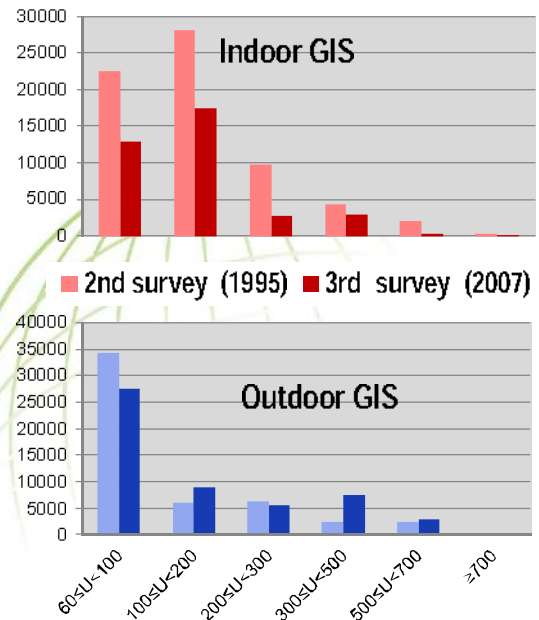


Service Experience – Location



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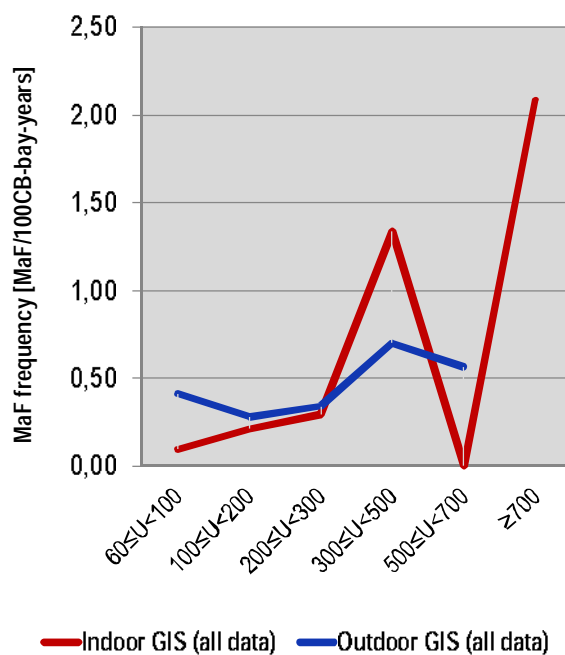
Comparison with the 2nd survey



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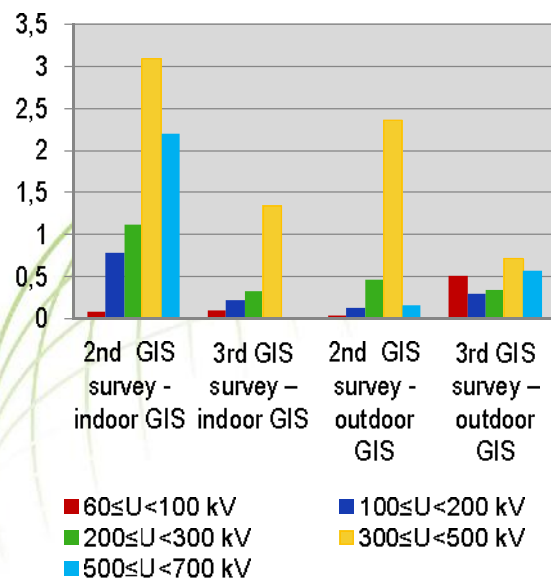


MaF frequencies – Location



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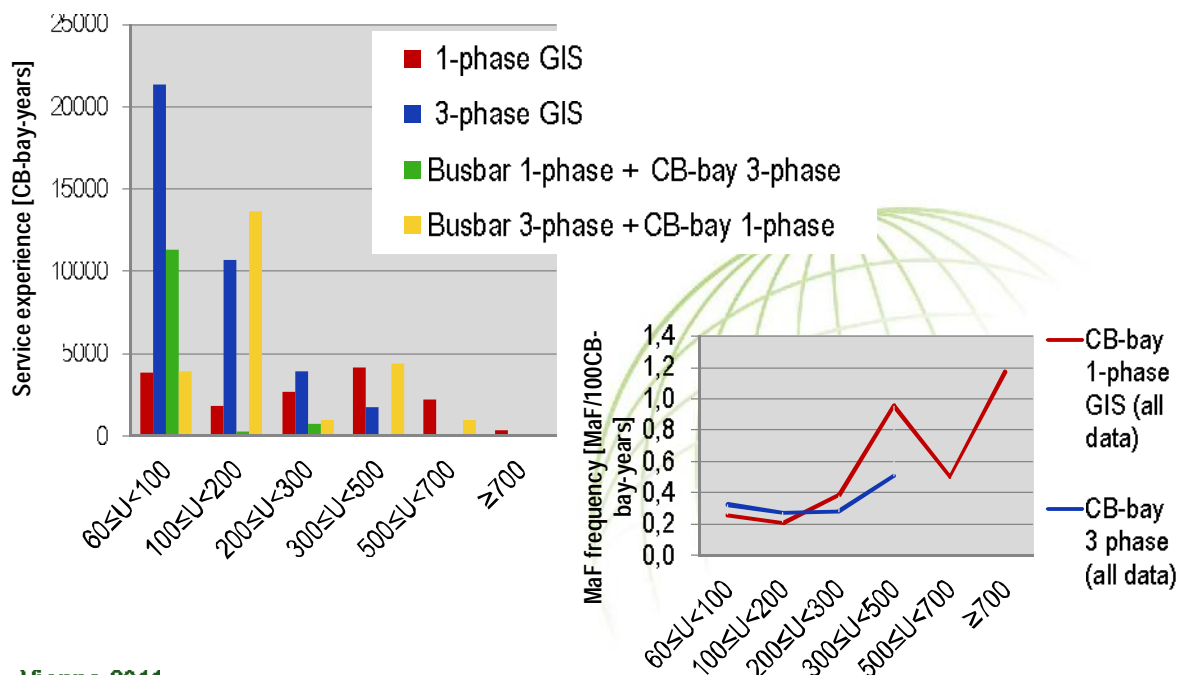
Comparison with the 2nd survey



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Service Experience & MaF Frequencies – Design



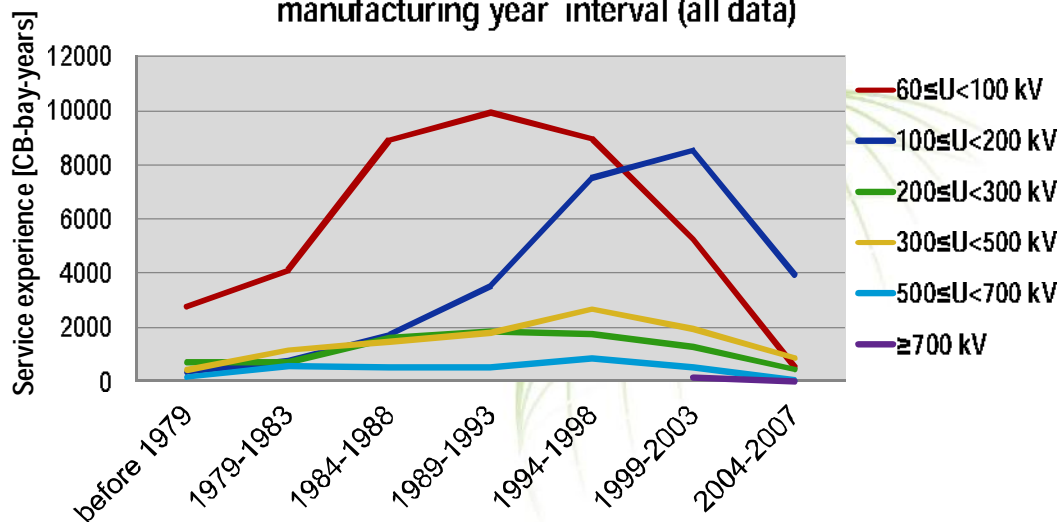
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Service Experience – “Age” manufacturing year dependence

Reported GIS service experience in dependence on manufacturing year interval (all data)

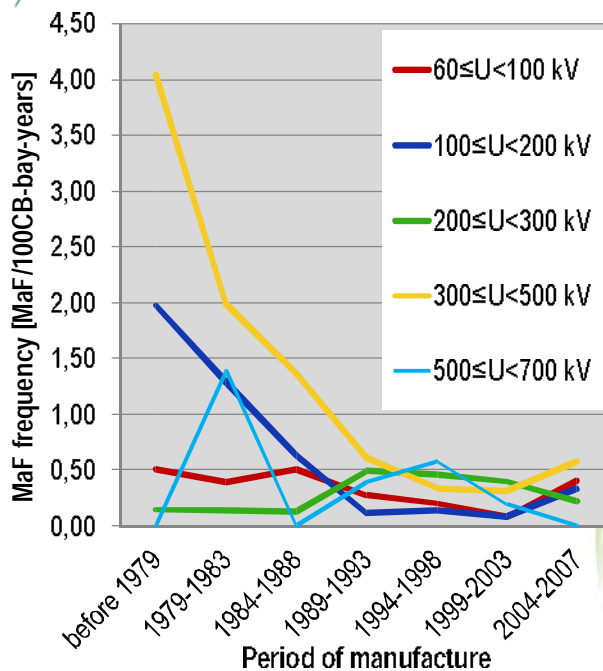


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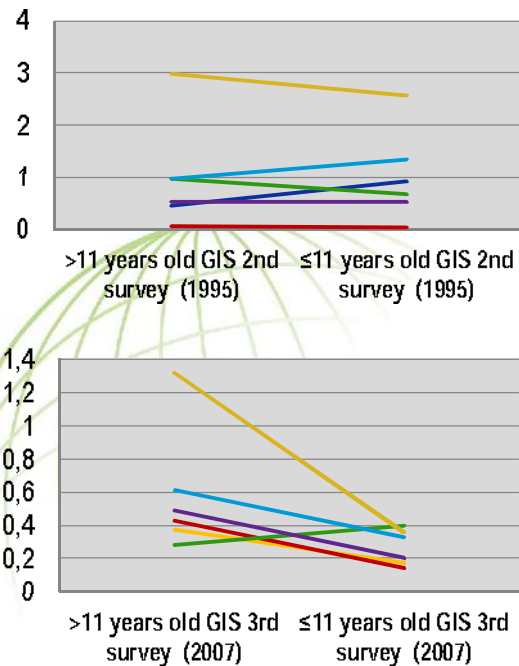


MaF frequencies – “Age”



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Comparison with the 2nd survey

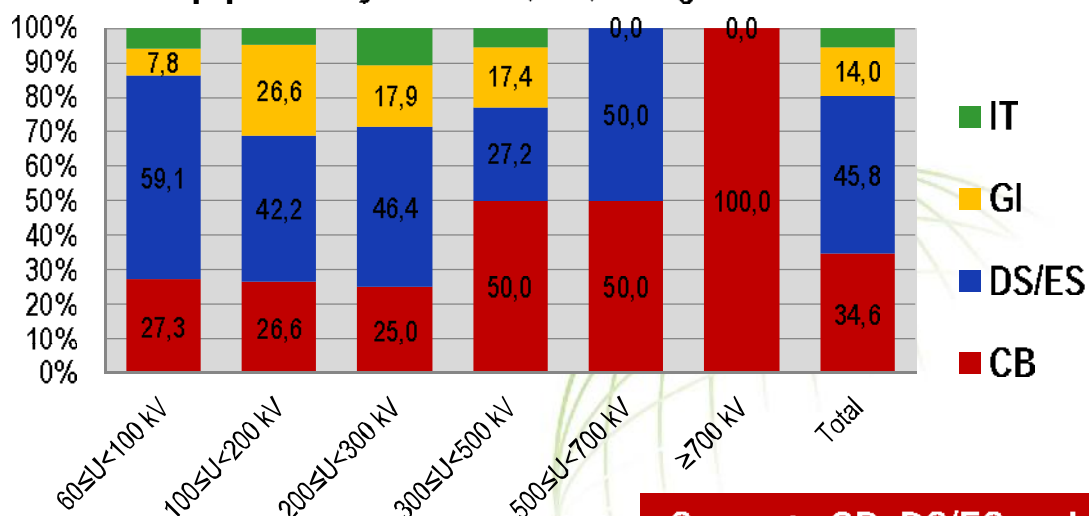


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Individual Equipment MaF Frequencies

GIS equipment major failures (MaF) voltage classes distribution



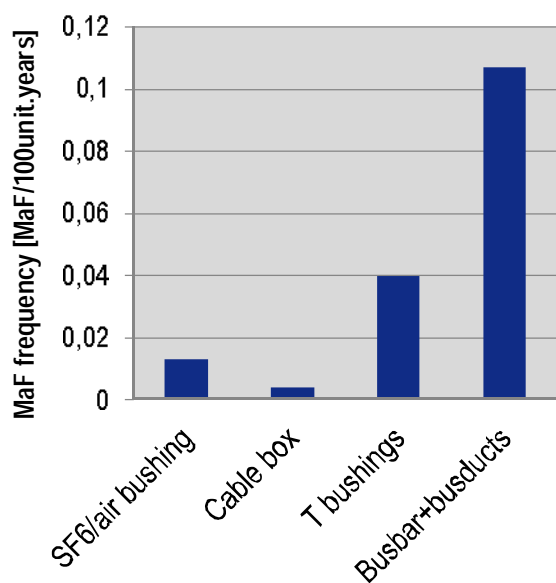
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Separate CB, DS/ES and IT MaF frequencies are included in Parts 2, 3, and 4

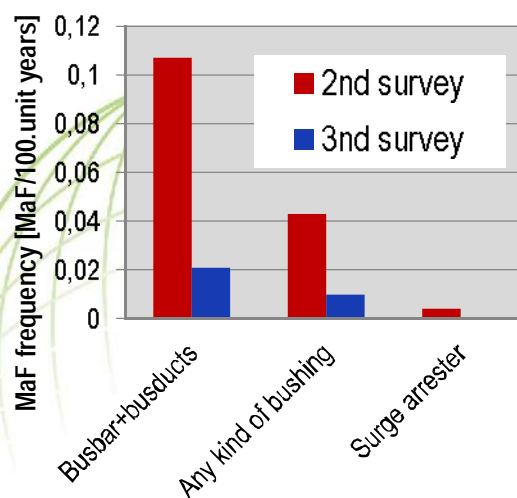
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Individual Equipment MaF Frequencies



Comparison with the 2nd survey



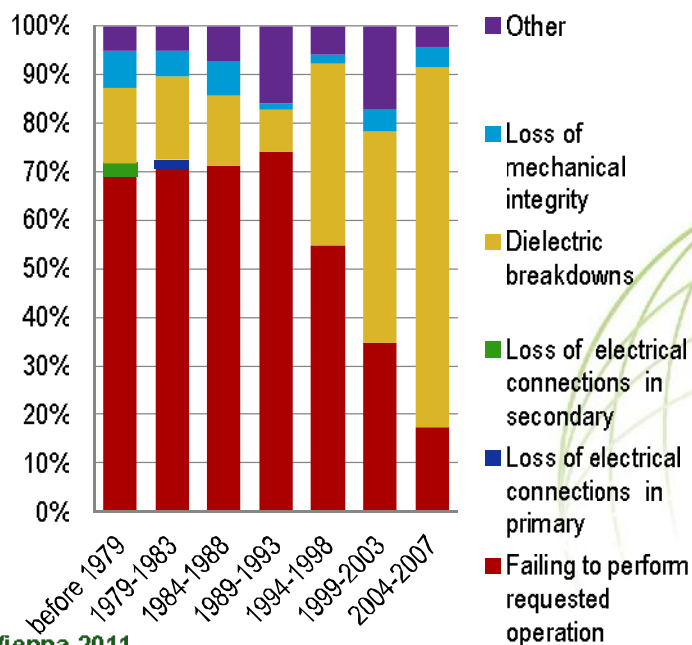
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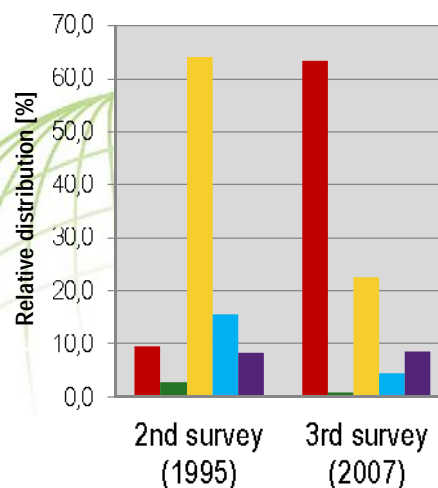
MaF Characteristics

MaF failure modes versus manuf. period



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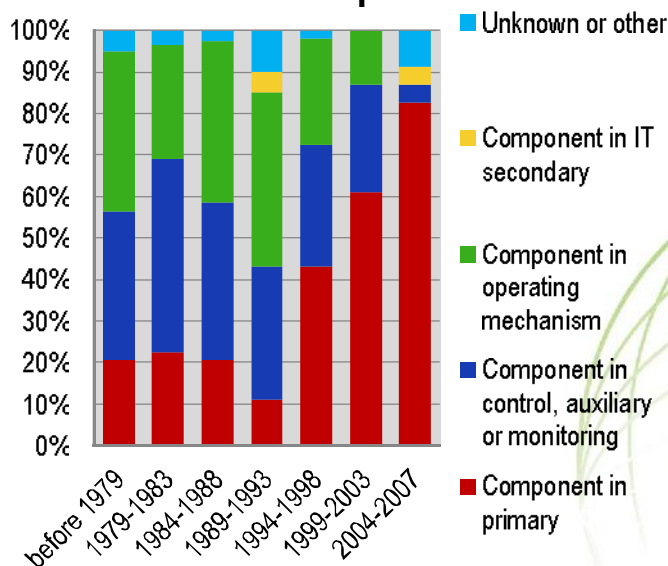
Comparison with the 2nd survey



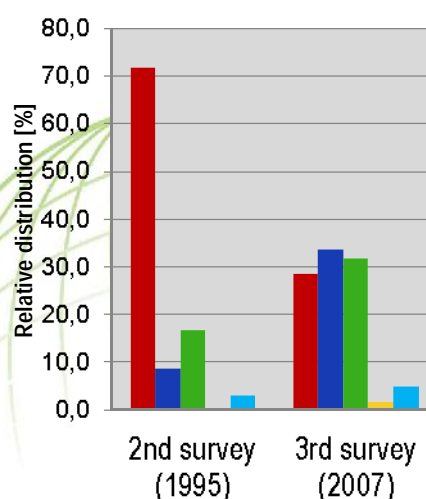
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MaF Characteristics

MaF failed subassembly versus
manuf. period



Comparison with the 2nd survey

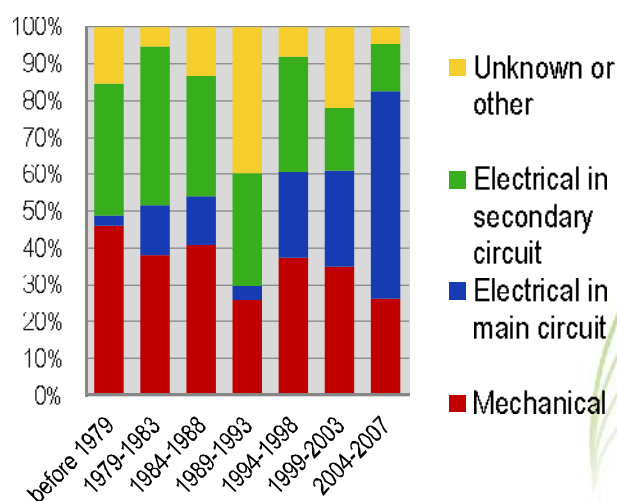


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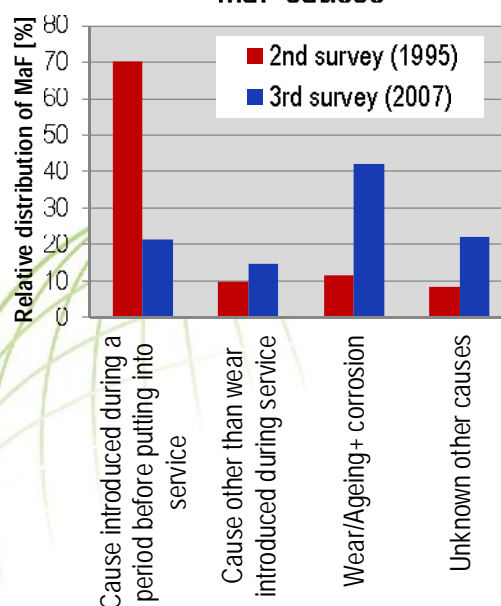
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MaF Characteristics

MaF origin versus manuf. period



MaF causes

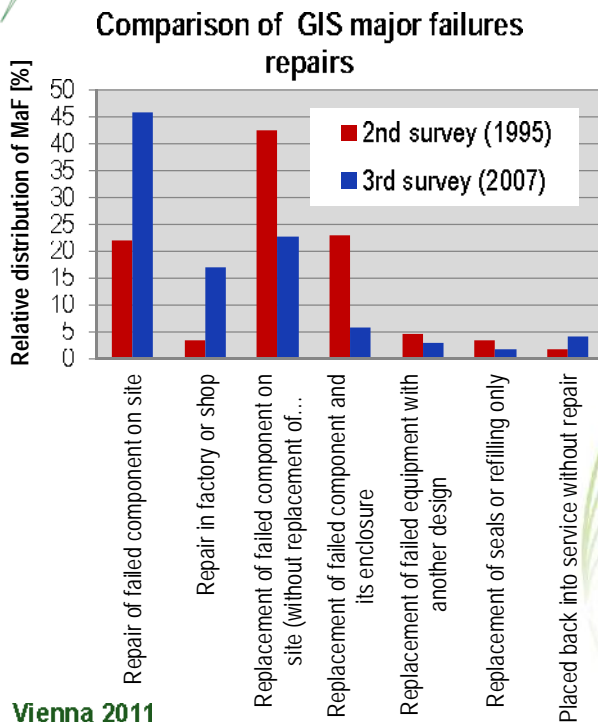


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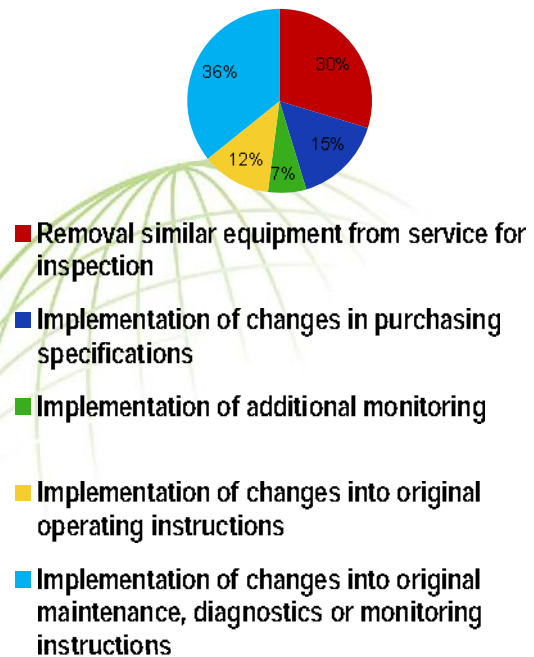


MaF Characteristics



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Active (148) consequential measures after MaF



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GIS Practices

- ➡ Commissioning (HV testing, practices after flashover, changes)
- ➡ GIS monitoring and diagnostics (strategies, special and SF6 quality tests)
- ➡ Specific problems
- ➡ Major maintenance experience
- ➡ New technologies applications (primary and secondary systems, engineering, turnkey projects)

Responses :

16 countries, 34 utilities

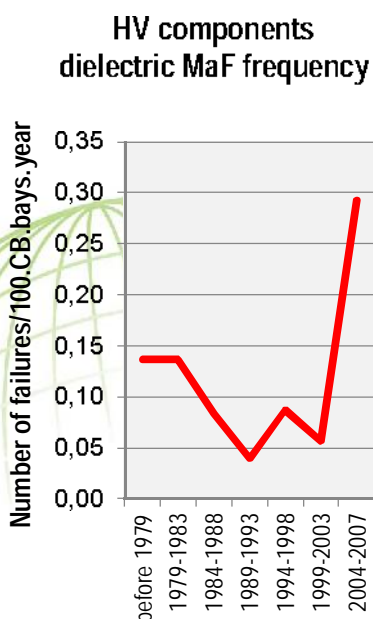
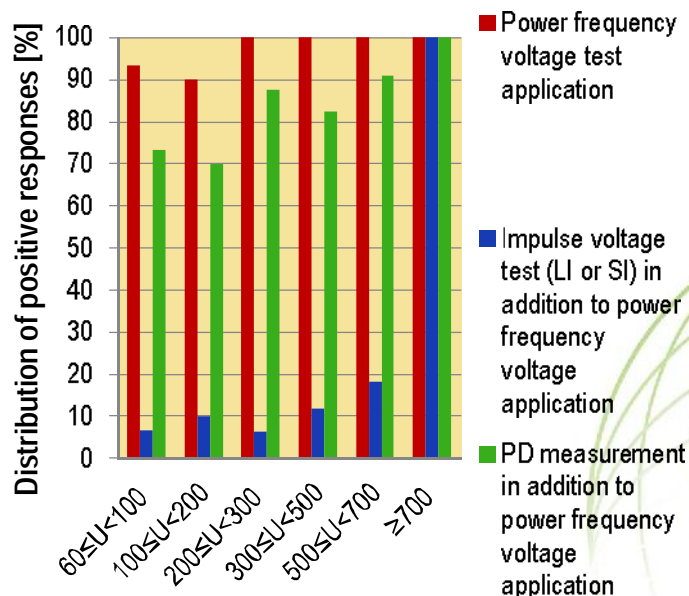
Number of received cards : 41 (49% Europe, 34% Asia, 15% Australia, 2% North America)

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GIS Practices – HV Testing at commissioning

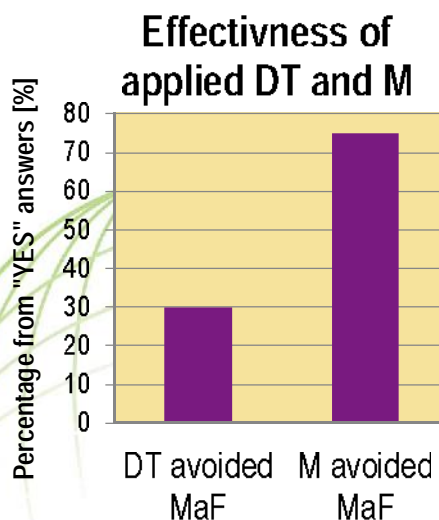
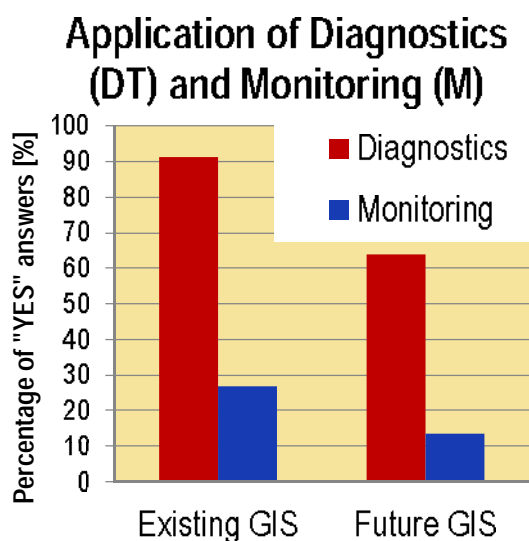


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GIS Practices – Diagnostics and Monitoring



Monitoring other than media pressure/density and number of CO

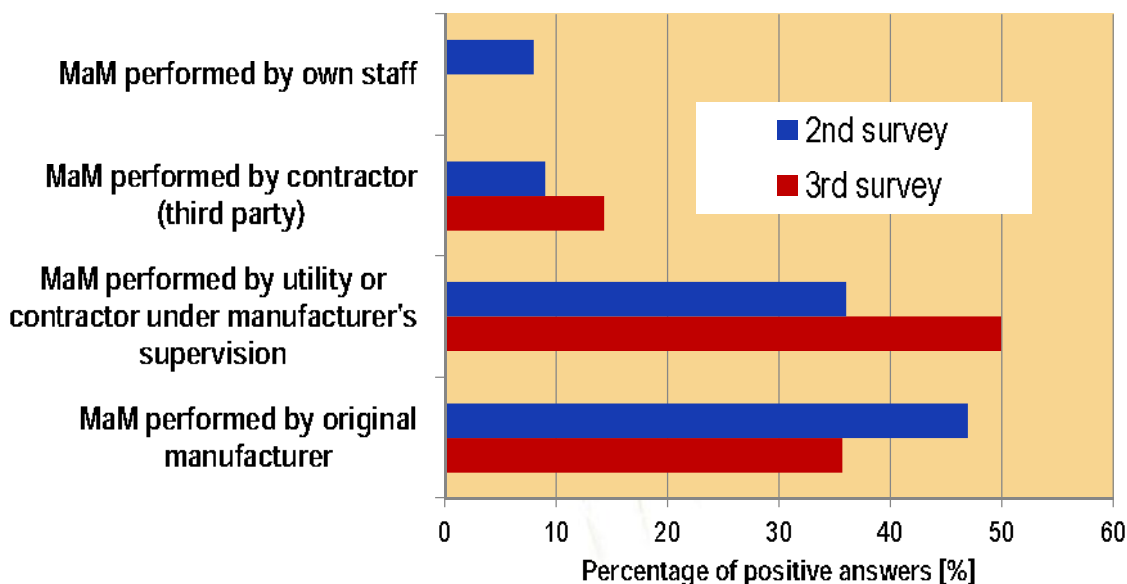
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GIS Practices – Major Maintenance Timing

GIS Major Maintenance Provider



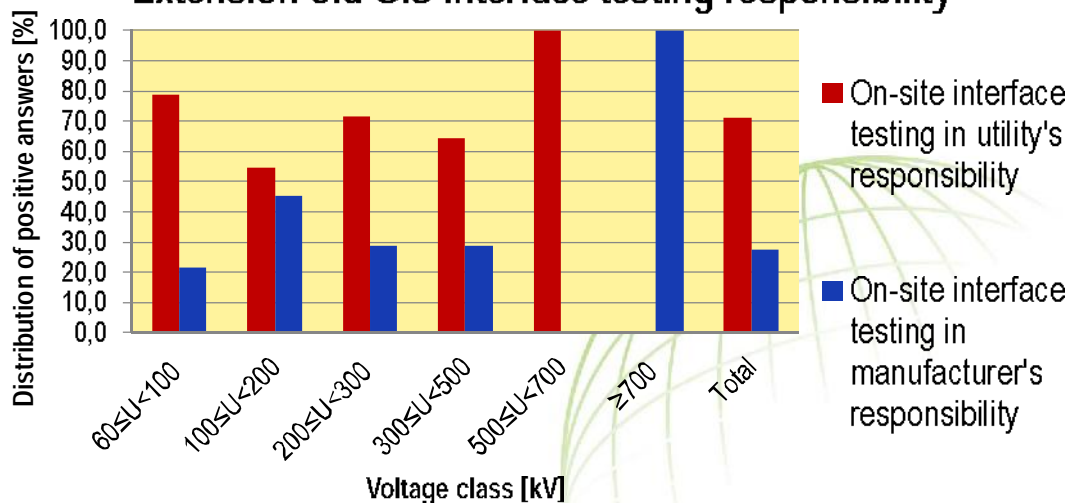
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GIS Practices – Extension Testing

Extension-old GIS interface testing responsibility



in 100% of extensions : made by the same manufacturer
in 52% of answers : no need of an adaptor piece

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Questions?



Thank you for your attention

