Paris Session 2022

Probabilistic engineering of cable systems

SC B1 Insulated Cables - PS2 - Q3

*"…To what extent do enhanced test methods, perhaps including more **variable environmental scenarios** offer benefits to enhanced reliability and system integrity?"*

Frank de Wild, Netherlands

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Probabilistic engineering of cable systems – current rating

Environmental parameters vary with position

Key parameters	*Variation*	*Uncertainty*
Soil thermal properties	large	average
Depth of burial	large	high
Ambient temperature	average	low
Cable Electrical resistance	some	low

- Variations and uncertainties can be quite high in real situations
- For all measurements, uncertainty can be quantified and identified (but not always easily)
- Note that some of these may change over the lifetime!

A single cable circuit can have many thermal bottlenecks, competing with each other

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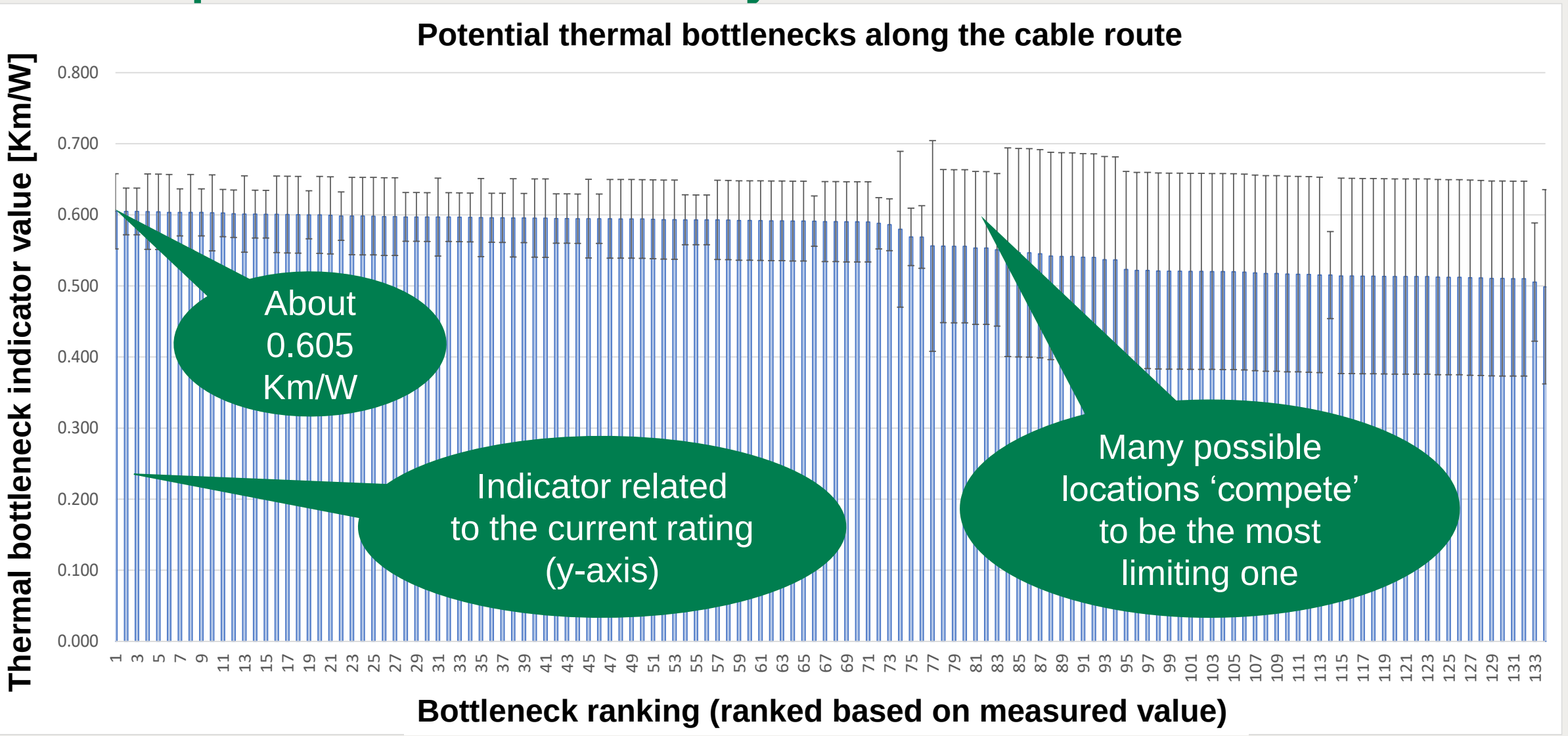
Example – submarine cable system



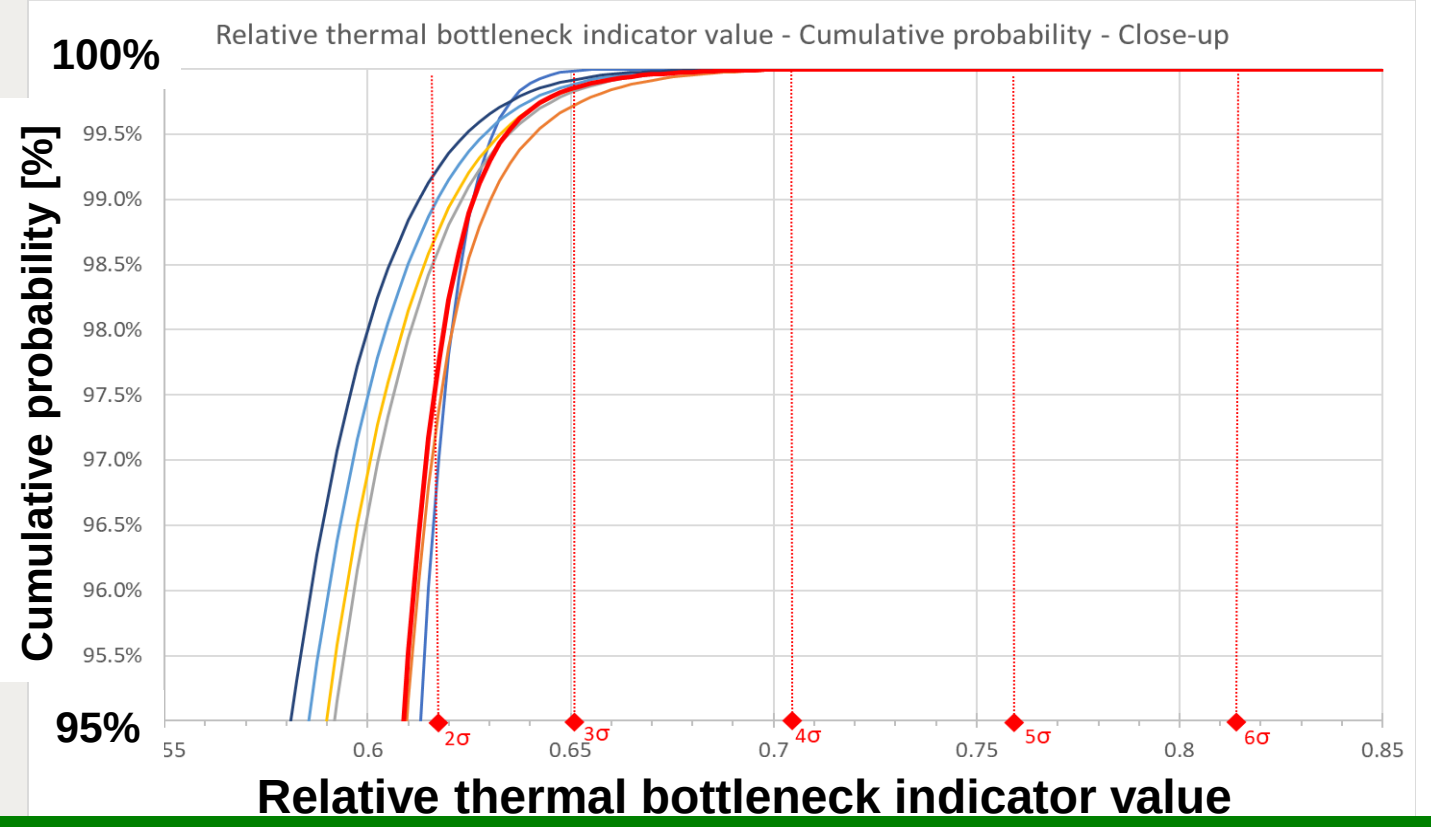
Example – submarine cable system

This leads to a probabilistic current rating

Example:

- 0σ tail -> 50%
- 2σ tail -> 97.7%
- 3σ tail -> 99.7%
- 4σ tail -> 99.996%

0.605 Km/W is at 92% (1 in 12)



- Typical design requirement: “1000 A continuous”. If calculation shows >1000 A, design is approved
- But: likelyhood of a current rating lower than 1000 A can be large resulting from variation and uncertainty

We propose to strive for a known and appropriate likelyhood that the current rating is indeed met

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