



3, 2, 1... Measure !

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Outline

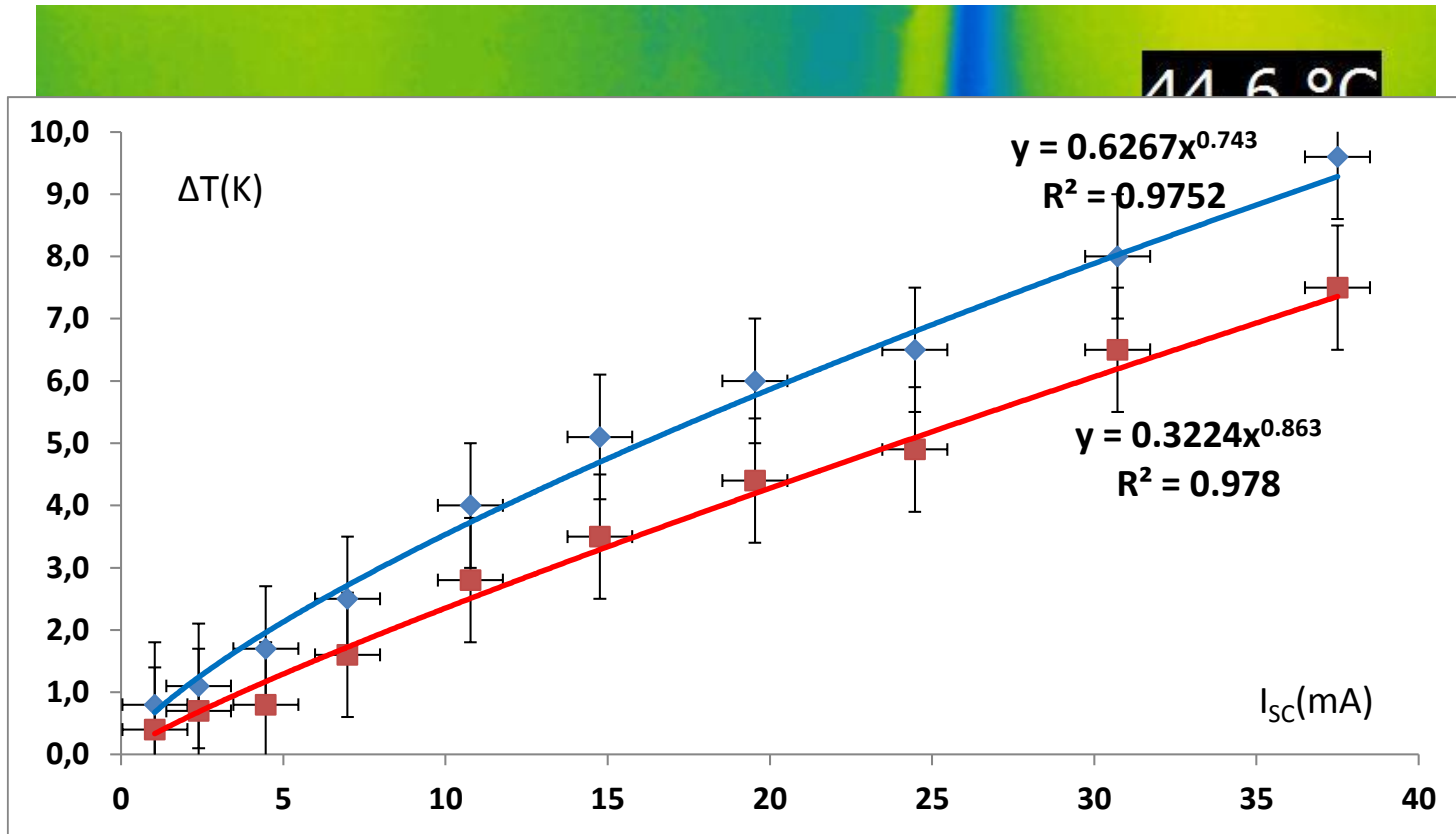
- PV-cell hot spot (nano-causes and macro-consequences)
- Energy-aware Communication in WiFi Networks
- Grounding system impulse impedance
- Energy efficiency
- Cable fault localization – cable radar

Sollar Cell Hot-spot:

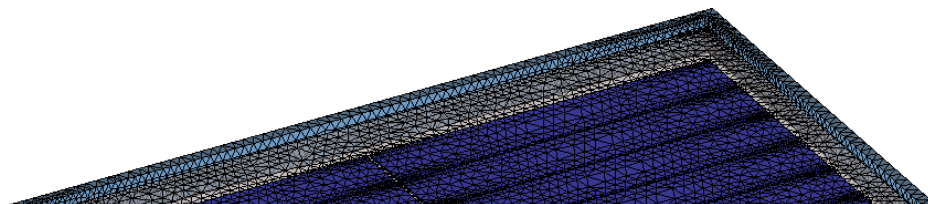
Sollar Cell Hot-spot: Nanotechnology on Macro-Scale

- Hot spot - solar cell within a module generates less current than the string current of the module.
- Solar cells are shaded or damaged to some extent.
- Typical examples of shading, other than clouds or objects surrounding the PV module, are bird droppings and dust.
- Partially or fully covered cells reduce the current through good cells, causing good cells to produce higher voltage which switches the shaded cell to the reverse bias mode.
- As a result of this, total generating capacity of the remaining cells dissipates in the shaded cell.
- In the extreme cases, this can lead to temperatures higher than 150°C , which is above the critical temperature of the cell encapsulants

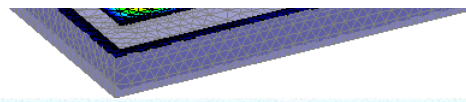
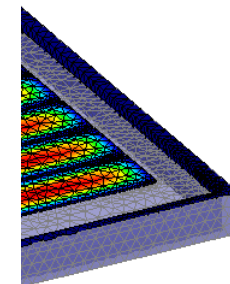
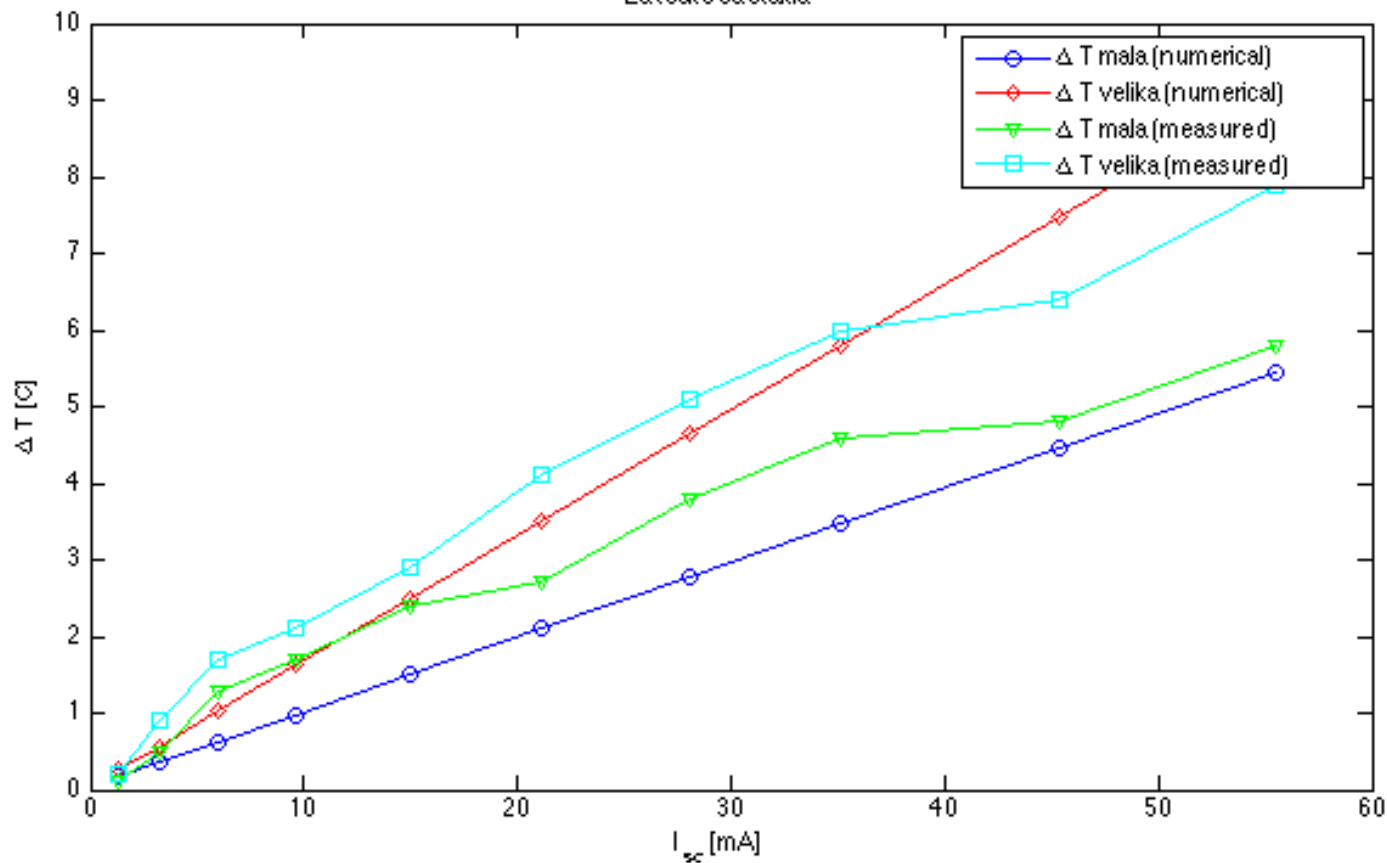
PV-cell hot spot: beyond what eyes see



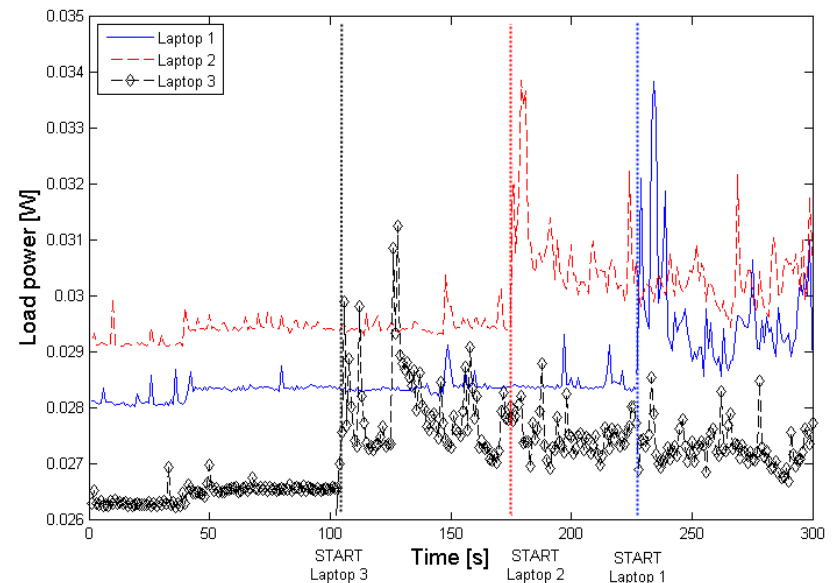
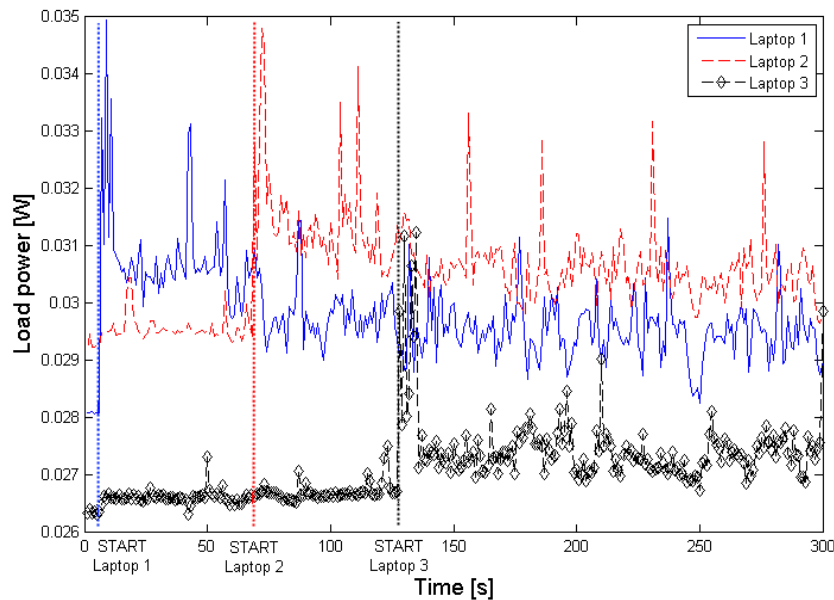
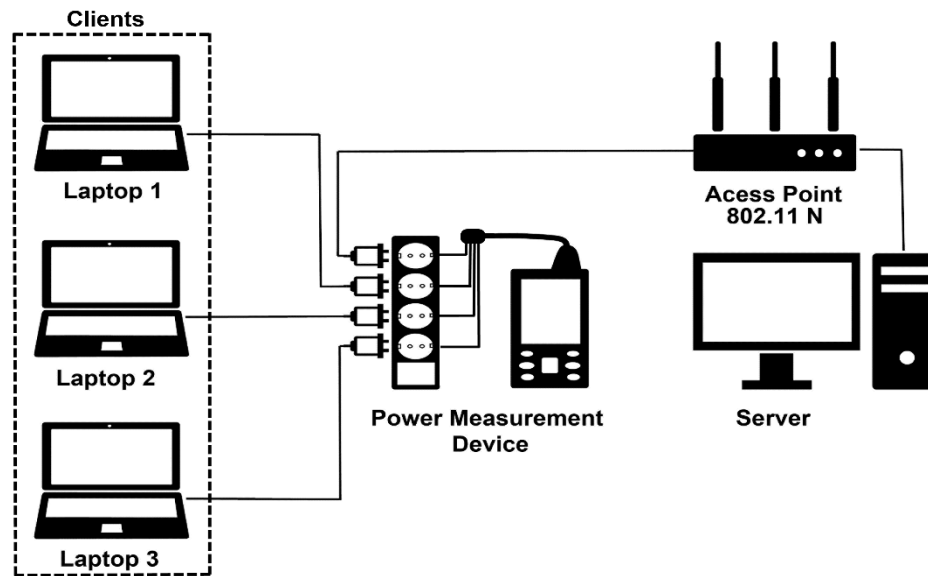
PV-cell hot spot: beyond what can be measured



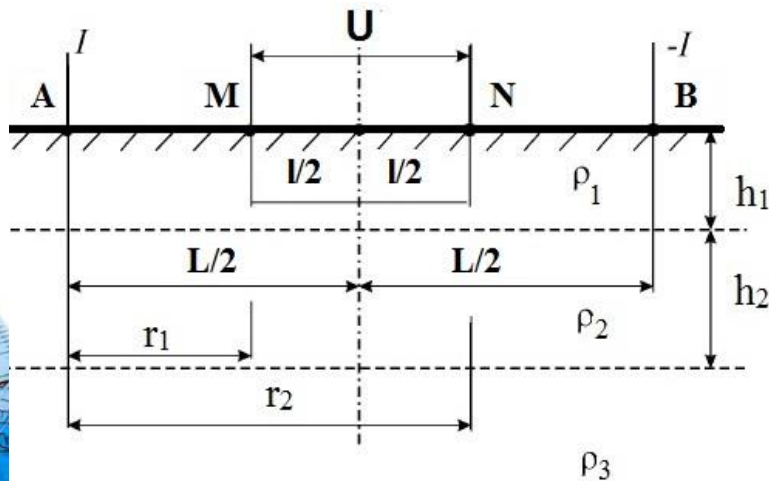
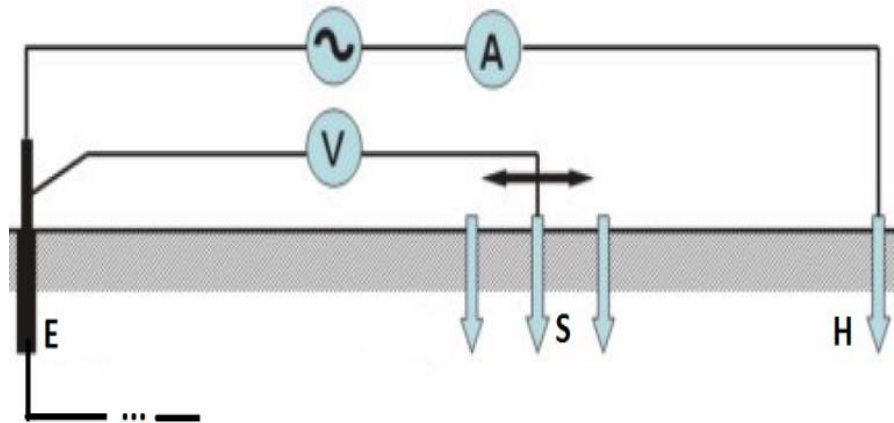
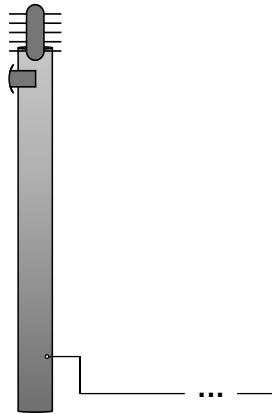
Za točke sa stakla



Energy-aware Communication in WiFi Networks



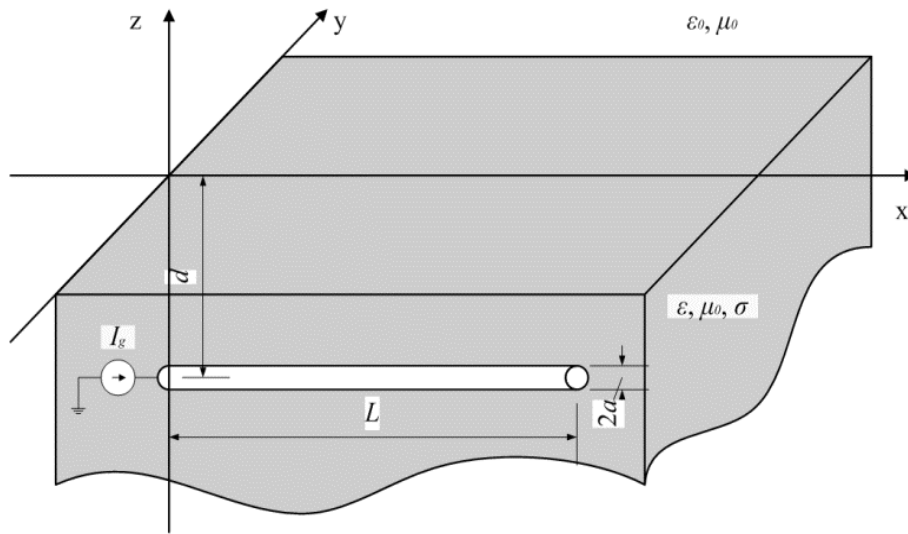
Grounding system impulse impedance: measurements



$$\rho_T = \frac{r_1 r_2}{r_1 - r_2} \rho_1 \int_0^{\infty} k(\lambda, \bar{x}) [J_0(\lambda r_1) - J_0(\lambda r_2)] d\lambda$$

$$\bar{\rho} = \frac{\pi R}{l} \left[\left(\frac{L}{2} \right)^2 - \left(\frac{l}{2} \right)^2 \right]$$

Grounding system impulse impedance: model



$$I(x) = I_g \frac{\Psi(0, \omega) \sinh[\gamma(L-x)]}{\Psi(x, \omega) \sinh(\gamma L)}$$

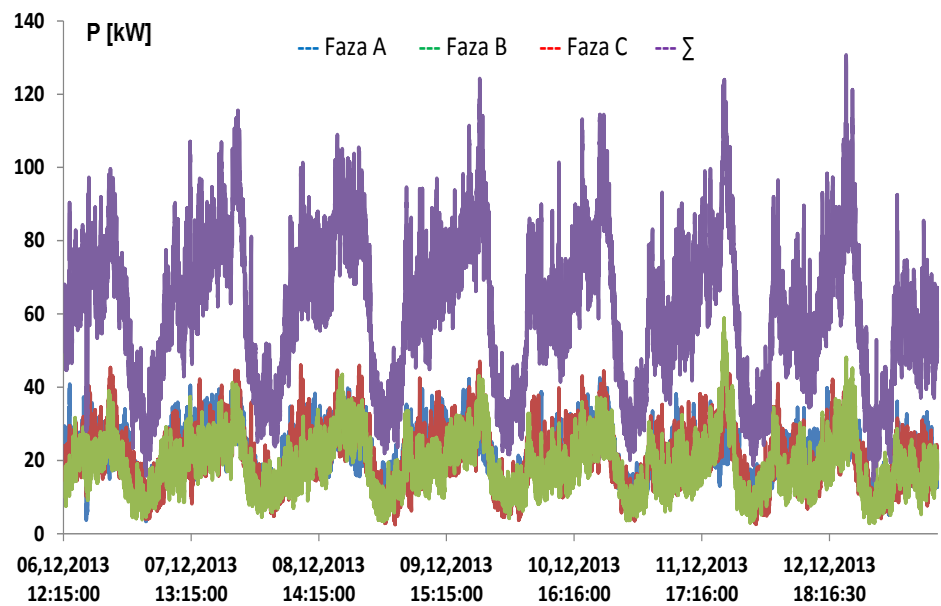
$$V^{sct}(x) = -\frac{I_g \Psi(0, \omega)}{j4\pi\omega\epsilon_{eff} \sinh(\gamma L)}$$

$$\int_0^L \frac{\partial}{\partial x'} \left\{ \frac{\sinh[\gamma(L-x')]}{\Psi(x', \omega)} \right\} g(x, x') dx'$$

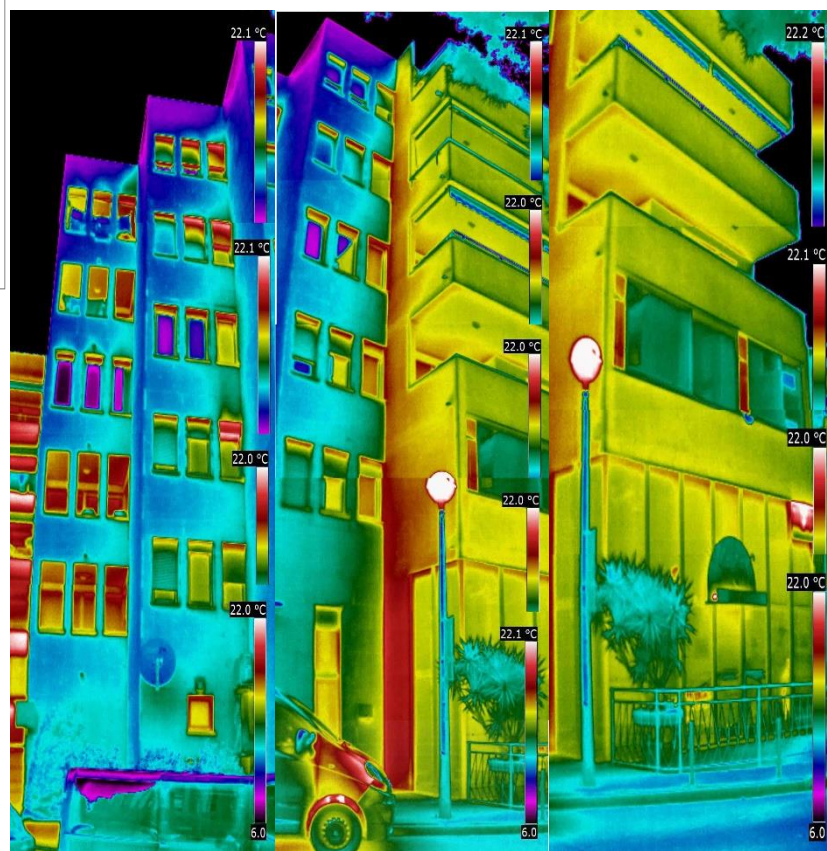
Grounding system impulse impedance: model vs measurements

R_E [Ω]	T_F [μs]	Z_P/R_E [-]	Z_{Pm} [Ω]	Z_{Ps} [Ω]
	0.7	1.25	13.15	17.62
10.52	3.0	0.88	9.28	10.27
	10.0	1.00	10.52	10.50

Energy efficiency



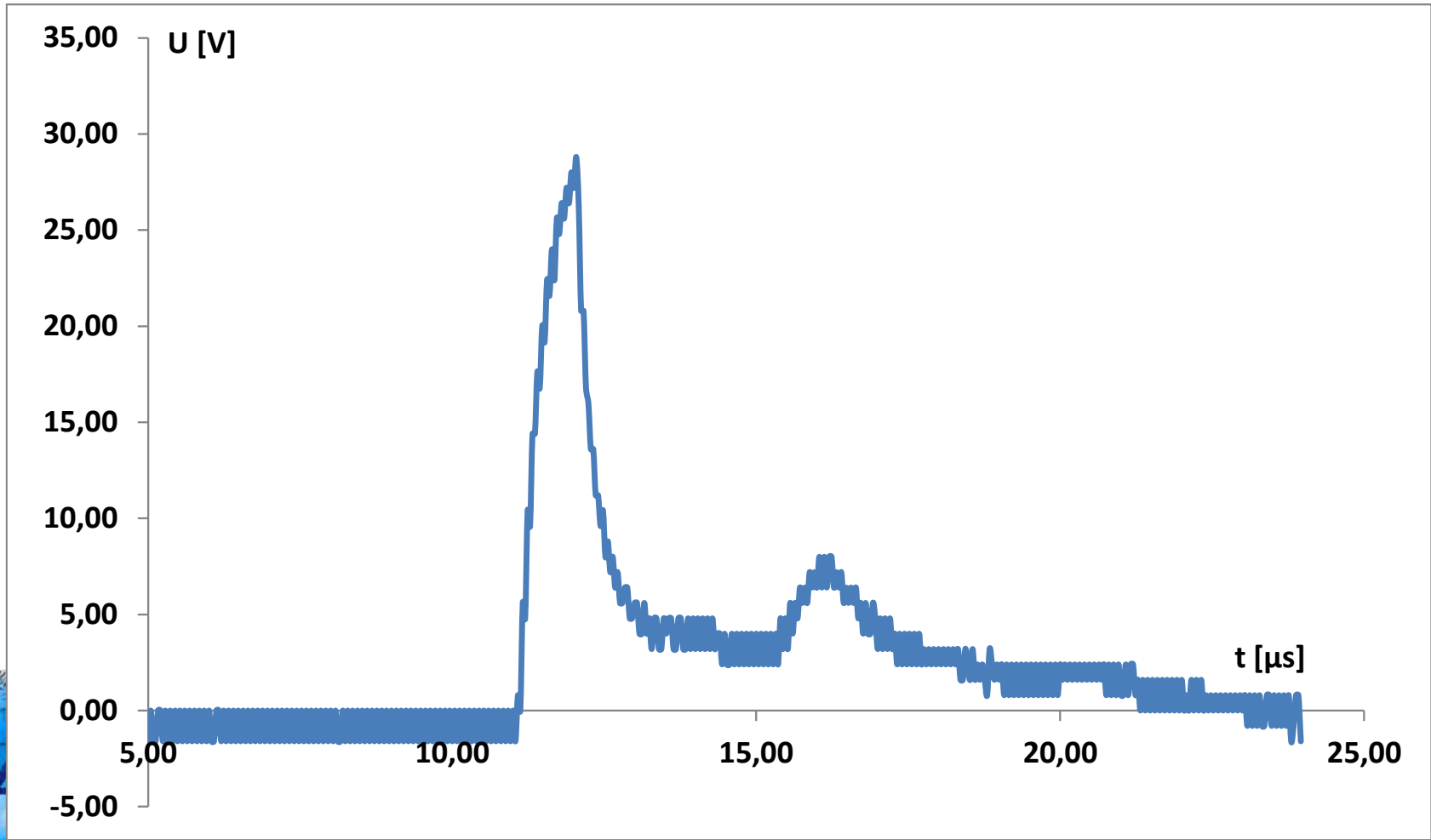
Prostorija	Vrsta žarulje	Mjereni svjetlosni tok [lx]
Hodnik	Žarna nit 60 W	120
Spavaća soba	Žarna nit 70 W	130
Dnevni boravak	Štedna 20 W	220
Kuhinja	Neonka 18 W + žarna nit 70 W	280
WC	Neonka 18 W + žarna nit 60 W	301



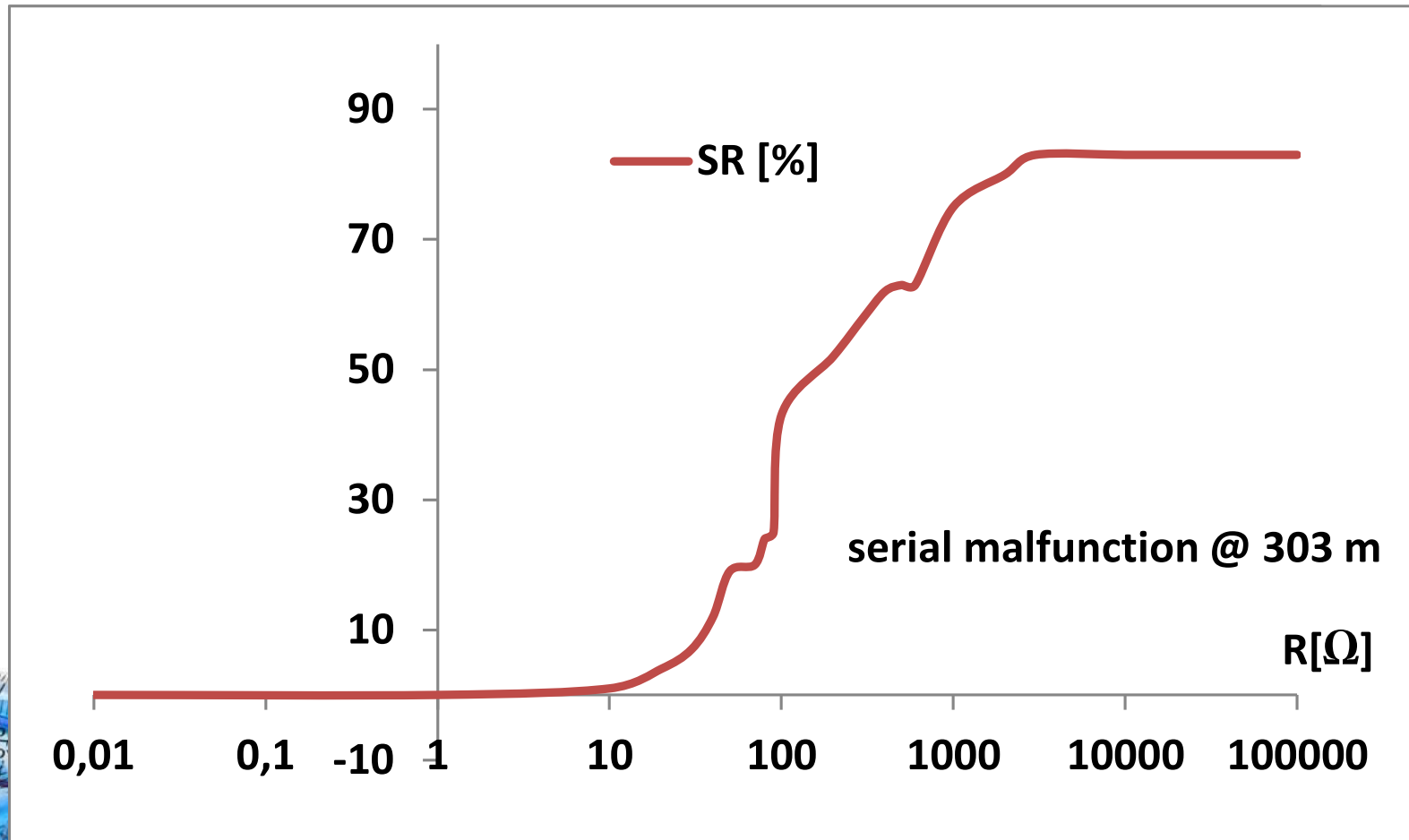
Energy efficiency - reference list

- 1. Garma, Tonko, Mjerenje značajki kvalitete električne energije u TS Križine- 5, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**
- 2. Garma, Tonko, Mjerenje značajki kvalitete električne energije u TS Vrh Sućidra - 18, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**
- 3. Garma, Tonko., Izvješće o ispitivanju značajki kvalitete električne energije u TS Smrdečac-4, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**
- 4. Garma, Tonko; Kovačević, Aleksandar., Termografski pregled TS Omial Novi, Naručitelj: Omial Novi d.o.o.; 2013. (izvješće).**
- 5. Krstulović, Lovre; Radica, Gojmir; Garma, Tonko.,Izvješće o energetskom pregledu aparthotela "Tamaris", Naručitelj: Petnjik d.o.o.; 2013. (elaborat).**
- 6. Krstulović-Opara, Lovre; Radica, Gojmir; Garma, Tonko., Izvješće o energetskom pregledu upravne zgrade HEP OPS PrP Split, Naručitelj: HEP OPS PrP Split; 2013. (elaborat).**
- 7. Krstulović-Opara, Lovre; Radica, Gojmir; Garma, Tonko., Izvješće o energetskom pregledu stambene zgrade D. Šimunovića 25, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**
- 8. Nikolić, Željana; Krstulović-Opara, Lovre; Garma, Tonko., Izvješće o energetskom pregledu upravne zgrade "Brodmerkur", Naručitelj: Brodomerkur; 2013. (elaborat).**
- 9. Nikolić, Željana; Krstulović-Opara, Lovre; Garma, Tonko., Izvješće o energetskom pregledu stambene zgrade Dobrilina 7, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**
- 10. Nikolić, Željana; Krstulović-Opara, Lovre; Garma, Tonko., Izvješće o energetskom pregledu stambene zgrade Vukovarska 113, Naručitelj: Novi dani d.o.o.; 2013. (izvješće).**

To Do: Cable fault localization – cable radar (test pulse)



To Do: Cable fault localization – cable radar (test pulse response)



Questions ...

