CIGRE/CIRED/IEEE C4.24 power quality in the future grid first introduction

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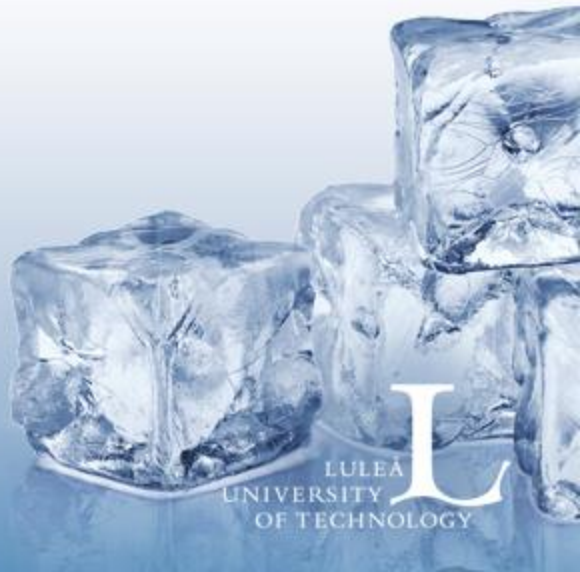
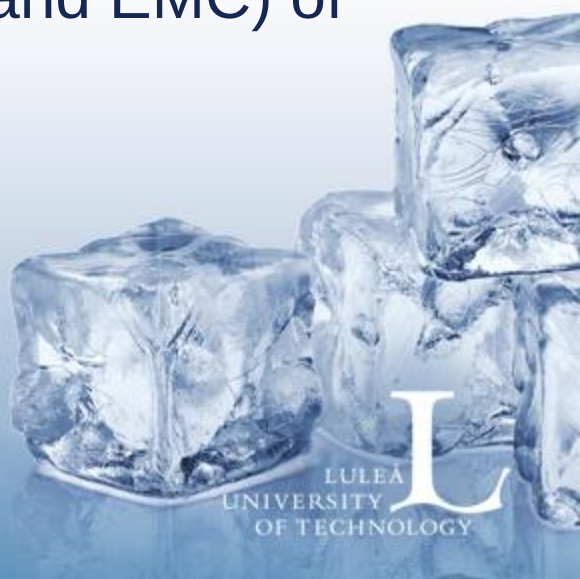
CIGRE/CIRED/IEEE C4.24

- CIGRE – international council on large electric power system
- CIRED – international conference on electricity distribution
- IEEE – Institution of Electrical and Electronics Engineers



CIGRE/CIRED/IEEE C4.24

- Power quality and EMC issues associated with future electricity networks
- Three-year mandate: 2013 – 2016
  - Emission (harmonics and unbalance) by new types of production and consumption
  - Positive and negative impact (on PQ and EMC) of new smart distribution applications
  - Impact on the transmission level



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Smart grid and power quality

- Smart-grid solutions for power-quality problems
  - Lots of possibilities, but limited by the costs
- Power-quality parts of the challenges
  - Need to quantify the challenges
  - Hosting capacity approach
- New power-quality problems that occur when smart-grid solutions remove some of the other challenges
  - Power quality should not be forgotten

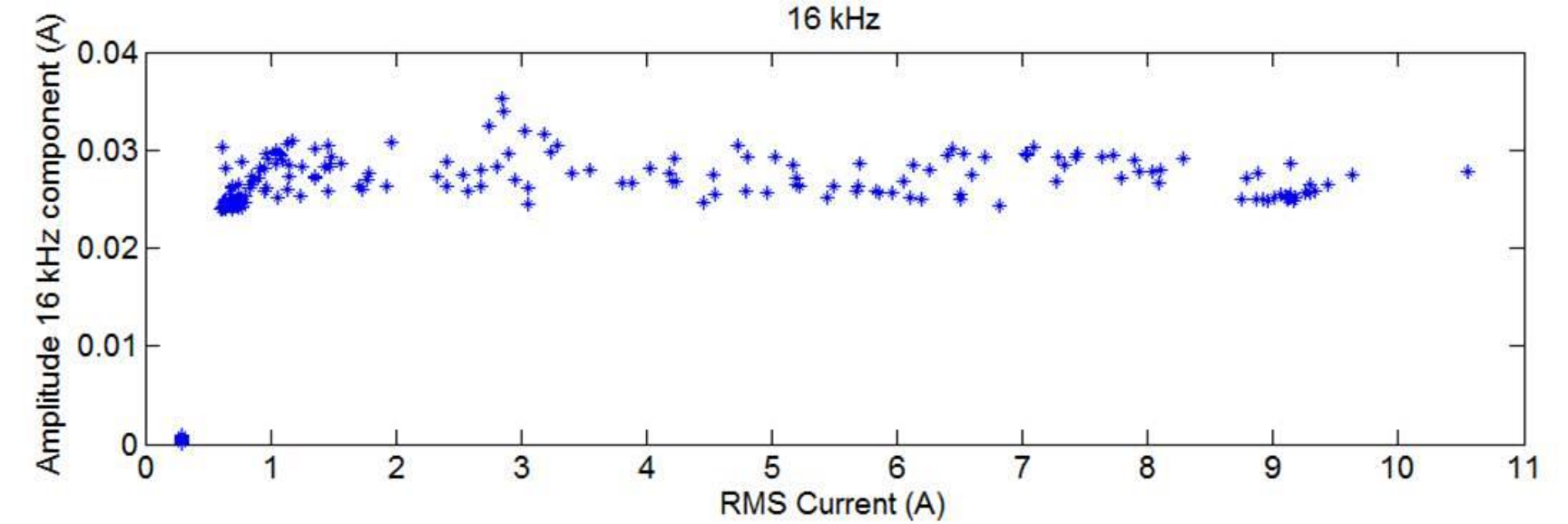
New types of emission

- Interharmonics
- Even harmonics
- Supraharmonics (2 to 150 kHz)

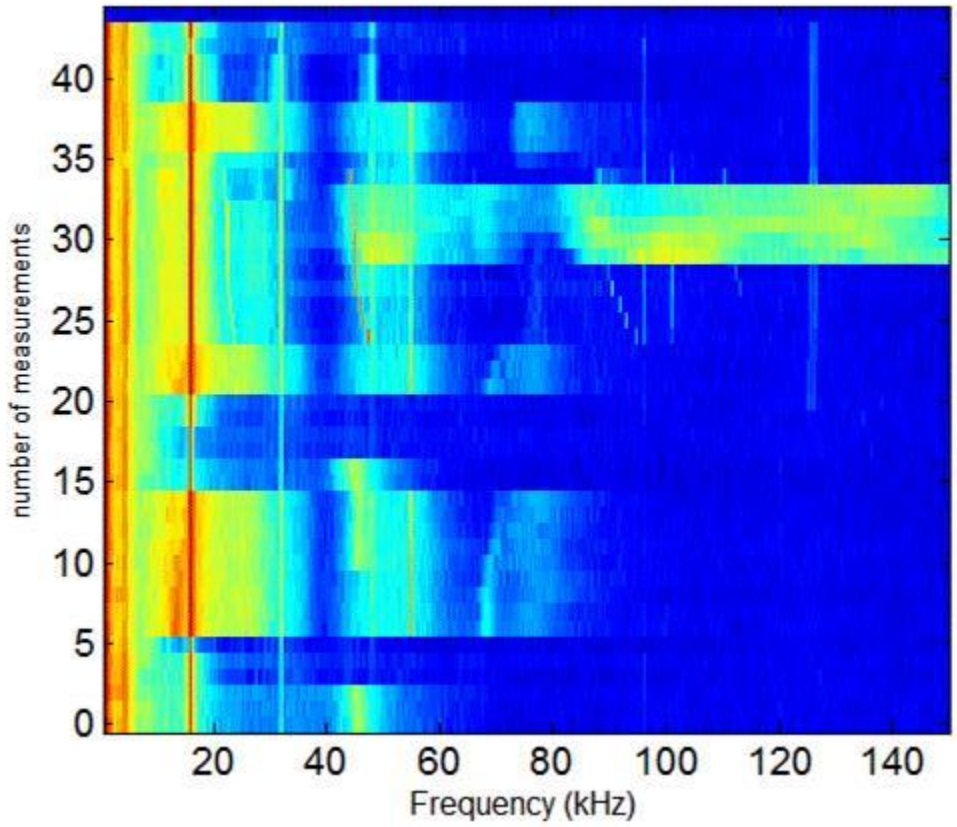
- Fast voltage variations (1 second to 10 minutes)

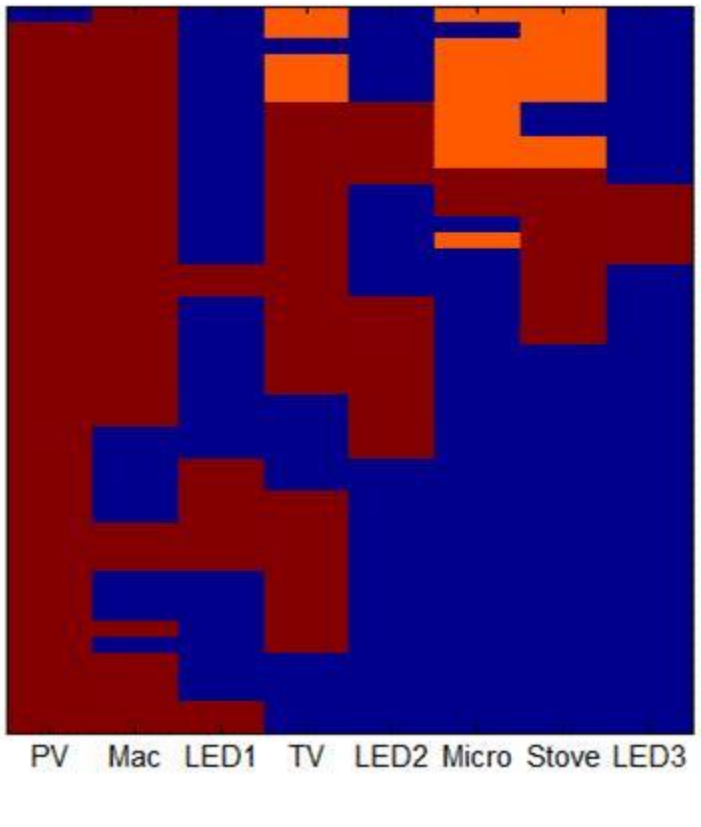
- Anything that causes LED lamps to flicker

Supraharmonics - 2.5 kW PV installation

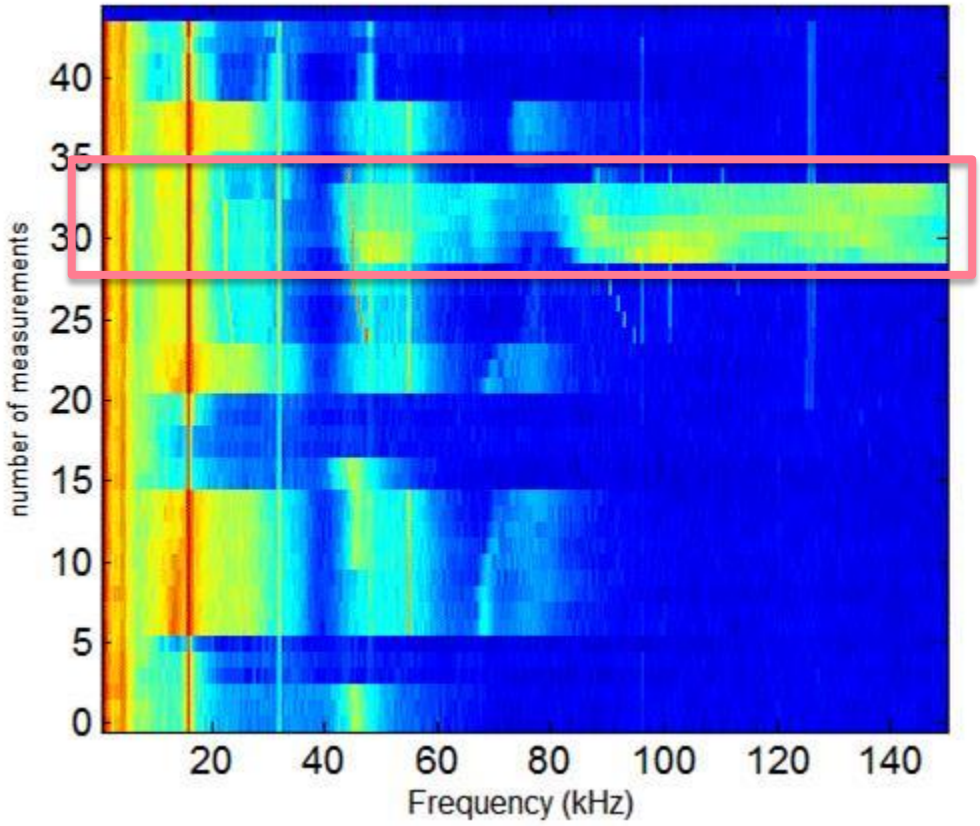


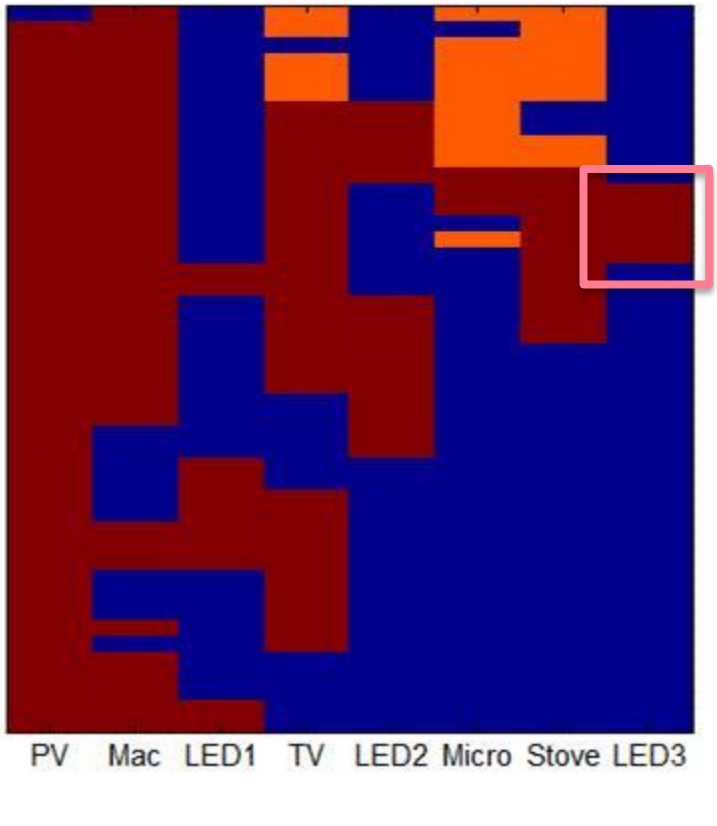
Propagation of supraharmonics



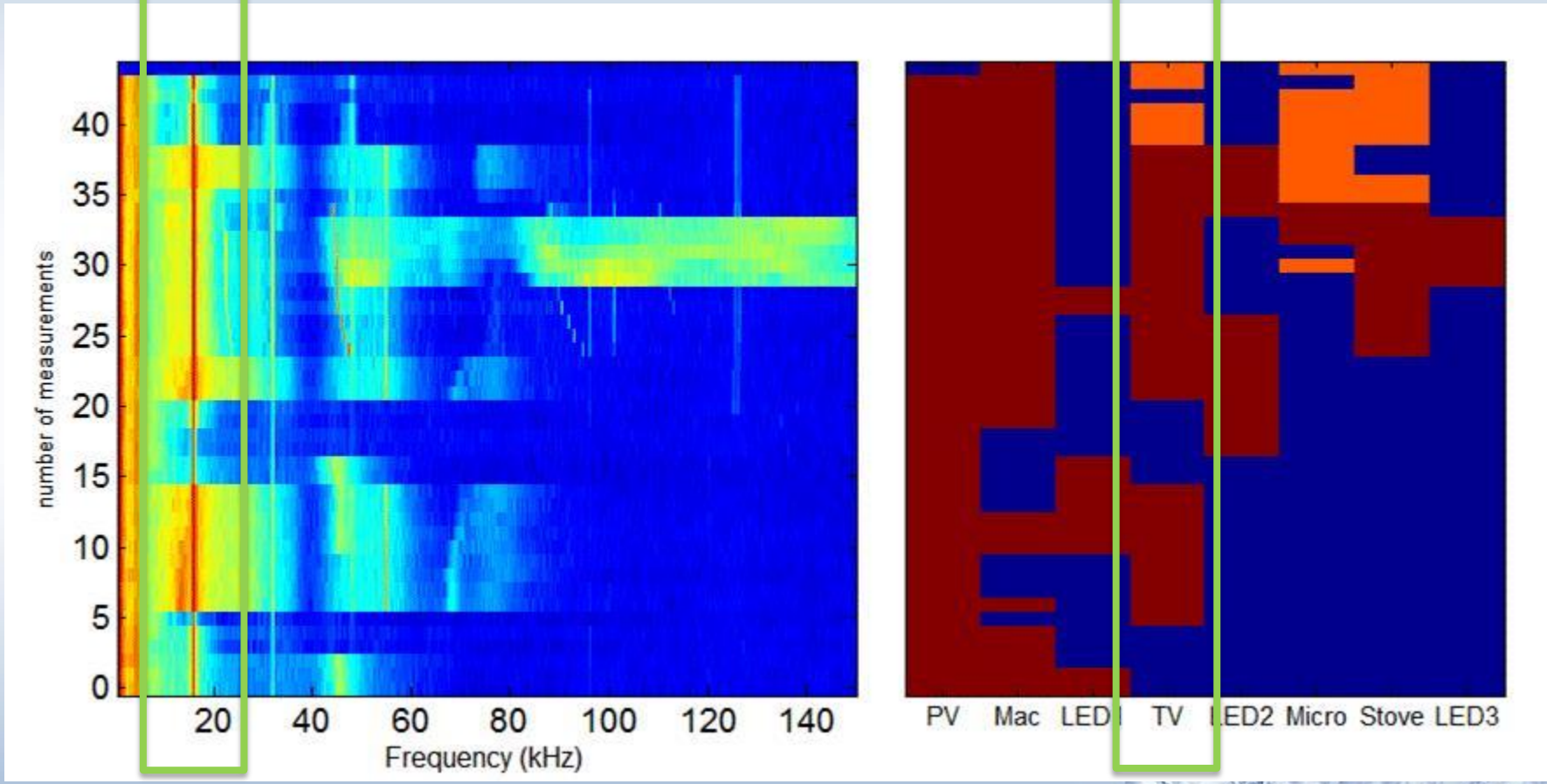


Propagation of supraharmonics
Secondary emission

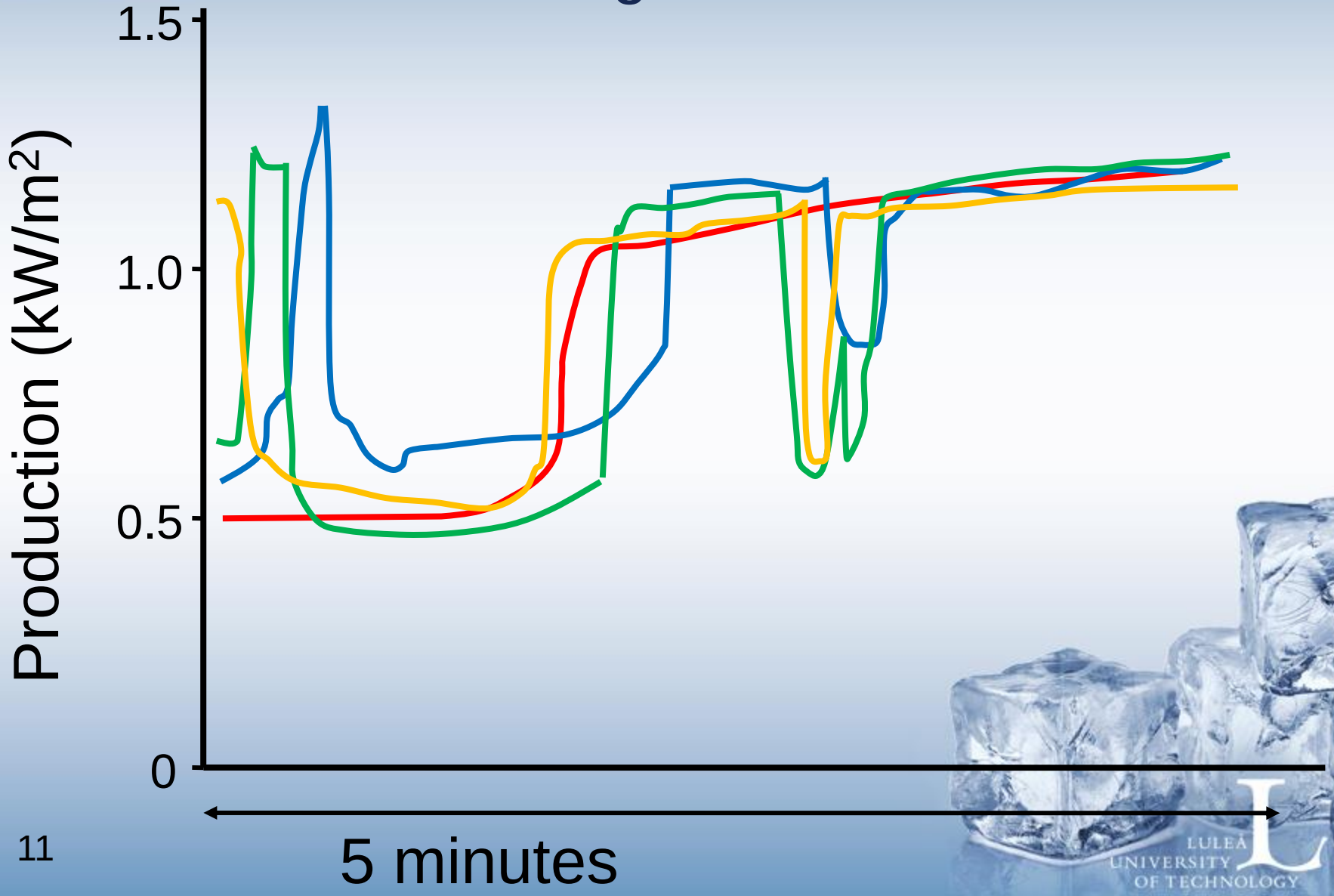




Propagation of supraharmonics
time—varying primary emission



Fast voltage variations



Volt-var-control and power quality

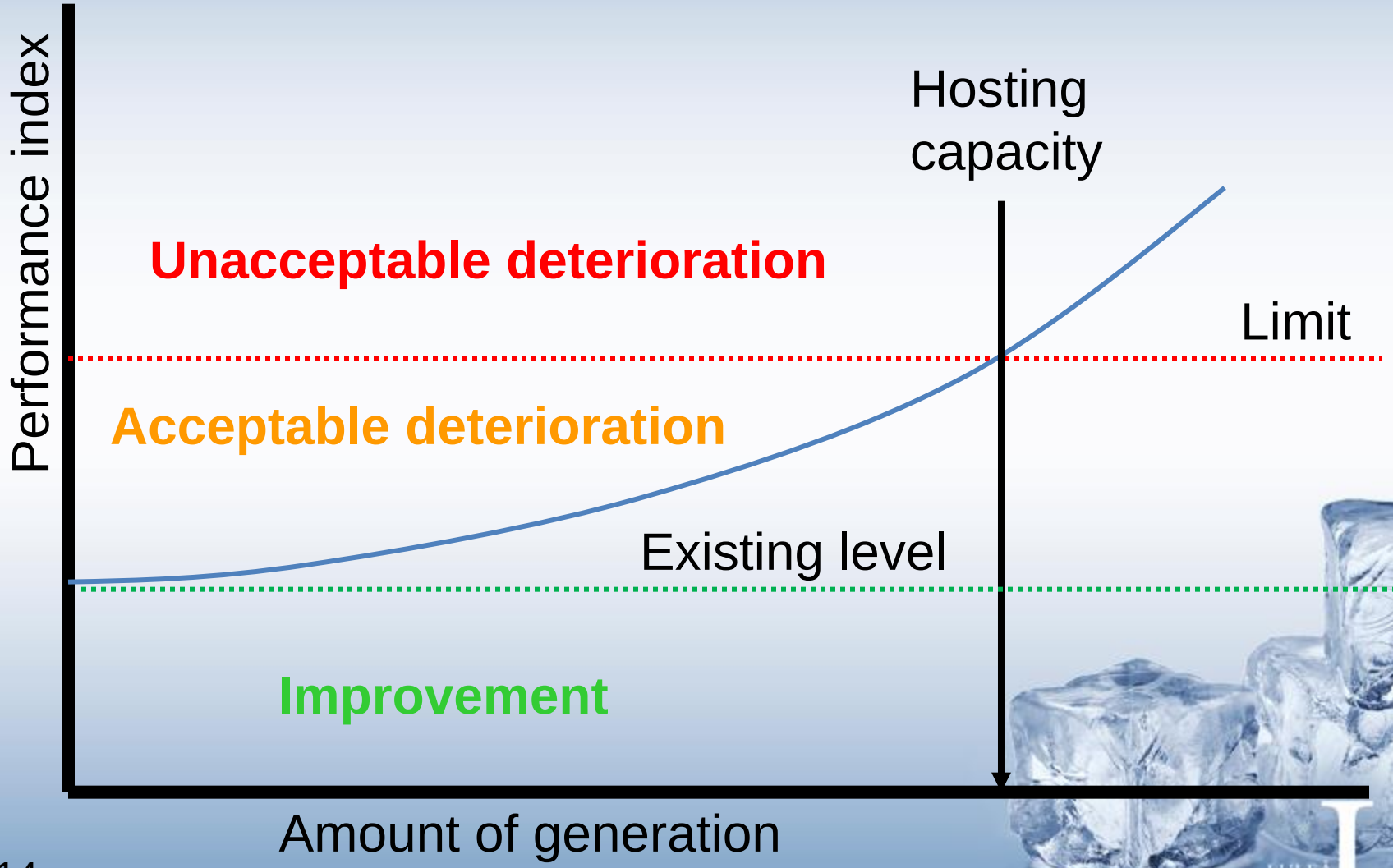
- Positive impact
  - Less overvoltage and undervoltages

- Negative impact
  - Capacitor banks shift harmonic resonance frequencies
  - Capacitor banks and tap-changers give voltage steps
  - Active control of reactive power gives supraharmonics
  - Conservation voltage reduction could give more dips and short-duration undervoltages

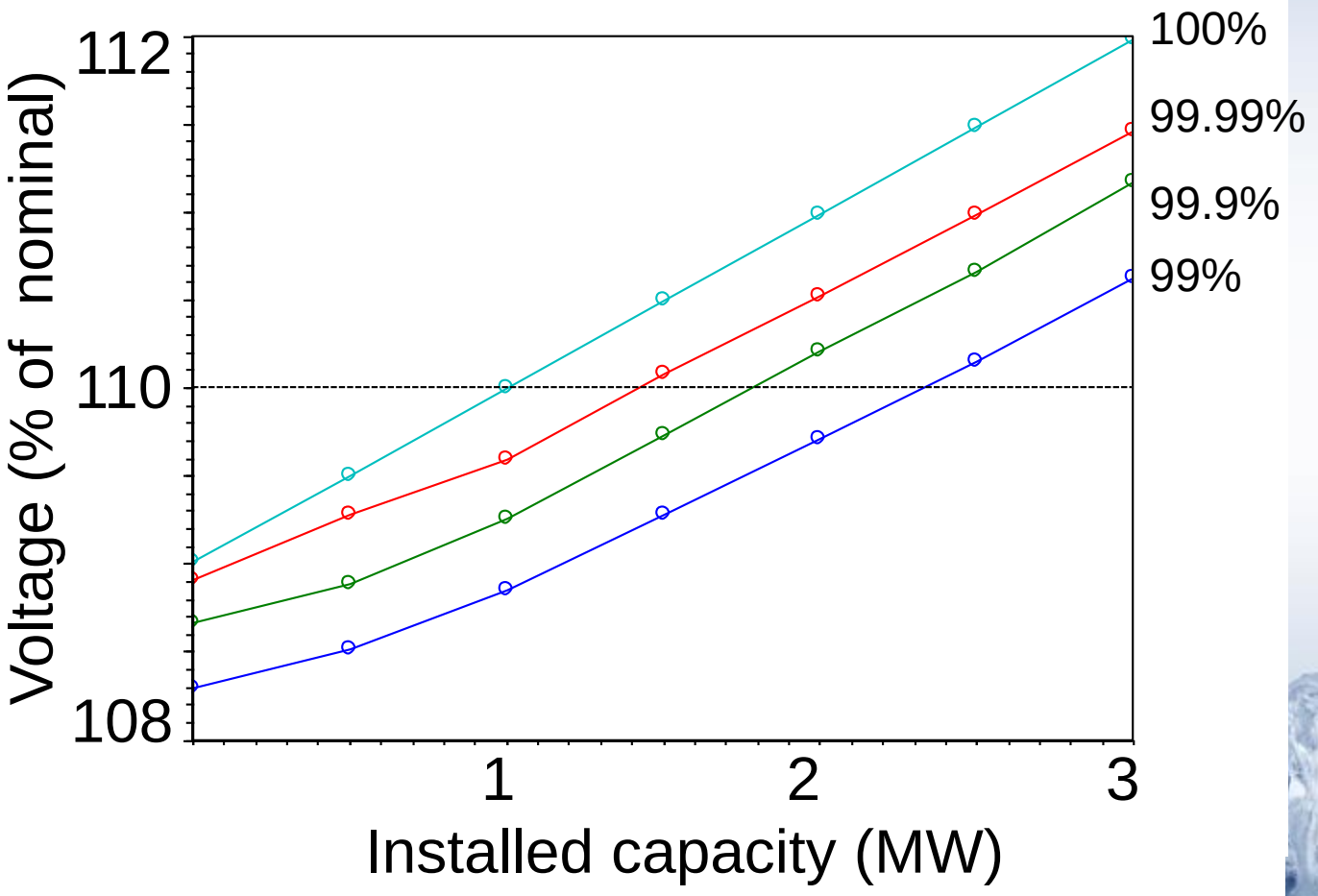
Economic aspects

- A recently-added chapter, contents is still under discussion
- Current status of the discussions
  - Future costs of power quality: to be included
  - Markets for power quality: not to be included
  - Hosting capacity approach: ?
  - Curtailment for improved power quality: ?

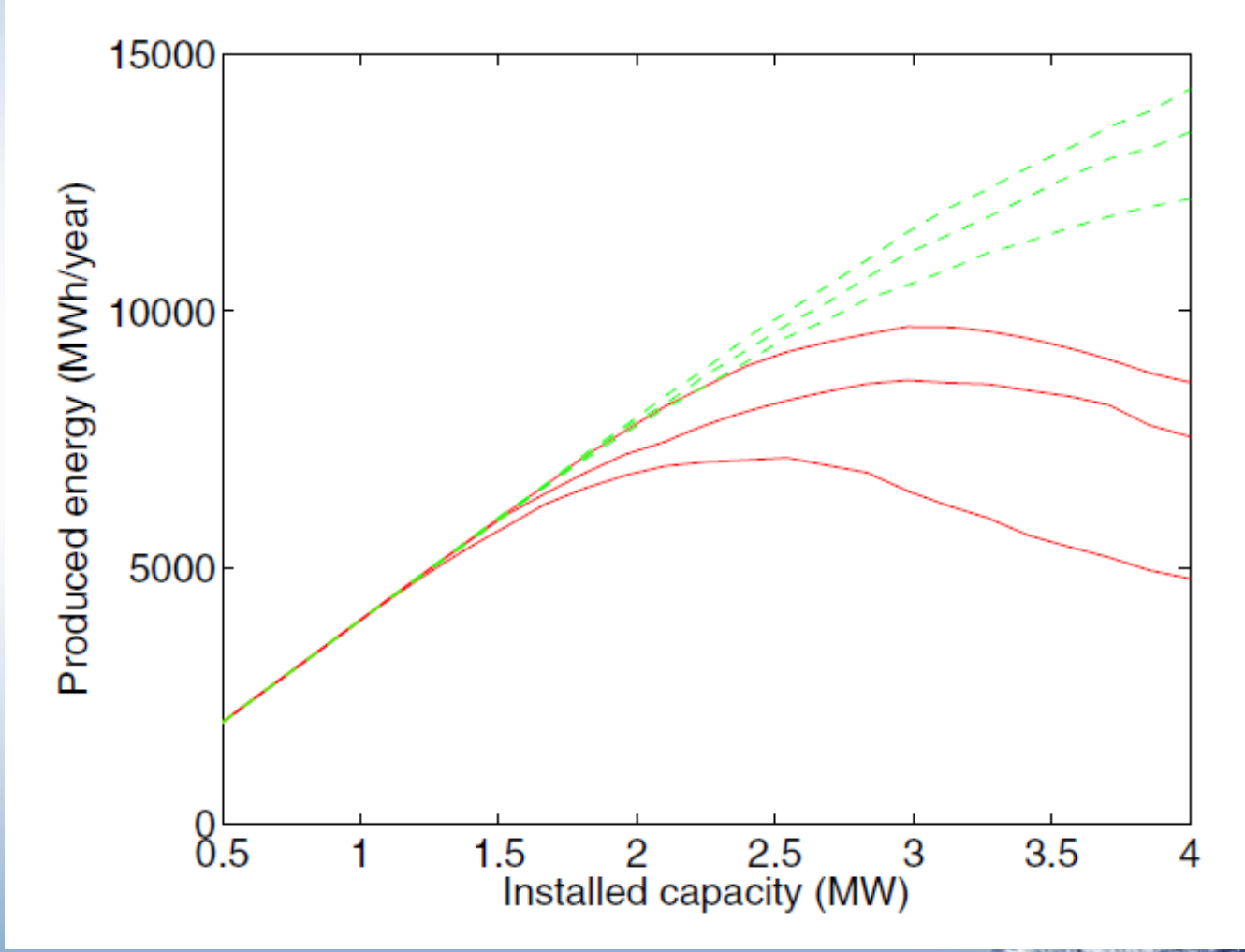
Hosting capacity approach



Impact of statistics



Curtailment against bad power quality



New measurements – new data

- One location, 10-min values, 40 harmonics
  - 2 million values per year
- 5.2 million smart meters, 10-min rms voltage
  - 270 GB/year
- One monitor, 3 phases, voltage and current, 256 samples per cycle
  - 2.4 TB (10^{12}) per year

More information about the working group

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- Questions are welcome, contributions even more