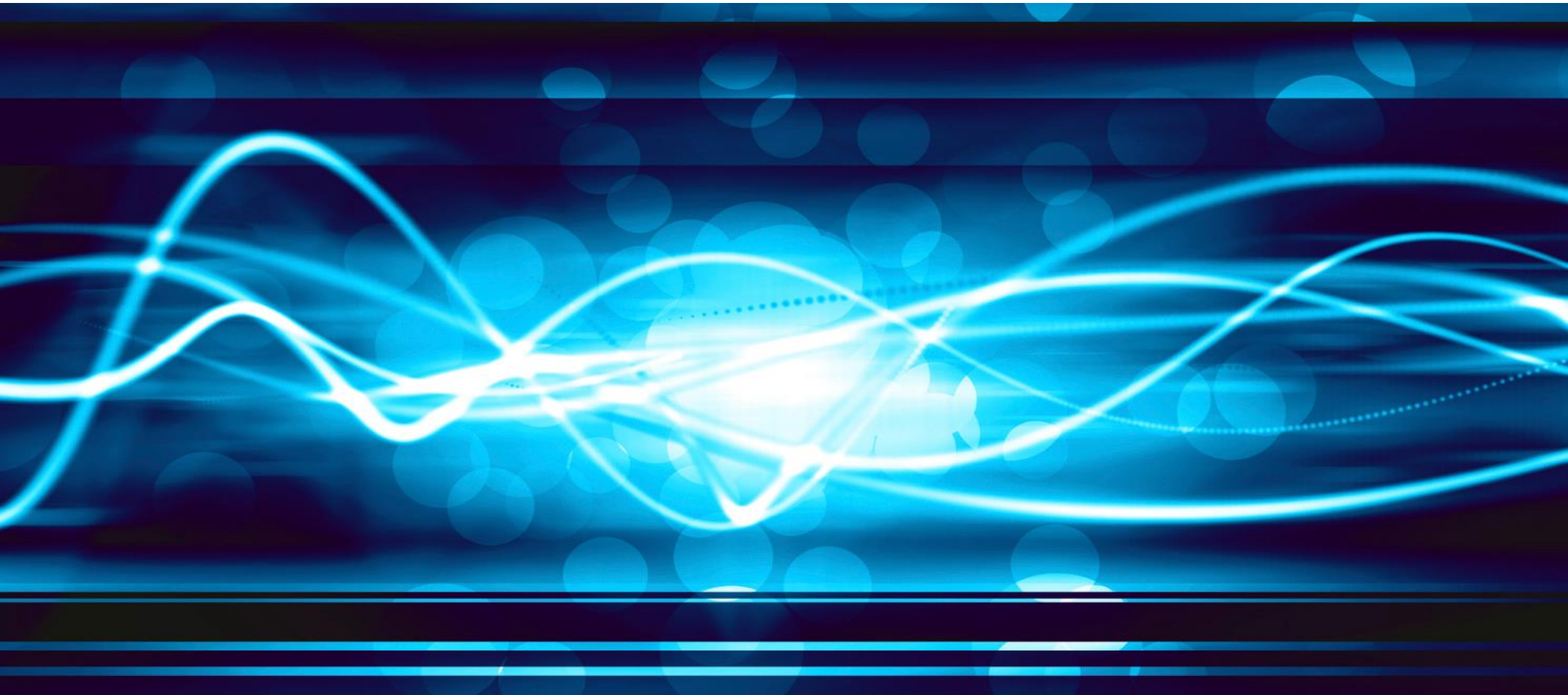


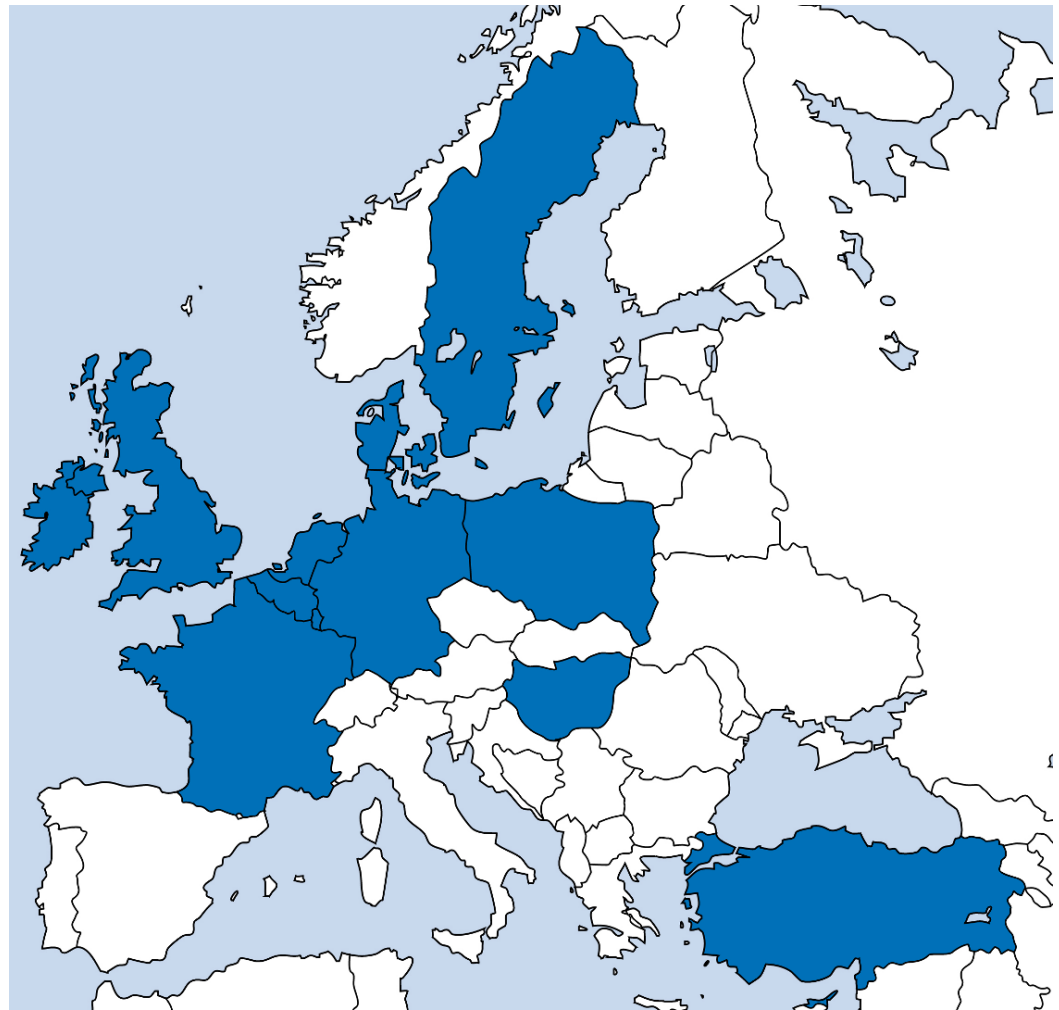
On shore powersupply facilities, Safety and availability

Fred Johansson



Grontmij at a glance

- Founded in 1915
- Strong European regional network
- 300 offices in Europe
- 50 offices RoW*
- 4 Business Lines
 - Planning & Design
 - Transportation & Mobility
 - Water & Energy
 - Monitoring & Testing
- 10,000 people
- Principle regions:
 - Benelux
 - France
 - Nordic
 - UK, Central & Eastern Europe
 - RoW*



* RoW: rest of the World

Grontmij engagement, Onshore Power Supply in port of Ystad

3

- System proposal
- System agreement ship owners
- Calculations
- Energy company contacts
- Building permit
- Technical specification for turnkey project
- Procurement support
- Client support during execution
- Building inspector
- Technical link between contractor and ship technicians
- Commissioning and testing

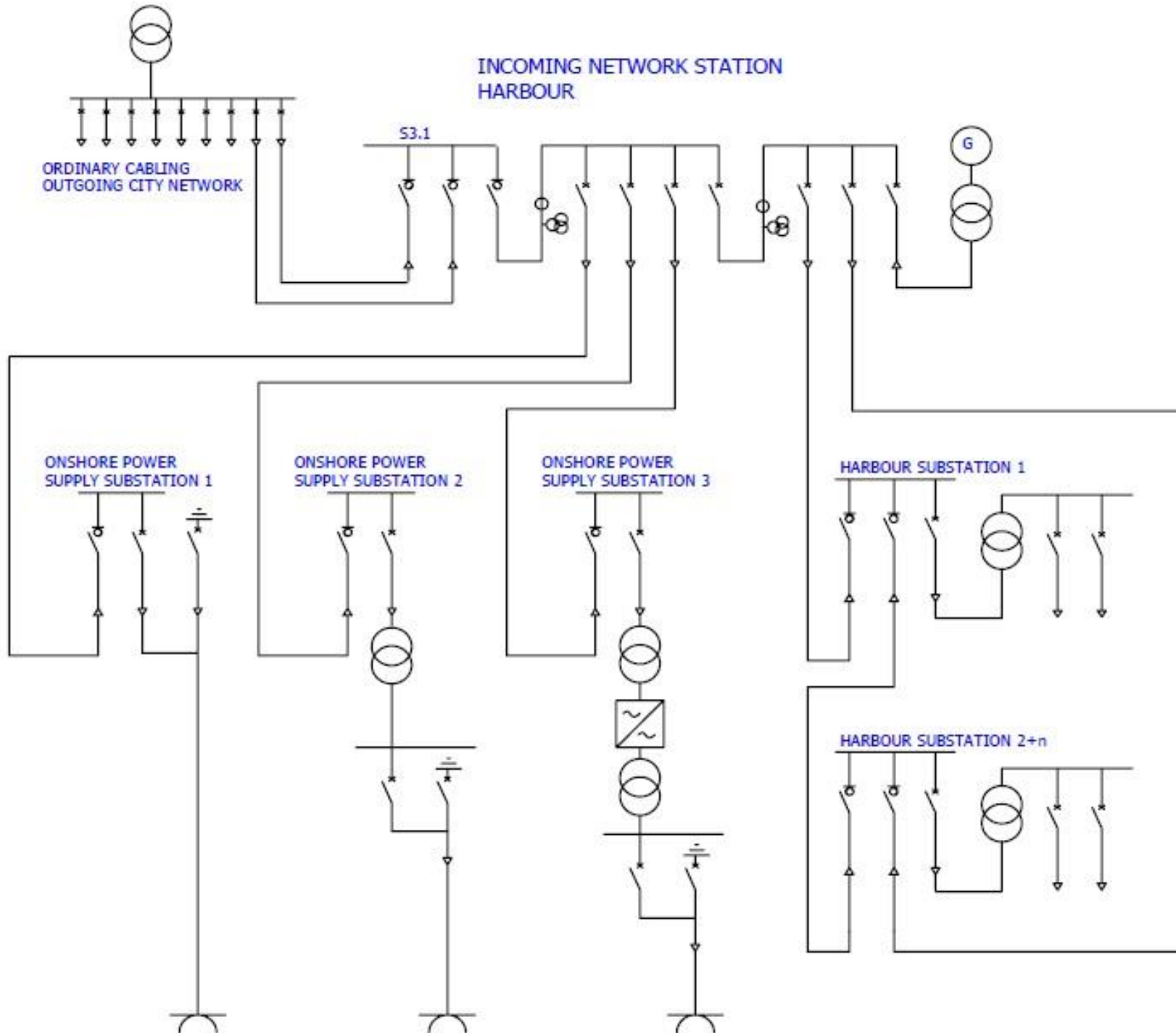
Maximum availability with highest safety at lowest cost?

4

Provided by:

- Switchgear technology
- Relay protection philosophy
- System solution high voltage network
- Electrical quality

Medium Harbour network



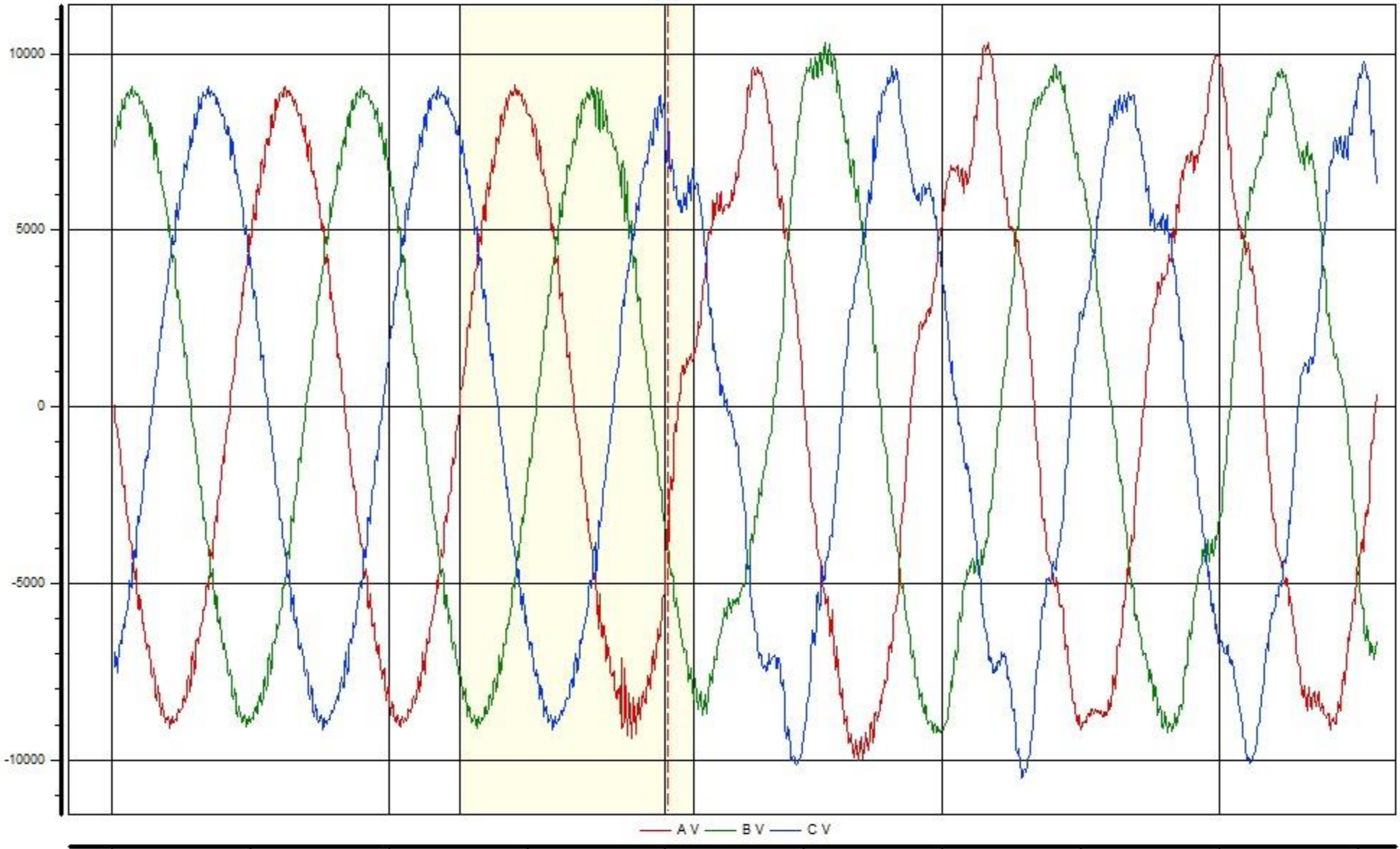
Electrical quality

- **IEC standard for On shore power supply (IEC 80005-1) states:**
- Frequency may vary with +/- 5% between no load and nominal load
- 6 % Voltage increase is allowed at no load condition
- -3,5% voltage drop on nominal voltage is allowed at nominal load

- Are these figures acceptable?
- **IEC standard for distribution networks 1-36kV**

Supply voltage characteristic	Statistical Evaluation	Compliance limit
Power frequency	95% of the time in 1 week	50 Hz \pm 1%
	100% of the time in 1 week	50 Hz + 4% to -6%
Supply voltage variations	95% of the time in 1 week	$U_c \pm 10\%$
Rapid voltage changes (and Flicker)	95% of the time in 1 week	$Plt \leq 1$
Supply voltage dips	1 year	None given ¹
Short interruptions	1 year	None given ²
Long interruptions	1 year	None given ³
Temporary overvoltages	1 year	None given
Supply voltage unbalance	95% of the time in 1 week	<2%
Harmonic voltage	95% of the time in 1 week	See Figure 1
	95% of the time in 1 week	THD <8%

Magnetizing ship B, while ship A is on shore supply



08:32:47.88
2015-03-25
Onsdag

Ship A, moment before blackout

