Fornecimento de bens e servicos na area de engenharia eletrica no CERN

ILO Industrial Opportunities Days, 3-4 September 2019

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CERN | EN ENGINEERING DEPARTMENT

Agenda

1. Introduction to CERN electrical network
2. Equipment, activities and contracts
3. Future activities and contracts
4. Conclusions

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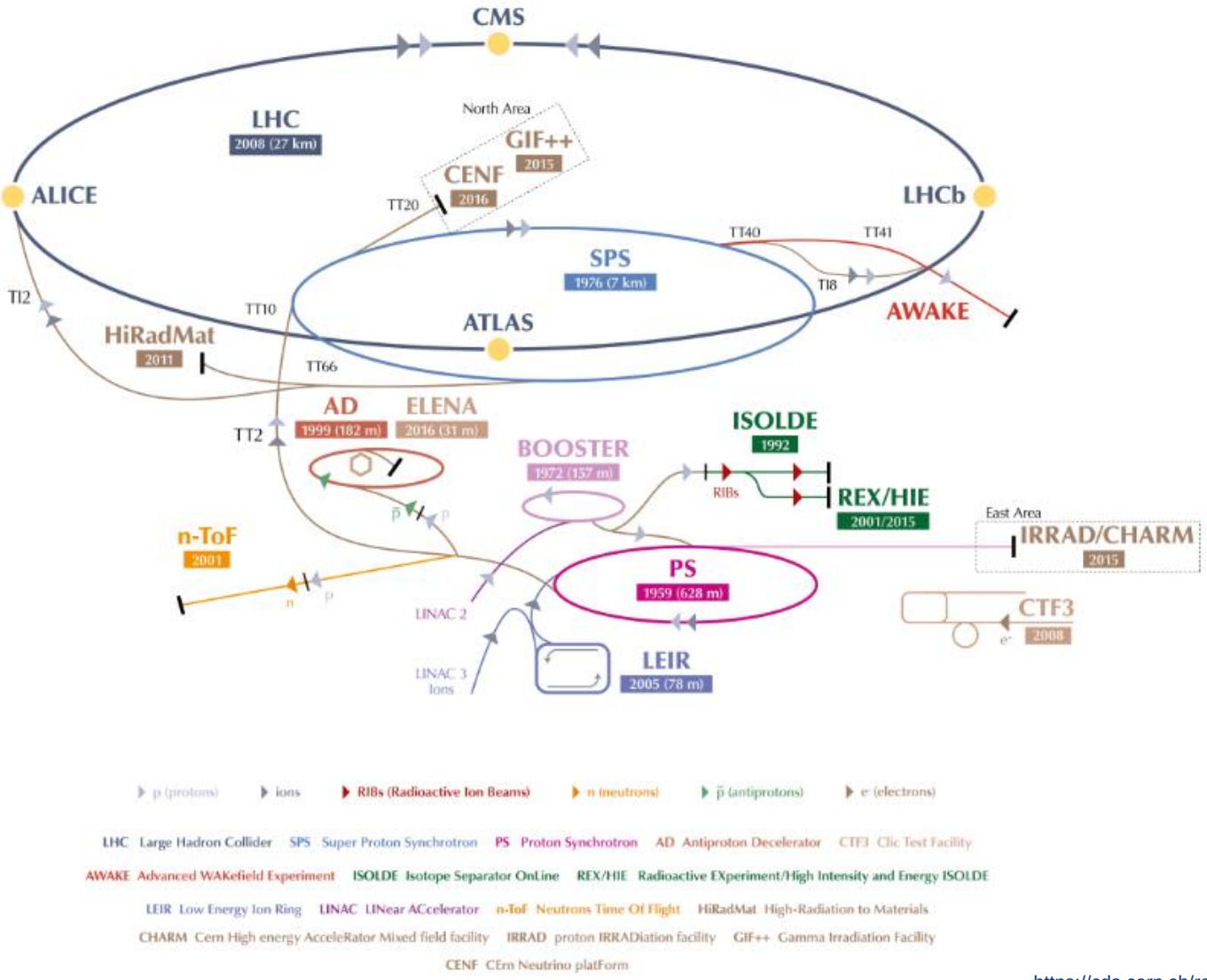
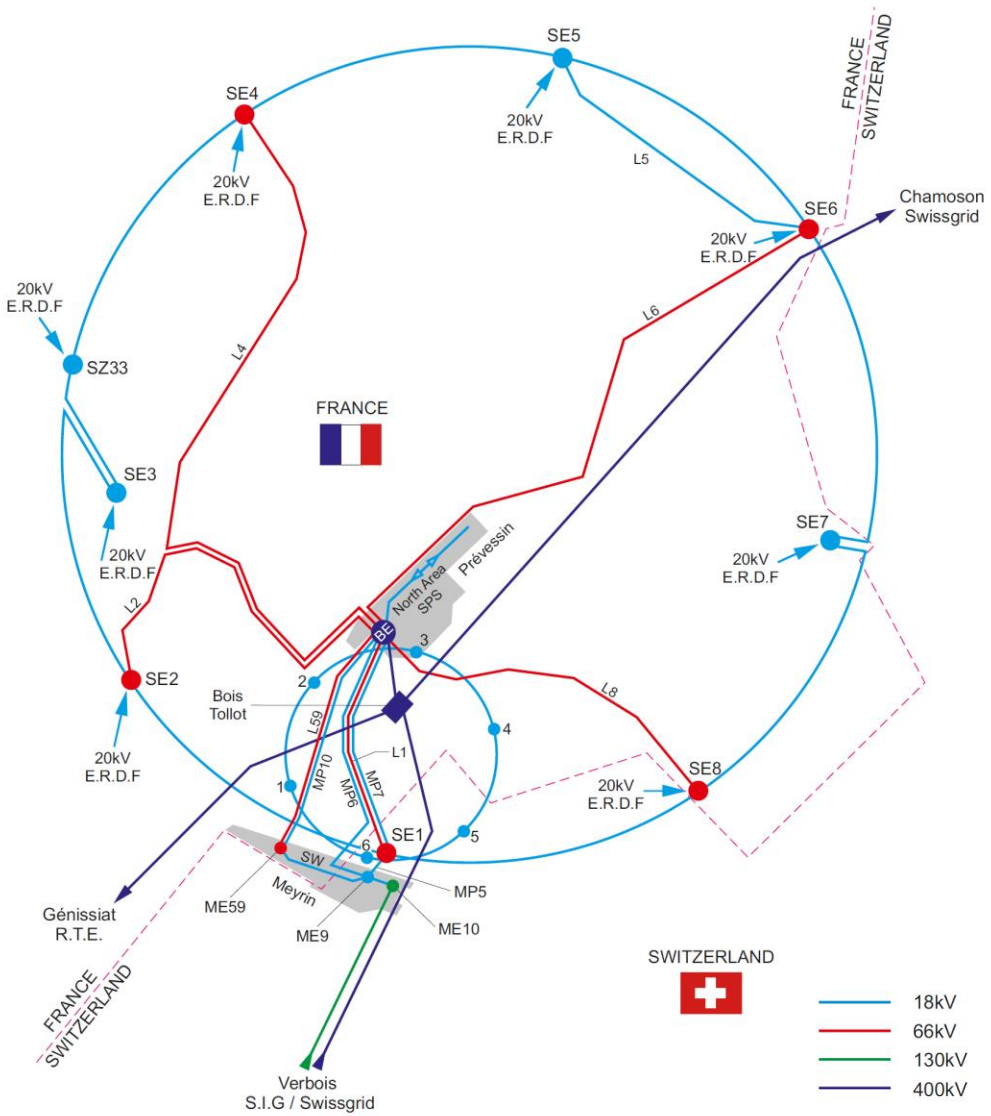
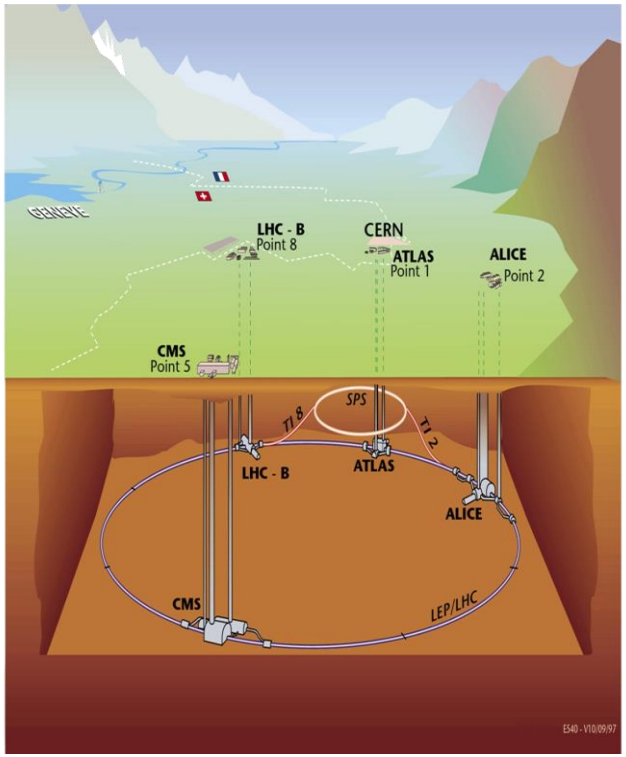
CERN accelerators complex



https://cds.cern.ch/record/2225847

Electrical network: geographical extension





Voltage levels:

- 400 kV main incomer
- 66 kV transmission
- 18 kV distribution
- 3.3 kV motors
- 0.4 kV users

Type and quantity of equipment

Equipment type	Quantity source EDMS 559013 v6.0
Power transformers (400 kV and 66 kV)	5 + 8
Distribution transformers (18/0.4 kV)	~750 (oil and dry-type)
HV switchgear (18 kV & 3.3 kV)	~1 000
LV feeders	~30 000
UPS	~300
48 Vdc battery systems	~100
Protection relays	~1 000
Gensets	17 (~22 MVA)
Water cooled cables	1 500 (length 3 to 250 m)
SCADA	23 000 devices / 250 000 data-points

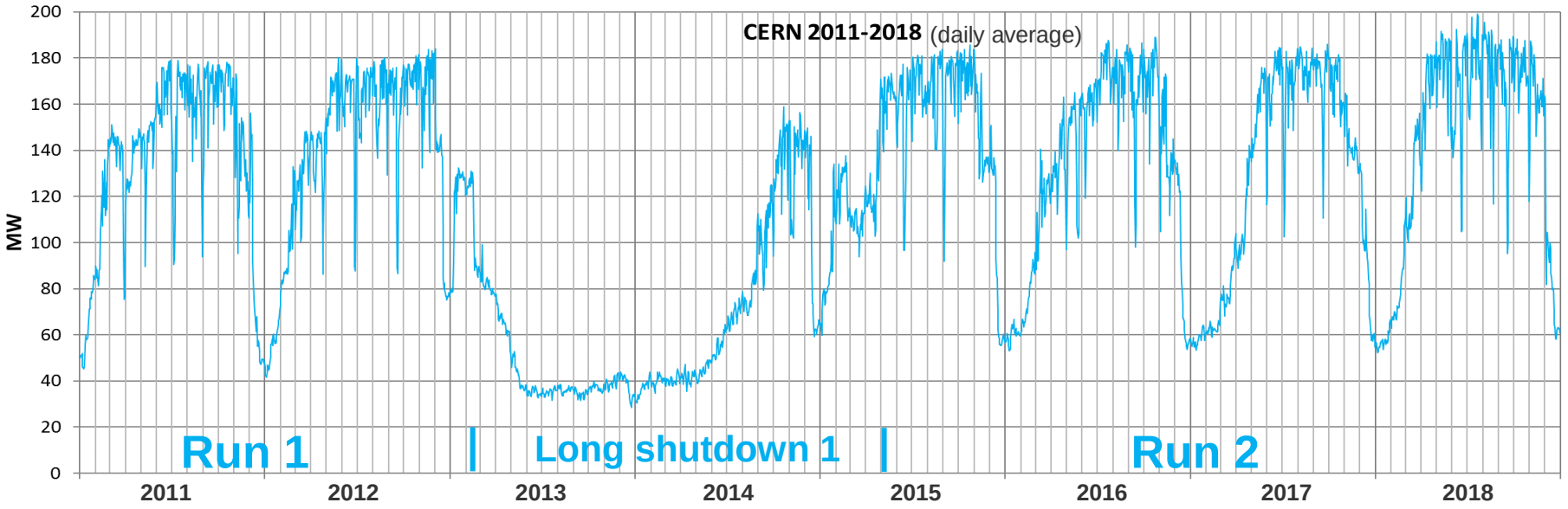
Electrical consumption: typical figure

GWh (annual consumption)

- 1’200 GWh (normal operation year)
- 350 GWh (shutdown year)

MW (max active power)

- 190 MW (daily average)
- 210 MW (10-min average)
- 320 MW (instantaneous)



Courtesy B. Mouche / EN-EL

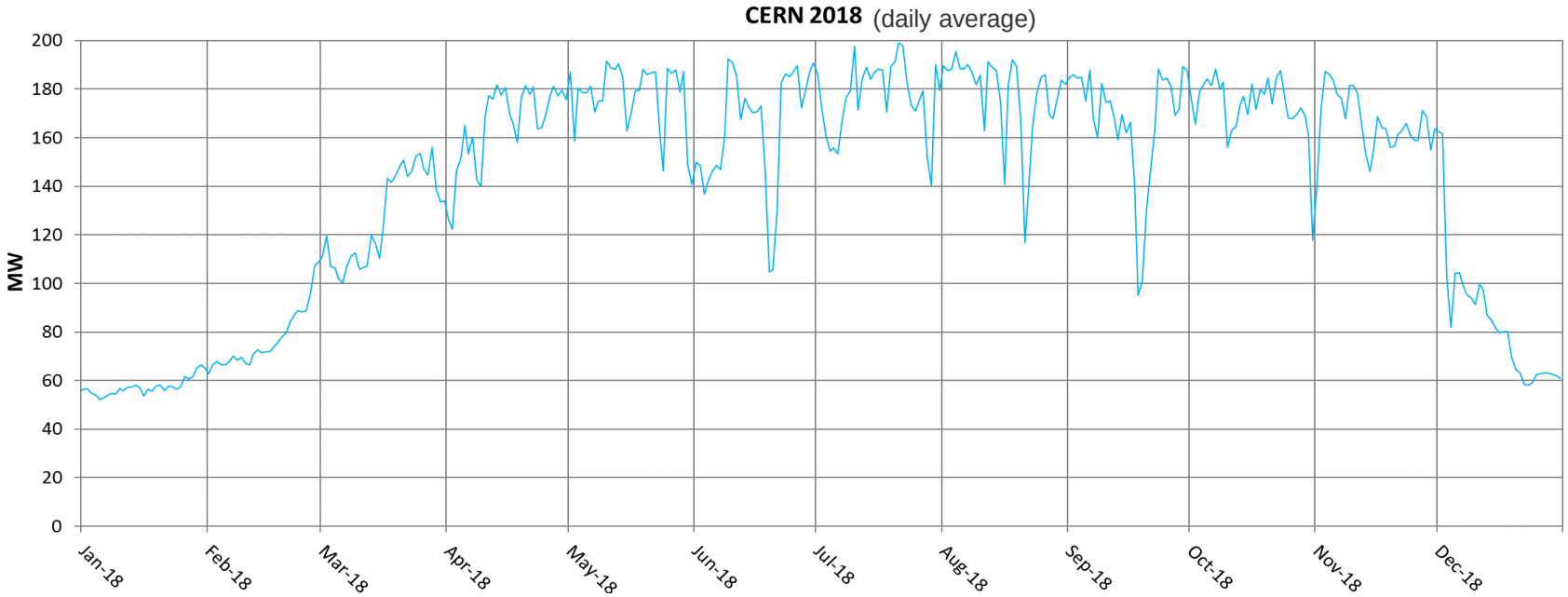
Electrical consumption: 2018 figures

GWh

- 1’251 GWh

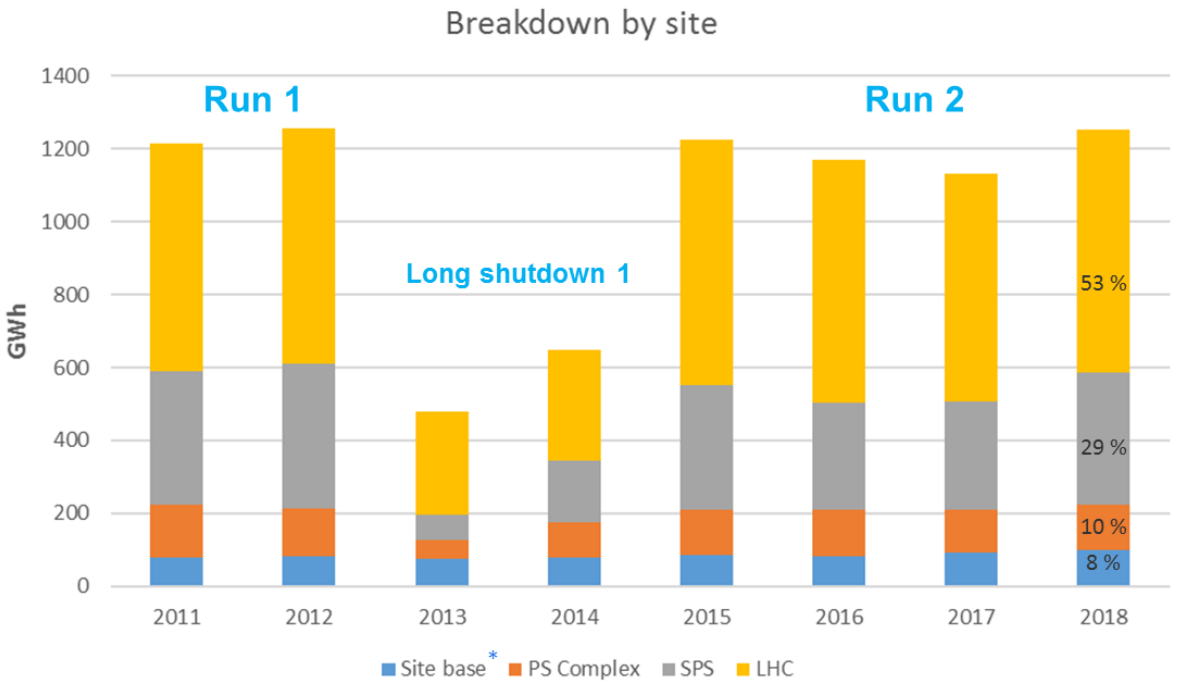
MW

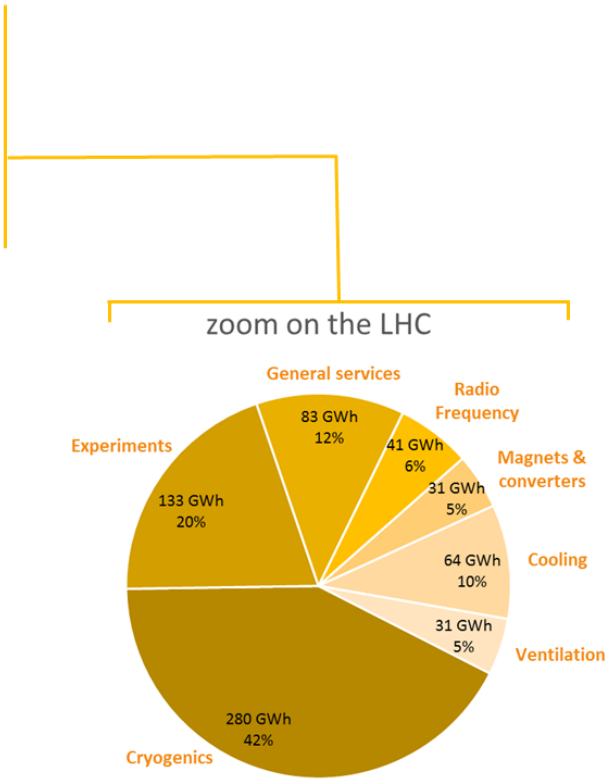
- 199 MW (daily average)
- 215 MW (10-min average)
- 320 MW (instantaneous)



Courtesy B. Mouche / EN-EL

Electrical consumption: Zoom on LHC





* Site base =
- office buildings (Meyrin & Prevessin sites)
- central services (computer center, pumping station)

Courtesy B. Mouche / EN-EL

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“Components” of the network

Can be classified in 5 groups:

HIGH VOLTAGE

- Transformers
- MV Cables
- Switchgear
- Gensets

LOW VOLTAGE

- 48 V_{DC} systems
- UPS
- Switchgear and switchboards
- LV Cables
- Gensets

CONTROL

- SCADA
- RTUs

CABLING

- Signal cables
- Coaxial cables
- Water cooled cables
- Optical fibers
- Connectors

ENERGY

- Supply of energy

The activities related to the electrical network target companies with experience in these five sectors

How activities are structured

- In general:
  - Blanket contracts for the supply of equipment
  - Service contracts for installation
- In some cases:
  - One contract for equipment supply + installation
- For specific projects:
  - Turn-key contracts
- Maintenance:
  - Service contracts
- Consultancy services:
  - For design studies or work supervision

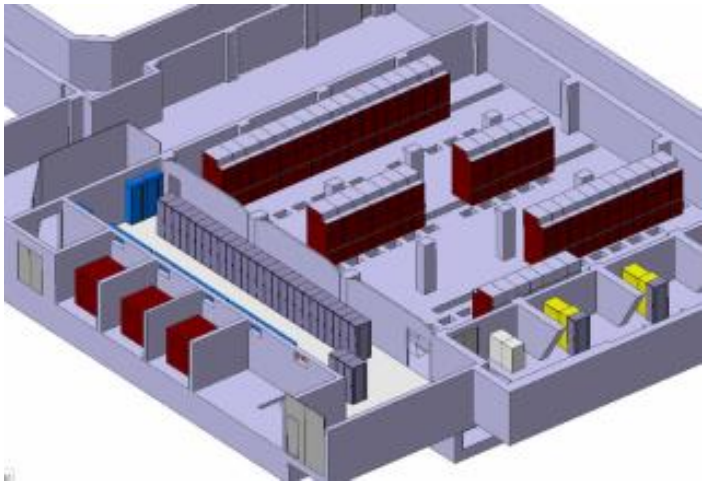
In the next slides some examples
- Renovation of electrical substations
- Upgrade of electrical substations
- Water cooled cables
- Turnkey projects

Example 1: Renovation of substations

Integration by CERN, equipment provided via blanket contracts, installation on site via existing service contracts

Example 2: Upgrade of substations

Integration by CERN, equipment provided via blanket contracts, installation on site via existing service contracts



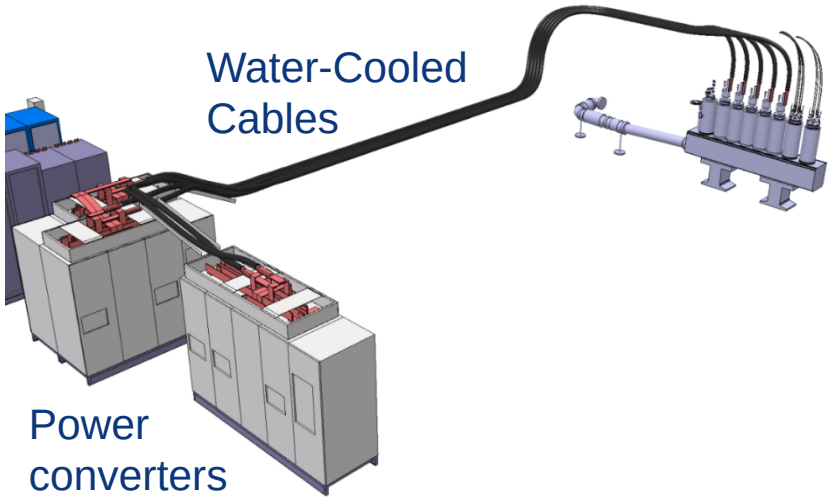
Example 3: Water-cooled cables

These flexible water-cooled cables or “WCC” are used for transporting high DC current from power converters to superconducting current leads.

40 cables are currently replaced during the LS2.

In the long term:

- Maintenance activities on existing cables or replacement
- New cables for HL-LHC
- R&D required



Example 4: Turn key contracts

Diesel generator power station for the Meyrin site with three 2.5 MVA gensets

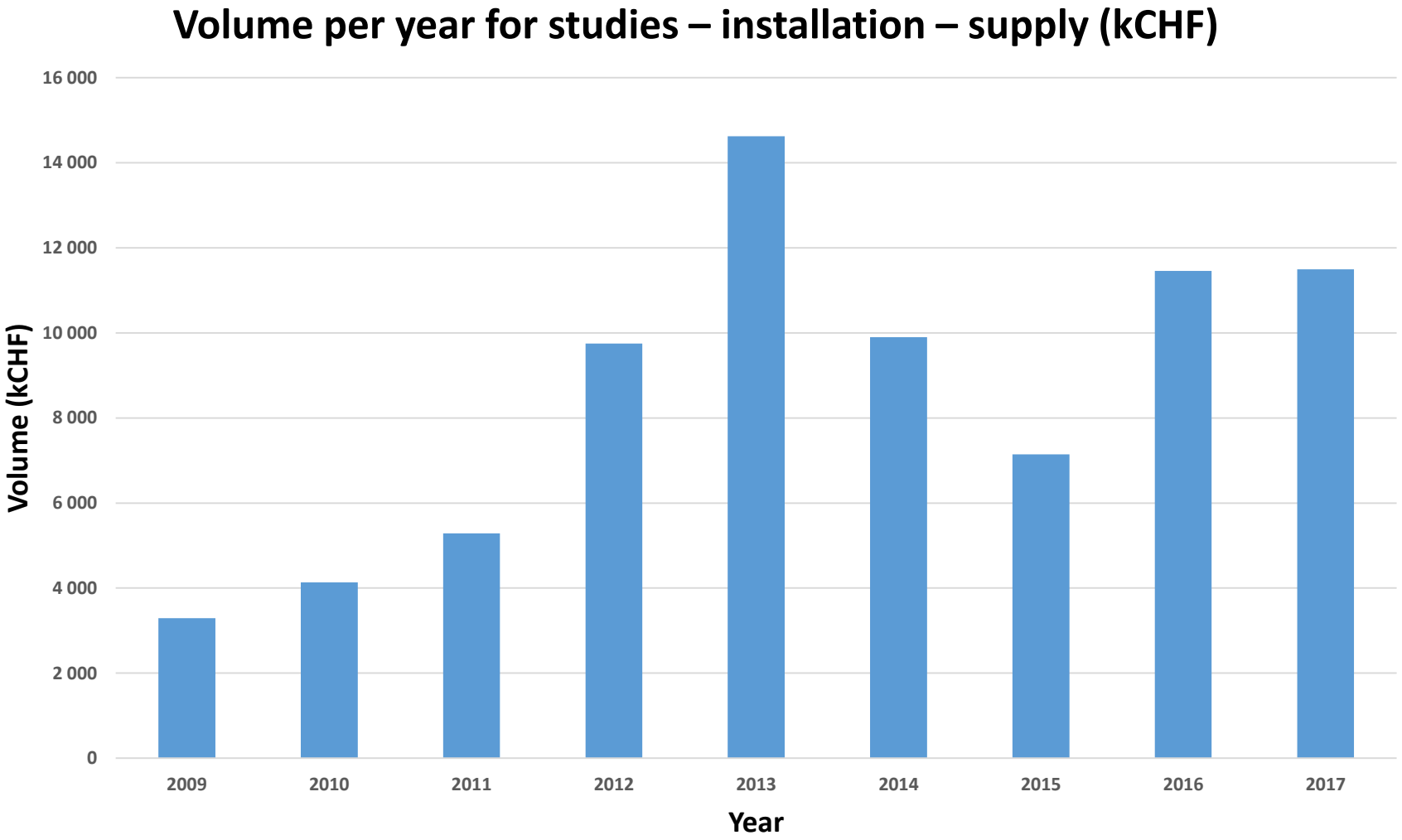
Example 5: Turn key contracts

Construction of a new 400 kV substation with a 220 MVA power transformer

Blanket contracts

Equipment type	Volume	Unit
High voltage switchgear	~ 300	kCHF/year
High voltage transformers	~ 350	kCHF/year
Low voltage switchboards	~ 14	unit/year
UPS	~ 11	system/year
48 Vdc systems	~ 5	system/year
Network protection relays	~ 40	unit/year
Power, control and special cables	~ 50 to 200	km/year
Optical fiber cables	~ 40 to 70	km/year

Service contract for installation



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Future activities and projects

Short term (2019 to 2020):

- This period correspond to the CERN long shut down 2 (LS2)
- Required contracts and external contributions are already set-up
- Major consolidation are ongoing on the SPS and PS electrical network, through existing frame contract

Mid term (2021-2025):

- CERN wide consolidation activities on existing infrastructure
- Major works for HL-LHC project in surface and underground (estimated volume up to 30 MCHF)

Contracts to be renewed

Equipment type	Volume	When
HV transformers	150 units over 5 years	Ongoing
WCC cables + hoses	40 units over 3 years	2019-2020
Supply and installation of optical fibers pre-fitted cables, connectors, terminals and patch cords	>100 km of cables + >10’000 component s (connectors, terminals and patch-cords)	2019-2020
Supply of electricity	1200 GWh/year over 3+1+1 years	2019-2020
UPS	120 units over 5 years	2020
48 Vdc battery systems	35 units over 5 years	2021
High voltage cubicles	To be defined	2021-2022
Installation of electrical equipment and control cabling	10 MCHF/year for 5 years	2021-2022
Low voltage switchboards	70 units over 5 years	2022-2023
Network protection relays	To be defined	2022-2023

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Conclusions

- The electrical network plays a central role in CERN accelerators complex
- The electrical network is evolving permanently according to accelerators needs thus requiring continuous consolidations, extensions and upgrades
- Maintenance is mandatory to keep availability and reliability high
- **Industrial partners are fundamental key players to grant a reliable state-of-the art electrical network**

Who to contact

- Technical contact:

  Nicolas.Bellegarde@cern.ch Leader of CERN Electrical Group

- Procurement contact:
  https://procurement.web.cern.ch/en/who-to-contact-at-cern

CERN OPENDAYS

Explore the future with us
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14-15 September 2019

The Electrical Group will have a exhibition stand
You are welcome to visit us

Thank you for your attention

Questions

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