Towards ISO 50001 certification at CERN

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Sustainable HEP Workshop

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https://indico.cern.ch/event/1160140/

Agenda

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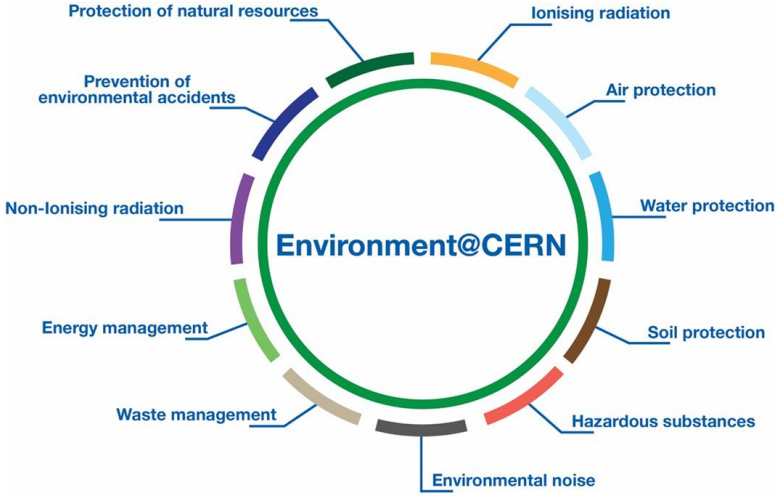
   - Energy performance indicators and targets
   - Action plan
4. **Conclusion**

Background

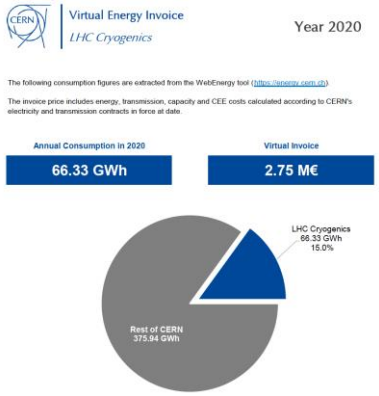
Energy Management at CERN

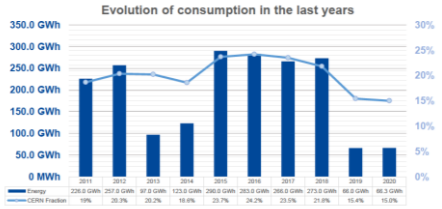
CERN Environmental Protection Steering Board (CEPS)



Energy Management Panel (EMP)

- Periodic coordination and studies by representatives of large consumers (> 25 GWh per year)
- Forecast update, awareness, good practices





Main drivers

- ✓ Consume less
- ✓ Improve efficiency
- ✓ Recover

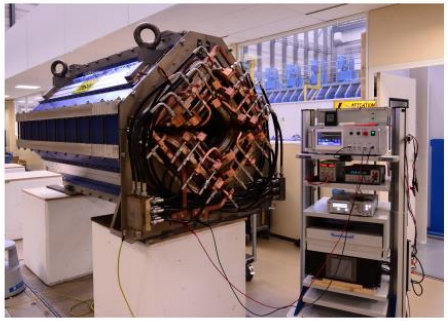
Workshop Energy for Sustainable Science

Energy Management for Large-Scale Research Infrastructures

- **CERN at the origin of « Energy for Sustainable Science » workshops since 2011**
- ➢ Next: ESSRI-2022, ESRF (Grenoble)

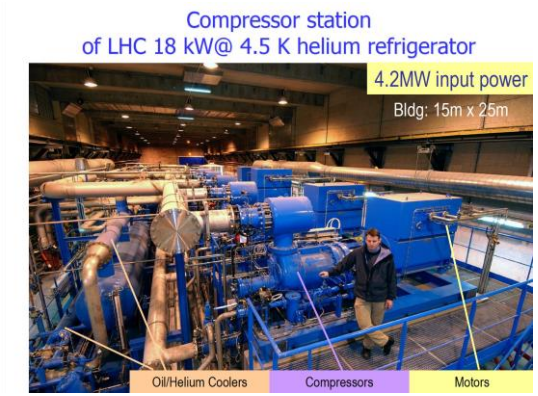
Energy Management at CERN

Facility upgrades: East Area renovation



Powering energy:
From 11 GWh/year to around 0.6 GWh/year
(> 90% reduction)

New equipment: cryogenic refrigerators



Award on CAPEX+OPEX

Buildings and site management

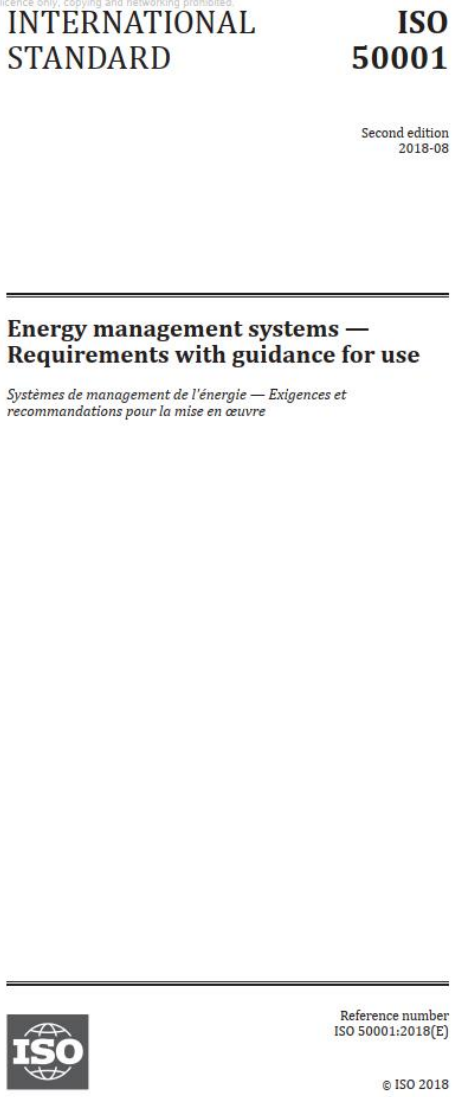
Renovation of up to two buildings per year (enveloppe, HVAC, electricity)

Heat recovery

For internal or external use

ISO 50001 – Energy Management Systems

Overview of ISO 50001



- **International standard – Second edition (2018)**

- **Main objective**
  - Implement a methodology (systems and processes) aiming at improving overall energy performance

    → Continual improvement process

- **Set up, monitor and improve an energy management system (EnMS) aligned with**
  - the organisational energy policy; and
  - the relevant legislation.

Overview of ISO 50001

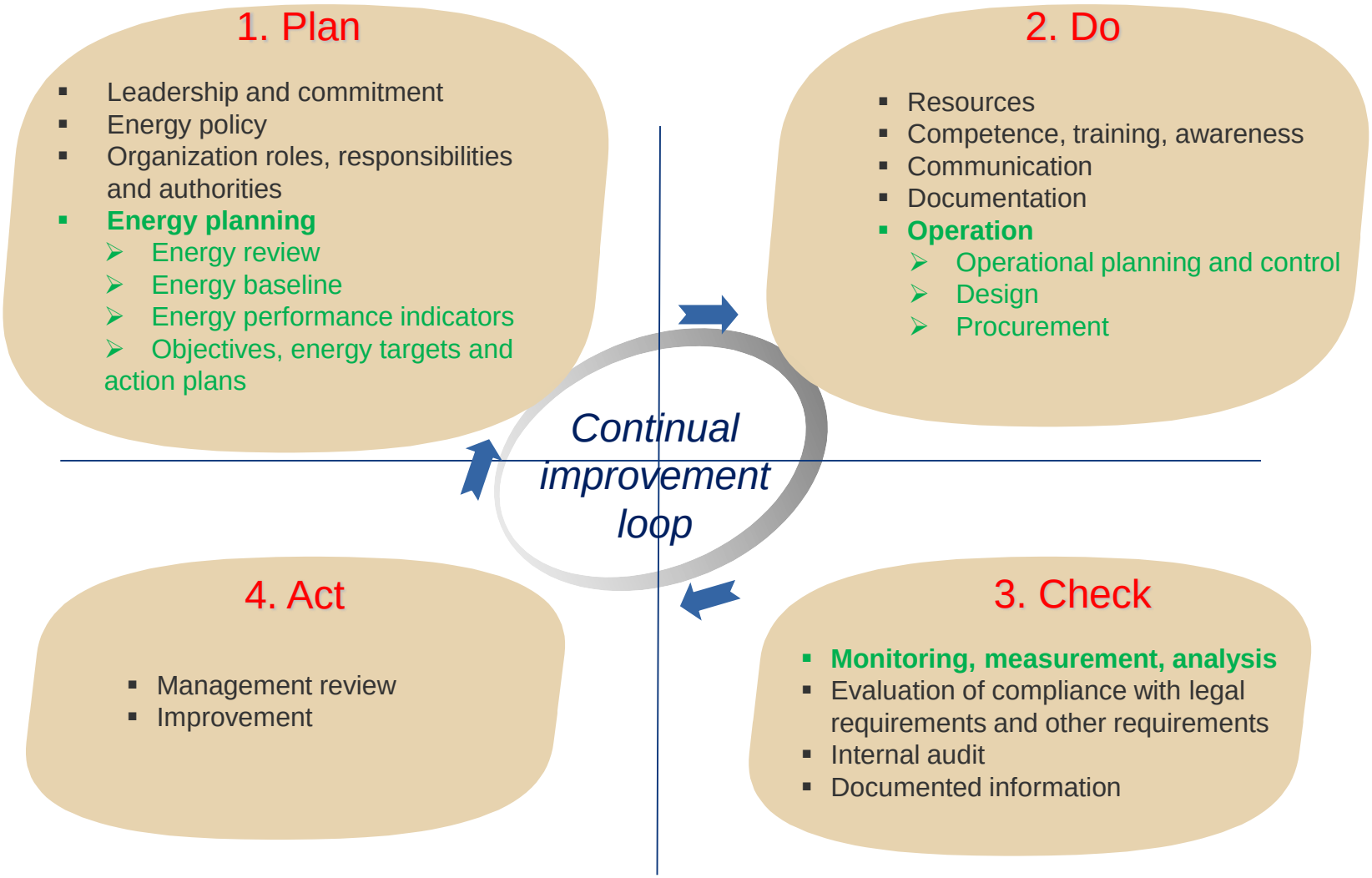
- **Main benefits – A systematic approach to:**
  - ➢ Improve energy performance level from an initial energy baseline
  - ➢ Use data to better understand and make decisions concerning energy use and consumption
  - ➢ Fix energy efficiency targets and objectives to meet them
  - ➢ Measure the results of energy efficiency improvements
  - ➢ Continually improve energy management
  - → **Continual process of global optimisation to minimise CERN's footprint**

  Also:

  - ➢ Obtain **rebate in electricity transmission costs**
  - → **To be re-invested in energy improvement actions**

Catégorie	Critère	Taux de réduction
Profil stable	Soutirage > 10 GWh et durée d'utilisation ≥ 7000 heures	81 %
Profil anticyclique	Soutirage > 10 GWh et taux d'utilisation en heures creuses ≥ 44 %	74 %
Grand consommateur	Soutirage > 500 GWh et taux d'utilisation du réseau en heures creuses compris entre 40 % et 44 %	76 %
Stockage	Soutirage > 10 GWh et taux d'utilisation en heures creuses ≥ 44 %	50 %

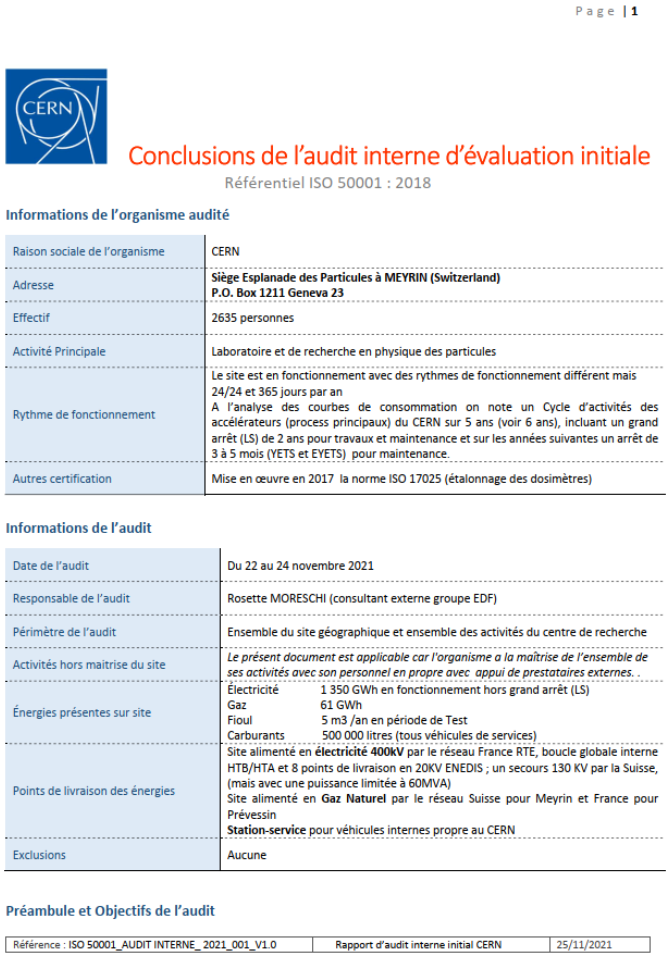
Requirements of ISO 50001



Initial evaluation audit

- **Carried out in November 2021**
- **Identify**
  - What is already compliant
  - The existing energy practices
  - The improvement areas
  - The resources needed
- **Conclusions**
  - **~ 50% of the requirements** are met
  - an **additional 15% is easily accessible**

→ Decision to go ahead with the ISO 50001 certification



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Conclusions de l'audit interne d'évaluation initiale

Référentiel ISO 50001 : 2018

Informations de l'organisme audité

Raison sociale de l'organisme	CERN
Adresse	**Siège Esplanade des Particules à MEYRIN (Switzerland)** **P.O. Box 1211 Geneva 23**
Effectif	2635 personnes
Activité Principale	Laboratoire et de recherche en physique des particules
Rythme de fonctionnement	Le site est en fonctionnement avec des rythmes de fonctionnement différent mais 24/24 et 365 jours par an A l'analyse des courbes de consommation on note un Cycle d'activités des accélérateurs (process principaux) du CERN sur 5 ans (voir 6 ans), incluant un grand arrêt (LS) de 2 ans pour travaux et maintenance et sur les années suivantes un arrêt de 3 à 5 mois (YETS et EYETS) pour maintenance.
Autres certification	Mise en œuvre en 2017 la norme ISO 17025 (étalonnage des dosimètres)

Informations de l'audit

Date de l'audit	Du 22 au 24 novembre 2021
Responsable de l'audit	Rosette MORESCHI (consultant externe groupe EDF)
Périmètre de l'audit	Ensemble du site géographique et ensemble des activités du centre de recherche
Activités hors maitrise du site	*Le présent document est applicable car l'organisme a la maîtrise de l'ensemble de ses activités avec son personnel en propre avec appui de prestataires externes.*
Énergies présentes sur site	Électricité 1 350 GWh en fonctionnement hors grand arrêt (LS) Gaz 61 GWh Fioul 5 m3 /an en période de Test Carburants 500 000 litres (tous véhicules de services)
Points de livraison des énergies	Site alimenté en **électricité 400kV** par le réseau France RTE, boucle globale interne HTB/HTA et 8 points de livraison en 20KV ENEDIS ; un secours 130 KV par la Suisse, (mais avec une puissance limitée à 60MVA) Site alimenté en **Gaz Naturel** par le réseau Suisse pour Meyrin et France pour Prévessin **Station-service** pour véhicules internes propre au CERN
Exclusions	Aucune

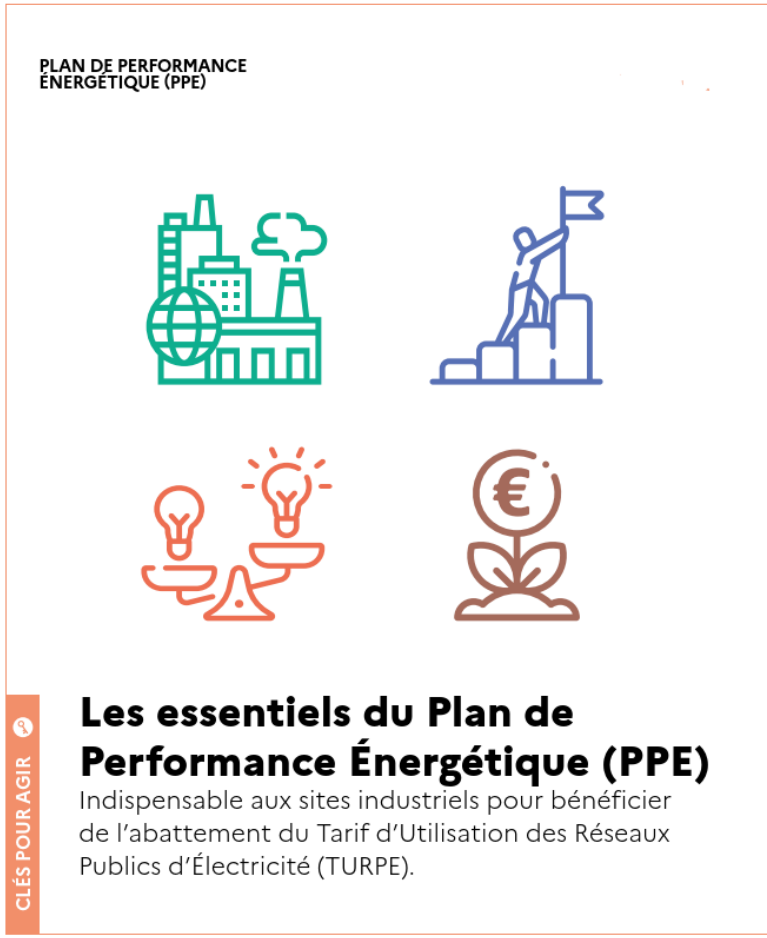
Préambule et Objectifs de l'audit

Référence : ISO 50001_AUDIT INTERNE_ 2021_001_V1.0	Rapport d'audit interne initial CERN	25/11/2021

Current and next steps

- **First step – Energy performance plan (« *Plan de performance énergétique – PPE* »)**
  - ➢ For the period 2022-2026
  - ✓ Issued to the relevant French authorities on **30th June 2022**

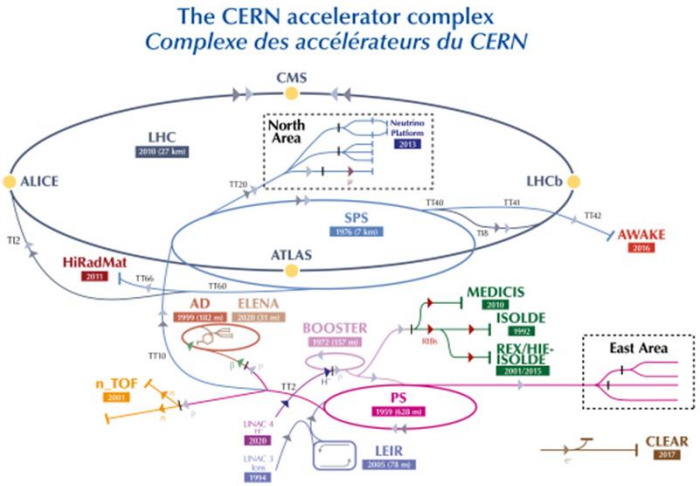
- **Second step – ISO 50001 certification**
  - ➢ Tentative internal and certification audits – **End of 2022**

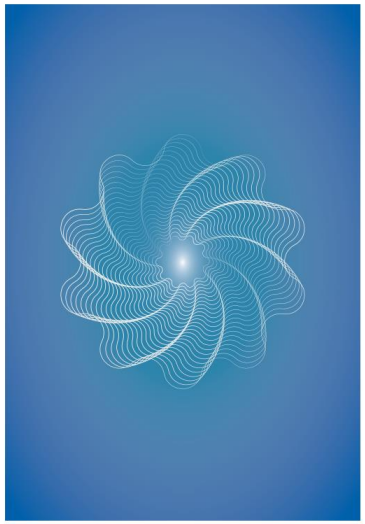


Energy Performance Plan

Boundaries and scope

- **Retained perimeter**
  - As per CERN environmental report, i.e. all sites, activities and energies[1]
- **Few exclusions**
  - Research equipment under the responsibility of collaborating institutes
  - Worldwide LHC Computing Grid (WLCG) for facilities not owned or operated by CERN

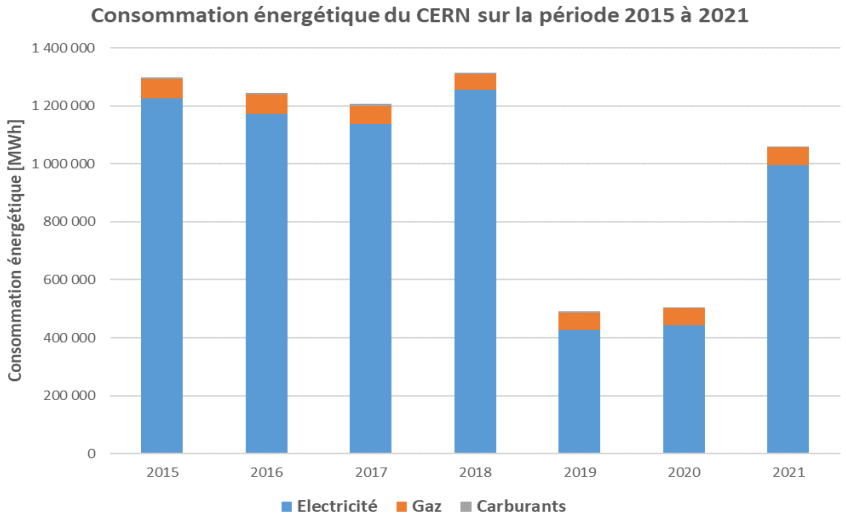


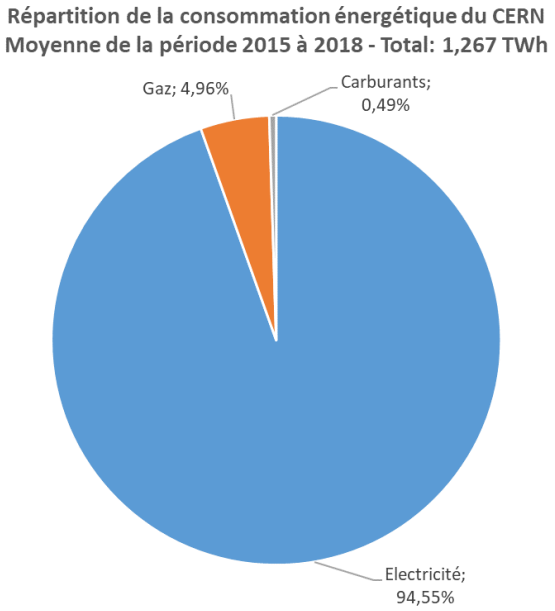


[1] Shall cover at least 80% of energy uses, CERN environmental report global

Energy baseline

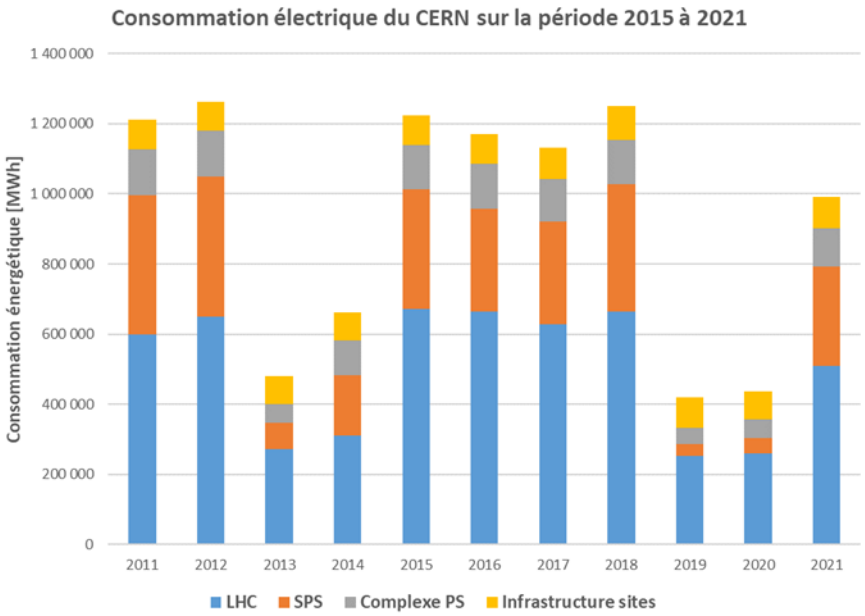
- **Three types of energies used**
  - Electricity for most uses
  - Gas for heating
  - Fuel for CERN fleet, heating (back-up in Meyrin) and diesel generators
- **Consolidated figures**

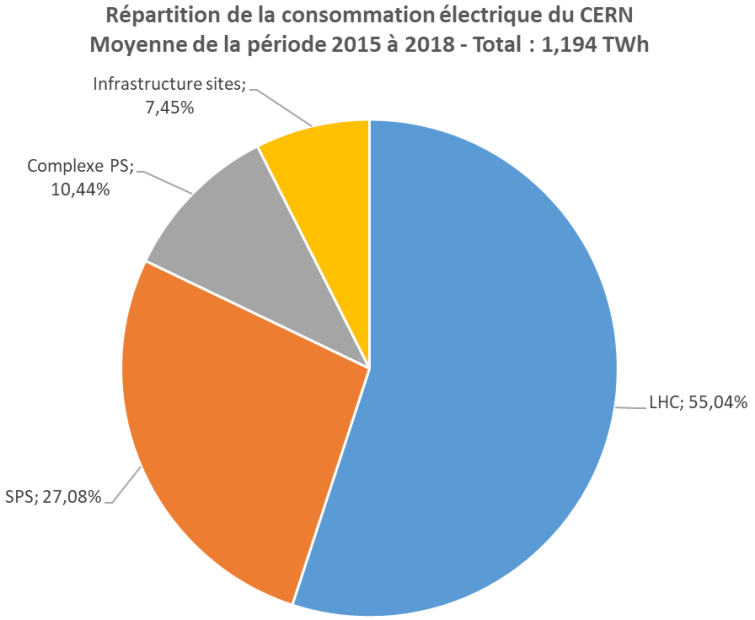




Energy baseline – Electricity

- **Consolidated global figures**





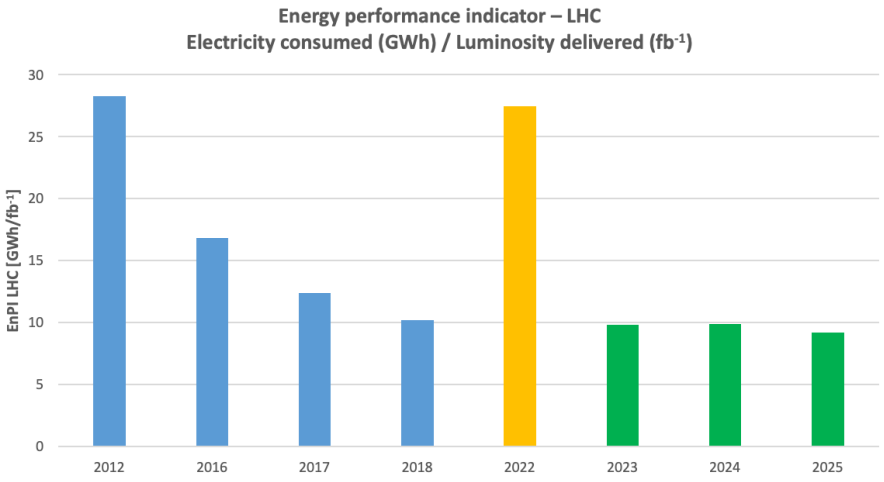
- **Main tool to monitor electricity use –** WebEnergy (energy.cern.ch)

Energy performance indicators and targets

- **8 energy performance indicators defined**
  - Accelerators and experimental areas (LHC, SPS, PS Complex)
  - Data centres (« PUE »)
  - Buildings (electricity for tertiary and overall gas consumption)

- **Exemple – LHC complex**
  - Run 2 average: ~ 13 GWh/fb^{-1} (2015 excluded)
  - Run 3 average – Target: ~ 9.5 GWh/fb^{-1} (2022 excluded)

  → **> 25% improvement**



→ To be complemented with monthly indicators to optimize LHC electrical consumption of main operation modes (e.g.commissioning, proton runs, ion runs, YETS, LS)

Action plan

- **Well-defined action plan for the next 5 years (taken into account to define objectives and targets)**
  - Cooling and ventilation consolidation projects: ~ 6 GWh/year of expected savings
  - Optimization of cryogenic operation modes for 2022: ~ 50 GWh of expected savings
  - 75 building consolidation projects: ~ 10 GWh/year of expected savings (thermal + electrical)
  - Science Gateway: ~ 200 MWh/year expected to be reinjected on CERN electrical network
  - Heat recovery projects :
    - Ferney-Voltaire: ~ 20 GWh/year made available for neighbours
    - Meyrin and Prévessin: 30+ GWh/year of expected savings on gas consumption
  - Improvement of CERN metering plan – Granularity (electrical and gas)
  - And many other studies (with ROI) to be done to assess potential future savings

Conclusion

Conclusion

- Initial baseline clear
- Excellent understanding on CERN energy use and metering plan in place
- First definition of energy performance indicators completed
- Energy consumption forecast well established, action plan in place

  → CERN energy performance plan issued to French authorities on 30.06.2022

- Releasing the Energy Performance Plan is just the beginning…

  → Progressively implement energy performance indicators

  → Identify, assess and rank new energy improvement potentials

- Internal and certification audit planned at the end of 2022


CERN