CERN and the Environment Town Hall meeting
Water

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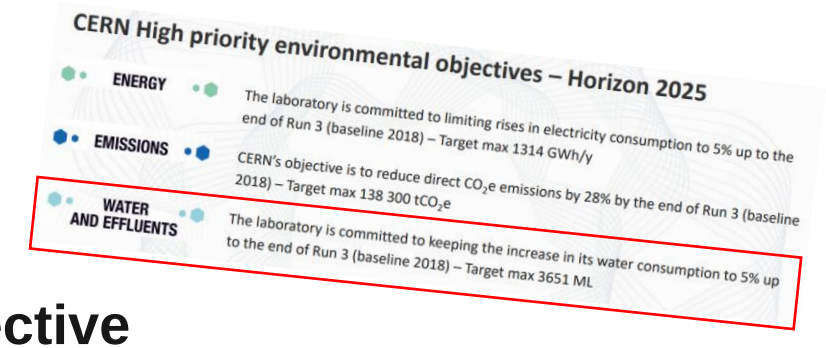
8 November 2024

CEPS
CERN Environmental Protection Steering Board

Context

Project launched in 2016
- **Reduce effluent water**
- **Improve effluent water quality**
- **Contain water consumption**

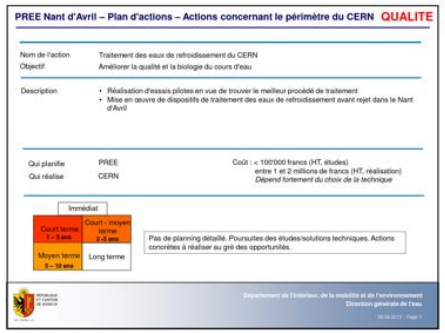
Completion during LS3

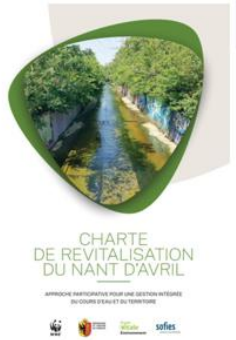


ONE Obligation

Respect the regulations regarding the quality of effluent water and reducing the discharge of effluent water into the 'Nant d'Avril'

History

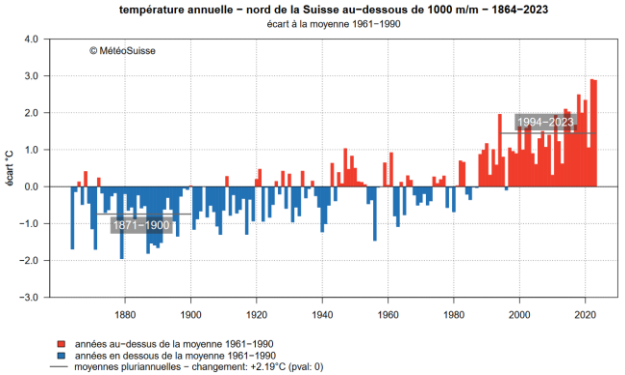




ONE Objective

Keep the water consumption at the level (+5% max) of pre LS2 despite:

- **LIU – power / performance upgrade**
- **HL-LHC – performance upgrade**
- **HostLab detector upgrade**
-



CERN water supply

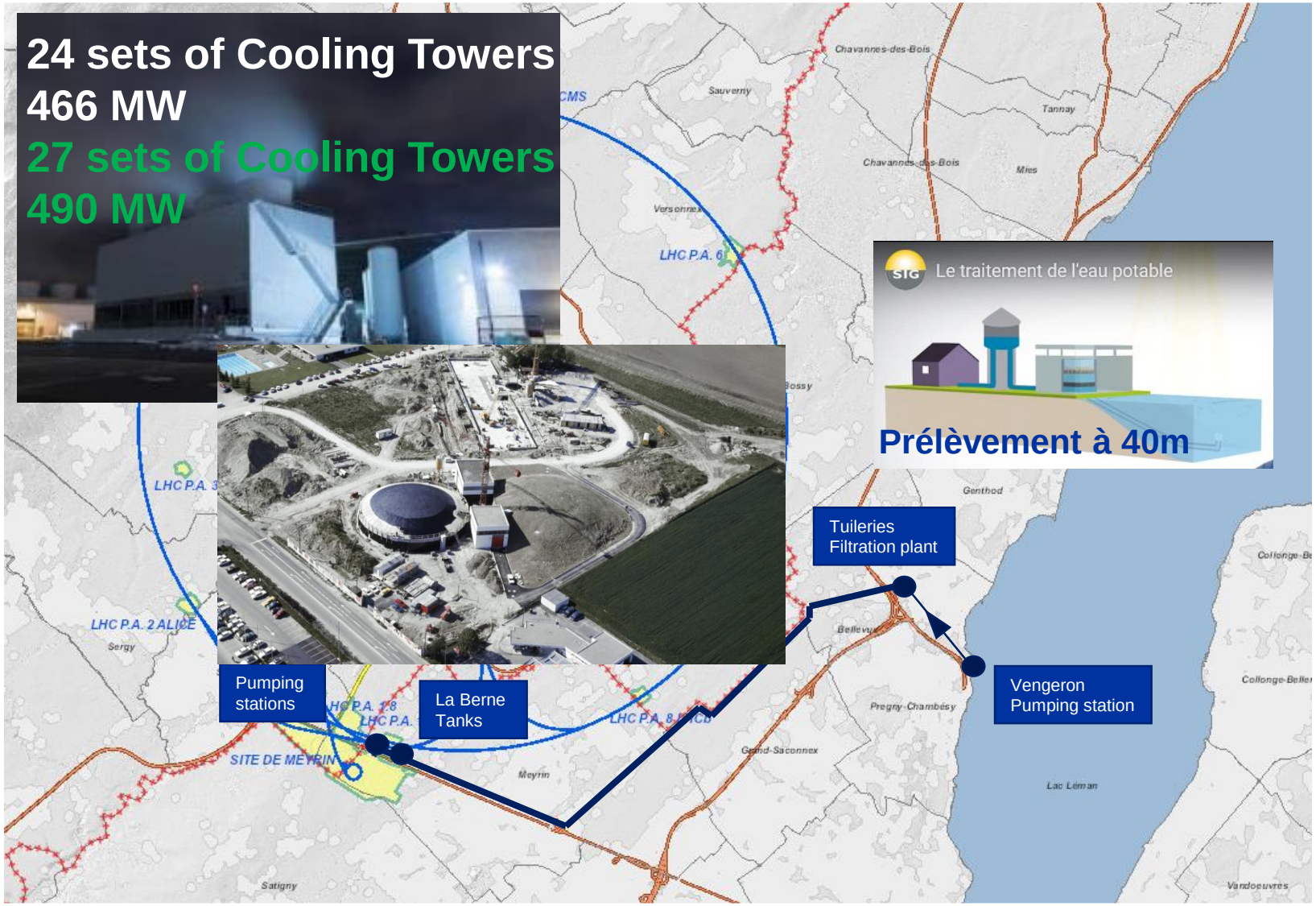
~99% by Services Industriels de Genève (SIG)

- Source – Lac léman
  - Used for drinking water and sanitary installations
  - **Used as raw / make up water for primary water cooling** and other industrial services
- 2.8 Mm^3 in 2023 (out of 58 Mm^3 distributed by SIG)
- Peak consumption at ~1260 m^3/h
- Water consumption is a direct function of Physics programme and climate

~1% by Régie des Eaux Gessiennes

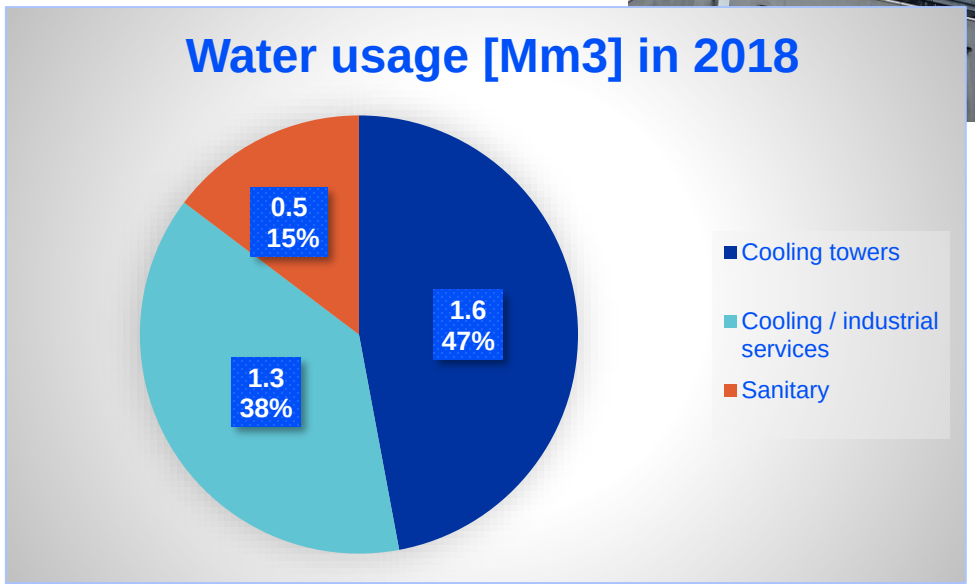
- Source - Nappe phréatique
- Used only for drinking water and sanitary installations

	l/s	m^3/h
Network capacity	1500	5400
CERN allocation	500	1800
CERN max use (~)	350	1260
Others	1000	3600



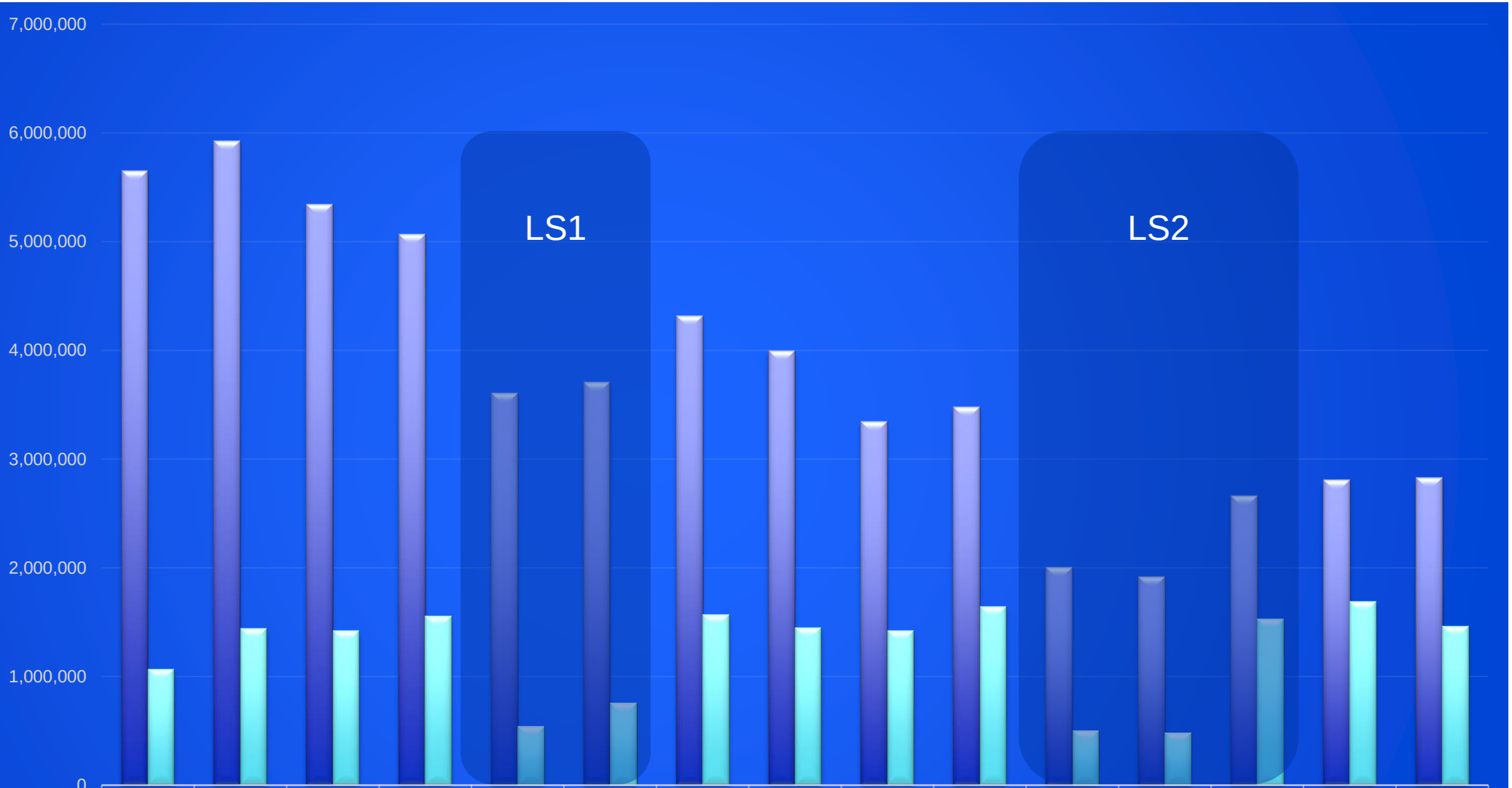
What are we using the water for?

- 2018 – reference year for RUN2
- ~1.6 Mm^3 for PS, SPS and LHC cooling towers
  - Evaporation
  - Blowdown water discharged into nearby rivers
- ~1.3 Mm^3 for other cooling/industrial services
  - Discharged into nearby rivers
- ~0.5 Mm^3 for Meyrin/Prévessin sanitary use
  - Evacuated via wastewater circuit
- **Total ~3.4 Mm^3**



Water consumption

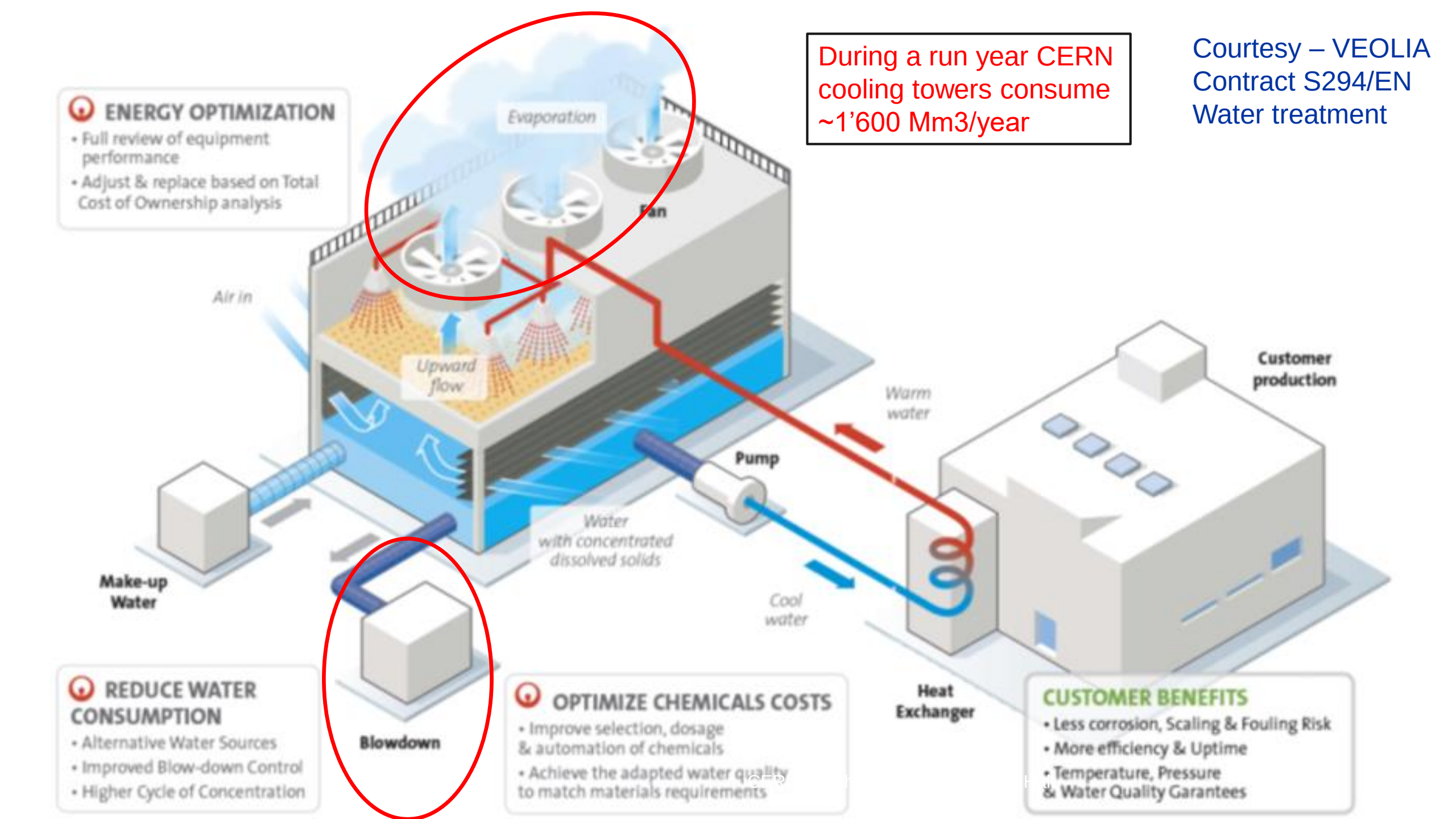
*consumption
> 20 Mm3
before 2000



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total water consumption	5,648,140	5,924,711	5,344,551	5,071,095	3,603,230	3,704,262	4,318,964	3,996,141	3,344,065	3,477,284	2,005,519	1,919,115	2,660,569	2,808,202	2,829,769
Cooling towers water consumption	1068366	1439584	1416837	1555139	542412	757819	1566916	1448435	1422141	1641012	499008	484581	1524678	1686602	1461137

During a run year CERN cooling towers consume ~1’600 Mm3/year

Courtesy – VEOLIA
Contract S294/EN
Water treatment



Why cooling tower water treatment ?

For Safety and technical reasons:

- **Minimise the risk of**
  - corrosion
  - scaling
  - fouling
  - microbiological build-up

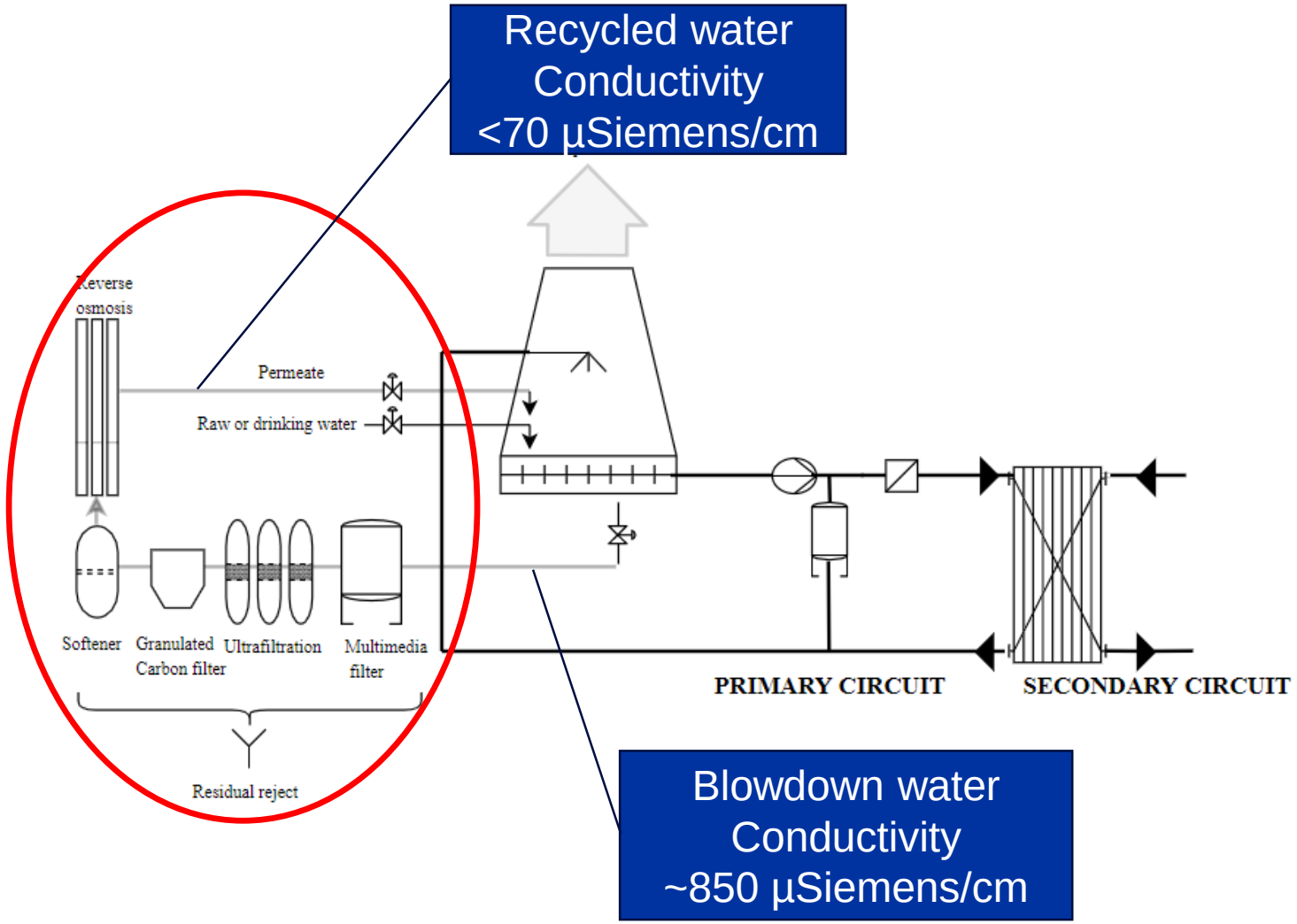
- **Minimise the risk of**
- **LEGIONELLA**
  - **Applying French law**
  - **Regular monitoring / laboratory tests**
  - **Annual emptying and cleaning of every cooling tower**

Side effect – Blowdown water with residual chemicals that is discharged into the Nant d'Avril

Solution - New specific water treatment station(s)

Solution to treat blowdown water quality AND reduce water consumption

- **Recycling of blowdown water by adding a specific water treatment plant**
- **Strong reduction of effluent water**
- **Residual effluent discharged into wastewater network**
- **No more discharge of cooling water from SPS and LHC cooling towers into the Nant d'Avril**
- **Solution applicable for bigger circuits with sufficient space**



Implementation - cooling tower of the SPS North Area

- **Cooling capacity = 57 MW; Water flow = 2400 m3/h**

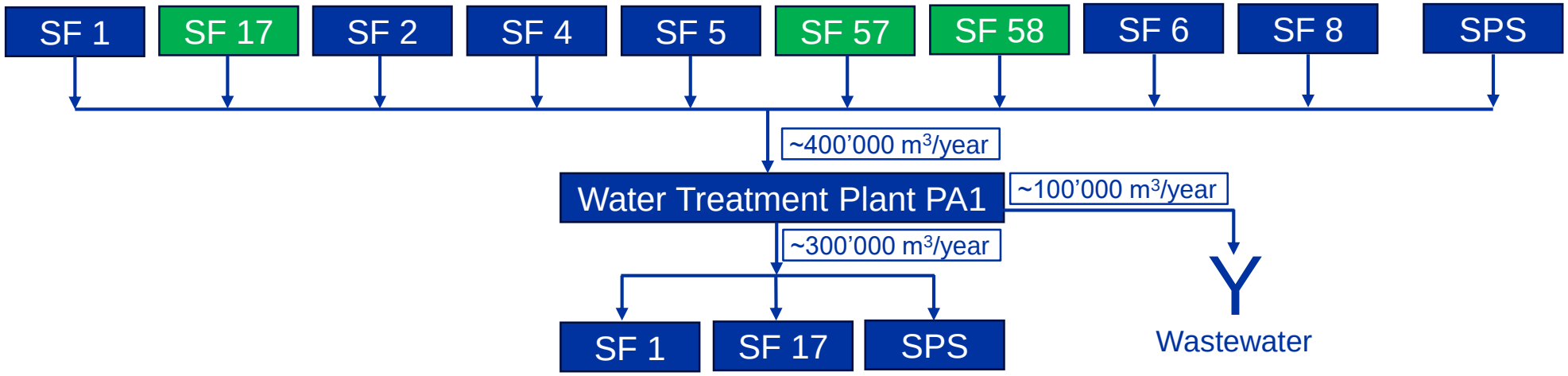
	2018	2022	Δ 2022 vs 2018	2023	Δ 2023 vs 2018
Make up	164 841 m3	145 530 m3	-12%	98 115 m3	-41%
Effluent – blowdown water	32 283 m3	10 109 m3	-69%	4 969 m3	- 85%
Reused	0 m3	26 778 m3		14 366 m3	
Average power in summer	ND	21 MW		16 MW	

- In 2023 14’366 m^3 of blowdown water recycled and fed back into the cooling towers
- Resulted in a strong decrease of the effluent water quantity
- Reduction of the water consumption despite the increase of the thermal load
- **Need to develop a set of more ‘meaningful’ performance indicators**

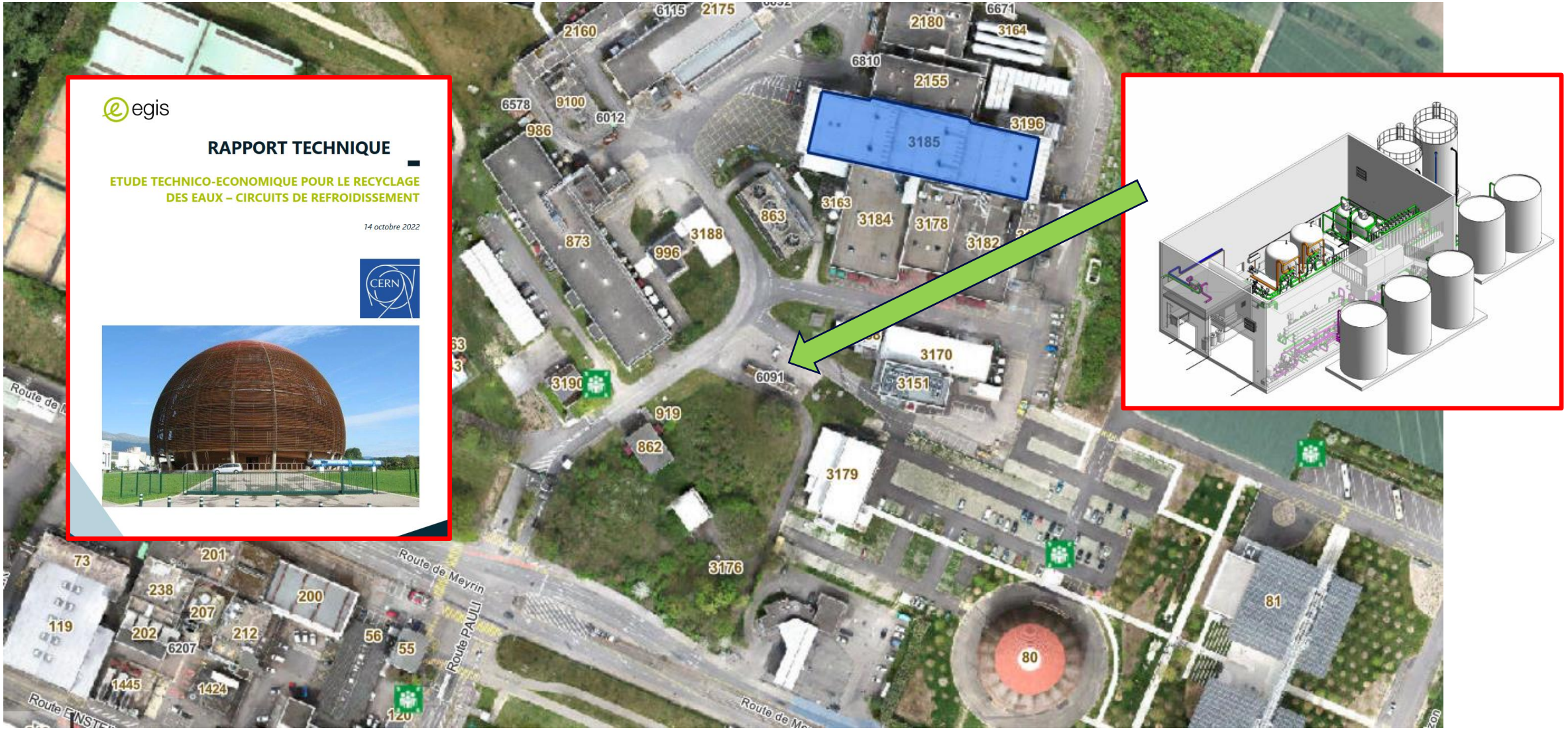
Objective: single water treatment plant for LHC and SPS

- **One treatment plant for all LHC and SPS circuits**
- **Recycled water will be used in the cooling towers closest to the treatment plant (SF1, SF17 and SPS)**

10 out of 27 Cooling Towers but with a cooling capacity of 354 MW (~72%)



New treatment plant for SPS and LHC cooling tower blowdown water



Summary

Objectives 2025 (completed)

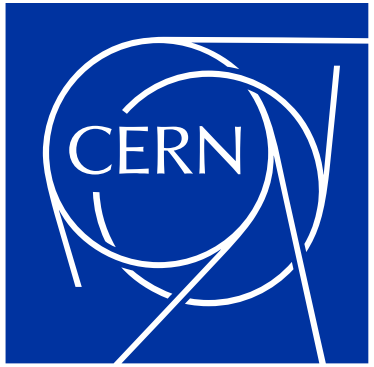
- **Optimisation of all (17) ‘smaller’ cooling towers was done between 2016 and 2023**
  - AD, LEIR / LINAC, PS TT2 / EAST Area, POPS PS, Booster, …
  - Installation and deployment of a new demineralised water production network on the Meyrin site
  - ~10% less water consumption, less water treatment and ~80% less effluent water
- **Specific blowdown water treatment pilot plant**
  - Design study
  - Implementation at CT2 (SPS / NA)
  - Successful operation
  - Confirmation of the expected results

Horizon 2030

- **Installation of a new water treatment plant at LHC PA1**
  - No more effluent water coming from the SPS and LHC cooling towers will be discharged into the Nant d’Avril
  - Recycling of ~300’000 m^3/year for the cooling towers
- **Closing last major open cooling circuit**
  - AD complex - will reduce the water consumption by about 140’000 m^3/year
- **Optimisation, sustainability and efficiency aspects - new technologies**
- Case by case studies for new installations and upgrade of existing installations
- **Implementing KPIs**
  - “Indicateur de performance aquatique”

Conclusion

- **Water management has always been a priority for the Organization**
- **With the new projects' respective upgrades, CERN cooling need has increased and will increase even more in the coming years**
- **CERN set up a project in 2016 in close collaboration with the local authorities to improve the quality and to reduce the quantity of effluent water as well as to contain the increase of the water consumption**
- **The modifications and optimisations works have shown the expected positive results**
- **The major investment for a completely new water treatment plant for the blowdown water of LHC and SPS cooling towers will be installed in 2027 – 2028**
- **More to come …**



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