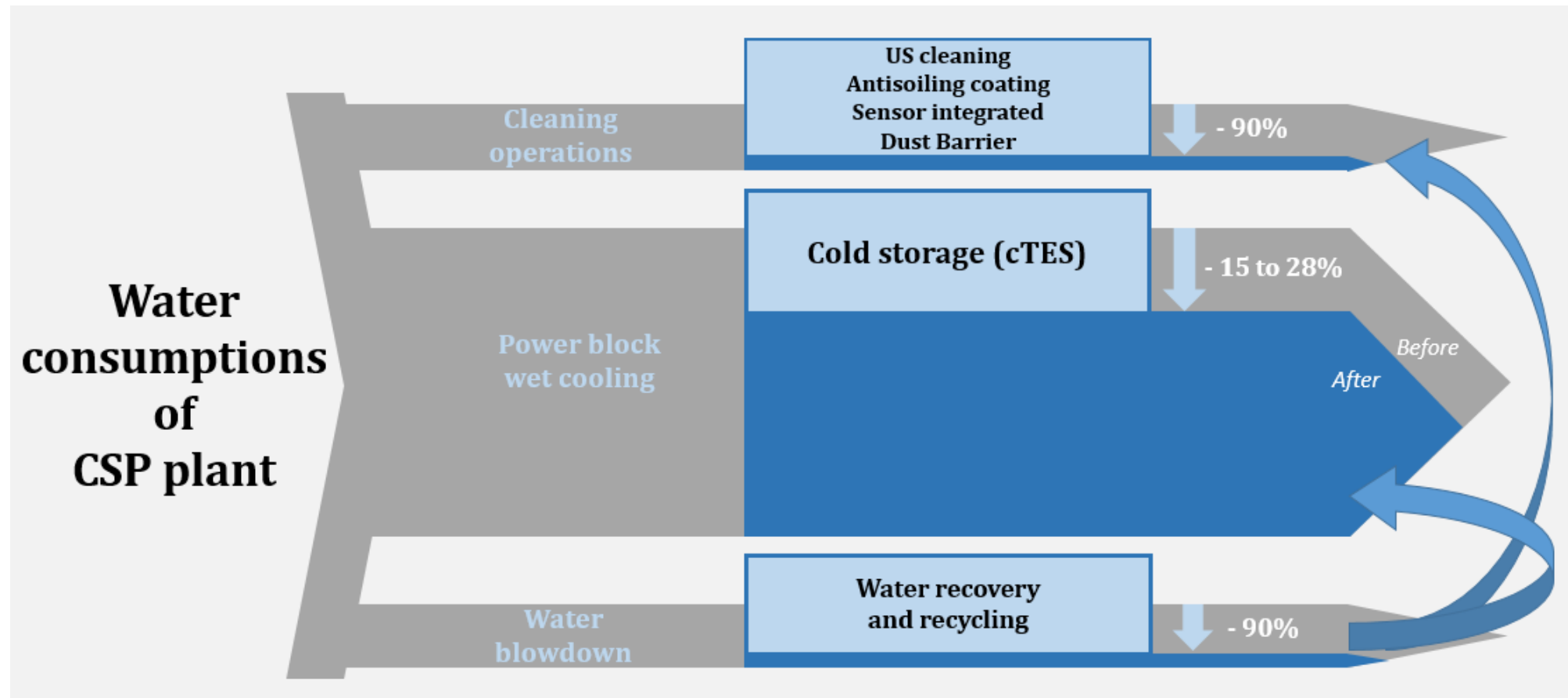




Solving Water Issues for CSP Plants

# Project concept

The overall purpose of the SOLWATT project is to upscale, implement and demonstrate cost-effective technologies and strategies that bring about a significant reduction of water of CSP plants while ensuring excellent performance of electrical power production.



# Project objectives

1. SOLWATT targets a reduction of water consumption of cleaning operations by 90%, i.e. savings nearly  $0.25\text{m}^3/\text{MWh}_e$  depending on the soiling rate and the location of the solar field.
2. To keep a low temperature at the turbine condenser, i.e. a high efficiency while reducing the water consumption, SOLWATT will demonstrate the efficiency of a cold storage reservoir, regenerated by the lower temperatures that occur at night.
3. SOLWATT will demonstrate the efficiency of using a Multiple Effect Evaporation (MEE) system to recycle and re-use 90% of these waste water streams ( $0.5\text{ m}^3/\text{MWh}_e$ ) using thermal energy otherwise dumped by defocusing parts of the solar field, achieving a water consumption reduced to  $0.05\text{ m}^3/\text{MWh}_e$ .
4. The probabilistic treatment of forecasts for the following days is essential for optimisation of CSP plant operations. SOLWATT will demonstrate the efficiency of the optimized global control of the plant thanks to a dedicated application.
5. Social, economic and environmental impacts on local communities close to CSP plants are a point of concern.
6. All technologies will be installed, demonstrated and validated under real conditions at “La Africana” and “Ashalim” CSP plants.

# Expected specific impact

Technology	Water consumption savings	State-of-the-art KPI	SOLWATT KPI*
Ultrasonic cleaner	0.26 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.03 m <sup>3</sup> /MWh (cleaning consumption)
Heliostat integral cleaning device	0.27 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.02 m <sup>3</sup> /MWh (cleaning consumption)
Dust barriers	0.12 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.17 m <sup>3</sup> /MWh (cleaning consumption)
Antisoiling coatings on reflectors	0.13 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.16 m <sup>3</sup> /MWh (cleaning consumption)
Antisoiling coatings on receivers	0.08 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.21 m <sup>3</sup> /MWh (cleaning consumption)
Sensors integrated on reflectors	0.07 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.22 m <sup>3</sup> /MWh (cleaning consumption)
O&M optimizer (soiling forecast)	0.10 m <sup>3</sup> /MWh	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.19 m <sup>3</sup> /MWh (cleaning consumption)
Soiling rate map product	0.8 m <sup>3</sup> /MWh (for future plants)	0.29 m <sup>3</sup> /MWh (cleaning consumption)	0.21 m <sup>3</sup> /MWh (cleaning consumption)
Nocturnal cold storage	1.20 m <sup>3</sup> /MWh	4.95 m <sup>3</sup> /MWh (cooling consumption)	3.75 m <sup>3</sup> /MWh (cooling consumption)
Water recovery system	0.45 m <sup>3</sup> /MWh	0 m <sup>3</sup> /MWh (No water recovery)	-0.45 m <sup>3</sup> /MWh (water gain by recycling)

# Expected specific impact

Technology	SOLWATT CAPEX*	SOLWATT OPEX savings**
Ultrasonic cleaner	300,000 €	110,500 €/year
Heliostat integral cleaning device	2,000,000 €	700,000 €/year
Dust barriers	394,000 € (0.2 €/m <sup>2</sup> of the total plant area)	51,000 €/year
Anti-soiling coatings on reflectors	181,000 € (0.3 €/m <sup>2</sup> )	55,250 €/year
Anti-soiling coatings on receivers	60,000 € (2.5 €/receiver)	34,000 €/year
Sensors integrated on reflectors	13,300 € (0.007 €/m <sup>2</sup> of solar field)	29,750 €/year
Nocturnal cold storage	900,000 €	510,000 €/year
Water recovery system	640,000 €	34,000 €/year
O&M optimizer	10,000 €	1 – 4 % profit increase

\* Calculated based on data from La Africana plant; \*\* Calculated for 50MW<sub>e</sub> plant, 2.5 €/m<sup>3</sup> water cost