

Lessons Learnt from Andasol 3



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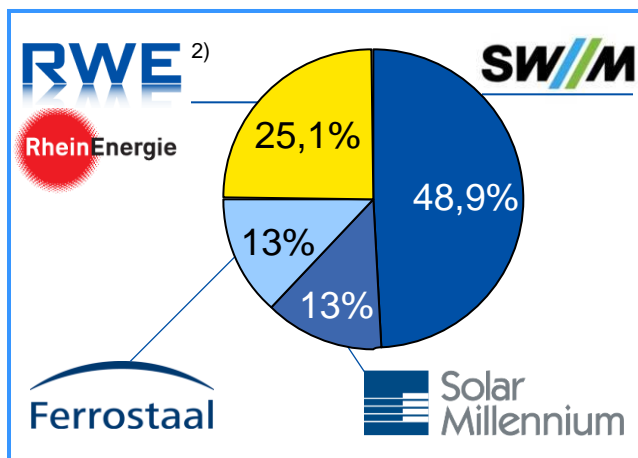
RWE Innogy GmbH
Director Hydro Power & New Technologies

Andasol is one of Europe's largest solar energy sites



Andasol 3 (AS3): Facts & Figures

- > Plant owner: Marquesado Solar S.L.
 - RWE Innogy GmbH: Technical responsibility (CTO)
 - Munich municipal utility (Stadtwerke München GmbH): Responsible for commercial project management (CEO, CFO), main shareholder
 - Ferrostaal AG: Executes the construction work (COO)
- > Location: Aldeire/La Calahorra (Granada, Spain)
- > 50 MW parabolic trough power plant incl. 7.5h molten salt storage
- > First electricity production in October 2011
- > EPC contractor: UTE¹⁾



Lessons Learnt: Technical improvements of Andasol 3 compared to Andasol 1 and 2



- > Smaller solar field due to more efficient mirrors
- > Heat absorber tubes with improved absorption level
- > Flexible hoses with special metal expansion joints to connect rotating absorber tubes with fixed tubes
- Improved security and reliability
- Lower maintenance cost
- > Enhanced 50 MW_{el} turbine (MAN Diesel & Turbo) with high- and low-pressure module especially developed and optimised for AS3
- High efficiency level reducing number of solar collector loops and investment cost
- > Check of material properties in advance
- > Use of proven technology



What project partners have to bring to the table for MENA projects

> **Project developer**

- Regional experience, contacts to local companies and politics

> **EPC**

- Reference for building, commissioning and operating CSP power plants – experience is invaluable
- Experts/workers for and from MENA region

> **Engineering**

- Start as soon as possible to avoid unexpected events/delays
- Core of complex power plant: Early procurement and experienced engineering

> **Risk management**

- Identified risks to be managed, as some risks actually come true

> **Time Management** is essential


> **Control functions**

What is important from a CSP investor's point of view

 ● Reliable regional and political boundary conditions

 ● Reduced project development costs

 ● Experienced contractors

 ● Early securing of grid, cooling system, engineering, procurement, experienced staff

Thank you very much for your attention



Back-up

Technical data for Andasol 3

Solar field	
Size of solar field	497,040 m ²
No. of parabolic mirrors	204,288 mirrors each 12m long and 6m wide
No. of receivers (Dewar tubes)	21,888 tubes each measuring 4m
No. of sensors	608 units
Annual direct normal irradiation (DNI)	2,136 kWh/m ² a
Altitude above sea level	1,100 m
Thermal store	
Heat storage capacity	30,000 t salt for 7.5 full load hours
Power plant output	
Turbine output	49.9 MW
Annual operating hours	Ca. 4,000 full load hours
Forecast gross electricity generated	Ca. 200 GWh
CO ₂ savings	150,000 t/a
Estimated service life	At least 40 years