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Preventing Biofouling in Steam Condensers: The MATChING Approach

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MATChING
MATERIALS & TECHNOLOGIES FOR PERFORMANCE IMPROVEMENT OF COOLING SYSTEMS IN POWER PLANTS

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PROJECT DRIVERS AND TARGETS

MATChING or "Materials & technologies for performance improvement of cooling systems in power plants" aims to **reduce the water demand in the energy sector** through the use of **advanced and nano-technology based materials. Two energy sectors have been taken into account: fossil fuel and geothermal sectors.**

MATChING MAIN TARGETS

1. Overall **reduction** in geothermal **steam** emitted into the atmosphere up to **15%**, through the use of hybrid solutions for cooling towers and advanced materials and coatings for dry modules.
2. Overall plant **efficiency increase** up **to 0.4-0.5%**, by enhancing the heat transfer efficiency in the condenser both on the steam side and water side via the use of advanced nano-engineered coatings and surfaces.
3. Overall **reduction** of **fresh water use** in fossil fuel power plants of about **30%** through a set of solutions for the recovery and treatment of cooling water in CT equipped plants.

DRIVERS FOR ANTIFOULING COATINGS AND SURFACES

Background
- Thermal Power Plants require enormous amounts of water to condense steam at the exit of the turbine.
- All systems cooled with natural water suffer from fouling and biofouling.

Main Issues
- Around the 33% of the overall heat transfer losses in a typical Cu/Ni condenser can be attributed to water side deposits and biofouling
- Due to heat transfer losses more water is needed to remove the same amount of heat and/or condensers must be operated at higher pressures and reduced efficiency

Technology Gaps
- The use of chemicals and biocidals to keep under control this phenomenon is no longer sustainable.
- **Coatings can be an advantageous option to limit water-side fouling in steam condensers and recover MWe**

MATChING NUMBERS

Starting Date:	First of March 2016
Duration:	42 months
Partners:	16
Overall Budget	€ 11.847.291,75
Grant Amount	€ 9.706.413,77
Demonstration sites	7

MATERIALS & COATINGS FOR BIOFOULING MITIGATION

SELECTED TECHNOLOGIES

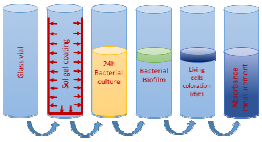
1. **Bio-inspired and bio-based antifouling coatings**

   Enzyme-based antifouling coatings

   Functionalization of hybrid coatings through the **addition of peptoids** (peptide-like compounds)

2. **Ultra smooth surface** coatings
3. Coatings with **embedded nano-particles** (like TiO_2 ecc..) with antibacterial properies
4. **Optimization of** existing **commercial systems** (like those based on silicone rubber or polyethylene glycol) through reduction of their thickness
5. Tailored **alloys with biocide properties** (introduction of alloying elements into stainless steel)

- Development of novel non-toxic antifouling agents and strategies
- High durability coating formulations
- Quick lab test for fouling adhesion

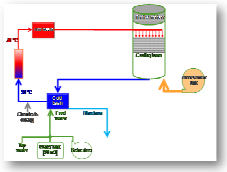


Laboratory

Formulation and laboratory scale testing:
- Evaluation of coating parameters (adhesion, hardness, roughness, thickness, surface energy, coating stability)
- Evaluation of weldability and repair methodologies for new SS with biocide alloying materials

Pilot Scale

- Most promising coatings and SS alloys from lab tests will be tested for three months with two kind of waters in the **EDF Pericles Facility**



Demo Site

- Selected coatings and materials from pilot scale test will be used to coat the internal side of the new condenser tube bundles that will be installed in **Endesa Power Plant in AsPontes.**
- The duration of the test will be around 6 months

16 PARTNERS FROM 6 EU COUNTRIES

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