

Advanced Material Technologies Pty Ltd | 28 Charlton Street, Mt Warrigal, NSW 2528 Australia

QUESTION?

FOR POWER UTILITY GENERATION

Is it Possible to Lower Emissions and Increase Turbine Output with Available Technologies Today?

ANSWER: ABSOLUTELY!

BY “PUSHING” WITH GREENSHIELD™ CERAMIC COATINGS AND “PULLING” WITH SUPERIOR™ MAGNETIC FIELD TECHNOLOGY TO CREATE NEW ENERGY FLOW DYNAMICS

WHAT DOES THIS MEAN...

PUSHING ENERGY FLOW DYNAMICS: Boiler efficiencies and maximum power generation are dependent on optimum heat transfer rates. These are compromised when slag accumulation and fouling of tubes takes place, especially when types of fuel (coal) utilized deviate from original design specifications. The utilization of low NOX technology to meet Govt. emission standards has also contributed to the problem. As well as in some cases increasing corrosion rates that compromise tube integrity and boiler availability.

The use of **GreenShield™ Ceramic coating** on the boiler tube surface prevents the formation of iron oxide which is the tubes reaction to high heat also it insulates and reduces the heat transfer rate.

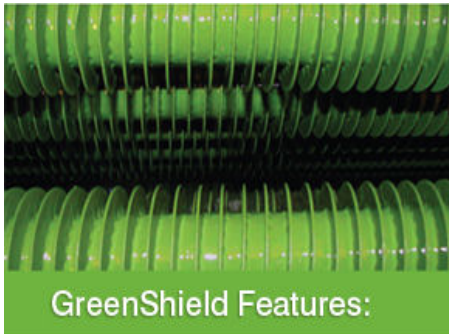
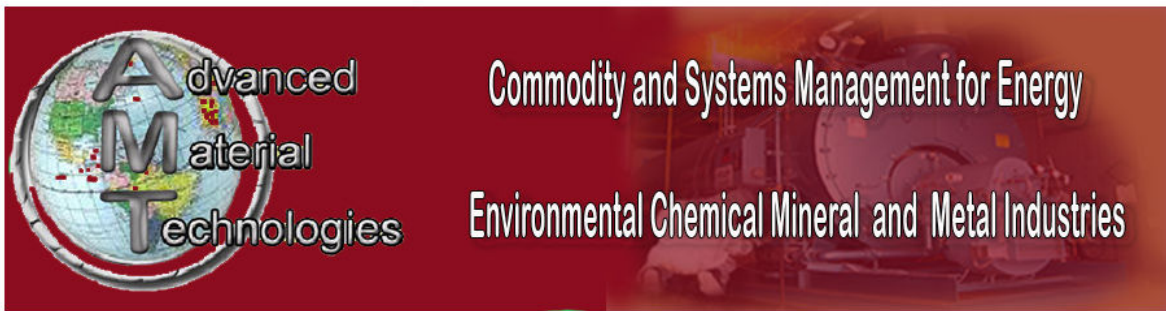
The most important benefit of installing **GreenShield™ coating** is to provide a ceramic coating barrier (6-9mils) between the metallic tube surface and the combustion by-products to prevent slag attachment and clinker build up on the tubes that drastically affects to the heat transfer rates.

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GreenShield Features:

- Superior adhesion designed to withstand the extreme thermal, physical and chemical conditions within a boiler environment.
- Forms an impervious barrier, preventing corrosive products of combustion from attacking the metal tubes.
- Environmentally safe, no volatile organic compounds (VOCs) which can affect the environment and human health.
- Non-catalytic technology, molten ash will not sinter and adhere to the surface of the coated tubes, preventing the buildup of an insulating layer.
- GreenShield is harder than carbon steel and will protect against abrasion. When used as a wear indicator, if the surface remains green the substrate material underneath has lost zero thickness.
- The uniform surface finish offers a much higher emissivity (0.95) than uncoated fireside water tubes, Improving heat distribution

In simple terms, this coating acts as a high temperature “Teflon” in a very hot, hostile environment. The use of this product in many applications over the last 5 years has demonstrated benefits, been cost effective and durable. The extended use of the **GreenShield™ coatings** provides the options to the equipment owner to realize more power generation or reduce fuel requirements and emissions to make full load, or both.

Testimonial: The spray-on ceramic coating applied at our power plant has resulted in several positive conditions which are saving us money and forced outages. With the addition of GreenShield coatings in the plant's boiler metal protection program in 2001, the unit has been able to operate at one-year intervals without any leak issues. I would like to comment on the professionalism that FMP brings with them while working on site. Their employees are very safety-oriented and very efficient in their work habits. I am a repeat user of the ceramic coating and do recommend it. We went from blowing four soot blowers every four hours to blowing two soot blowers every six. The ROI was 6 months. FMP has always completed its scope of work in a safe and timely fashion, and has been well prepared and willing to respond to our

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needs with innovative solutions. I could stand on top of our primary superheater intermediate section and look down through that section into the economizer hoppers. That was really nice. We've tried different coatings on our boiler tubes and the FMP product has been the top performer in our unit. The spray-on ceramic coating applied at our power plant by Furnace Mineral Products has resulted in several positive conditions which are saving us money and forced outages.

Additional benefits have been found to be:

- Reduce the abrasive wear of fly ash on boiler tubes
- Minimize soot blower activity and related erosion wear
- Demonstrate excellent corrosion and acid resistance including issues associated with chlorine attack
- Minimize water cannon activity and related thermal stress cracking
- Reduce the oxidation of metals at high temperature
- Improve the temperature profile of boiler water wall tubes
- Eliminates clinkers as a safety and operational concern

PULLING ENERGY FLOW DYNAMICS: Boiler efficiencies and maximum power generation in conjunction with the cooling tower and condenser (cooling water system), can create a back pressure within the turbine and the systems efficiency can be compromised by calcium carbonate build up (scale) and algae or organic matter accumulation.

The traditional way to treat this occurrence is to treat the system with large amounts of chemicals to deal with the various issues. Although generally effective it is at best a costly balancing act never 100% effective. Thus scheduled cleaning is required and a certain amount of back-pressure is tolerated.

Our Superior Magnetic water conditioner technology replaces the high cost spent on chemicals and / or maintenance clean outs by applying a safe permanent cathodic protection voltage to cooling process liquids to aggressively remove hard scale deposits and bio-fouling at no risk. Also to reduce or eliminate water related maintenance outages.

SUPERIOR WATER CONDITIONERS™ a patented water treatment system that **controls the formation of scale and corrosion** without the use of hazardous and costly chemicals. We offer this water treatment solution to all boiler applications where scale corrosion is a problem, cooling towers, heat exchangers, boilers etc. We want to share with you some of the positive results of this 45 year old technology using the permanent, in-line magnet with alternating and reversing polarity field orientation along the length of the permanent bar magnet.

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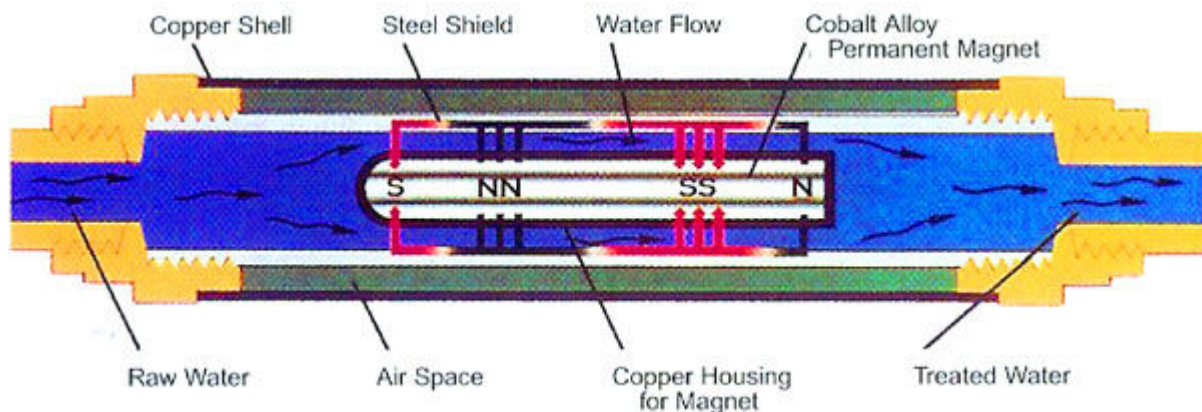
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Product Description:

Superior Water Conditioners® are a unique, flow through, in-line plumbed design fitted within the water pipe at the site. They are NOT a “clamp-on” device that fits over a ferrous or plastic pipe.



Unlike the “clamp on” type, our in-line permanent magnetic water conditioners are built with a ferrous carbon steel shell that retains and actually concentrates the magnetic fields inside the treatment chamber shown above not allowing the magnetic fields to stray off.

Advantages of the permanent in-line Superior® Water Conditioner:

The Superior Magnetic Water Conditioner has greater “magnetic field flux density” with its permanent magnet located in the centre of the water conditioner exposing the molecules which make up the water and minerals to alternating, reversing polarity electrical charges produced by the magnetic field which travels between north and south poles of the magnet as the water passes through it.

How does it work to prevent scale build up?



As the water and minerals pass through the unit in a perpendicular motion, they are intimately exposed to the reversing polarity electrical charges several times, which have a great influence on the molecular structure, causing the dissimilar properties (+ve and -ve ions) of the mineral (eg Ca, Mg, Fe) to repel, rather than attract to one another thus eliminating scale, oxide formation and corrosion. For this to happen, it is imperative that the water cuts or breaks through the magnetic fields at a perpendicular angle, causing a shear force effect on the molecules which make up the water and the minerals. Minerals will precipitate out of solution into a state of suspension known as aragonite. These suspended solids will flow right on through the plumbing system leaving the equipment clean of corrosion and scale.

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What is the key to Superior® Water Conditioners success?

The Superior® magnetic water conditioner is the only one on the market that utilizes a special cobalt alloy bar in which we induce a very unique multiple pole, multiple field, reversing polarity, magnetic orientation along the length of the bar as water and minerals pass through the unit providing 100% success in removing scale and corrosion from any volume of water.

Superior® Water Conditioner technology is advantageous for over 400 applications in residential, commercial and industrial markets. It is a valid alternative in Australia and many other countries for applications where conventional water treatment chemicals must be minimized or eliminated. Some of the applications include;

- Ice makers
- Coffee and cappuccino machines
- Hot & cold water dispensers
- Steam cookers
- Dishwashers
- Water heaters
- Humidifiers
- Open loop geothermal systems
- Boilers & HVAC use of industrial hot water or steam process
- Cooling towers for HVAC use or industrial process cooling
- Evaporative condenser
- Heat exchangers

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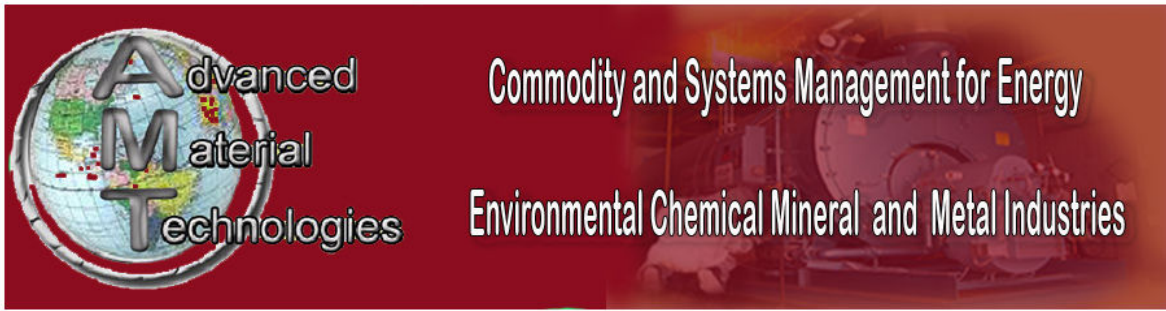
- Greatly reducing chemical expense associated with water treatment
- The magnetic system “works” and is the permanent solution to water treatment issues giving immediate benefit
- Life and effectiveness of the magnetic system will match the operating equipment
- Elimination of downtime and lost revenue associated with mechanical cleaning of fouled or restricted system components (tubes)

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- Greatly reduced water loss (and disposal cost) from flushing or periodic replacement of chemical laden “soup”
- Optimum heat transfer occurrences between water loops and within the water itself (surface tension)
- Elimination of iron corrosion or scale deposits as a result of a positive charge in the water

BOTH PUSHING AND PULLING ENERGY FLOW DYNAMICS: The current and future costs of resolving pollution issues and increased carbon tax, increased energy cost will not go away. Current and future plans of power generation expansion will involve mass expenditures, permits and many years of development and construction. What is offered by **ADVANCED MATERIAL TECHNOLOGIES** is proven technologies that are available today. They are available at a fraction of the cost of traditional and planned solutions to the problems of pollution and more energy needs worldwide.

This is a simple proposal that will work with the existing equipment today. The extensive use of inexpensive ceramic coating materials easily applied in one scheduled outage, has measurable effect on boiler performance by increasing the heat transfer rate through the tube. The magnetic field system is engineered specifically for each application.

The R.O.I. (return on investment) for both are calculated (within 1 YEAR with chemical savings alone) and again easily installed during an outage.

The combination of both these **“PUSH AND PULL”** technologies or even the use of one of the strategies alone can build the bridge to the future evolution of our power industry that has options of reducing fuel requirements (and pollution) to meet full load and accepting added revenue from increased power output.

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