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TMCAqua™

ENERGY | WATER | SUSTAINABILITY

INTRODUCTION

Industrial heating-drying processes generate moisture rich gas streams that are vented to the atmosphere. As much as half the water used in the process may be lost up the stack as well as a significant amount of energy. Gas combustion processes produce 12.5 gallons of water in the exhaust gas per MCF of gas combusted.

These waste exhaust gases represent an untapped source of water and energy that can improve process efficiency while creating a new source of water for water scarce regions.

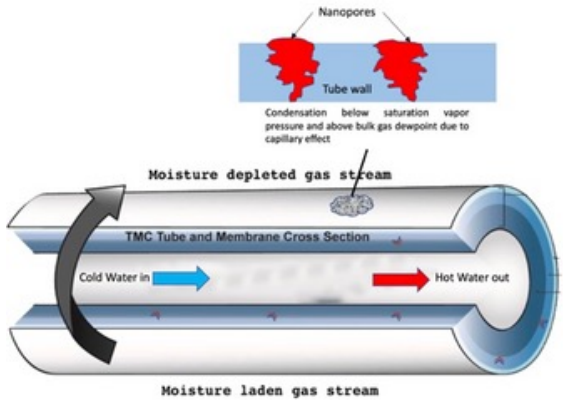
Examples of such equipment and processes include: Spray Dryers, Paper Dryers, Process Dryers, Gas Package boilers, utility boilers, furnaces and ovens.

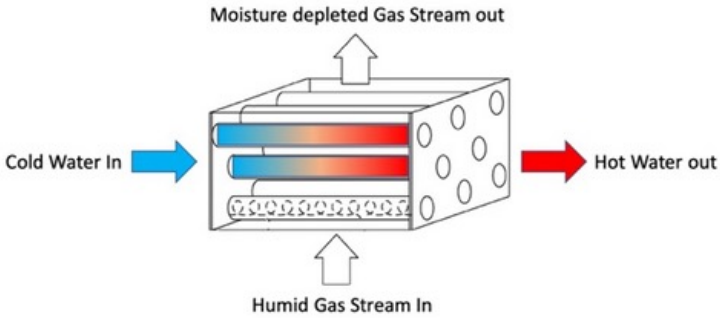
TMCAqua is designed to recover the residual energy and water from these waste exhaust gases!

TECHNOLOGY

The TMCAqua! technology comprises of a ceramic membrane tube coated with several layers of ceramic material to create a pore geometry on the surface to induce capillary condensation of water. This water is then transported through the tube wall and collected as clean water.

The ceramic tubes are arranged in a heat exchanger (Hx) package and placed in a hot humid gas stream. Cold water enters one side of the Hx and cools the tubes causing hot moisture to condense and be collected as hot water at the heat exchanger outlet. These Hx modules are arranged 3 deep in the gas flow. A system can range anywhere from 3 modules to 300+ modules depending on the application and gas flow.





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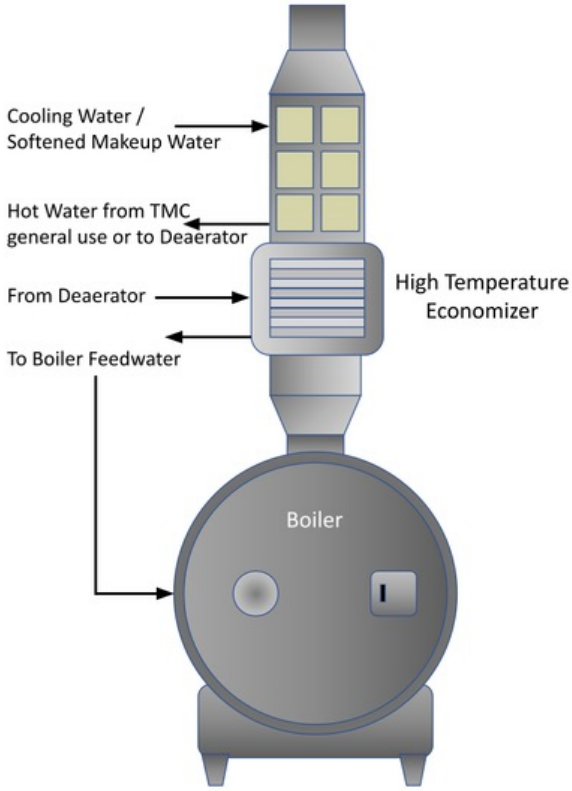
PACKAGE BOILER APPLICATION

In the case of a package boiler, the TMCAqua modules are installed on the exhaust stack and after any economizers already installed.

If the boiler does not have condensate recovery in place, the boiler makeup water is fed into the TMCAqua and the outlet of the TMCAqua is then fed into the economizer. From there, it goes to the Deaerator and then finally feeds in as boiler feedwater.

If the boiler has condensate recovery, then any cold water source may be fed into the TMCAqua and the hot water recovered can be collected in a tank and utilized for any process or utility function in the plant. In some cases, the hot water may be used in an Adsorption or Absorption chiller to generate chilled process water.

The TMCAqua system can improve boiler efficiency by 5-12% depending on the boiler setup and condensate system.



SAMPLE SAVINGS:

For a 1000 HP boiler TMCAqua can recover 1.4MM gallons of water, save 16000 MCF of natural gas and reduce 1000 Tons of carbon emissions, annually.

Sample water and energy recovery for Gas Package Boilers

	Water Recovery	Natural Gas Savings	TMCAqua System Model
Boiler Horse Power (HP)	Gallons/year	MCF/year	
50	55,000	650	PB-13
100	109,000	1,300	PB-13
200	218,000	2,600	PB-31
300	410,000	4,855	PB-33
500	683,000	8,092	PB-36
600	820,000	9,714	PB-36
700	984,000	11,357	PB-38
1000	1,394,000	16,193	PB-38
1200	1,667,000	19,433	PB-39

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SPRAY DRYER APPLICATION

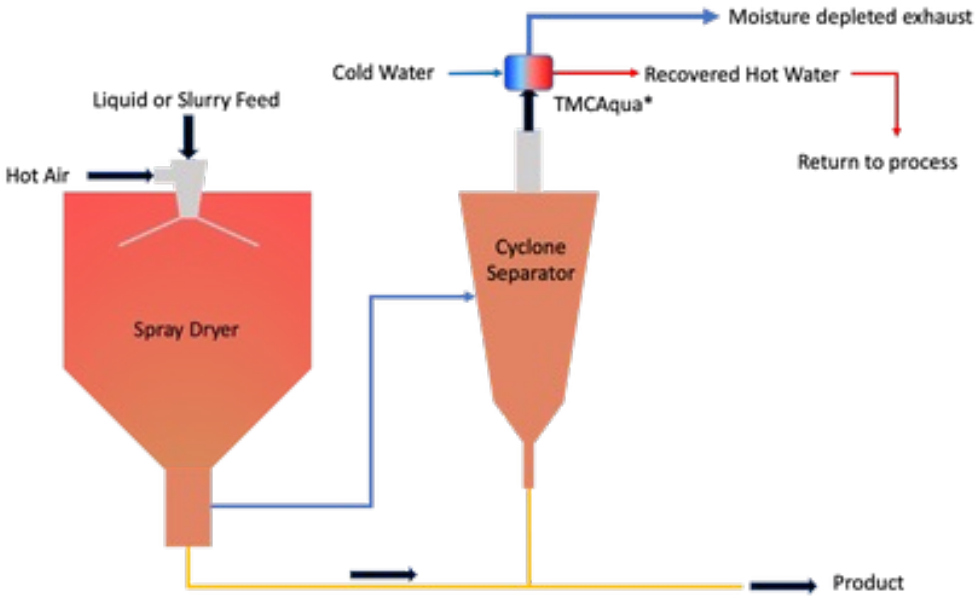
Spray dryers are utilized in a variety of industries for the manufacture of powdered products from liquid or slurry feed. The moisture from the feed is driven up in a reactor where it is exposed to hot air. The exhaust gas stream from a spray dryer is then passed through a cyclone separator or baghouse to recover entrained particulate. The exhaust from the particulate collection device then goes up the stack into the atmosphere. This gas contains as much as 50% of the total water utilized in the process.

For spray dryer applications, TMCAqua can recover 80%+ of the water and energy from the exhaust gases.

Examples: Milk powder, nutraceuticals, chemicals, pharmaceuticals and adsorber reactors.

SAMPLE SAVINGS:

For a Spray Dryer with 20000 ACFM exhaust gas flow with 40% moisture by volume, TMCAqua can recover 17 MM Gallons of water, save 175,000 MCF of natural gas and reduce 11,000 Tons of carbon emissions, annually



OTHER APPLICATIONS

Other applications include:

- Process dryers, ovens and furnaces
- Utility Boilers and District heating
- Coal to Gas converted boilers

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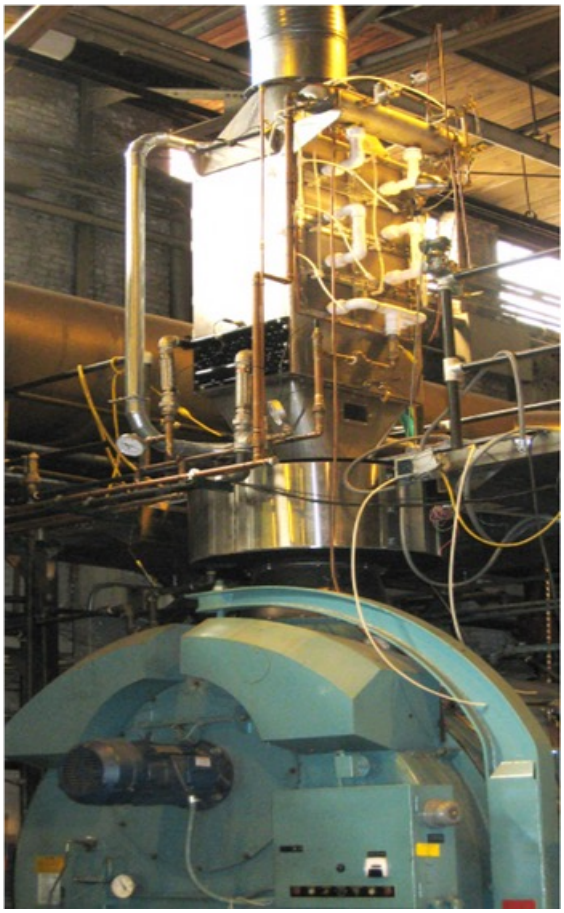
CARBON CAPTURE SYSTEM OPTIMISATION APPLICATION

Carbon capture systems are sized based on flue gas volume. When TMCAqua is installed ahead of a carbon capture system in the flue gas stream, it can remove 50-80% of the Moisture which reduces gas volume by 10-20%, additionally TMCAqua removes 50-80% of the enthalpy and cuts the flue gas temperature by as much as half, thereby reducing the flue gas volume a further 50%.

Therefore, combining TMCAqua with a carbon capture system can reduce flue gas volume by 50-70% thereby reducing CapEx and OpEx for the carbon capture system.

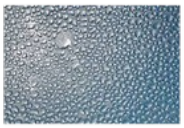


SUMMARY

TMCAqua is a unique patented technology that simultaneously recovers clean water and energy from waste exhaust gas streams thereby improving the process efficiency and reducing its water consumption.

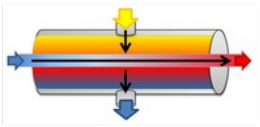
TMCAqua is in effect a device that performs three functions simultaneously:

Condenser



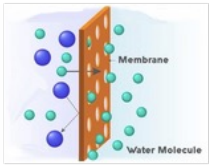
Condenses moisture out of waste gases

Heat Exchanger



Recovers Hot Water thereby recovering enthalpy

Membrane Filter



Filter water through the membrane filter wall and produces clean water