

CHENG | POWER SYSTEMS

Cheng Power System (CPS) is a well-established company in the Green Power Generation industry that has developed patented technologies to enable power plants to provide higher power output, increased efficiencies, and lower emissions. With over 300 installations throughout the world since the 1980's, CPS is a recognized technology leader.



Cheng Low NOx (CLN[®]) Emission Control Technology

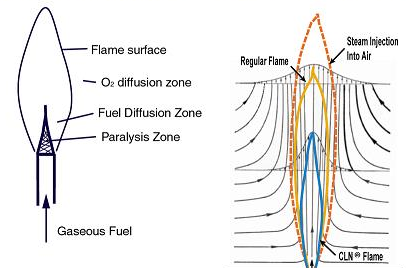


- ✓ The CLN[®] is an emissions control system for combustion turbines to reduce emissions while improving efficiency and power.
- ✓ CLN[®] simultaneously reduces NOx, greenhouse gas and fuel burned
- ✓ CLN[®] is the only product allowing the user to implement emissions control with savings vs. penalties to fulfill governmental regulations
- ✓ Implementation of the technology allows biomass and cheaper coal gassifiers to be used in current power generation equipment
- ✓ Emission reduction technology for mixed steam and fuel diffusion combustion systems that saves \$ for the user rather than costing \$.
- ✓ CLN[®] reduces NOx, CO & saves fuel in gas turbines simultaneously.
- ✓ The steam and fuel are mixed to at least 97% homogeneity, typically 99%.
- ✓ Homogeneous mixing is essential to get rid of local concentration fluctuations.
- ✓ CO is not affected significantly by diluting steam.
- ✓ Fuel side dilution increases diffusion rate temperature gradient & pyrolysis in flame.
- ✓ Has achieved combustion in gas turbines at a steam/fuel ratio of up to 4/1 (at 4/1 you have 200 Btu/cubic foot N.G.), resulting in NOx level below 3 ppm.
- ✓ The CLN[®] system uses computer controls to coordinate mixing steam and fuel to a desired ratio, integrated with the engine dynamic control system for the engine operation.
- ✓ System includes all the necessary ASME code-required control and safety features in the design.
- ✓ The system has the option of taking appropriate existing steam source or providing the waste heat recovery steam source.
- ✓ CLN[®] is not limited to gas turbine combustors.
- ✓ CLN[®] can be applied to gas burners: boilers, incinerators, & appliances.
- ✓ CLN[®] is the simplest NOx reduction without alternating combustion liner systems in gas turbines.
- ✓ CLN[®] has potential low costs and fast implementation.
- ✓ CLN[®] is a unique product, which immediately improves gas fired turbine efficiency by 20 – 40% with power boost of 50 – 70%.

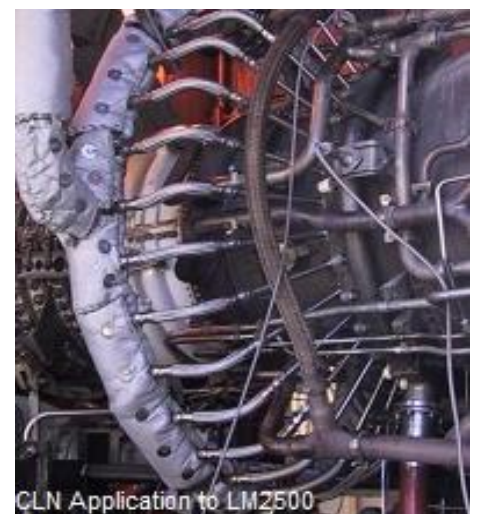
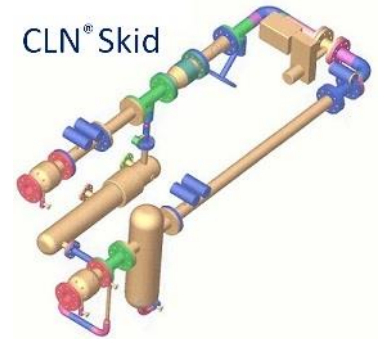
Advantages of CLN[®]

- Doubles hot parts life
- Saves catalyst replacement cost
- Removes ammonia slip stream
- Improves heat rate
- Reduces greenhouse gas
- Improves power output

Diffusion Flame Jet & Flame Profile



CLN[®] Skid



CLN Application to LM2500

CHENG | POWER SYSTEMS



Over 3 million operating hours across more than 300 global installations

Partial List:

*Large Electric Utility Co.
Kauai Hawaii
San Jose State University
Sunkist Growers
Frito Lay, Inc.
Hershey Foods, Inc.
SRI International
Kawasaki Heavy Industries
Loma Linda University & Hospital
Kawasaki Heavy Industries
Toho Gas Company
City of Osimo, Italy
Toho Gas Company
Mainichi News Paper
Carrozzeria Bertone SpA
N.V. PNEM T&O
Mayr-Melnhof Karton GmbrH
Unichema
Anne Claude Center
Alfred Hospital
Dandenong
Geelong Hospital
Royal Melbourne Hospital
St. Vincent's Hospital
Stadtwerke Riesa
Technical University Munich
Chuetsu Metal Works Co. Ltd.
Nisshin Steel
Semprit
Twin City Power Authority*

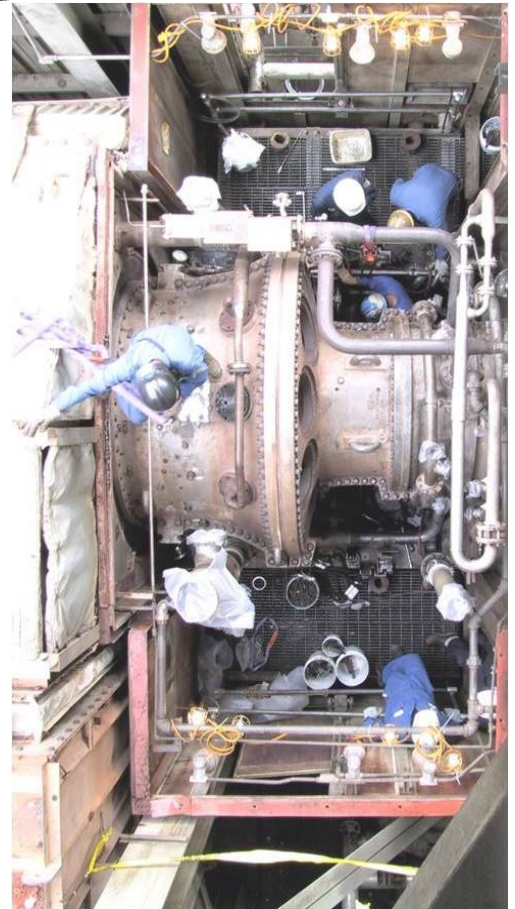
Midwest, USA
Kauai, HI
San Jose, CA
Ontario, CA
Bakersfield, CA
Oakdale, CA
Menlo Park, CA
Akashi, Japan
Loma Linda, CA
West Kobe, Japan
Aichi, Japan
Osimo, Italy
Aichi, Japan
Osaka, Japan
Turin, Italy
Heusden, Netherlands
Neuss, Germany
Port Melbourne, Australia
Bendigo, Victoria, Australia
Prahran, Victoria, Australia
Dandendong, Victoria, Australia
Geelong, Victoria, Australia
Melbourne, Victoria, Australia
Melbourne, Victoria Australia
Riesa, Germany
Garching, Germany
Toyama, Japan
Ichikawa, Japan
Vienna, Austria
Hildale, Utah

Cheng Power System, Inc. is a well-established company in the Green Power Generation industry that has developed patented technologies to enable power plants to provide higher power output, increased efficiencies, and lower emissions. With over 300 installations throughout the world since the 1980's, Cheng Power System is a recognized technology leader.

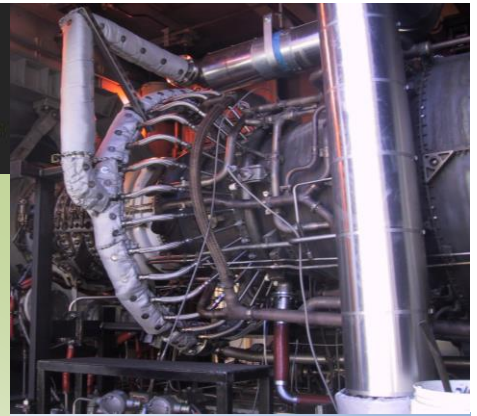
Our goal at Cheng Power Systems is to design, build and perfect power generation products that result in a cleaner and more efficient combustion process while improving output and lowering operating & maintenance costs.

Cheng Cycle[®] Power augmentation & efficiency enhancements through steam injection to boost the power output of certain combustion gas turbine generators by up to 50%

Cheng Low NOx CLN[®] Utilizing steam injection to reduce the NOx emissions of certain combustion gas turbine generators by up to 95%



CHENG | POWER SYSTEMS



Cheng Low NOx (CLN®) Emission Control Technology

- ✓ The CLN® is an emissions control system for combustion turbines to reduce emissions while improving efficiency and power.
- ✓ CLN® is the only emission control product with payback to the customer for their investment.
- ✓ CLN® reduces NOx & saves fuel in gas turbines simultaneously.
- ✓ CLN® is a NOx reduction system that does not alter combustion systems in gas turbines.
- ✓ CLN® immediately improves gas fired turbine efficiency by 20 – 40% with power boost of up to 25%.
- ✓ CLN® is applicable to any gaseous fuel.

Advantages of CLN®

More than Doubles Hot Parts Life
 No Catalyst Replacement Cost
 No Ammonia Slip Stream
 Improves Heat Rate
 Reduces Greenhouse Gas
 Increases Power Output

	CLN®	DLE	SCR	Comment
Increased Output Power	Yes	No	No	CLN increases output by up to 25%. SCR may cause slight decrease in power
NOx Emissions Reduction	<5 ppm	25 ppm	<2 ppm	SCR provides lowest NOx levels
CO Emissions Increase	0 ppm	<50 ppm	0 ppm	CLN does not increase CO
Heat Rate	Lowered	Increased	Same	
Part Load operation	Yes	Limited	Yes	
Water/Steam Requirement	Yes	No	N/A	
Ease of Retrofit	Days (Simple In Situ)	Weeks (Complex & Expensive)	Weeks (Expensive & HRSG Modification Needed)	DLE needs combustion system change, multiple sets of nozzles, and may require compressor modifications. CLN requires 1 set of new nozzles.
Engine Stability	Normal	Complex (Increases Pressure Drop across Combustor)	Normal	Potential Blowout problems for DLE because of low fuel-air ratio. CLN potential flameout risk is small.
Controllability/Ease of Operation	Easy	Difficult	Difficult	Limited dynamic operating range for DLE. SCR needs to find right mix and amount/location of mixing chemicals. SCR needs a stable environment and conditions to work properly. CLN is simpler design.
Time Between Overhaul/ Hot Section Life	Long	Short	Unchanged, Catalyst replaced every 4 years.	CLN lengthens time before needed overhaul. DLE has higher maintenance costs due to frequent replacement of expensive combustor.
Return on Investment	Yes	No	No	CLN saves user \$\$ from reduced emissions and gains additional profit from increased power output. Potential CO ₂ emission Credit.
Gaseous Fuel Type	Any	Only Natural Gas	Any	

Cheng Power Systems (CPS) is a well-established company in the Green Power Generation industry that has developed patented technologies to enable power plants to provide higher power output, increased efficiencies, and lower emissions. With over 300 installations throughout the world since the 1980's, CPS is a recognized technology leader. Our goal at Cheng Power Systems is to design, build and perfect power generation products that result in a cleaner and more efficient combustion process while improving output and lowering operating and maintenance costs.