

**THE WORLD'S
LEADING SUPPLIER OF
HEAT RECOVERY
STEAM GENERATORS**

NE



**OUR MISSION IS TO UTILIZE OUR DESIGN, ENGINEERING,
MANAGEMENT AND CONSTRUCTION EXPERIENCE TO PROVIDE
INNOVATIVE, HIGH QUALITY, ENVIRONMENTALLY COMPATIBLE,
COST EFFECTIVE PRODUCTS AND SERVICES TO MEET THE NEEDS
OF OUR CLIENTS IN A PROFESSIONAL MANNER WHILE FIRMLY
ADHERING TO THE HIGHEST STANDARDS OF ETHICS AND BUSINESS.**

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[WWW.NE.COM](http://www.ne.com)

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OUR COMPANY

WHO WE ARE

Nooter/Eriksen is a part of the CIC Group, an employee-owned company with subsidiaries that have specialized in the design, manufacturing and construction of steel products for over 100 years.

N/E is the world's leading supplier of Heat Recovery Steam Generators (HRSGs). These HRSGs, as well as other specialized heat recovery systems, are custom designed to meet each customer's specific requirements.

WHERE WE ARE

N/E's two operating offices are in St. Louis, MO (world headquarters) and Milan, Italy. Both offices have full design and supply capabilities to service their respective markets. Additional offices are in China, South Korea, United Kingdom, Saudi Arabia, Thailand, Indonesia, Oman and Qatar. N/E has a global network of representatives and licensees to support customers and jobsites worldwide.

WITH A GLOBAL NETWORK OF DIRECT OFFICES, REPRESENTATIVES AND LICENSEES, NOOTER/ERIKSEN IS UNPARALLELED IN ITS DESIGN, SUPPLY AND SUPPORT CAPABILITIES.

HRSG'S SUPPLIED TO OVER 50 COUNTRIES

Albania	Japan
Algeria	Jordan
Angola	Korea (South)
Argentina	Kuwait
Armenia	Malaysia
Australia	Mexico
Azerbaijan	Morocco
Bangladesh	New Zealand
Belgium	Nigeria
Brazil	Oman
Brunei	Pakistan
Bulgaria	Peru
Canada	Poland
Chile	Qatar
China	Russia
Colombia	Saudi Arabia
Dominican Republic	Singapore
France	Spain
Georgia	Thailand
Germany	Turkey
Ghana	Ukraine
Greece	UAE
Hong Kong	United Kingdom
India	USA
Indonesia	Uzbekistan
Ireland	Venezuela
Israel	Virgin Islands (US)
Italy	



WHAT WE WANT

N/E strives to be "Our Customer's Preferred Choice". Our objective is to supply the best designed, most efficient, highest quality, and most reliable heat recovery systems available on the market. Our policy is to take all necessary steps to ensure our products meet our customer's specification, our standards and the applicable Code requirements.

HOW WE DO IT

N/E is an authorized holder of the ASME 'S' Certification Mark. We also have experience in designing boilers to different code requirements such as ASME, METI, EN, TRD, GOST, TSSA, etc. depending on our customer needs.

N/E's licensees and manufacturing partners maintain comprehensive in-house quality assurance programs to ensure that all their HRSGs meet the highest possible standards. In 1993 N/E was the first HRSG supplier in the USA to obtain ISO 9001 certification. Also, our N/E Srl office has obtained the OHSAS 18001 certification. Underscoring our commitment to quality, the program has since been regularly audited and re-certified by DNV-GL.

EXPERIENCE

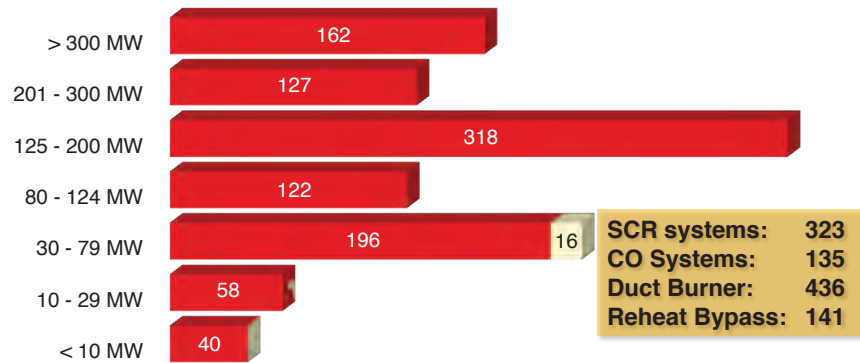
As the world's leading supplier of Heat Recovery Steam Generators, N/E has built and installed a full range of heat recovery systems. Included are many of the world's largest natural circulation HRSGs, several producing in excess of 580 tons/hr of steam. To date more than 1,000 HRSGs have been supplied for use behind gas turbines with outputs from 2 MW to over 300 MW. Over 425 N/E HRSGs incorporate supplementary firing, with burner duties often in excess of 600 MMBtu/hr (175MW). Since 1992 N/E has supplied over 400 HRSGs with reheat systems for improved plant efficiency behind large advanced gas turbines.

A dedicated designer and supplier of heat recovery boilers with the experience to back it up.....

- #1 HRSG supplier over the past 10 years in the world
- #1 HRSG supplier in North America over the past 10 years
- Supplied HRSGs to over 50 countries
- 52 major projects with 4 to 8 HRSGs each
- Largest single project - 3,750 MW in West County Energy Center, Palm Beach, Florida
- Over 350 HRSGs behind F-Class CTs
- Over 180 HRSGs behind G/H/J-Class CTs
- CE marking and PED compliance
- Full service Aftermarket support

Nooter/Eriksen Experience by Gas Turbine Size

Total HRSG Fleet: 1023



CORPORATE HEADQUARTERS



Nooter/Eriksen, Inc. USA (World headquarters)



Nooter/Eriksen, SRL | Italy

VALUE ENGINEERING



OUR SPECIALTY

Complex heat recovery systems are Nooter/Eriksen's specialty. All systems are designed for maximum reliability, efficiency and availability. The heat recovery systems for each specific application are custom designed to meet the customer's requirements at the lowest possible cost without sacrificing quality or easier maintainability.

N/E performs a complete engineering analysis to assure the industry's most well-planned and efficient installation. Using state of the art computer aided design methods, entire systems are modeled to prevent interferences and expensive rework at site. N/E is the industry leader in providing HRSGs with constructability features that minimize field installation labor and shorten construction schedules. N/E's design features provide for optimum flexibility in the installation sequence, taking into account transportation limitations, while maximizing overall shop fabrication.

HRSGs can be designed to include important features to meet the latest thermal and environmental standards. N/E has extensive experience with Selective Catalytic

Reduction (SCR) systems, Carbon Monoxide (CO), and VOC oxidation catalysts and dual function (SCR/CO) catalyst systems. N/E has also developed its own noise attenuation technology, with results substantiated at over 30 installations.

NEW PRODUCT DEVELOPMENT/RESEARCH & DEVELOPMENT

Research and development is a key part of N/E's on-going product improvement. This R&D includes an in house calibrated wind tunnel that is used to conduct basic thermal/hydraulic research. An entire department of engineers is dedicated full-time to exploring areas for continuous improvements and new products.

N/E has significant experience with Computational Fluid Dynamics (CFD) modeling the velocity and pressure fields of both the turbine exhaust gas side and working fluid side of the heating surface.

We also have extensive capabilities to support customer requests to perform Finite Element Analysis (FEA) for critical components of the heat recovery boiler operating in cycling modes.

USING STATE OF THE ART MECHANICAL DESIGN SYSTEMS, ENTIRE SYSTEMS ARE MODELED TO PREVENT INTERFERENCES AND COSTLY REWORK AT SITE.

WEST COUNTY ENERGY CENTER

3750 MW
COD June, 2011

Largest Combined Cycle Facility
in North America



CYCLING CAPABILITIES



SAMRA
Zarqua, Jordan
369 MW Capacity
COD 2008

ENSURING RELIABLE OPERATIONS

There are several major areas that are affected by cycling an HRSG:

1. Equipment flexibility
2. Potential equipment malfunction
3. Operational concerns
4. Fatigue of thick pressure parts

As units have become more and more cyclic, the operating demand for the units to cycle, Nooter/Eriksen has learned that there are several very important things that must be done to ensure the equipment will operate reliably. Some of these features directly address the concerns owners have regarding cycling units and others are offered as options to help make equipment last longer.

A. HP Superheater and Reheater Coil Flexibility: All coils in N/E designed HRSGs are top supported. N/E uses constant load spring supports on one or more of the upper headers of HP Superheaters and Reheaters at the high temperature end of the system. All tube to upper and lower header connections are straight with no bends to minimize stress. Adequate flexibility is provided when attached piping restrains the headers from free thermal expansion.

NOOTER/ERIKSEN KNOWS THERE ARE SEVERAL IMPORTANT FACTORS THAT MUST BE ACCOUNTED FOR TO ENSURE ALL CYCLIC SERVICE EQUIPMENT OPERATES RELIABLY.

B. External Piping: When possible, avoid top to bottom routing of piping from one coil to the other.

C. Desuperheaters: To minimize the potential for desuperheater condensate tube quenching, it is N/E's standard to supply inline condensate pots upstream, downstream or both from the desuperheater location. All N/E HRSGs are supplied with thermocouples at appropriate distance downstream of the desuperheaters.

D. High Chrome Materials: For cyclic units it is important to keep the thickness of key components as thin as possible. N/E has substantial experience with all alloy materials (low to high alloys).

E. Stack Dampers: One method of assisting in maintaining temperature and pressure within the HRSG during a period of shutdown is the use of a Stack Damper. N/E recommends that the exhaust stack be externally insulated up to the stack damper.

F. Lower Header Coil Restraints: N/E's coil restraints are specially designed to allow all tube rows to expand in the vertical direction freely but at the same time allow restraint of gas flow induced movement.

G. Combined Upper and Lower Headers: It is never N/E's practice to use partition plates, where the headers are tied together top and bottom. The standard approach is to split the lower headers apart into pressure levels so the tubes can expand independently of the other pressure section. If required, upper headers can be separated when required, as well.

H. Tube Stub to Header Connections
Helps minimize header thicknesses.

**RIVERTON EC**

255 MW Capacity
COD March, 2016
Riverton, KS

FAST STARTUP



FASTER ON-LINE OPERATIONS

The industry continues to focus on getting power facilities on line fast for the following reasons:

1. The quicker the power can be produced for customers, the sooner revenue can be generated.
2. The quicker the plant startup, the easier it is to incorporate as a backup for renewable power resources, such as wind and solar energy, which are prone to rapid load changes.
3. The quicker the HRSG ramp rate the earlier the plant can be in emission compliance in accordance with local and state regulations.

Nooter/Eriksen understands the requirements and needs for today's power plant owners. With that in mind, our focus is to maintain the industry leading reliability of a natural circulation design while accompanying with traditional feed water control and conventional water treatment systems.

With the industry trend towards faster plant startup times, N/E offers several options to support the owner's needs, such as:

1. Material enhancements in critical areas of the HRSG to improve plant startup time by reducing component thicknesses
2. Multi-drum designs that do not restrict gas turbine or plant startups while utilizing traditional natural circulation technology's operating reliability
3. Licensed Benson and in-house developed Once Through Steam Generator (OTSG) designs that do not restrict plant startups, but require special water treatment and flow control systems

**N/E OFFERS MULTIPLE DESIGN
OPTIONS TO MAINTAIN NECESSARY
INDUSTRY RELIABILITY.**



**Multi-HP
Drum**

GRAND RIVER ENERGY CENTER (GREC UNIT 3)
Chouteau, Oklahoma
495 MW Capacity
COD December, 2017



**FIRST MULTI DRUM UNIT IN OPERATION
FOR N/E AND FIRST MHPSA J MACHINE
IN NORTH AMERICA**

CONSTRUCTABILITY



MODULARIZATION OPTIONS

Nooter/Eriksen offers several options to maximize the modularization of our equipment to reduce overall installation costs to suit your site specific needs.

- Large Modular
- C-Frame
- Shop Modular
- Small Modular

Not all modular construction is created equal

Other OEMs offer what they call modular construction, but fall short of N/E 's industry leading constructability. Our objective continues to be to reduce field man-hours to save both cost and schedule.

Standard features that reduce field man-hours

N/E has developed standard features that dramatically reduce installation man-hours.

- Minimizes piping welds and casing penetrations
- Compression type tubing for atmospheric drains

- New and improved secondary casing panel handling and fit-up for faster erection
- Compression fit corners at casing wall to floor and roof simplifies connection, eliminates corner angles and allows for work to be completed from the outside
- Improved field seam details at column lines reduce field man-hours

Options for enhanced constructability

N/E can offer options to enhance constructability at most sites.

- Bolted moment connections
- Maximize module sizes
- Large bore and small bore valves shop installed
- Shop installed pipe support stanchions
- Shop fabricated small bore piping
- Bolted platform connections
- Eliminate tailing crane for setting modules
- Exhaust stacks large sections drum trim shop fabricated
- Duct boxes

WITH A STRAIGHTFORWARD APPROACH TO INSTALLING HRSGS, N/E IS DEDICATED TO REDUCING THE ERECTOR'S MAN-HOURS ON SITE WITH INNOVATIVE FEATURES AND OPTIONS FOR ENHANCED CONSTRUCTABILITY.



Large Modular



C-Frame

FLEXIBILITY



Shop Modular

OTHER PRODUCTS



MULTIPLE APPLICATION SYSTEMS

Apart from gas turbine HRSGs, Nooter/Eriksen supplies heat recovery systems for such diverse applications as Enhanced Oil Recovery units (EORs), Coke Ovens, and various other waste heat recovery applications.

Additional products include Simple Cycle Systems, and HRSGs for Integrated Gasification Combined Cycle (IGCC) applications.

**N/E PROVIDES FOR MULTIPLE
WASTE HEAT APPLICATIONS.**



**Waste Heat
Boilers on
Coke Ovens**



QARN ALAM

Enhanced Oil Recovery
Largest EOR Facility in the World



BETHPAGE SIMPLE CYCLE

40MW Output
COD July, 2005

AFTERMARKET SERVICES



MAINTENANCE AND OPERATION SUPPORT

Nooter/Eriksen is committed to supporting the maintenance and operation of our customers' HRSGs. With our proven experience in boiler design, fabrication and installation, we have the expertise and the technology to provide aftermarket services tailored to meet the demanding requirements of the industry. We can be contacted **24 hours a day, 7 days a week at 636-651-1400 or aftermarket@ne.com** to help our clients achieve the highest level of reliability and availability.

With an ever-evolving power industry, N/E's Aftermarket Services can offer any service needed to operate, update, maintain, modify or repair any OEM's HRSG based on today's technology and design philosophies.

N/E Aftermarket Services can offer turn-key projects complete with design, fabrication and installation in mind.

- In-Kind and Redesigned Coil Replacements
- Coil Condensate Management Retrofit
- Catalyst Retrofit and Replacement
- Stack Damper Retrofit
- Spring Hanger Coil Support Retrofit

With over 25 Years of industry experience, N/E Aftermarket Services can assist with the day to day needs of your HRSGs.

- Internal and External HRSG Inspections
- Engineering Studies for Upgrades and Alternate Operation
- Current Design Standards and Operating Procedures
- Troubleshooting and Failure Analysis
- Spare Part Supply
- Field Technical Support for HRSG Work

N/E OFFERS COMPLETE SUPPORT FROM DETAILED INSPECTIONS TO TURN-KEY SERVICES INCLUDING DESIGN, FABRICATION AND INSTALLATION OF REPLACEMENT COMPONENTS.



Coil Replacement – Restores reliability and performance to a coil with a widespread failure mechanism.



Stack Damper Retrofit – Enable plants to maintain a warm and hot start for longer periods of time.



Automated Condensate Detection Retrofit – System for the automatic removal of condensate from drain lines now required by ASME Code.



Coil Spring Support – Adds flexibility to the coil and minimizes future damage due to cycle fatigue. This is standard on more recent N/E HRSGs

PROJECT MANAGEMENT & GLOBAL SUPPLY CHAIN



Nooter/Eriksen provides flexibility in project execution through the experience of the Project Management Team. Each project is staffed with a Project Manager, a Project Engineer, and full project execution support including Quality Assurance, Procurement, and Supplier Management in addition to an in-house network of Shop Inspectors.

Global Supply Chain includes a Supplier Management Team consisting of Manufacturing Product Specialists & Engineers who focus on developing and supporting N/E's sub-suppliers. They provide direct support of Procurement, Projects, and Quality Assurance activities. This team includes direct shop interaction and leadership with respect to shop processes. Their shop presence ensures consistent high-quality products and on time deliveries

N/E EXECUTIVE TEAM

PRESIDENT'S MESSAGE

Nooter/Eriksen, an employee owned company, has been proudly serving its customers for over 30 years. Our commitment to quality and excellence is shown in our performance and aftermarket services which results in repeat customers and orders. Everyone representing Nooter Eriksen from the top executives on down understands that our vision is to be our Customers' Preferred Choice. We achieve this by being consistent with all specifications, standards and delivery schedules.

Nooter/Eriksen has operating offices in the United States, Italy as well as marketing offices in China, Korea, United Kingdom, Thailand, Indonesia, Oman and Qatar. We are also proud to partner with our licensees in China, Mexico, Turkey, India and Canada.

EXECUTIVE MANAGEMENT TEAM



Piero Scapini
President

Twenty-six years experience



Mike Filla
Executive Vice President

Twenty-seven years experience



Darla Gavin
Vice President, Operations

Thirty years experience



Matthew Burns
Director of Sales

Eighteen years experience

NOOTER/ERIKSEN, SRL, ITALY



Marco Perini
Managing Director

Nineteen years experience



NE **NOOTER/ERIKSEN**
HEAT RECOVERY STEAM GENERATORS

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