

Higher efficiency for steam reformers with EARTH[®] technology



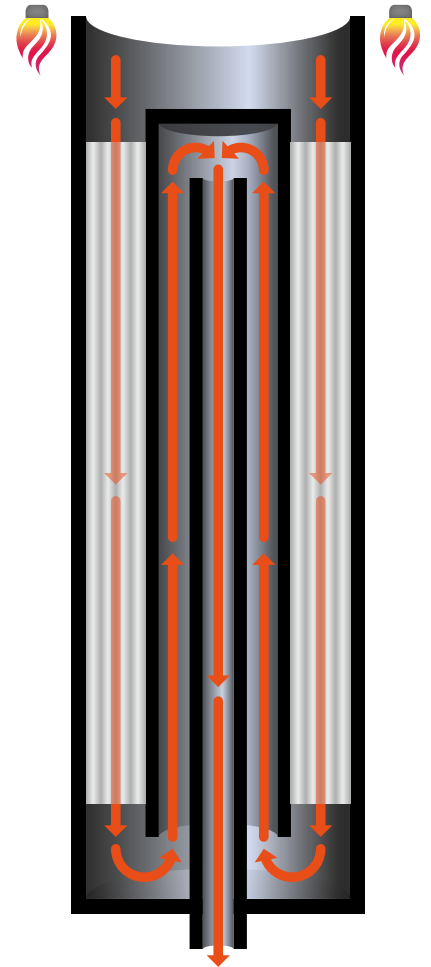
The **Enhanced Annular Reforming Tube for Hydrogen (EARTH[®])** and syngas production is a drop-in insert consisting of a structured reforming catalyst and concentric flow tubes, installed in existing or new reformer tubes, to simultaneously achieve **higher throughput** and **heat recovery** in steam reformers.

EARTH[®] is an innovative, recuperative steam reforming technology which facilitates efficient recovery of high-grade process heat, thanks to the unique geometric arrangement of a structured catalyst and concentric heat exchange tubes positioned inside the main reformer tube.

Technip Energies and Clariant have joined their collective expertise in process, heat transfer and catalysis technology to develop and deliver EARTH[®] technology to the market, comprising this proprietary geometric layout in combination with a **highly active, stable and mechanically robust catalyst** that promotes efficient and optimized heat transfer as well as low pressure drop.

The EARTH[®] reactor technology is advantageous for achieving a **capacity increase of up to +20 percent**, at otherwise constant reforming conditions with no or minor modifications on the steam reformer furnace and heat recovery system. Moreover, EARTH[®] enables energy efficiency and carbon footprint benefits compared to conventional steam reforming technologies, allowing for **up to 10 percent CO₂ emissions reduction** per unit of hydrogen produced.

EARTH[®] also provides an excellent match with decarbonization of hydrogen and syngas production. Together with synergistic design changes, including for example carbon capture, it can achieve **up to > 99 percent reduction** of the carbon footprint.



Performance benefits

Commercial benefits



Reduction of CO₂ emissions



High catalyst activity and low pressure drop



Capacity increase of up to 20 percent



Reduced CO₂ emission penalty



High heat transfer and heat recovery resulting in improved furnace efficiency



Stable and robust catalyst with long service life



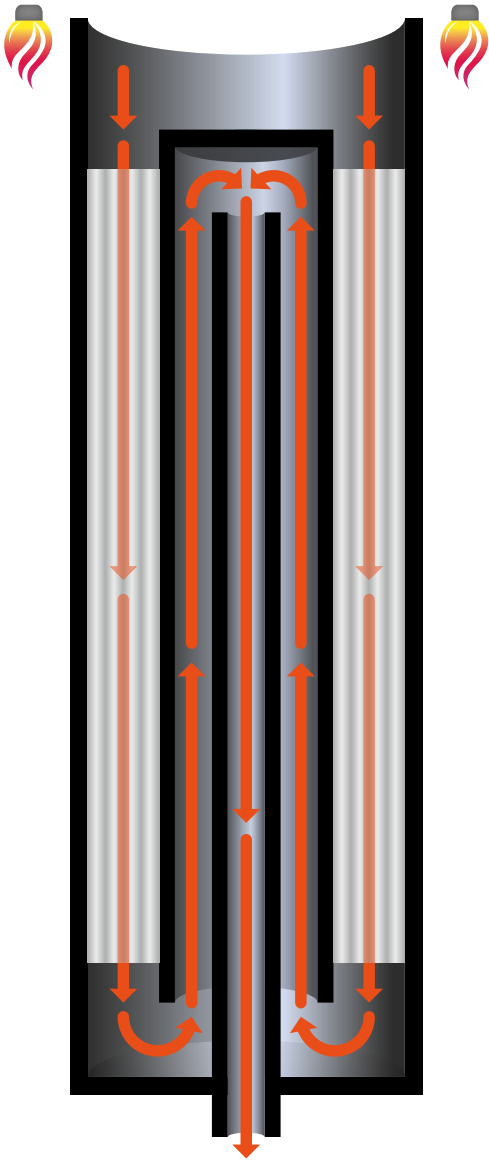
Reduced feedstock and fuel



Excellent synergies with decarbonization and CC(U)S



Internals and catalyst optimized for plant performance



Advantages

as demonstrated in reference unit

Technology	Capacity	Feed and fuel to H ₂	CO ₂ footprint per Nm ³ of H ₂	Steam export
Conventional technology	Base	Base	Base	Base
EARTH® (achieved)	Same	-10% ↑	-10% ↓	-50% ↓
EARTH® (estimated)	+20%	↑	↓	↓

Functionality

While traditional steam reforming technologies degrade high-grade process heat to generate high-pressure steam, EARTH® offers the possibility to **utilize high-value heat to produce additional hydrogen, and/or to save energy** (and operating cost) by reducing the firing duty of the reformer.

The tradeoff between steam generation and energy savings may be easily optimized to meet the desired outcome.

EARTH® Reference

EARTH® has already been implemented in industrial units for H₂ and syngas production, with significant benefits in terms of fuel savings and furnace efficiency compared to a conventional packed bed reactor.

Key results achieved:



- >30% fuel savings
- >10% decreased CO₂ footprint
- ~20% decreased pressure drop
- >20% increased furnace firebox efficiency, i.e. the energy absorbed by the conversion process versus the total energy liberated in the furnace
- ~50% decreased steam export

Please contact

Technip Energies

martin.vanthoff@ten.com

vinay.khurana@ten.com

Clariant

stefan.gebert@clariant.com

This information corresponds to the present state of our knowledge and is intended as a general description of our products and their possible applications. Supplier makes no warranties, express or implied, as to the information's accuracy, adequacy, sufficiency or freedom from defect and assumes no liability in connection with any use of this information. Any user of this product is responsible for determining the suitability of supplier's products for its particular application.* Nothing included in this information waives any of supplier's General Terms and Conditions of Sale, which control unless it agrees otherwise in writing. Any existing intellectual/industrial property rights must be observed. Due to possible changes in our products and applicable national and international regulations and laws, the status of our products could change. Material Safety Data Sheets providing safety precautions, that should be observed when handling or storing supplier's products, are available upon request and are provided in compliance with applicable law. You should obtain and review the applicable Material Safety Data Sheet information before handling any of these products. For additional information, please contact supplier.

*For sales to customers located within the United States and Canada the following applies in addition:
NO EXPRESS OR IMPLIED WARRANTY IS MADE OF THE MERCHANTABILITY, SUITABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE OF ANY PRODUCT OR SERVICE.

»Supplier« means Clariant and/or Technip Energies.

EARTH® technology is patented by Technip Energies. EARTH® is a trademark owned by Technip Energies.

© 2022 Clariant International LTD

CLARIANT INTERNATIONAL LTD
Rothausstrasse 61
4132 Muttenz
Switzerland
www.clariant.com

BUSINESS UNIT CATALYSTS
Arabellastraße 4a
81925 Munich
Germany
CLARIANT.COM/CATALYSTS

T.EN Netherlands B.V.
Afrikaweg 30
2713 AW Zoetermeer
The Netherlands

TEN.COM