

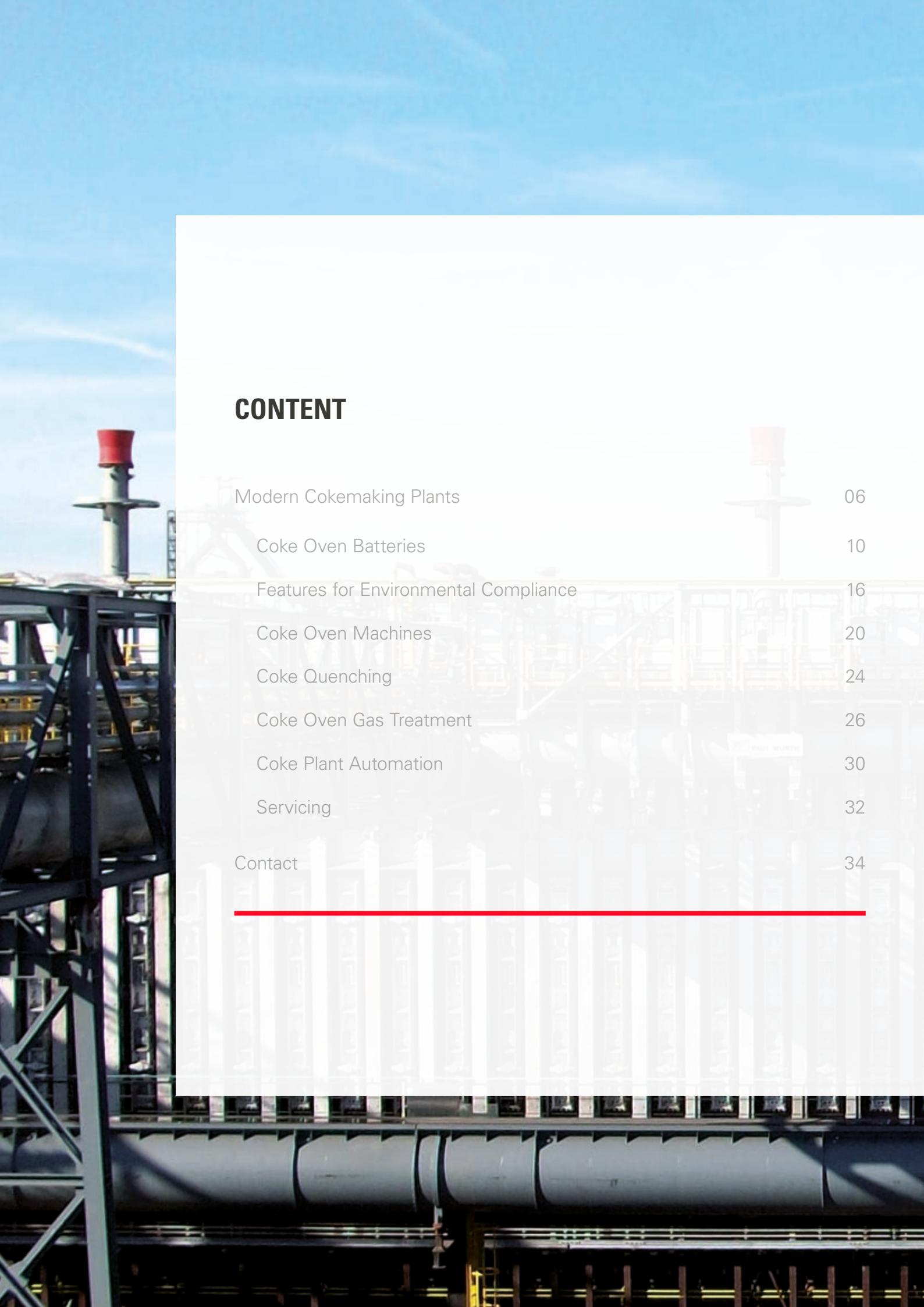
PAUL WURTH

SMS group



COKEMAKING TECHNOLOGY

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CONTENT

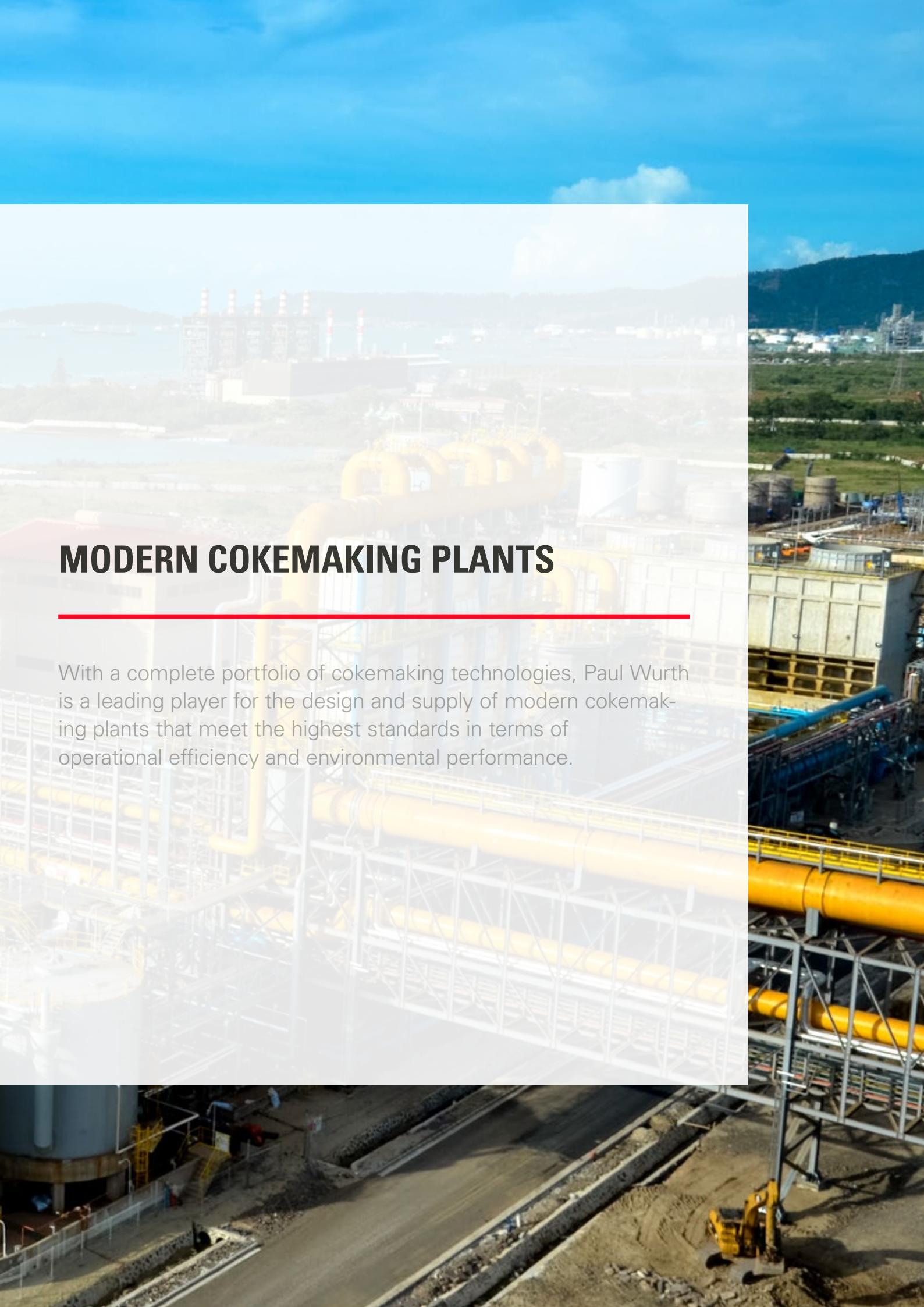
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MODERN COKEMAKING PLANTS

With a complete portfolio of cokemaking technologies, Paul Wurth is a leading player for the design and supply of modern cokemaking plants that meet the highest standards in terms of operational efficiency and environmental performance.



THE STATE-OF-THE-ART OF COKEMAKING TECHNOLOGY

Hot metal and pig iron produced by blast furnaces stand for 60% of all steel products which the world's population consumes. In the melting process of blast furnace ironmaking, coke is used as a reducing agent. The availability of good quality coke at sustainable prices is one of the priorities of blast furnace operators.

In cokemaking, Paul Wurth offers tailor-made and state-of-the-art solutions for your turnkey construction projects, modernisations, top to stamp charging conversion as well as hot repairs.

In constant dialogue with the customer, we define all process steps within a global approach and develop the concept accordingly. This includes profitability studies, project management plus manufacturing and quality control. Thereby, a special focus is on efficiency and environmental performance.

A COMPREHENSIVE PORTFOLIO

Our portfolio includes the design and construction of complete cokemaking plants, coke oven batteries of top and stamp charging type, coal & coke handling, coke quenching plants, coke oven gas treatment, by-product & auxiliary plants. A full range of coke oven machines, based on Schalke as well as Koch technology, makes Paul Wurth a global player for cokemaking projects - from preparing the coal to be charged into the ovens to the delivery of coke in suitable fractions to the final users.

Complemented by the most advanced automation and control systems along the entire coking process, our plants and equipment meet the highest standards in terms of coke productivity and quality, emission control, energy consumption, user friendliness and plant safety.



TOP QUALITY COKE PLANT ENGINEERING

- VAP - Virtual Assembly Program, an engineering tool developed in-house by Paul Wurth is used to fully automatically design the bricks of the coke oven battery so as to optimise refractory design, reduce execution time and avoid mistakes.
- A 3D modelling system is used to perform the engineering of the mechanical, structure, piping, instrumentation and electrical components.
- Fluodynamic simulation can be applied to the heating flues in order to optimise the combustion of mixed gas and coke oven gas in the heating wall.

COKE OVEN BATTERIES

Paul Wurth adopts the most advanced plant arrangements and operational techniques for the design and construction of coke oven batteries. Relying on more than forty years of experience in cokemaking technology, Paul Wurth holds proprietary know-how and can bank on significant and highly technological references in the cokemaking sector worldwide.

Depending on the customer's needs and requests, Paul Wurth provide the tailor-made design and state-of-the-art technologies for coke oven batteries of top charging as well as of stamp charging type. Whatever charging technology is chosen, the batteries designed by Paul Wurth integrate the latest technological developments in order to assure long campaign life, high productivity and full compliance with the most advanced standards in terms of pollution control.





TOP CHARGING

In the field of top charging batteries, Paul Wurth favours the so-called "Jumbo oven" battery concept. With an oven height of 7.6m and a useful volume of 79m³, the number of pushing & charging operations per day are drastically reduced, and so is the number of ovens.

This means that, compared to conventional batteries, the number of possible fugitive emission sources is reduced. Indeed, these emissions mainly occur from leaks at the closed openings of the coke oven battery or are non-captured emissions during the pushing & charging operation. Consequently, Paul Wurth's Jumbo oven battery concept is a technical solution with substantial ecological advantages.

HEATING SYSTEM

Depending on the battery operation, Paul Wurth supplies very flexible heating system configurations that assure minimal NO_x and CO concentrations, uniform temperature distribution and optimised fuel consumption.



BRACING SYSTEM

High stability of the heating wall and gas tightness are the result of state-of-the-art design of the bracing system and of the heating wall itself. This has to compensate the tensile stresses generated by the coal swelling pressure during distillation and by the pushing forces during oven discharging.





JUMBO OVEN CONCEPT FOR LONGER BATTERY LIFETIME

	Conventional 6.25 m	Jumbo Oven
Coking time	17 [h]	24.5 [h]
Oven width	410 [mm]	550 [mm]
Pushes per day per oven	1.41	0.98
Pushes per year per oven	515	358
With 16.000 estimated pushes per oven during battery lifetime		
Expected battery lifetime	31 years	44 years

STAMP CHARGING

Considering the coke plant operator's objective to achieve reductions in OPEX, the increasing coal blend price and the ever lower quality of coking coal, stamp charging technology offers substantial benefits for cost effective coke production.

Paul Wurth's coke oven batteries of stamp charging type distinguish themselves by a particularly strong battery structure, an optimised combustion and specifically developed features for environmental protection.

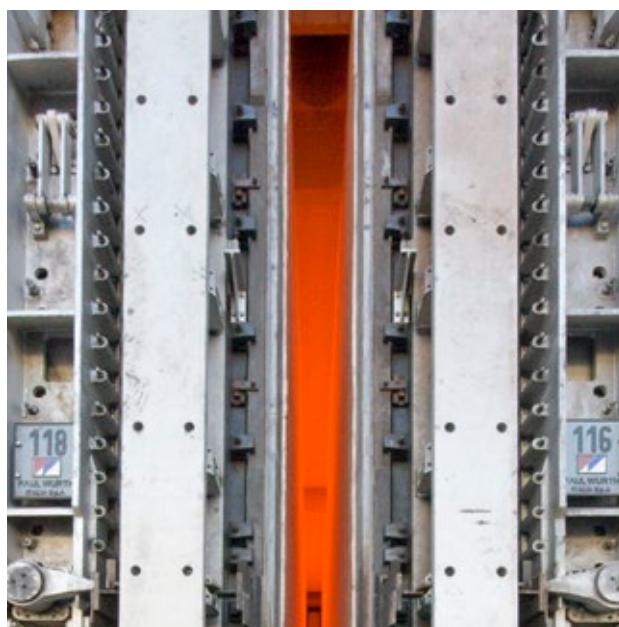
COMBUSTION SYSTEM

A dedicated optimised combustion configuration assures uniform heating of the coal cake in height and reduced NO_x emissions.



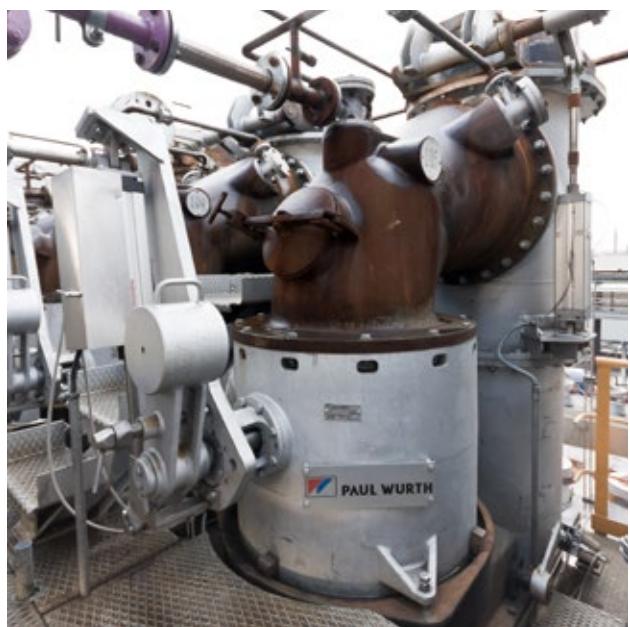
BRACING SYSTEM

A state-of-the-art bracing force profile avoids tensile strength in the brick work and leakages between the oven and the heating wall, thus leading to a longer battery lifetime.



SMOKELESS CHARGING SYSTEM

By combining the Sopreco® system, advanced charging gas transfer car technology and the pushing sequence 2-1 pattern, Paul Wurth offers a smokeless charging system that avoids emissions to be released into the atmosphere.





FEATURES FOR ENVIRONMENTAL COMPLIANCE

Coke plant operators have to comply with ever more challenging regulations in terms of emission control and environmental protection. Therefore, Paul Wurth pursues a policy of continuous improvement and development of its technological tools and solutions, thus proposing a series of innovative special design features, which largely contribute to an emission-free and energy-saving coke plant operation.





COKE OVEN DOORS

The specially designed Paul Wurth coke oven doors suit the actual requirements for a low-maintenance and environmentally friendly system. The special design with elastic diaphragm and air-cooled body guarantees that the coke oven doors adapt to the door frame, acting with necessary forces given by regulating springs on the whole contact surface, therefore assuring a maximum tightness of the system.

COKE^{Xpert}™

COKE^{Xpert}™, the level-2 system for coke oven plants developed by Paul Wurth, provides coke oven operators with an advanced, accurate and easy-to-use support tool, which can be successfully used to improve both the operational and environmental performances of the plant.

Besides improving operation stability and productivity, assuring constant coke quality and increasing the battery lifetime, the application of COKE^{Xpert}™ leads to substantially reduced fuel consumption and minimised environmental emissions.



SOPRECO®

The Paul Wurth SOPRECO® Single Oven Pressure Control system for coke oven batteries allows to maintain individualised and technologically appropriate pressure conditions inside the oven during the entire coking process. Thanks to this innovative system, fugitive emissions that may occur through doors, charging holes and stand pipes, are reduced and the charging procedure is done in an environmentally friendly way without the use of high pressure ammonia water.

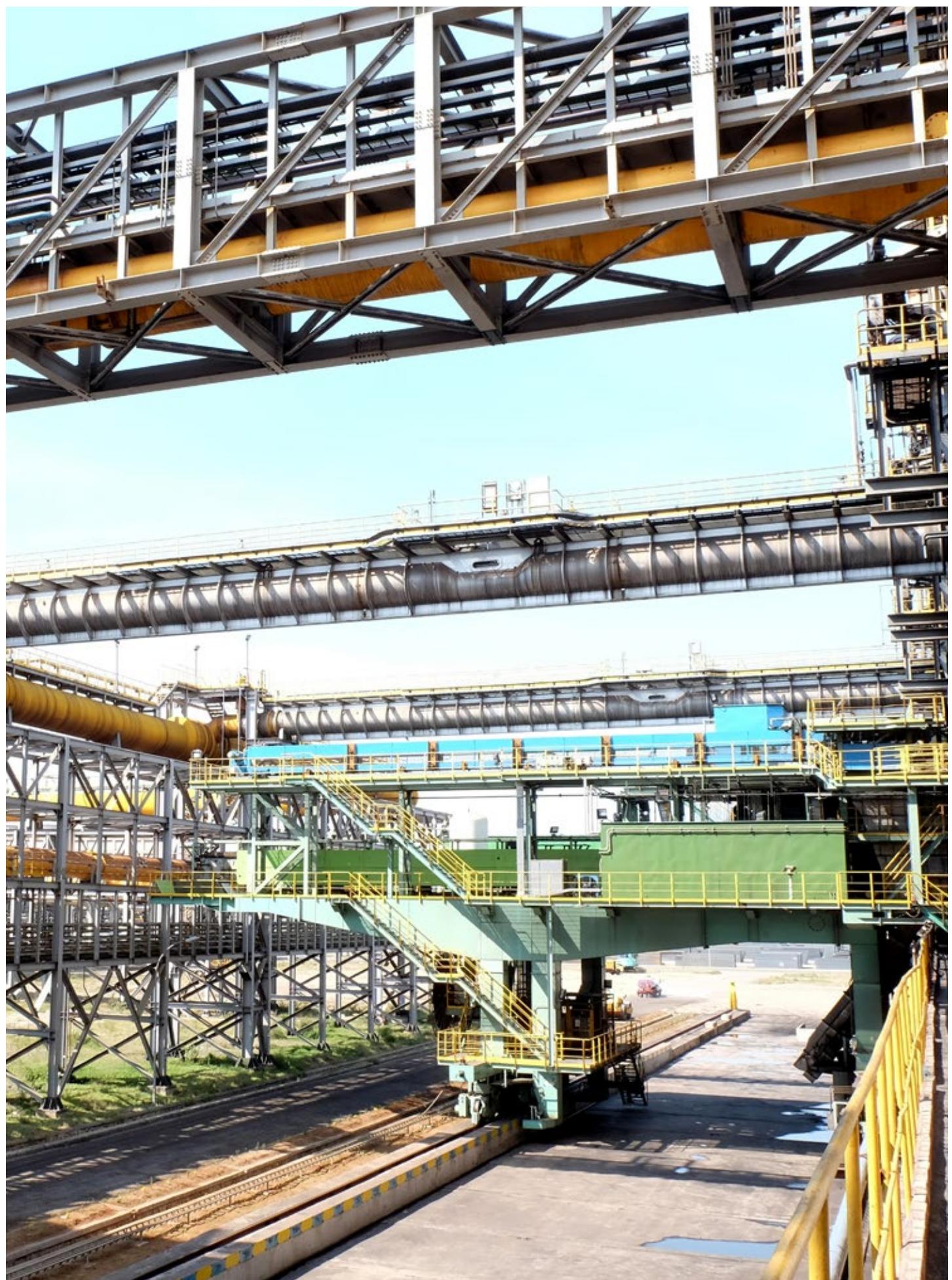
As a result of their efficient and robust design, all components are suited for reliable operation under aggressive conditions. SOPRECO® is easy to install, is maintenance-free and can be retrofitted onto existing batteries without interruption of the ongoing operation.



COKE OVEN MACHINES

Paul Wurth offers a full range of coke oven machines for top charged and stamp charged batteries, based on Schalke as well as Koch technology. Our comprehensive portfolio includes charging cars, pusher machines, stamping-charging-pushing machines, coke transfer cars, charging gas transfer cars, quenching cars, crane systems, maintenance & service cars as well as all related automation and emission control systems.

Thanks to this state-of-the-art technology, the most modern and largest coke oven batteries in the world can be equipped with automated coke oven machines which meet the highest standards in terms of coke productivity, emission control, user friendliness and plant safety.



PUSHER MACHINES

Operating in principle as single-spot machines, our pusher machines are optimally designed for door handling, coke pushing and coal levelling. In view of a smoke-free operation and given specific oven or battery conditions, they are optionally equipped with a number of advanced features. Paul Wurth pusher machines have an extremely long service life.



CHARGING CARS

Coal charging cars provided by Paul Wurth are principally designed as single-spot machines and distinguish themselves by a robust-design sealed charging as well as fast and controlled charging. In order to meet the requirements of ever more stringent pollution control standards, a whole range of specific charging car features and systems have been developed and optimised.





COKE TRANSFER CARS

Integrated coke transfer cars provided by Paul Wurth are of high dust catching efficiency, when the oven is open during the pushing operation. The single-spot coke transfer cars rely on advanced technology for handling the doors and guiding the pushed coke from the oven into the quenching car. For efficient emission control and in order to meet specific plant requirements, a number of state-of-the-art systems can be used in combination.

QUENCHING CARS

Paul Wurth offers two different types of wet quenching cars, namely for conventional top spray quenching and for coke stabilizing quenching (CSQ). Both machines can be self-propelled or locomotive driven. Being of robust design, the quenching cars offer the advantage of easily exchangeable wearing parts.

Paul Wurth's coke oven machinery portfolio also includes coke dry quenching bucket cars.



COKE QUENCHING

In the field of coke quenching, the Paul Wurth Group offers both wet and dry coke quenching systems, with all associated equipment and technological features for best environmental compliance and energy recovery.

WET QUENCHING SYSTEM

In wet quenching, Paul Wurth has developed its own technology called "Lo-Mo Type", standing for low moisture content. High dust removal efficiency is obtained in a double way by a dust abatement system and steam washing. In that way, dust contents of less than 10 g/ton of coke and coke water contents of less than 3% are reached.

DRY QUENCHING SYSTEM

Through the strategic alliance with IHI Corporation within the joint venture Paul Wurth IHI, the Group offers coke dry quenching (CDQ) technology, relying on a proven track record of CDQ plants supplied mainly in Japan, South Korea and Brazil. Being under continuous improvement, CDQ technology assures best environmental protection, highly efficient energy recovery, optimised product quality and long-lasting, stable operation.



COKE OVEN GAS TREATMENT

Coke oven gas production and the related recovery of its by-products are of utmost importance in the overall cokemaking and ironmaking process when it comes to provide an environmentally responsible global concept with limited investment cost.

In this respect, Paul Wurth set up a strategic cooperation with the German company DMT GmbH & Co. KG and is able to offer the design and construction of complete coke oven gas (COG) treatment and by-product recovery plants.

Banking on the references and sound expertise of both companies, our portfolio in coke oven gas treatment includes a wide range of gas scrubbing and by-product extraction solutions, which are available in many combinations and configurations so as to meet any specific requirement. The in-house developed know-how of the joint Paul Wurth/DMT teams is brought in for feasibility studies, coke plant revamps, greenfield projects, plant inspections or operational support.





A FULL RANGE OF PROCESSES

Our tailor-made solutions in coke oven gas treatment combine a full spectrum of processes and associated equipment for ensuring reliable operation, a minimised environmental impact and best economic results.

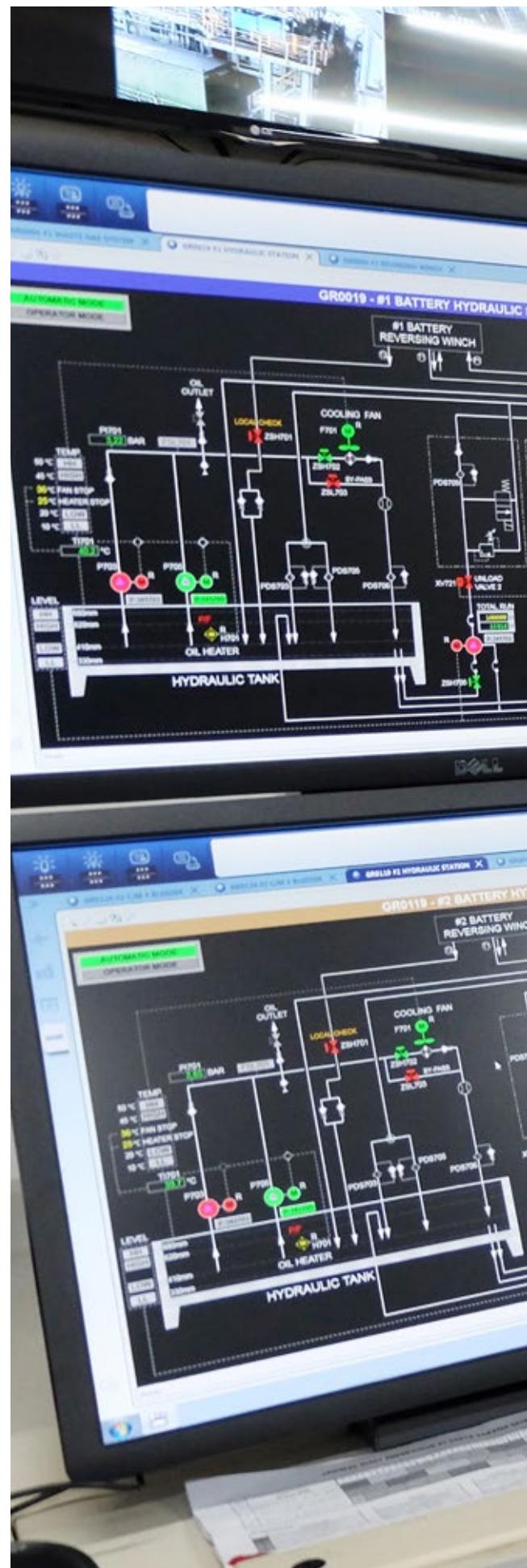
- GAS COOLING
with optimised heat exchange surface and continuous tar emulsion cleaning
- TAR SEPARATION
by vertical tar decanter with no movable parts inside
- COAL WATER FILTRATION
by means of gravel beds
- NH₃ REMOVAL
NH₃ scrubbing via either expanded metal or structured packings technology; NH₃ stripping and cracking. NH₃ outlet concentration in coke oven gas less than < 30 mg/Nm³
- AMMONIUM SULPHATE PRODUCTION
- H₂S REMOVAL
H₂S scrubbing by absorption with NH₃ via either expanded metal or structured packings technology; stripping and elementary sulphur recovery by Claus process or sulphuric acid production down to concentrations <0.2 g/Nm³
- BTX RECOVERY
BTX scrubbing via either expanded metal or structured packings technology and stripping with BTX purity >95%
- NAPHTHALENE REMOVAL
Naphthalene scrubbing and stripping down to 0.1 g/Nm³ in coke oven gas
- EMISSIONS CONTROL SYSTEM with N₂

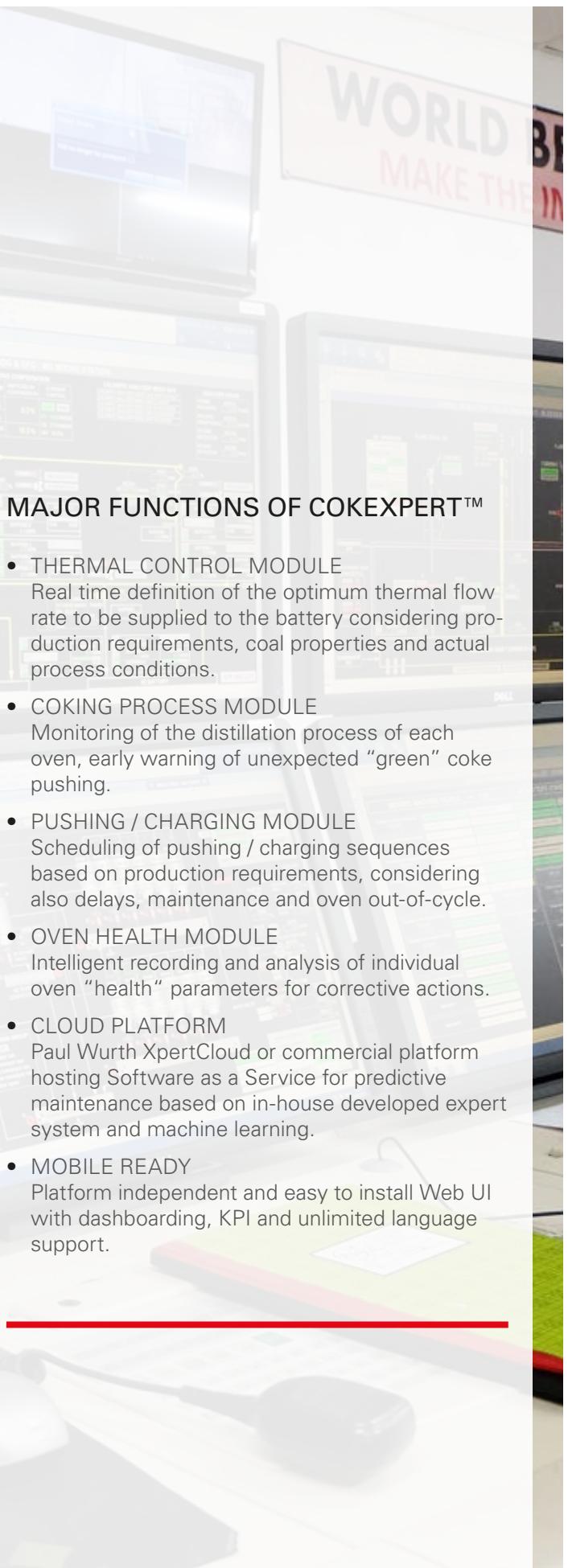


COKE PLANT AUTOMATION

Thanks to COKExpert™, the Level-2 automation system for coke oven plants developed by Paul Wurth, coke oven operators can rely on state-of-the-art automation technology to achieve best operational performances while satisfying the ever more stringent environmental standards.

COKExpert™ is a modern and user-friendly tool that helps to improve the operation stability and productivity, reach constant coke quality, reduce fuel consumption, limit environmental emissions and increase the battery lifetime.





MAJOR FUNCTIONS OF COKEXPERT™

- THERMAL CONTROL MODULE

Real time definition of the optimum thermal flow rate to be supplied to the battery considering production requirements, coal properties and actual process conditions.

- COKING PROCESS MODULE

Monitoring of the distillation process of each oven, early warning of unexpected "green" coke pushing.

- PUSHING / CHARGING MODULE

Scheduling of pushing / charging sequences based on production requirements, considering also delays, maintenance and oven out-of-cycle.

- OVEN HEALTH MODULE

Intelligent recording and analysis of individual oven "health" parameters for corrective actions.

- CLOUD PLATFORM

Paul Wurth XpertCloud or commercial platform hosting Software as a Service for predictive maintenance based on in-house developed expert system and machine learning.

- MOBILE READY

Platform independent and easy to install Web UI with dashboarding, KPI and unlimited language support.

SERVICING

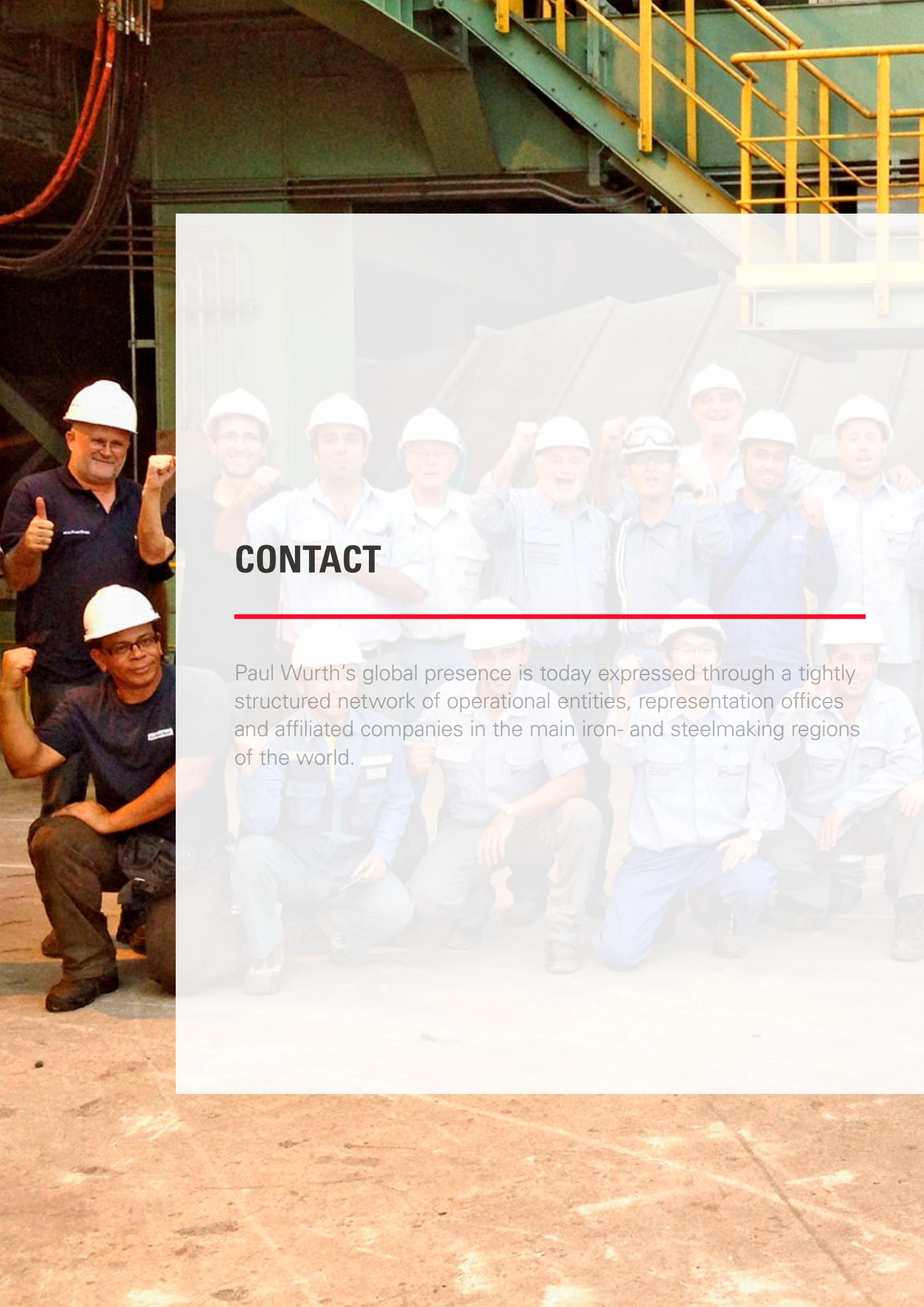
Our comprehensive product portfolio in cokemaking technology is well rounded off by a full-range of after-sales services, which enable us to accompany the customer throughout the lifetime of his installations.

Thanks to our in-depth knowledge and experience in coke oven plants, coke oven machinery and coke oven gas treatment, our teams of experts can provide specialist consulting and support for your revamp and modernisation projects, operational challenges or maintenance programmes.

With coke oven hot repairs, new ground has also been broken in the field of cokemaking servicing. Thanks to particular expertise, coke oven renovations can be carried out while the plant continues to run, with a minimum loss of production.







CONTACT

Paul Wurth's global presence is today expressed through a tightly structured network of operational entities, representation offices and affiliated companies in the main iron- and steelmaking regions of the world.



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