



# OUTOTEC ROASTER SHUTDOWN SERVICES

Outotec® is a market leader in roasting plants and metallurgical furnaces, performing plant assessment, shutdown planning and executing demolition works for the past 40 years with references from over a thousand projects.

Our shutdown services for roasters use a network of experts to assess your plant performance for best asset utilization prior to shutdown planning, make use of correct chosen robotic demolition machines operated remotely to reduce downtime and execute projects on time and budget with safety first.

Our state-of-the-art roaster remote refractory demolition concept enables a fast and safe shutdown service using our proprietary roasting demolition platform.

## BENEFITS

- Increase efficiency of build-up descaling and refractory demolition
- Personnel safety
- Assessed plant performance
- Reduced labour resources
- Decreased downtime
- Increased productivity and availability

# ABOUT OUR ROASTING SHUTDOWN SERVICES

Our holistic roaster shutdown approach is a comprehensive service for your plant, assessing your roasting asset performance well in advance, identifying bottlenecks of the operations and feasible solutions that could be implemented during the shutdown. Our proven 12-point planning system and proficiency considers the suitable way to implement agreed plant area or equipment improvements within the planned downtime. The remote demolition services and skills assure safety, minimal labor resources and shortest downtime. The construction management expertise ensures execution of the shutdown at the shortest possible downtime without risking safety and quality. Our technology expertise provides you with further remote support evaluating the performance of the plant after shutdown through technical and digital solutions. Visit [www.outotec.com](http://www.outotec.com) for further information.

## Customer Value

- Reduced downtime
- Increased safety, availability, productivity and reliability
- Increased plant performance
- Efficient use of labour resources
- Focus on the customer's core business

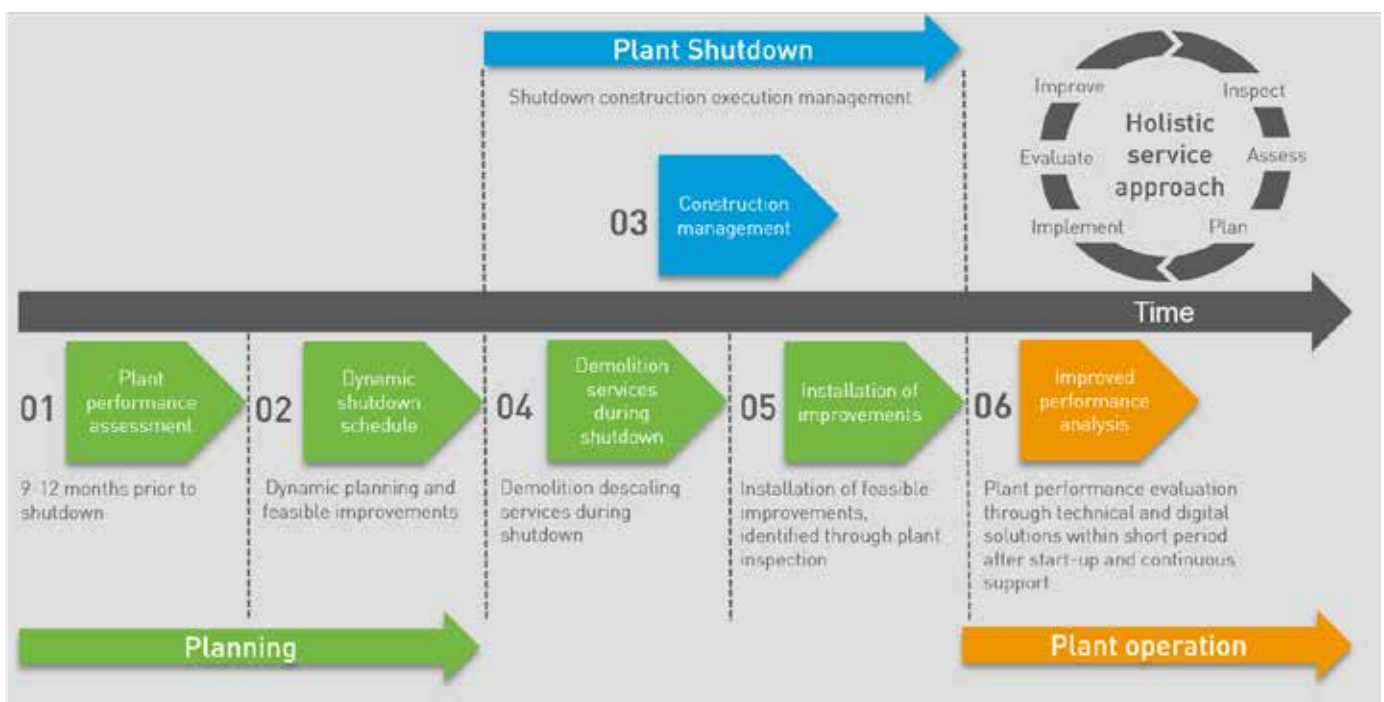
## Our Offering

- Maintenance strategy support and development
- Condition monitoring
- Site and equipment-specific maintenance programs, from expert support to total maintenance execution
- Plant performance assessment and optimization
- Spare parts assessment and recommendation
- Installation and commissioning support
- Shutdown planning, execution, and management services to safely shorten plant downtime
- Area and equipment performance optimization services

## Services Product Categories

- Maintenance strategy and program
- Maintenance planning and scheduling
- Emergency maintenance
- Corrective maintenance
- Preventative maintenance
- Condition monitoring
- Installation and commissioning
- Shutdown planning and scheduling
- Shutdown management and execution
- Refractory demolition
- Refractory installation supervision
- Spare part management services
- Engineering services
- Modernization services
- Connected services
- Remote support
- Dynamic training simulator

## HOLISTIC ROASTER SHUTDOWN APPROACH





## SHUTDOWN PLANNING AND SCHEDULING

Successful shutdowns or turnarounds require careful planning to achieve the least amount of production downtime. We focus on meticulous planning and extensive collaboration across workforce disciplines to plan shorter but attainable project schedules.

- Safety excellence
- Shorter planned shutdowns
- Higher plant utilization
- Includes a complete shutdown plan and related documents for your plant – your blueprints for a successful shutdown

### Features

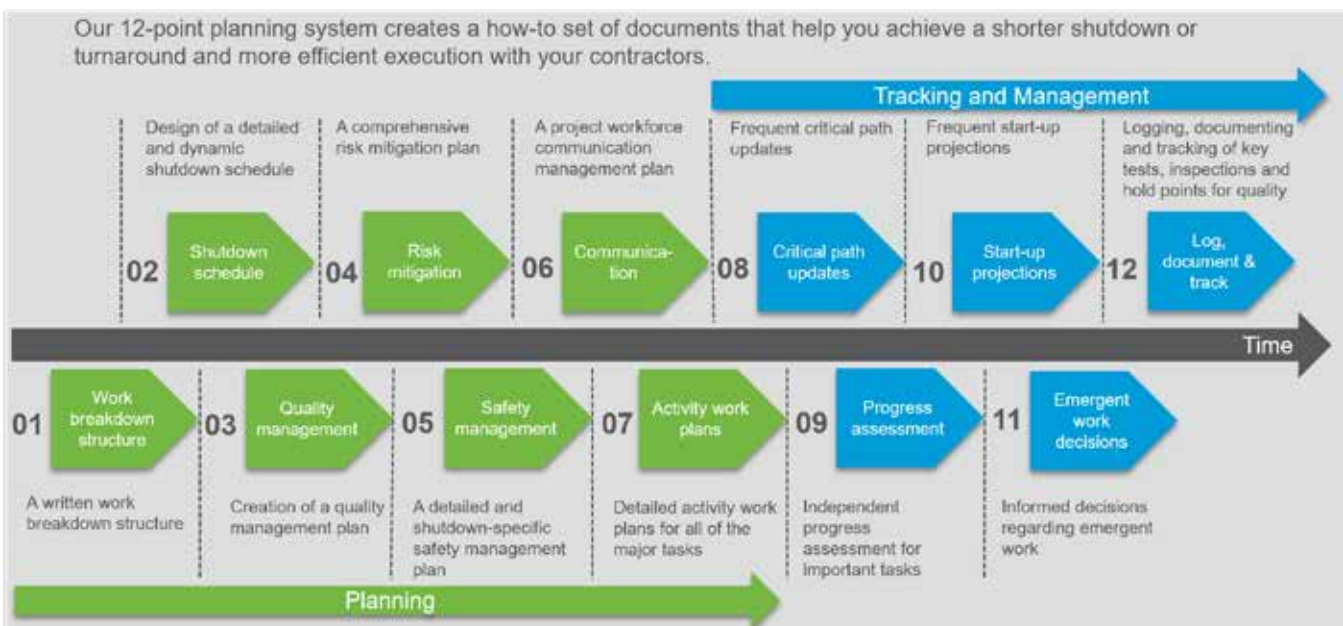
Our 12-point planning system creates an instruction guide to achieve shorter shutdowns or turnaround and more efficient execution with your contractors.

### Scope

Depending on the scope and complexity of the shutdown or turnaround project, we begin planning several months in advance, taking into account previous shutdown activities and the current plant performance assessment.

Planning consists of work at your site and at our offices. Our planning and asset maintenance experts meet and work with your project team and the construction contractors that you select to optimize and agree on the plan and schedule. At the completion of the planning phase, you and your contractors will have a comprehensive understanding of the agreed shutdown plan as well as all necessary documents to manage and execute the project.

## OUR PROVEN 12-POINT SHUTDOWN PLAN





## SHUTDOWN MANAGEMENT AND EXECUTION

Our experts can manage and execute a shutdown or turnaround in the shortest time possible without compromising safety or quality. The result is an asset that performs as designed with improved availability.

- Safety excellence
- Shorter shutdown without compromising quality
- Peace of mind from having Outotec at your side to help you manage a large, complex shutdown project
- Freedom to dedicate valuable resources to other high-value tasks
- Results in higher asset availability and production profit

### Features

As your shutdown or turnaround manager, we coordinate all the resources, materials, and equipment needed to execute the project. Starting with a comprehensive shutdown plan developed by Outotec, our shutdown management team will perform several critical functions including:

- Shutdown construction management
- Dynamic schedule and budget tracking
- Safety management
- Quality management
- Cross-functional communications and reporting
- Control of scope and change management.

### Scope

Outotec shutdown management teams can consist of as few as one consultant integrated into your project team to as many experts as needed for large and complex asset turnarounds.

Our experts include project managers, construction managers, construction superintendents, planners and schedulers, commissioning experts, quality experts, safety experts, contract management personnel, and other disciplines. Many of our specialists have extensive backgrounds in skilled trades and are able to not only supervise but also coach tradespeople conducting the asset maintenance work. Outotec shutdown managers spend a great deal of time in the field, ensuring that your project stays on schedule while also meeting key performance indicators like quality and cost.

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**The result is a shutdown conducted on time and on budget, allowing you to return to full production with an asset that delivers according to strategy with increased performance.**

## ROASTER DEMOLITION SEGMENTATION

Demolition services such as refractory demolition, descaling, digging and breaking of accretion build-ups within the confined space of a roaster need to be carefully carried out by experienced personnel. These are critical preventative maintenance activities of a roasting plant, usually conducted on an annual basis. Our experience enables us to select the right robotic machines and dedicated tools for each roaster and project conditions without jeopardizing safety, quality and time. Skilled personnel ensure protection of roaster insulation material, nozzle grate and cooling coils. The duration periods below are guidelines for different roaster sizes and may vary according to actual conditions of the roaster.

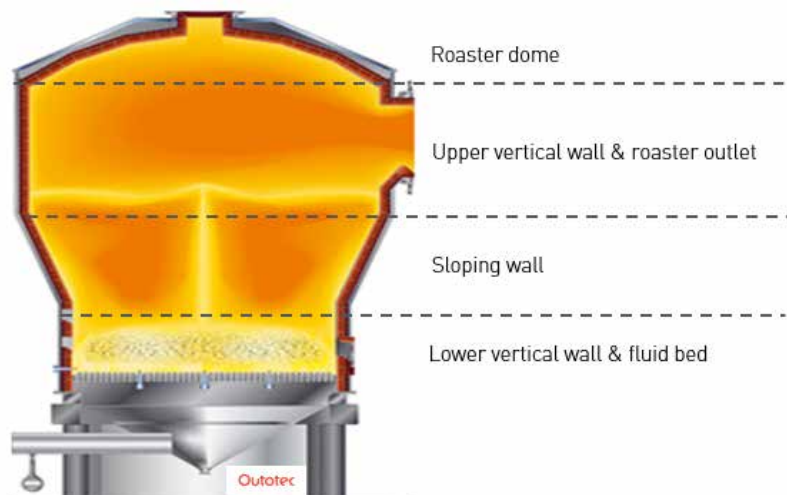
During annual planned shutdown, remote descaling of accretion build-ups on the sloping wall, lower vertical wall and digging, cleaning of the fluid bed, can be carried out within a day for small roasters and up to 2 days for large roasters, subject to accretion conditions, with no removal of the roasting cooling coils, utilizing two operators per shift.

**The number of resources is reduced since no human intervention is required, providing safety of personnel without jeopardizing quality.**

SHUTDOWN DEMOLITION SERVICE	FREQUENCY	DURATION
1. Sintered bed material removal	On emergency basis (unplanned)	Up to 2 days
2. Descaling of sloping wall - lower vertical wall and bed cleaning 2)	Annually – planned shutdown	Up to 2 days
3. Refractory demolition of upper vertical wall -roaster outlet and point 2 areas 2)	Normally once in 10-20 years or more. Planned for a major shutdown.	Up to 8 days
4. Refractory demolition of roaster dome and point 2, 3 areas	On emergency basis or planned for a major shutdown	Up to 11 days
5. Roaster rebuild	Once in a lifetime – partly or whole furnace	30-60 days

1) For zinc roasting, pyrite roasting and partial-roasting of copper applications

2) Mainly for zinc roasting



### 1. Roaster dome demolition

The roaster dome refractory demolition is conducted with our special remote-controlled machines in combination with our Outotec Roasting Demolition Platform in a safe manner.

For safety reasons, a portion of the work is conducted outside the roaster to prevent damage to the demolition equipment.

### 2. Demolition of the upper vertical wall

Refractory demolition above the sloping wall is done using smaller machines mounted on our Outotec Roasting Demolition Platform, which are compatible with various roaster sizes. The end result is faster demolition and decreased downtime conducted by our highly skilled operators.

The platform is suspended from above using a mobile crane through the opening in the center of the roaster dome. The crane size is subject to the machines and platform size used.

The platform is then positioned at the required elevation and the machines are operated remotely for the demolition of the upper vertical wall as well as the roaster outlet. Experienced operators are crucial to ensure no damage to the roaster insulation material, avoiding further downtime and production losses.

### 3. Descaling of accretion build-up on the sloping wall

Descaling is a preventative measure to prevent loose material on the sloping wall from falling onto the roaster floor, sintered bed or cooling coils, which is typically incorporated into the planned annual shutdown.

Descaling consists of removing the accretion buildups on the sloping wall and lower vertical wall of the roaster using a demolition machine with Outotec proprietary scraper attachment.

Once all accretion build-up material is dislodged, it is removed in the same manner as the sintered bed, using a demolition machine with a bucket attachment and remote-controlled payloader.

### 4. Removal of sintered bed material

The roaster is shut down to remove the sintered bed and material from the roaster floor. Emergency downtime may result in lengthy production losses, subject to plant conditions and resources.

Our shutdown service is conducted by experienced operators using remote-controlled equipment due to the risk of falling scale and refractory, protecting operators from any potential falling debris and safely reducing removal time.



## OUR SPECIALIZED REMOTE-CONTROLLED MACHINES

Our fleet of robotic machines is one of the largest in the industry and includes descaling and unloading equipment. They can be fitted with various specialized tools to suit the required application.

Tools include:

- **Bucket attachment** – used to excavate through rubble from descaling or demolition tasks. The material is placed at the main door where it is collected from outside the roaster by means of a remote-controlled ride-on loader.
- **Rock breaker attachments** – used to break up any accretion build-up, sintered material or scale that the bucket is unable to excavate.
- **Outotec proprietary scraper attachment** – used to remove accretion build-up from the sloping wall quickly and reliably.

Our expert team conducts the necessary inspections and maintenance services including spares throughout the project to ensure each remote-controlled machine is in proper working condition before being assigned to the next task.



## OUR EXPERIENCE AND RESOURCES

We have vast experience in demolition planning and execution management.

### Furnace types and metals

- Flash furnaces – Ni, Cu
- Electric furnaces – round, six-in-line – Ni,
- Pt, Fe-alloys, Ti-O<sub>2</sub>, slag-cleaning
- Noranda reactors – Cu
- Peirce-Smith converters – Cu, Ni
- TSL furnaces – Ausmelt, Isasmelt – Cu,
- Pb, Sn, e-scrap
- Kivcet furnaces – Cu, Zinc, Pb
- Anode furnaces – Cu
- Rotary holding furnaces - Cu
- Shaft furnaces
- Pelletizing line furnaces – Fe
- Blast furnaces – Fe

### Outotec roasting experience

- >40 years' experience ensuring project delivery on time and on budget
- >25 years' experience in furnace reconstruction, combined with process know-how
- One of the largest fleet of remote-controlled machines in the metallurgical industry
- The only provider with two types of shaft scalers for rapid descaling of furnace shafts
- Pioneer of remote refractory demolition without human intervention within the confined roaster furnace
- Specialized PPE and award-winning safety management strategy

**“A great effort with zero incidents, highly skilled operators and an excellent outcome.”**

**Mark Breen, Turnaround Manager, Nyrstar Hobart**

# Outotec

Outotec develops leading technologies and services for the sustainable use of Earth's natural resources. Our 4,000 top experts are driven by each customer's unique challenges across the world. Outotec's comprehensive offering creates the best value for our customers in the mining, metal, and chemical industries. Outotec had sales of approximately EUR 1.2 billion in 2019, and its shares are listed on NASDAQ Helsinki.

**[www.outotec.com](http://www.outotec.com)**