

# BITUMEN BY BITUROX®



ENGLISH 2015

**BITUROX®**  
BITUMEN OXIDATION TECHNOLOGY

**pör  
ner**  
PÖRNER GRUPPE

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# MODERN BITUMEN IS A SPECIAL PRODUCT.

## THE WORLD OF TODAY AND TOMORROW NEEDS MORE AND BETTER ROADS...

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Roads connect people. Bitumen is the most versatile and qualified material for fast construction of long-life and inexpensive roads. The building industry is also a consumer of extra bitumen qualities used for isolation and roofing felts, construction coatings, bitumen emulsions etc. Biturox® Bitumen products help to create a worldwide network of perfect roads and help to protect people and property from rain and humidity.

Roads have to be inexpensive both in construction and maintenance. They must provide utmost durability. And finally, the used road paving should be easily and completely reprocessable and reusable.

Bituminous binders of highest quality, as a component of road pavement formulations, need to meet all of the criteria listed above. They need to perform excellently under extreme climatic conditions and must stand heavy traffic. Furthermore, drivers prefer the comfort of jointless bitumen roads. With this in mind, bitumen production presents itself as an increasingly attractive and profitable sector of downstream business.



# 02

Biturox® Plant, Morocco

BITUMEN BY BITUROX®





## REFINERIES NOW NEED MORE THAN ONLY CRUDE DISTILLATION

Today's petroleum product marketers are confronted with the need to supply top quality bitumen binder to the construction industry at reasonable prices. Another business line of interest is the speciality chemicals sector. An advanced bitumen processing technique is the key to new valuable business relations in the field of premium lubricants and special process products.

The main aim of any large-scale refinery in the world is to produce millions of tons of fast moving products (e.g. gasoline, diesel fuel, kerosene, feedstocks for the petrochemistry etc.) at the lowest possible cost. The usual way to reach this goal is a proper crude mix and a sophisticated refinery. This approach, however, has the consequence that the straight production of high quality bitumen is more and more impractical.

**BITUROX® IS THE OPTIMAL TOOL TO SATISFY THE DEMAND FOR TOP-GRADE BITUMEN.**



# PÖRNER: BITUMEN UPGRADING SPECIALISTS

## THE PÖRNER GROUP

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With a workforce of about 500 people the Pörner Group has made a name for itself as a reliable engineering partner in the industry. Pörner is an expert for bitumen technology providing consulting, process design, application technology, plant engineering and construction for complete bitumen production plants. Pörner develops tailored Biturox® concepts, in its own test and research facilities, to meet international product standards utilizing the available crudes and refinery intermediate feedstock.

With more than 45 licenses for Biturox® Bitumen plants awarded and over 40 Biturox® Bitumen plants constructed, the Pörner Group is the worldwide market leader in bitumen oxidation technology. The Pörner Group designs and realises turn-key bitumen plants including all infrastructures from one source: production units of high production, fully automated to operate well and designed to last long.

The Pörner Group, based in Vienna (Austria), is present in nine locations worldwide. All group companies feature a uniform organizational structure, where each of them is able to set up entire systems and plants with their specialists and equipment.

## BITUROX® BITUMEN MEANS:

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**TO THE DRIVER:  
THE MOST COMFORTABLE ROAD**

**TO THE ROAD DEPARTMENT:  
ECONOMY OF TOTAL PROCESS**

**TO THE REFINERY:  
PRODUCTION FLEXIBILITY  
AND SPECIAL QUALITY**



# □ TAILORED BITUMEN

## THREE COLUMNS OF COMPETENCE

The Biturox® Process is the modern and time-tested answer to the need for first class bitumen made from a variety of raw materials. Pörner's expertise includes technological, commercial and market aspects of the industry. Biturox® plants produce bitumen according to various national quality standards (conventional, viscosity or performance based).

### PROCESS TECHNOLOGY

The core element of the Biturox® Process is the unequalled loop reactor. With this reactor, it is possible to control all important process parameters.

The Biturox® technology proves that the oxidation process can run both effectively and very softly: The valuable resins are formed and preserved in the reaction mixture and, the degradation of organic compounds to coke and the build-up of deposits are minimized.

Features such as safe and automated operation, lowest possible turnaround and minimum maintenance as well as environmental compatibility make the Biturox® Process the most attractive choice for a modern bitumen producer.



### DESIGN, RESEARCH & PILOT TESTING

Bitumen quality depends on the harmonized balance of chemical components: saturates, aromatics, resins and asphaltenes.

In more than 35 years and supported by several hundred research lab and pilot tests, using almost any type of crude worldwide - Pörner, together with its partner OMV, developed methods of how to formulate and process bitumen: All findings have been stored in a knowledge database.

This enables Pörner to recommend the most efficient and economical way of producing top quality bitumen for almost every feedstock/product combination.



### ENGINEERING EXPERIENCE

Pörner knows a lot about bitumen. Based on this vast engineering expertise ideal bitumen plants have been realised all around the world.

All principles of efficiency are applied to the blending, heating and cooling of the bitumen, optimizing instrumentation and automation, minimizing the generation of by-products and emissions, saving and recovering energy as well as keeping maintenance and downtimes at a minimum.

By selecting the ideally suited equipment Pörner minimizes delivery times and makes construction fast and easy. Pörner also takes care of personnel training, commissioning and start-up.





# THE MODERN WORLD OF BITUMEN

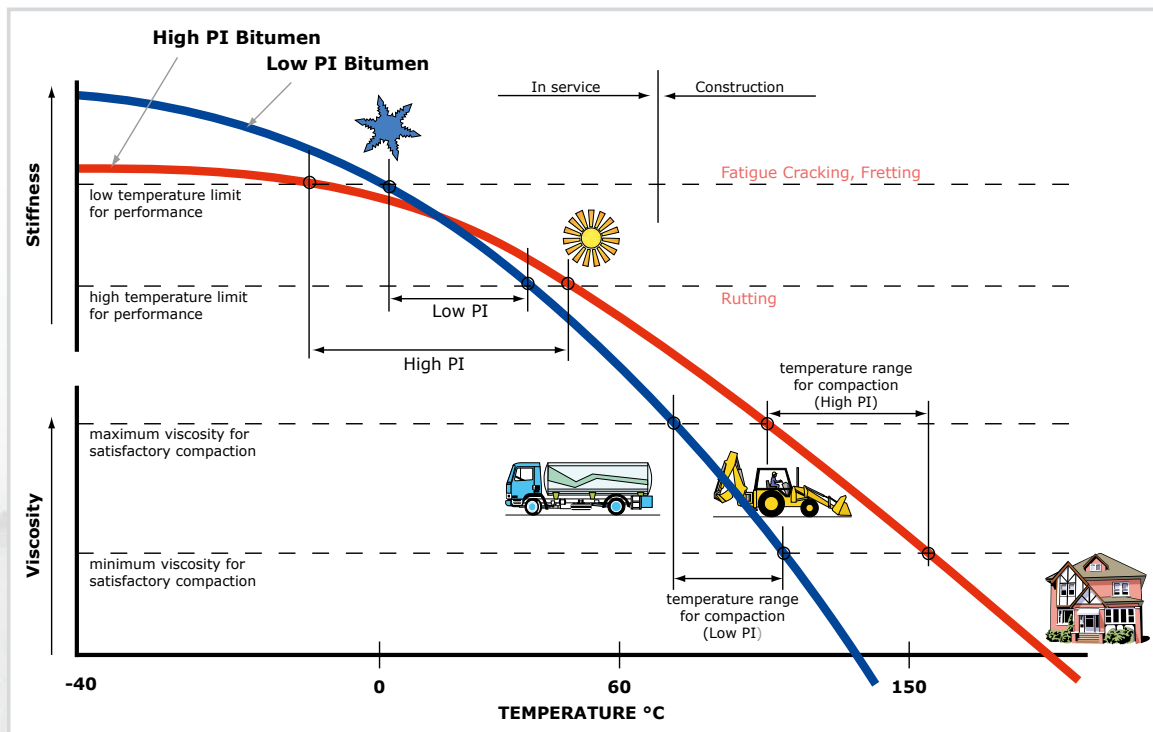
## CHANGES – CHALLENGES – CHANCES

Almost every day, crude prices, qualities and availability undergo radical changes. The number of bitumen producers is falling as some refineries decide to crack or coke their short residues. Thus, bitumen becomes more and more of a specialty business.

While meeting the demands of highway departments and road constructors in public-private partnerships, bitumen producers have to fulfil new performance-oriented bitumen standards (e.g. SHRP). Flexibility and rapid response to new requirements are a must in the petroleum industry's day-to-day struggle for market share. Modern refineries need to improve the bitumen processing technology, which should fit into their completely automated manufacturing pattern and contribute to the plant's economic efficiency by allowing for higher production flexibility combined with greater independence from the crude type available.

The Biturox® Process is the right solution for the production of both big quantities of standard road paving bitumen binders as well as special "multigrade" and industrial bitumens in a continuous, fully automatic operation and allows for the utilisation of crude baskets beyond the limits of traditional bitumen feedstock selection. The Biturox® Process guarantees the user the highest independence from crude types and best bitumen qualities that are eco-friendly and reasonable in cost.

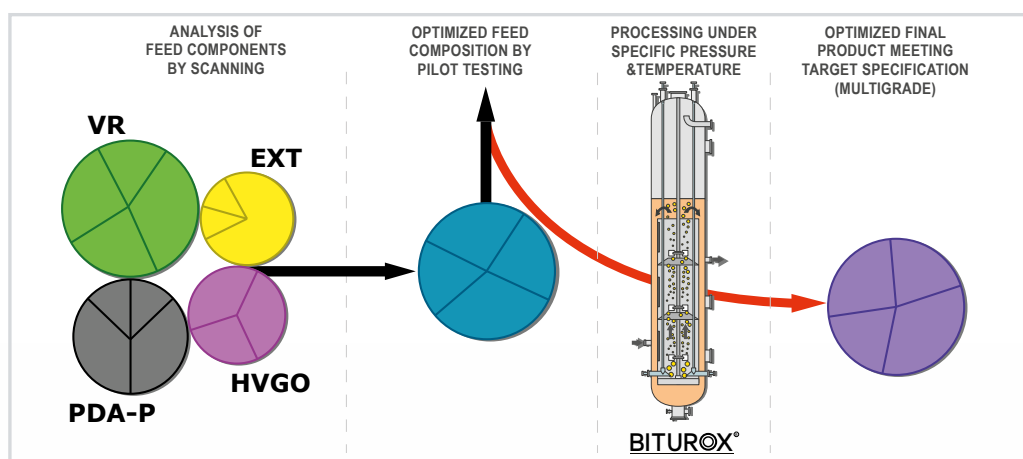
This is what the Biturox® system stands for: Better quality from cheaper feedstock components.



**MULTIGRADE: COMBINED AND IMPROVED PRODUCT CHARACTERISTICS AT HIGH AND LOW TEMPERATURES**

# □ BITUROX® - MULTIGRADE BITUMEN

Multigrade bitumen is a special product for which the Biturox®-based refinery technique is applied. This kind of bitumen shows a reduced thermal susceptibility - meaning that it behaves like a stiff grade at high and like a soft grade at low temperatures. Preferably, multigrades are used as binder for High Stiffness Modulus Asphalt (HSMA) mixes. Applied in the bearing course of the road, these show high consistency against rutting as well as good resistance to fatigue, combined with excellent aging stability. The HSMA concept provides for a longer service life of roads and minimizes cost because of reduced layer thickness.



Biturox® Process Scheme

## THE FEEDSTOCK

A variety of high molecular weight refinery components of all chemical configuration types present in most crude oils are suited as feedstock for the Biturox® Process. Besides short residue obtained from vacuum distillation, the following refining products are on the list of bitumen raw material:

- Vacuum residue (short residue) VR
- Atmospheric residue (long residue)
- Pitch from solvent deasphalting process SDA-P
- Heavy vacuum gas oil HVGO
- Aromatic extracts from lubricating oil processing EXT
- Heavy cycle oils from cracking, visbreaking and coking processes (in a limited amount)

## THE METHOD

High quality bitumen must show a harmonic distribution of saturates, aromatics, resins and asphaltenes. Biturox® multigrade bitumen is made by the method of composition control.

Several raw material components of different chemical natures are selected and combined to an adequate feed composition. This feedstock blend is introduced to the Biturox® reactor where it is integrated by mild air oxidation under clearly defined and absolutely controlled processing conditions.

## BITUROX®-CONTROLLED OPERATION

The Biturox® reactor is the perfect tool for such operation: efficient, controllable and safe. The feed composition is processed very gently under elevated pressure and the amount of asphaltenes is increased minimising the risks of local overheating and coke build-up. Internal reactor cooling enables exact temperature control. The process runs continuously resulting in a consistent and homogenous finished product quality.



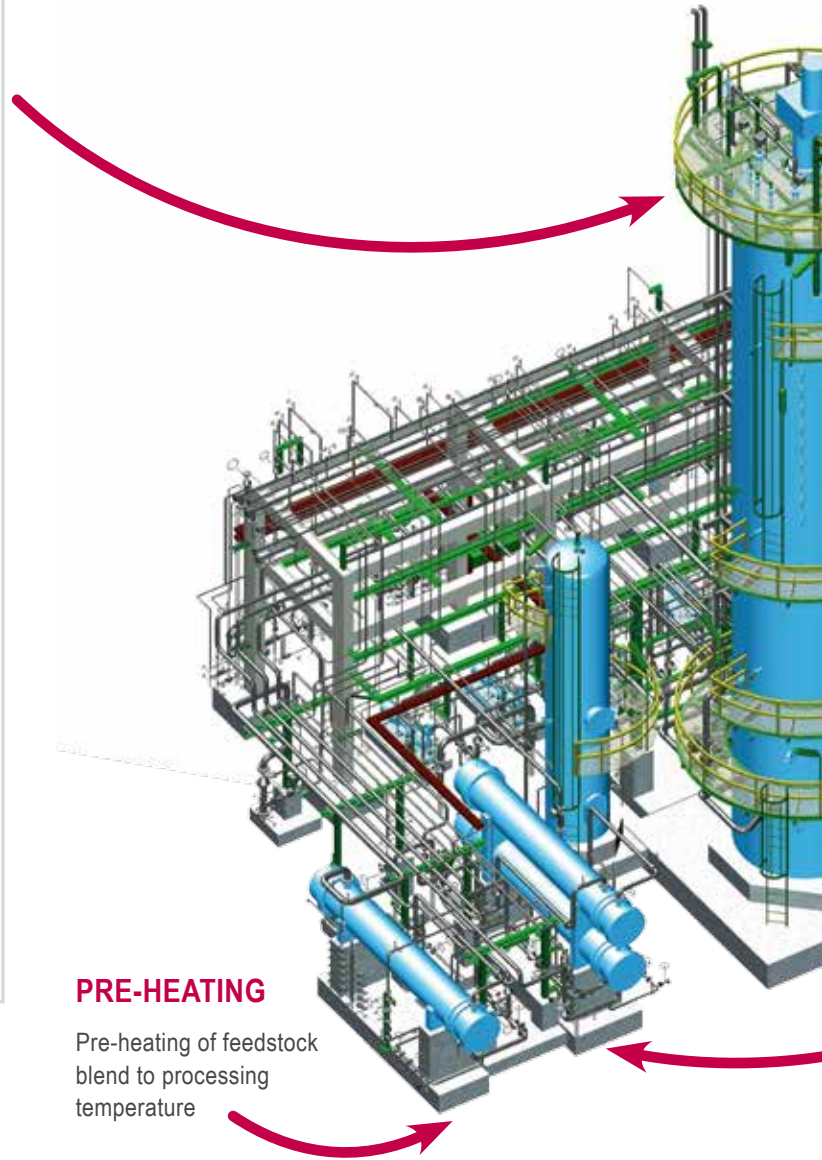
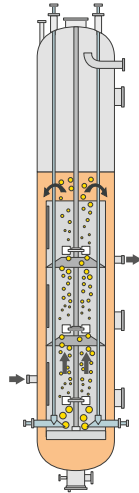


# THE MODERN WORLD OF BITUMEN

## REACTOR

The core element of the Biturox® Process is the unequalled loop reactor. In this perfect air-lift reactor with agitator, the thermochemical conversion of selected raw material blends by **atmospheric oxygen** takes place continuously and under repeatable conditions. All of the important process parameters (pressure, temperature, flow rates, residence time etc.) are controlled.

- Inner loop type reactor design stands for optimised but also very gentle treatment of the medium
- Operation is very safe due to total utilisation of oxygen



## PRE-HEATING

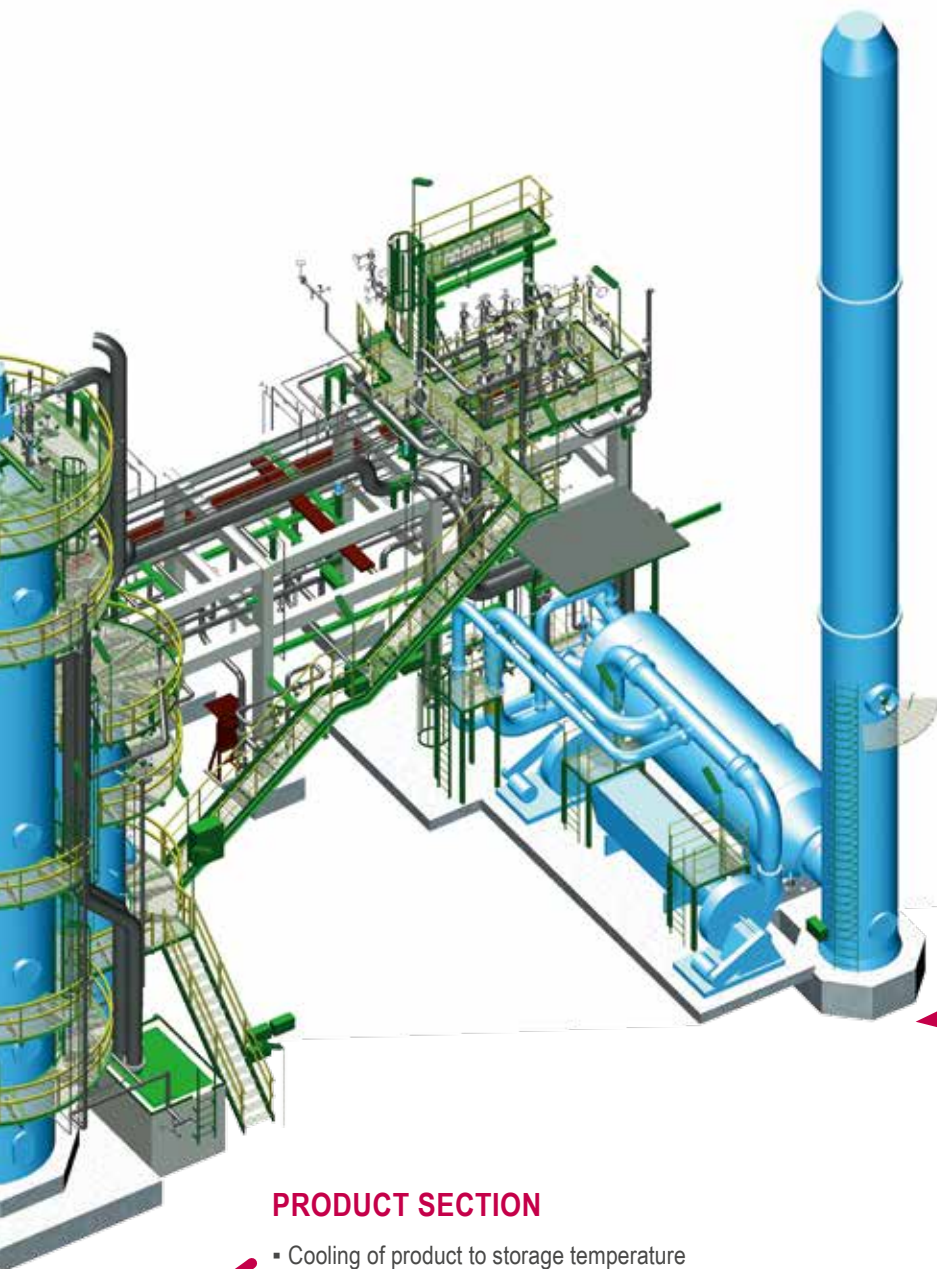
Pre-heating of feedstock blend to processing temperature





# BITUROX®

BITUMEN OXIDATION TECHNOLOGY



## OFF-GAS SECTION

- Recovery of hydrocarbons
- Thermal treatment
- Heat recovery (optional)
- Desulfurization (optional)

## PRODUCT SECTION

- Cooling of product to storage temperature
- Heat recovery for pre-heating
- Product blending for tailor-made products (optional)

## BATTERY LIMITS

- Feedstock components from storage
- Products to storage and loading
- Utilities: plant and instrument air, electrical power, steam, water





# RESEARCH AND PILOTING

## BITUROX® RESEARCH FACILITIES

After more than 35 years of service to the bitumen industry, the Biturox® research centre is the widely known service provider for the development of high quality bitumens made from various crude and refinery feedstocks. Up to date laboratory and semi-technical research and development facilities, latest analytical methods and the backup of the nearby OMV refinery enabled and promoted Pörner's efforts to stock up the most comprehensive expertise on bitumen making worldwide.

The Biturox® pilot plant is available for practical testing of feedstock or compositions of several components in batch or continuous mode. The results of pilot tests are used as design basis for Biturox® plants (i.e. reactor rating). Reference samples of bitumen can be produced from defined feed compositions ready for further applied testing by the client. With their own pilot plant, the licensee can fully optimize the utilization of feedstock components, blending ratios of components, product quality and/or the production capacity

All results of basic and applied research, the experience gathered during design, construction, start-up and routine operation of the numerous Biturox® plants, the feedback from the Biturox® licensees, the latest findings of the Biturox® enhancement technique (chemical upgrading of bitumen) and, obviously, the performance reports on the application of Biturox® Bitumen have been collected and stored in a comprehensive database.



Biturox® pilot test unit



3D model of client Biturox® pilot test unit



## OBJECTIVE

Many bitumen research institutes over-emphasise the significance of crude oil provenance and compositional classification, simultaneously neglecting to notice and review the chances, which lie in the thermo-chemical modification of an almost unlimited range of crude oil derived feedstock.

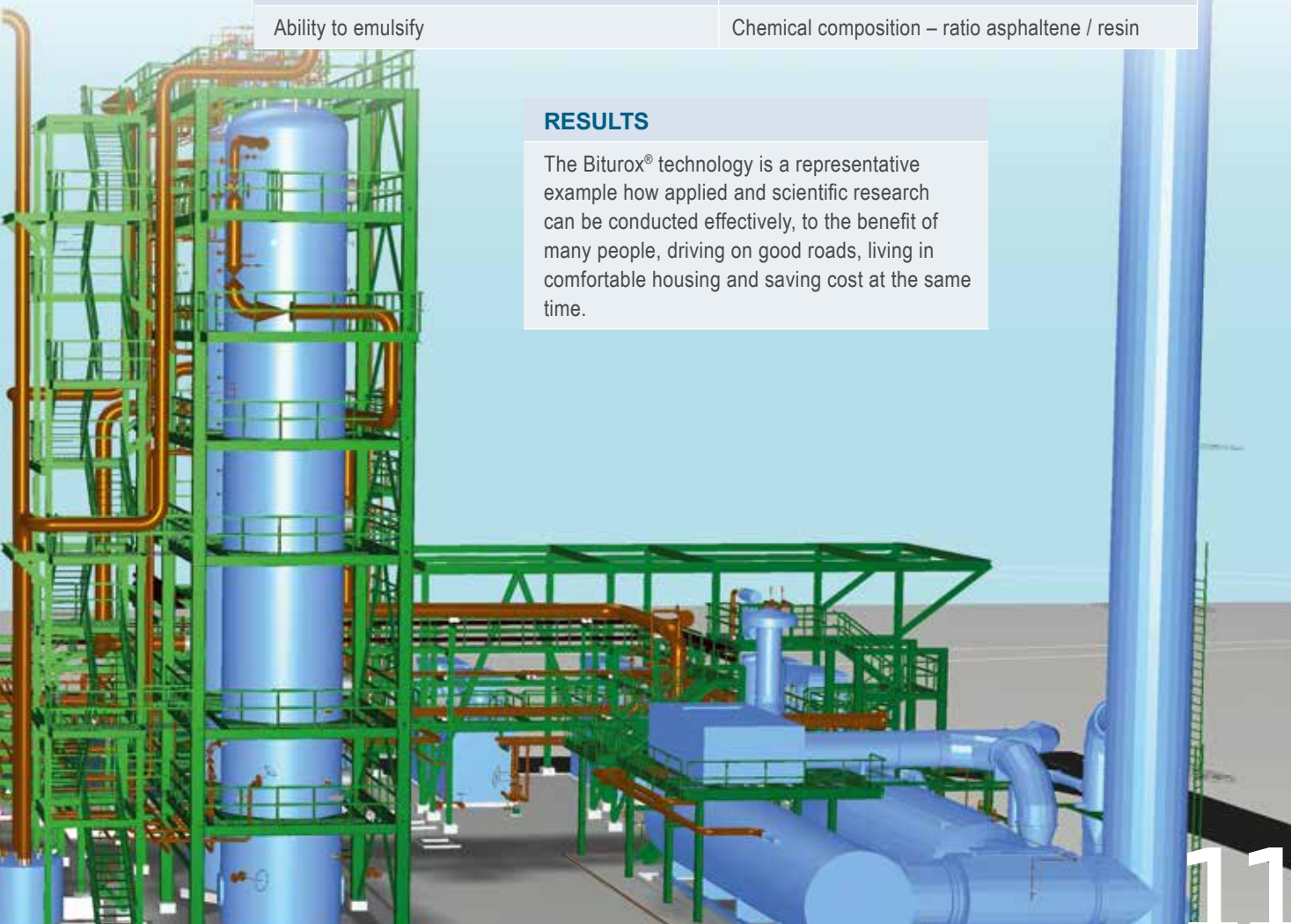
The main objective of the Biturox® research facilities are therefore to optimize the product quality by using the right feed blend, controlling the operation conditions and improving the chemical composition of the bitumen.

The ultimate goal of all this is to satisfy the needs of the market for bitumen with superior qualities that is available at reasonable prices.

DESIRED CHARACTERISTICS	PROBLEMS TO SOLVE
Stiffness against rutting (high temp. deformation)	Chemical composition – asphaltene content
Fatigue resistance (low temp. cracking)	Chemical composition – ratio asphaltene / resin
Stability against fretting	Chemical balance
Adhesive properties	Chemical composition – ratio asphaltene / resin
Resistance to ageing	Chemical balance, stabilization by oxidation
Compatibility with polymers	Chemical balance
Ability to emulsify	Chemical composition – ratio asphaltene / resin

## RESULTS

The Biturox® technology is a representative example how applied and scientific research can be conducted effectively, to the benefit of many people, driving on good roads, living in comfortable housing and saving cost at the same time.







## PROJECT REALIZATION

The Pörner Group is the most experienced designer and constructor of bitumen processing plants worldwide. The huge collection of data in electronic form is the basis for an expedient and cost-saving project realization in every single step. The scope and steps of the realization of a “turn-key grass-root” project include the following:

- Preliminary studies, information & data collection
- Feasibility study
- Evaluation of raw material, laboratory & pilot plant testing
- Evaluation of the technical, commercial, legal and environmental conditions
- Project management
- Process design & basic engineering
- Detail engineering (civil, mechanical, electric & instrumentation)
- Procurement & logistics of equipment and material
- Engagement and supervision of contractors
- General on-site supervision of the construction work
- Commissioning of the complete plant
- Staff training
- Acceptance test
- Final documentation



Biturox® plant SAMIR, Morocco, 2011

**PÖRNER HAS LEARNED A LOT ABOUT BITUMEN  
IN OVER 40 YEARS.**

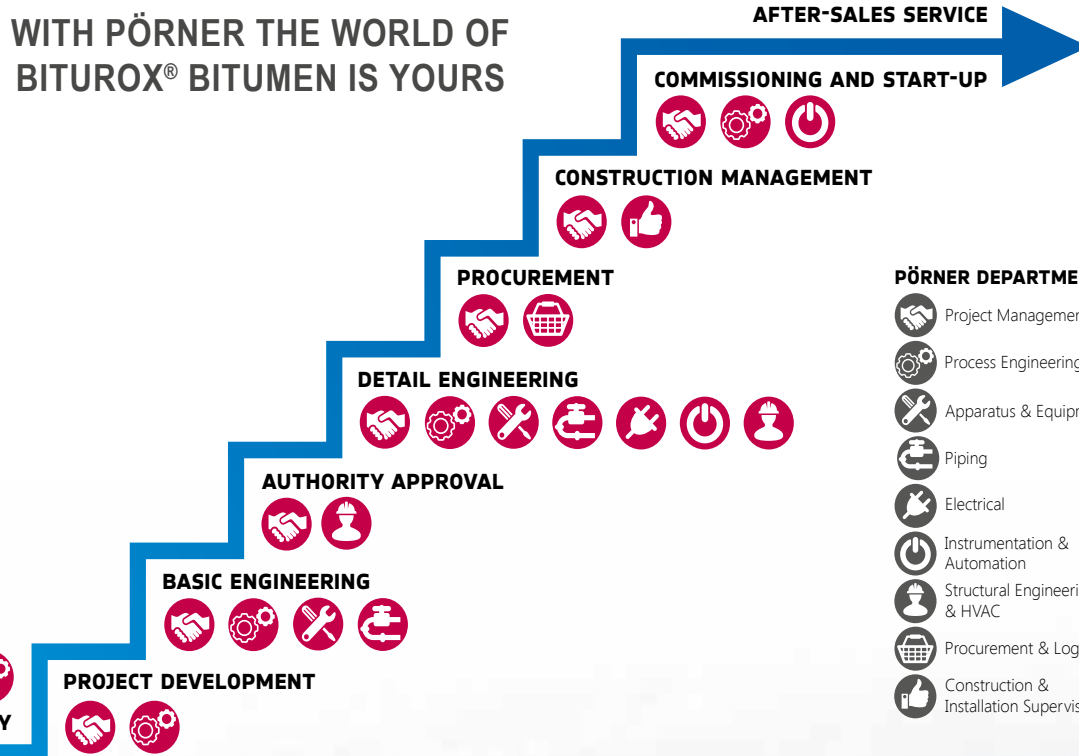


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Biturox® Plant, Russia

It takes many steps and the cooperation of several departments, to ensure that a project succeeds. The Pörner Group offers all engineering services for the planning and construction of modern process plants: these all from a single source. As a process-oriented plant engineering company, the Pörner Group supports customers right from the very concept all the way to the turn-key completion of every phase of the project. Each project is tailored to the specific customer requirements.

Every Pörner office has a complete organizational structure with all disciplines to execute plant engineering and construction projects. Teams are put together depending on the requirements of the individual project to meet the specific needs of the client. The customer has only one contact for complete solution and coordination, the Pörner project manager.



# REFERENCES



## BITUROX® PLANT ROSTOV

Construction of a Biturox® plant with 2 reactors for production of paving-grade bitumen, including newest generation off-gas treatment and heat recovery components

<b>Pörner scope:</b>	Basic & detail engineering, procurement, supply of key components, license, construction supervision, commissioning support, documentation
<b>Client:</b>	OJSC Novoshaktinskij Zavod Nefteproduktov
<b>Capacity:</b>	2 x 900 TPD
<b>Location:</b>	Rostov / Russia
<b>Year:</b>	2014



## BITUROX® PLANT PARCO

Construction of a Biturox® plant for the production of paving-grade and industrial bitumen

<b>Pörner scope:</b>	Basic & detail engineering, procurement, supply of key components, license, construction supervision, commissioning support, documentation
<b>Client:</b>	Pak-Arab Refinery Ltd (PARCO)
<b>Capacity:</b>	800 TPD
<b>Location:</b>	Qasba Gurjat / Pakistan
<b>Year:</b>	2012



## BITUROX® PLANT SAMIR

Turn-key Biturox® plant including tank farm and truck filling station

**Pörner scope:**  
General planning incl. license, financing support, project management, basic engineering, detail engineering, procurement and delivery of the entire plant, construction supervision, commissioning, training and documentation

**Client:**  
Société Anonyme Marocaine de l'Industrie du Raffinage (SAMIR)

**Capacity:**  
800 TPD

**Location:**  
Mohammédia / Morocco

**Year:** 2011



## BITUROX® PLANT CEPESA

Biturox® plant for special road paving bitumen

**Pörner scope:**  
License, basic engineering, detail engineering, supply of core components, commissioning support & start-up, personnel training and documentation

**Client:**  
Compania Española de Petróleos, S.A.U. (CEPSA)

**Capacity:**  
1.080 TPD

**Location:**  
La Rabida / Spain

**Year:**  
2011





**BITUROX® PLANT OMV**

Biturox® plant for production of special road paving bitumen

**Pörner scope:** License, basic engineering, detail engineering, procurement and supply of process unit, site supervision, start-up assistance, training and documentation

**Client:** OMV Austria GmbH

**Capacity:** 240 TPD

**Location:** Schwechat / Austria

**Year:** 2006



**BITUROX® PLANT LOTOS**

Extension of an existing bitumen production by Biturox® Process

**Pörner scope:** Basic engineering for the process unit, detail engineering, procurement and supply of key equipment, site supervision, start-up assistance, training and documentation

**Client:** LOTOS Gdansk

**Capacity:** 1.680 TPD

**Location:** Gdansk / Poland

**Year:** 2005



**BITUROX® PLANT LAVERA**

Revamp of an existing bitumen oxidation plant based on the Biturox® Process

**Pörner scope:** Basic engineering for the process unit, supply of key equipment, start-up assistance, training and documentation

**Client:** BP Lavera

**Capacity:** 750 TPD (1x 480 TPD and 1x 270 TPD)

**Location:** Lavera / France

**Year:** 2004

**FURTHER REFERENCES**

Plant	Client	Location / Country	Year
Biturox® plant Ras Tanura	Saudi Aramco	Ras Tanura / Saudi Arabia	2017
Biturox® plant Karbala	SCOP State Company for Oil Projects	Karbala / Iraq	2017
Biturox® plant Sohar	ORPIC Oman Oil Refineries and Petroleum Ind. Co.	Sohar / Oman	2016
Biturox® plant Barauni	IOCL Indian Oil Corporation Ltd.	Barauni / India	2016
Biturox® plant Baiji	Al-Wataniya Group for Oil & Gas	Baiji / Iraq	2015
Biturox® plant Kochi	Bharat Petroleum Kochi Refinery	Kochi / India	2007
Biturox® plant Nizhnekamsk	JSC "TAIF-NK"	Nizhnekamsk / Russia	2007

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AUSTRIA

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