

# Oil shale technology

**UMATAC** Industrial Processes

A company of ThyssenKrupp Polysius

ThyssenKrupp Polysius



ThyssenKrupp

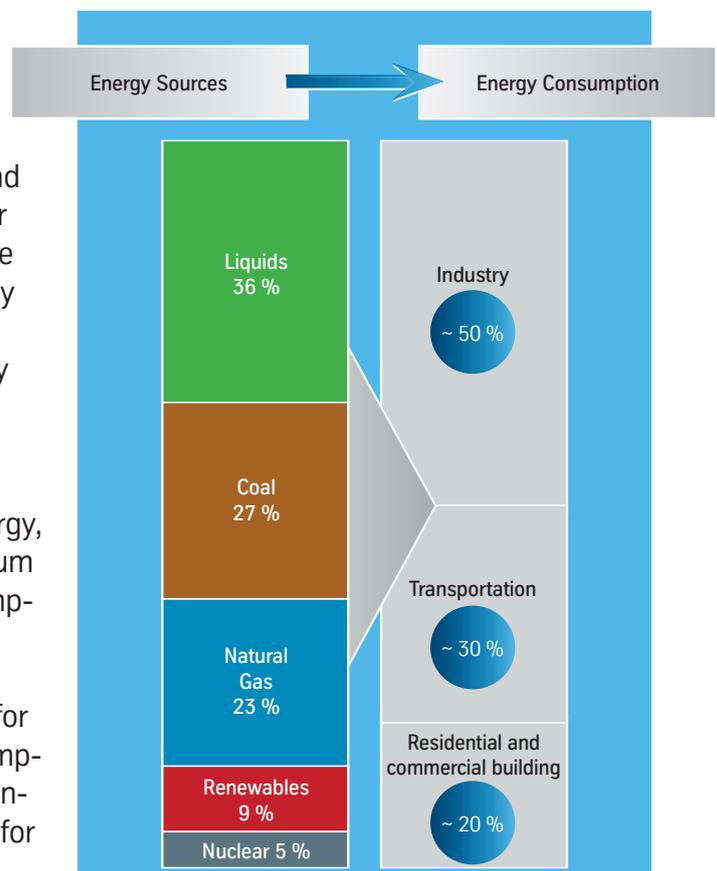


## Future tasks

The increasing demand for energy is a megatrend. All around the world, additional energy sources will be required in order to respond to population and economic growth as well as the advance of underdeveloped regions which depend on energy supply from abroad. This energy must not only be sufficient but must also be provided in an environmentally and socially responsible way.

Currently, the demand for energy is covered from different sources, mainly including: oil, natural gas, coal, nuclear energy, oil sands and other renewable sources. However, the optimum energy-mix as well as the sectorial distribution of its consumption varies from region to region.

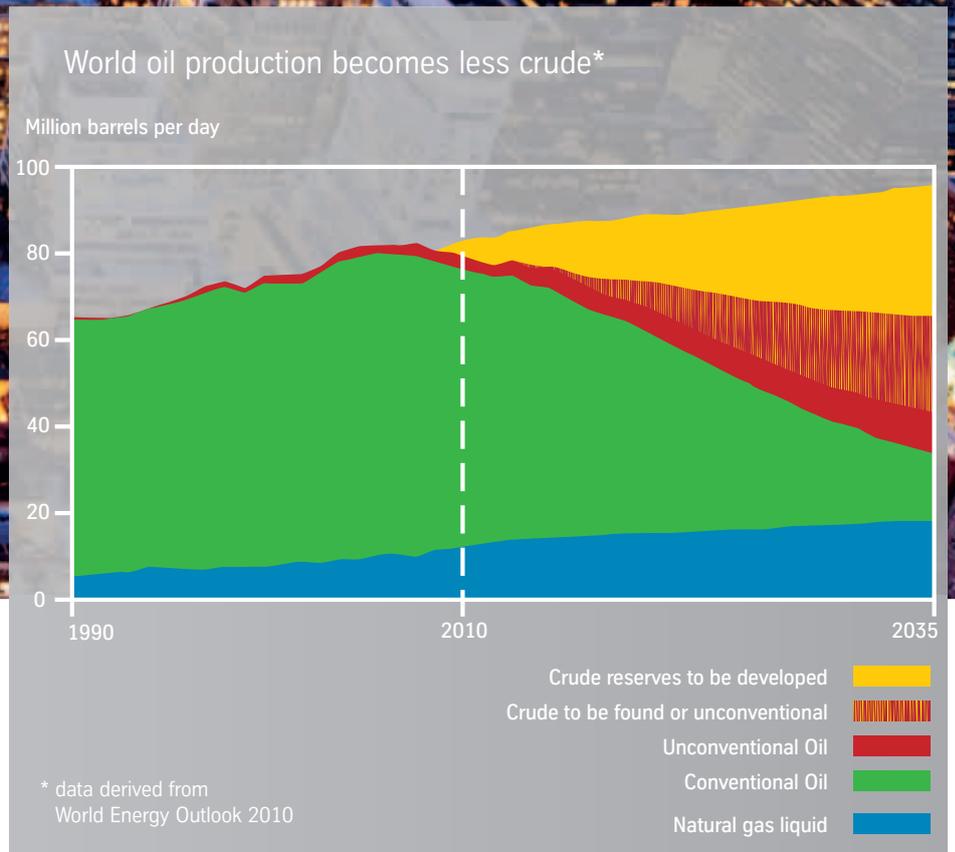
Globally, the main energy source is liquid fuels, accounting for around 36% of the total marketed energy. The entire consumption is distributed among industry, transportation and residential and commercial buildings. Industry alone is responsible for half the total consumption.





Growing megacities create increasing demand for energy.

Forecast of future oil production.



The worldwide demand for energy is expected to increase substantially over the next 20 years. Although renewable energies have become popular, very few countries will have sufficient sources.

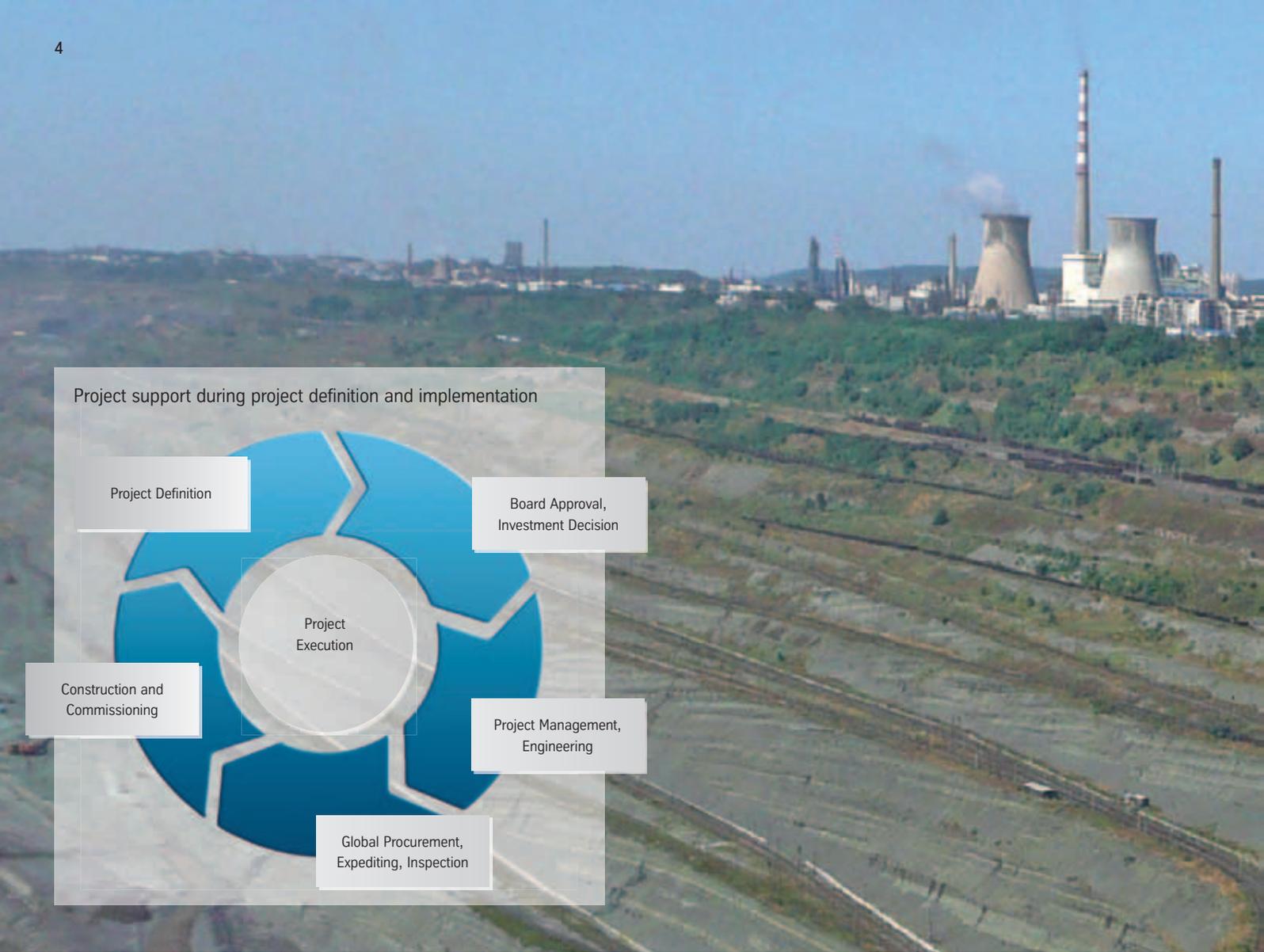
A hitherto barely exploited energy source is oil shale. Oil shale is an organic-rich sedimentary rock from which liquid hydrocarbons can be obtained.

Deposits of this energy source are widely distributed around the world and these are reported to be more than three times larger than conventional oil reserves. The largest known deposit is Green River in the United States. Other significant deposits are located in Brazil, Jordan, Morocco, Australia, China and Estonia.

Processing these abundant resources will be of greater importance in the future in view of the projected depletion of conventional oil resources. Even if other alternatives such as coal, natural gas, renewables and nuclear energy are available, liquid hydrocarbons are expected to cover a large proportion of the estimated future demand for energy.

Oil shale can make a significant contribution, compensating the declining conventional oil resources.

# Oil shale is an essential hydrocarbon resource for securing the future global energy supply



## Future-oriented solutions Innovative - Sustainable - Comprehensive

ThyssenKrupp Polysius offers the entire process chain from mining to the final product: our long-standing knowhow in the construction of complex plants, as well as our efficient cooperation with competent partners within the ThyssenKrupp Group, enable us to configure integrated concepts for oil shale processing. These take full account of profitability, environmental protection and social responsibility.

A combination of various individual processes forms the overall value creation chain:

### **Quarrying operations planning and oil shale mining**

Ranging from the geological investigations via material analysis right up to the correct selection and application of appropriate mining equipment.

### **Crushing and materials handling**

Selection of the appropriate technologies for the comminution and storage of the oil shale for processing.

### **Oil shale processing**

The prepared oil shale is then fed to an ATP Processor. In an enhanced thermal environment, the oil is efficiently extracted from the shale rock in the form of vapour.

### **Oil recovery and upgrading**

Refinery blocks are used for oil recovery and refinement. The finished products are stored prior to dispatch.

### **Additional products**

The spent shale can be used as a raw material in the cement manufacturing process. Potential sulphur products go to the cement or fertilizer market. Excess fuel gas and waste heat will be used to generate electricity.

Furthermore, Polysius offers single-source responsibility for planning, delivery, erection, commissioning, supply of spare parts and all after-sales services.



Mine – Planning and Exploitation



Crusher, Stockpile, Shale-/Spent Shale Handling



Process, Design and Supplies: ATP Processor, Rotary Dryer, Flue Gas Handling



Oil Recovery and Upgrading



Spent Shale Utilization

ThyssenKrupp Polysius Applications around Oil Shale: Together with competent partners within the ThyssenKrupp Group, Polysius works out coordinated process-technological and mechanical solutions for all aspects of oil shale processing.

Comprehensive oil shale processing from a single source!



## Centrepiece of the plant: the Processor

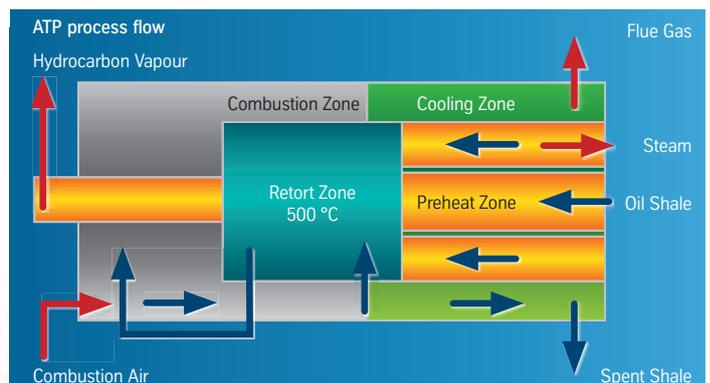
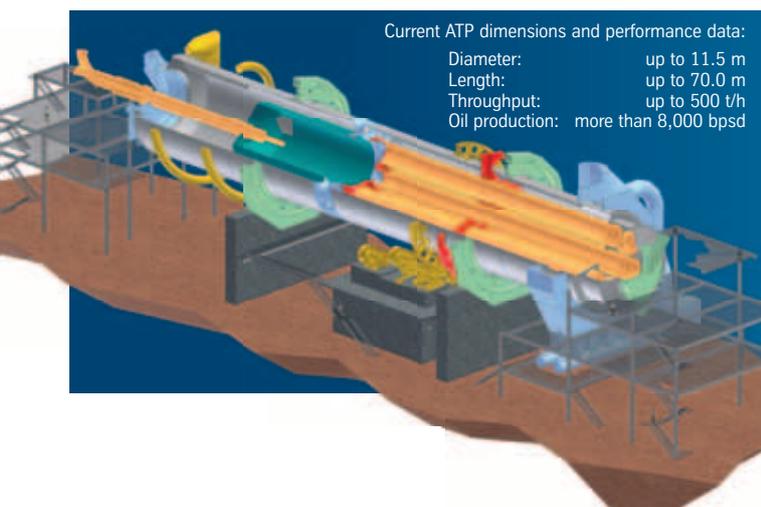
A horizontal, rotating vessel, the Alberta Taciuk Processor (ATP) has individual compartments for separating and recovering several product streams.

**The Preheat Zone:** Hot spent solids and combustion flue gases indirectly heat incoming fresh feed. Free water is evaporated – its steam works as an extra air seal. Condensed steam and some hydrocarbons are recovered by external cooling.

**The Retort Zone:** Preheated feed mixes with hot solids recycled from the Combustion Zone. The resulting heat liberates the kerogen in an oxygen-deficient atmosphere, yielding hydrocarbon vapour and residual char containing ashes. The vapour is condensed externally to recover product oil together with rich fuel gas.

**The Combustion Zone:** Air is added to burn the char off the solids. A significant amount of hot spent shale is recycled to the Retort Zone.

**The Cooling Zone:** Hot solids and flue gases are cooled through indirect heat transfer to fresh feed. Spent shale is discharged for disposal or further processing. Flue gases are disposed of through an off-gas treatment system.





Erection of China ATP processor completed:  
Plant to produce more than 2,600 bpsd of light and heavy oil as well as fuel gas.

### Research and Development

ThyssenKrupp Polysius provides the necessary knowhow as well as the essential design-backup equipment and systems to develop the custom-made plant concept for individual material properties.

To assure selection of the appropriate process and correct dimensioning of the plant components, ThyssenKrupp Polysius and UMATAC test the feedstock oil shale in laboratory-scale equipment and perform trial processing in pilot plants at the R&D centre, Calgary, Canada.

As a matter of routine, ThyssenKrupp Polysius designs and dimensions processors of this size on the basis of Finite Element calculations in order to eliminate weak points from the very outset.

ThyssenKrupp Polysius provides decades of experience in the engineering and design, delivery, erection and commissioning of large rotating machines. Moreover, on the pyroprocessing sector the numerous large rotary kilns installed by Polysius provide impressive credentials.

UMATAC Oil Shale / Oil Sands Research Centre, Canada:  
providing full variety of oil shale services (upper picture).

UMATAC ATP60: a mobile pilot plant used for design and scale-up investigations (lower picture).



**Worldwide Experience:**  
UMATAC has examined oil shales from many countries:  
e.g. Australia, Canada, Cuba, Estonia, Jordan, Mongolia, Thailand, Brazil, China, Egypt, Israel, Madagascar, Morocco, USA.

# Oil shale technology made by ThyssenKrupp Polysius