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Thermal Separation

High-performance separation processes – engineered from a system perspective. Delivering impact in the process.

Thermal Separation Technology

Engineered from a system perspective.
Delivered where it matters: in the process.

Thermal separation technology is a core element of many industrial process systems.

For decades, GKT has developed solutions based on a deep understanding of process engineering interactions, combined with strong engineering and manufacturing expertise.

We support companies worldwide in efficiently separating industrial liquids through evaporation, distillation, and drying – while systematically optimizing energy and process flows.

Efficiency emerges from the interaction of system and process: At the system level, the relevant leverage points are identified. Within the process, they are translated into measurable efficiency gains, reduced energy consumption, and stable product quality.

This is not only about separating process streams. It is about making energy economically usable, recovering valuable substances, and minimizing losses across the entire process.

Depending on the application, GKT applies systems based on conventional evaporation technology as well as thin-film and short-path technology.

In this way, thermal separation technology becomes the technological foundation for economically viable processes – as well as for efficiency and circularity.



At the GKT technical center in Gloggnitz, customized trials can be conducted for thermal separation processes and CO₂ valorization.



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Plant Lifecycle

Validate. Scale-up.
Industrial implementation.

High-performance separation processes do not emerge in isolation. They result from the structured interaction of simulation, validation, and industrial implementation.

That is why GKT supports projects across the entire lifecycle – tailored to the specific task and project context.

The starting point is a thorough analysis of processes and systems. Depending on project requirements, we evaluate operational data through feasibility studies or directly within the live process environment, identify the key leverage points within the overall system, and develop concrete solution concepts.

Where required, these concepts are tested and validated under real conditions in our in-house technical center or are transferred directly to the next phase based on existing operational data and experience. Laboratory and pilot trials provide the basis for reliable scale-up concepts and process simulations where needed.

Building on this, engineering defines the technical foundation for industrial implementation. Execution includes the manufacturing of key components, procurement, and project management – up to turnkey plant delivery.

Through consistent control of cost, schedule, and quality, we ensure investment security and reliable project execution.

The result: scalable solutions – from simulation to full industrial plant.

Our Lifecycle Services

- Consulting and feasibility studies
- Trials in the technical center
- Basic and detail engineering
- Manufacturing and project execution



GKT supports projects across the entire lifecycle.



Explore further insights

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Conventional Evaporation Technology

Tailor-made falling-film technology for high evaporation performance and stable operation.

To meet the diverse requirements of different industries, evaporator types and process solutions are applied in various configurations.

Multi-effect evaporation systems

Objective: **Energy efficiency at high evaporation capacities**

Operating principle

The first evaporation stage is heated with live steam, while the vapor generated in subsequent stages is reused as the heating

medium. With an increasing number of stages, the specific consumption of live steam decreases.

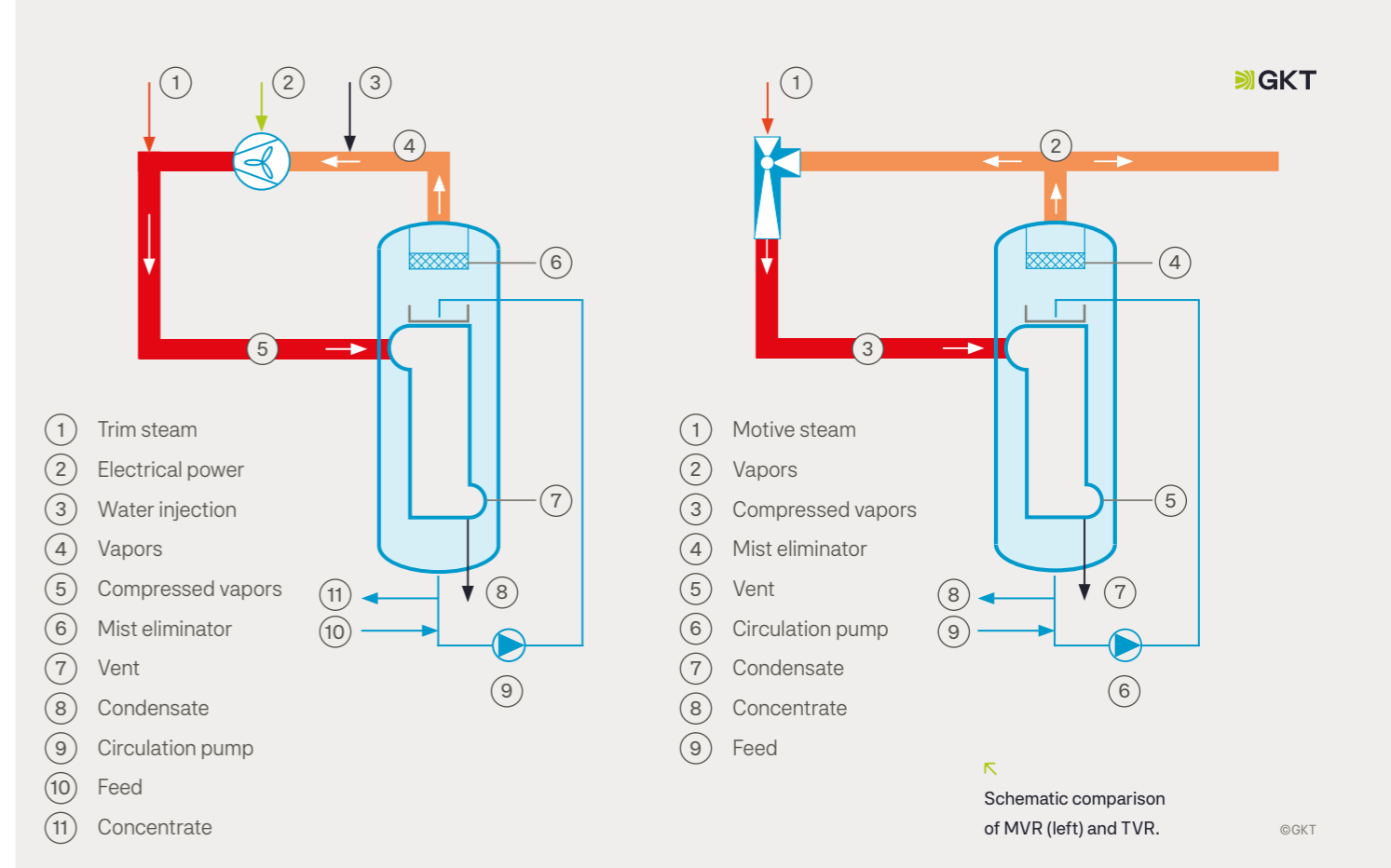
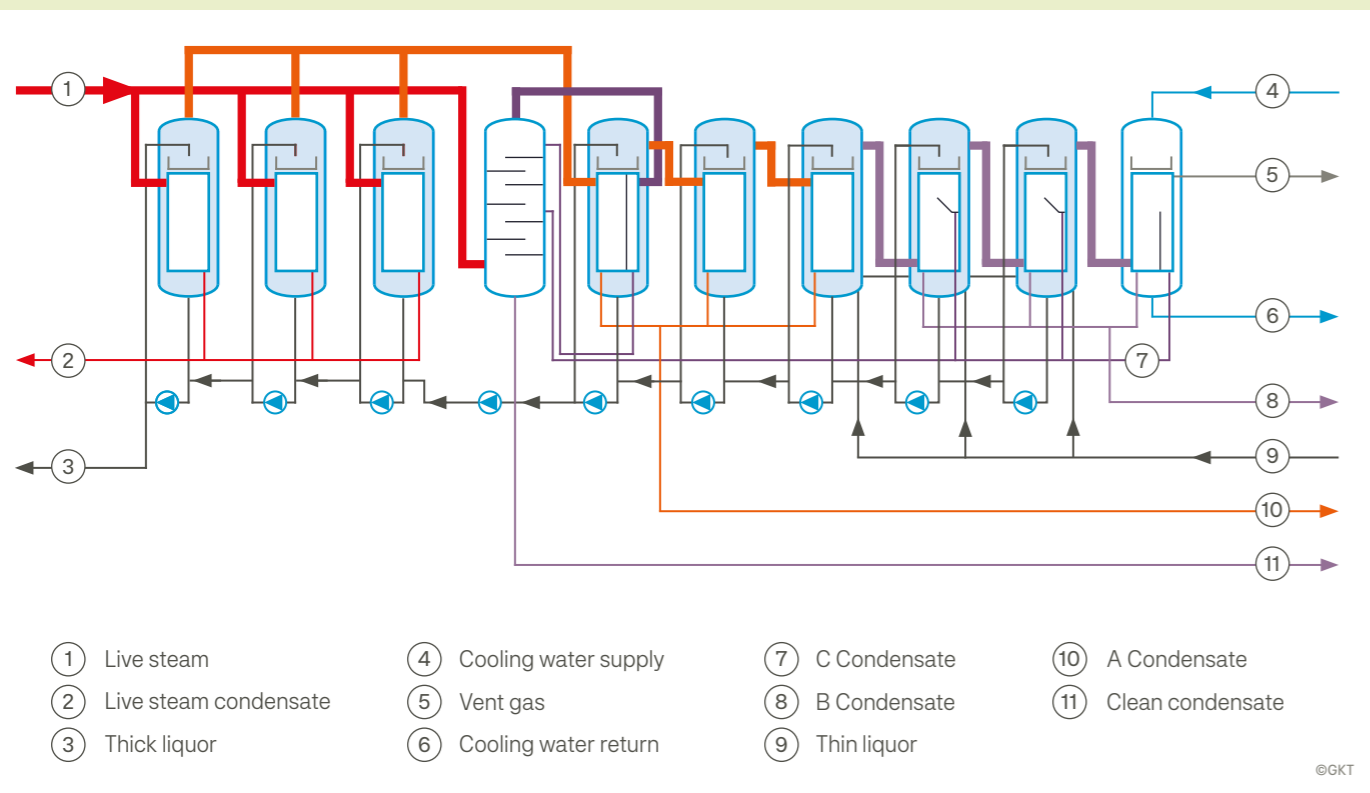
The number of stages is primarily determined by the available temperature gradient. Additional parameters include the temperature sensitivity of the medium, the maximum available steam pressure, and the cooling water temperature.

In close coordination with our customers, GKT develops tailor-made process solutions and plant designs to optimize both energy consumption and investment costs.

Benefits

- Optimized energy consumption and reduced operating costs
- Very high evaporation capacities
- Suitable for substances with higher boiling point elevation
- Improved condensate quality through targeted purification

Example of a multi-effect evaporation plant for the pulp industry with integrated condensate purification.



Mechanical Vapor Recompression (MVR)

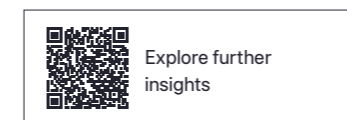
Objective: **Use electricity as the primary energy source, while reducing live steam, cooling water, and CO₂ emissions**

Operating principle

Generated process vapor is compressed by an electrically driven compressor. This increases both temperature and energy level, allowing the compressed vapor to be reused as a heating medium in the evaporator.

Depending on the application, single- or multi-stage compressors are used, operating according to the principle of an open heat pump.

When powered by renewable electricity, the system can significantly reduce the plant's CO₂ footprint. In addition, it is characterized by low operating costs and minimal cooling water demand.



Thermal Vapor Recompression (TVR)

Objective: **Use steam as the energy source while reducing live steam and cooling water demand**

Operating principle

A portion of the process vapor is reused to heat the evaporator, while the remaining share is either transferred to the next stage or condensed. Compression is achieved using a steam jet ejector, typically designed for a defined operating point. Additional motive steam is required for operation.

Benefits of MVR / TVR

- Reduced consumption of live steam and cooling water
- Significantly lower operating costs
- CO₂ reduction through the use of electrical energy (MVR)
- Gentle evaporation temperatures
- Utilization of low-pressure steam possible

Plate Falling-film Evaporators

For high evaporation rates and low-viscosity, heavily fouling media.

Our plate falling-film evaporators are particularly suited for high evaporation capacities as well as low-viscosity and heavily fouling media.

Operating principle

The medium is concentrated along plate heating elements (lamellas) arranged in bundles. The more volatile component evaporates and is discharged from the effect.

Optimized distribution systems ensure uniform wetting of the heating surfaces, enabling high evaporation performance.

Benefits

- Ideal for heavily fouling media
- Very high evaporation capacities
- Efficient separation of liquid and vapor phases
- Optimized spot- and laser-welded plate heating elements
 - Long service life
 - Minimized fouling and corrosion risk
 - Energy-optimized design
- Integrated droplet separator
- Condensate separation via secondary heating surface



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In-house manufacturing

All components are manufactured at our modern in-house facility in Gloggnitz, Austria, and undergo strict quality control.

To meet specific requirements, GKT offers a wide range of lamella formats and materials. A plate forming process developed over many years enables optimized spot- and laser-welded lamellas.

- ↖ Top: Spot-welded lamella
- Middle: Laser-welded lamella
- Bottom: Lamella cross-section

Applications

- Concentration of black liquor, sulfite liquor, and wastewater
- Recovery and separation of solvents and alcohols
- Volume reduction of liquid-liquid mixtures
- Separation of multi-component mixtures
- Removal of water
- Concentration of the liquid phase of fermentation residues in biogas plants

Tube Falling-film Evaporators

For small to medium evaporation capacities and low-viscosity media.

Our tube falling-film evaporators are commonly used in standard applications as well as for lower evaporation capacities.

Operating principle

The medium flows through vertically arranged tube bundles, forming a thin liquid film along the inner tube walls that flows downward by gravity.

As the more volatile component evaporates at the heating surface, vapor is generated and flows co-currently with the boiling liquid inside the tubes.

The vapor phase is then separated from the liquid phase in the lower evaporator chamber using integrated droplet separators or external separators. Heating is typically provided by steam on the shell side.

Benefits

- Suitable for small evaporation capacities
- Flexible use across a wide range of industries
- Optimized droplet separator design
- Simple and cost-effective cleaning
- Compact design with low space requirements



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In-house manufacturing

These units are also manufactured in our own production facilities and meet the highest quality standards.

Particular expertise lies in droplet separation and cleaning-friendly design.



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- ↖ The tube falling-film evaporator is based on the principle of a shell-and-tube heat exchanger.

Applications

- Concentration of moderately fouling liquids and wastewater
- Volume reduction of liquid-liquid mixtures
- Recovery and separation of solvents and alcohols
- Separation of multi-component mixtures
- Removal of water
- Recovery of valuable substances

Thin-film and Short-path Technology

For high-viscosity and temperature-sensitive applications

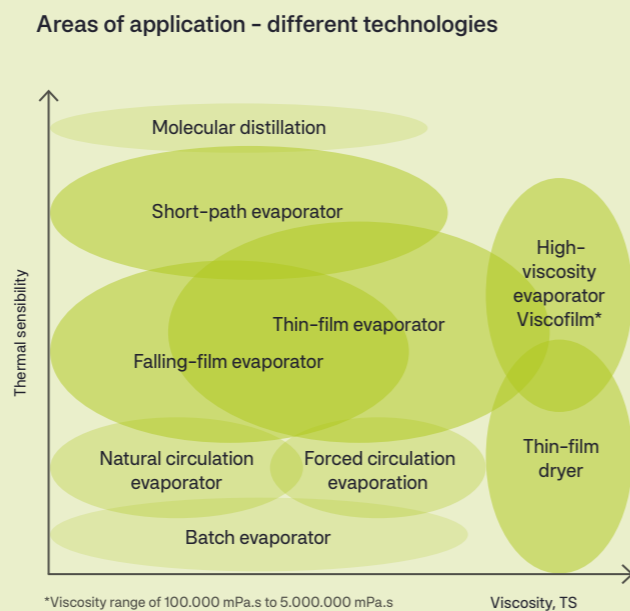
Complex process requirements demand specialized solutions. Thin-film and short-path technology is applied where conventional methods reach their limits.

GKT has specifically built its expertise around these technologies, developing various evaporator types for demanding applications.

By selecting and combining the appropriate technologies, a wide range of substances can be processed.



Explore further insights



Assembly of a short-path evaporator

Thin-film Evaporators

Efficient concentration and purification of demanding substances

Our thin-film evaporators are used for both concentration and purification of product streams, delivering excellent results even with sensitive media.

Different rotor and wiper designs ensure that each unit is optimally adapted to the specific application.

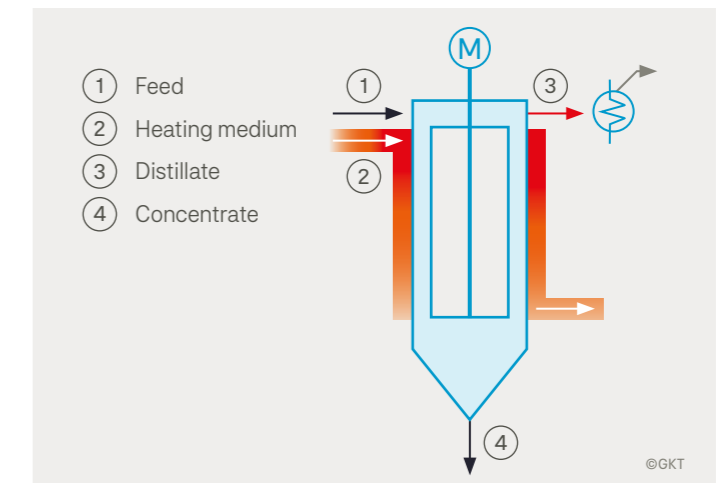
Operating principle

The thin-film evaporator consists of an internal rotor and a cylindrical heating surface, which is heated externally by steam or thermal oil. The medium is distributed evenly via a distribution ring at the top and flows downward along the heated evaporation surface.

Special wiper elements ensure uniform distribution of the medium and generate a thin liquid film. Turbulence created at

the wiper blades enhances heat transfer and continuously renews the liquid film. As a result, the medium is exposed to the heating surface only briefly and subjected to minimal thermal stress.

This gentle evaporation process ensures maximum product quality.



Operating principle of a thin-film evaporator

Applications

- Concentration of shear-thinning, high-viscosity, and temperature-sensitive substances
- Distillation of low-boiling media
- Special applications such as re-boilers for rectification systems
- Purification by distilling valuable products from high boilers



Thin-film evaporator – skid unit

Benefits

- Customized design – optimized heating surface and rotor type tailored to the application
- Continuously renewed liquid film
- Optimized product residence time
- Short downtime for installation, maintenance, and inspections
- Fast spare parts service
- Improved heat transfer due to optimized wiper design
- Reduced corrosion risk
- No lubrication of lower bearings required for certain rotor types

Thin-film Dryers

Gentle drying with high product quality

GKT manufactures vertical and horizontal thin-film dryers for the gentle drying of temperature-sensitive media.

Based on proven thin-film evaporator technology, they combine high performance with economical operation.

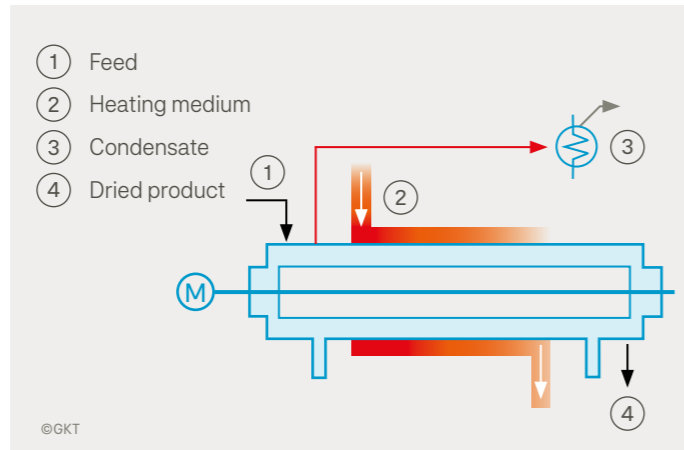
Operating principle

The medium is continuously distributed over the entire circumference of the heating surface. Special wiper elements continuously renew the contact between the product and the heating wall while ensuring the transport of the product stream.

As the solid rotor blades do not touch the heating jacket (defined clearance), fouling or blockage of the heating surface is prevented. This allows even liquid substances to be dried into powder form under gentle process conditions.

Benefits

- High product purity
- Minimal product loss
- Maximum dry solids content
- Gentle drying due to short residence time and continuous product circulation
- Minimal fouling of heating surfaces through mechanical cleaning
- Reduced maintenance effort thanks to smart design of bearing and shaft sealing systems



Operating principle of a thin-film dryer

Applications

- Sewage, process, and industrial sludge
- Chemical products (intermediates or precursors)
- Moist solids
- Suspensions
- Pastes
- Salts



Horizontal thin-film dryer

Short-path Evaporators

Gentle distillation under high vacuum

Our short-path evaporators offer a particularly wide range of applications for the gentle evaporation of sensitive substances.

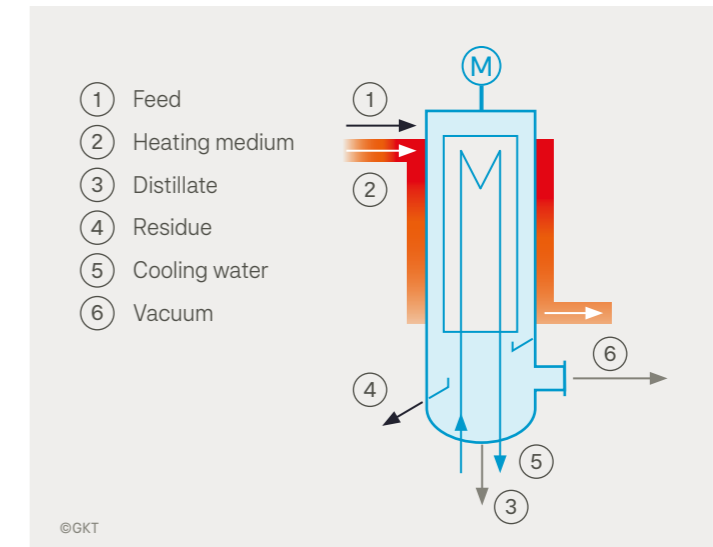
This specialized equipment is primarily used for the distillative purification of demanding media that cannot be separated using conventional methods.

Operating principle

The fundamental operating principle is based on that of thin-film evaporators. The key difference is an integrated condenser within the apparatus. This design ensures an extremely short vapor path to the condenser, minimizing pressure losses and enabling operation under fine and high vacuum conditions.

Benefits

- Particularly gentle evaporation due to minimal pressure losses
- High boilers are prevented from reaching the condenser thanks to efficient droplet separators
- Enables distillative purification of demanding substances that cannot be separated using conventional thermal processes



Operating principle of a short-path evaporator

Applications

- Distillation of viscous media at low process pressure (0.001–1 mbar(a))
- Concentration of fatty acids, derivatives, and flavor compounds
- Separation of extracts
- Distillation of vitamins and oils



Short-path evaporator with integrated condenser

WE ENGINEER GREEN KEY TECHNOLOGIES

GKT is a globally operating system partner for thermal separation and environmental technologies – built on nearly 90 years of metalworking expertise and today defined by deeply rooted process engineering competence. In an industry where resources, circularity, energy, and CO₂ determine competitiveness, we make challenges technologically manageable and economically effective.

Our approach:
We Engineer Green Key Technologies.

We develop and implement key industrial technologies – from falling-film, thin-film,

and short-path evaporators to distillation and drying, as well as CO₂ valorization, waste heat recovery, and IIoT-enabled process optimization.

As part of the Dr. Aichhorn Group, we validate processes in our own technical center under real operating conditions and scale them up to turnkey EPC facilities.

For our customers, this means maximum efficiency, reduced energy consumption, lower CO₂ emissions, and stronger economic viability – proven worldwide through numerous successfully executed projects.



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