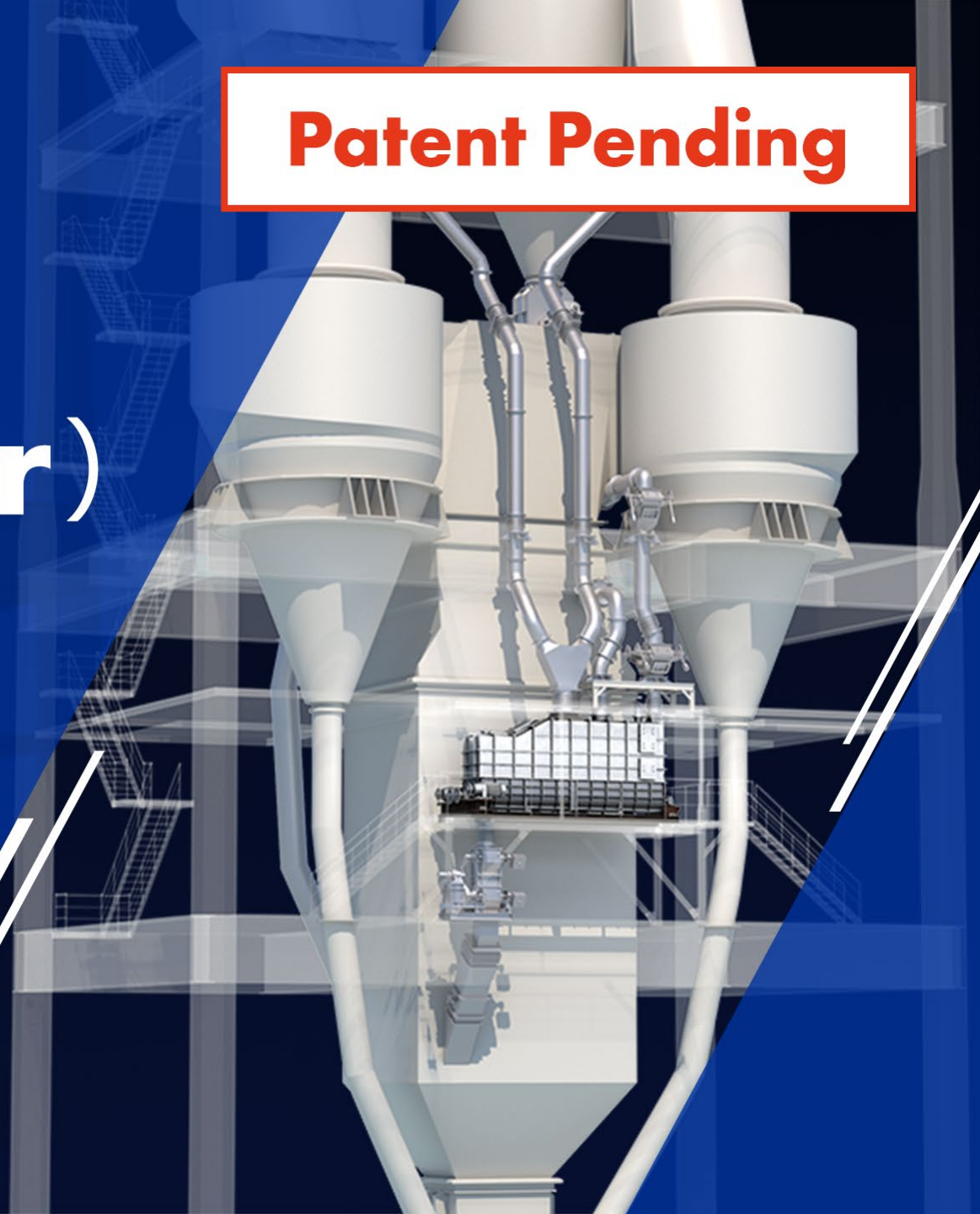
TTR®(Taiheiyo Thermal Reactor)

for Sludge Drying

Innovation for Sludge Utilization in Cement Plants

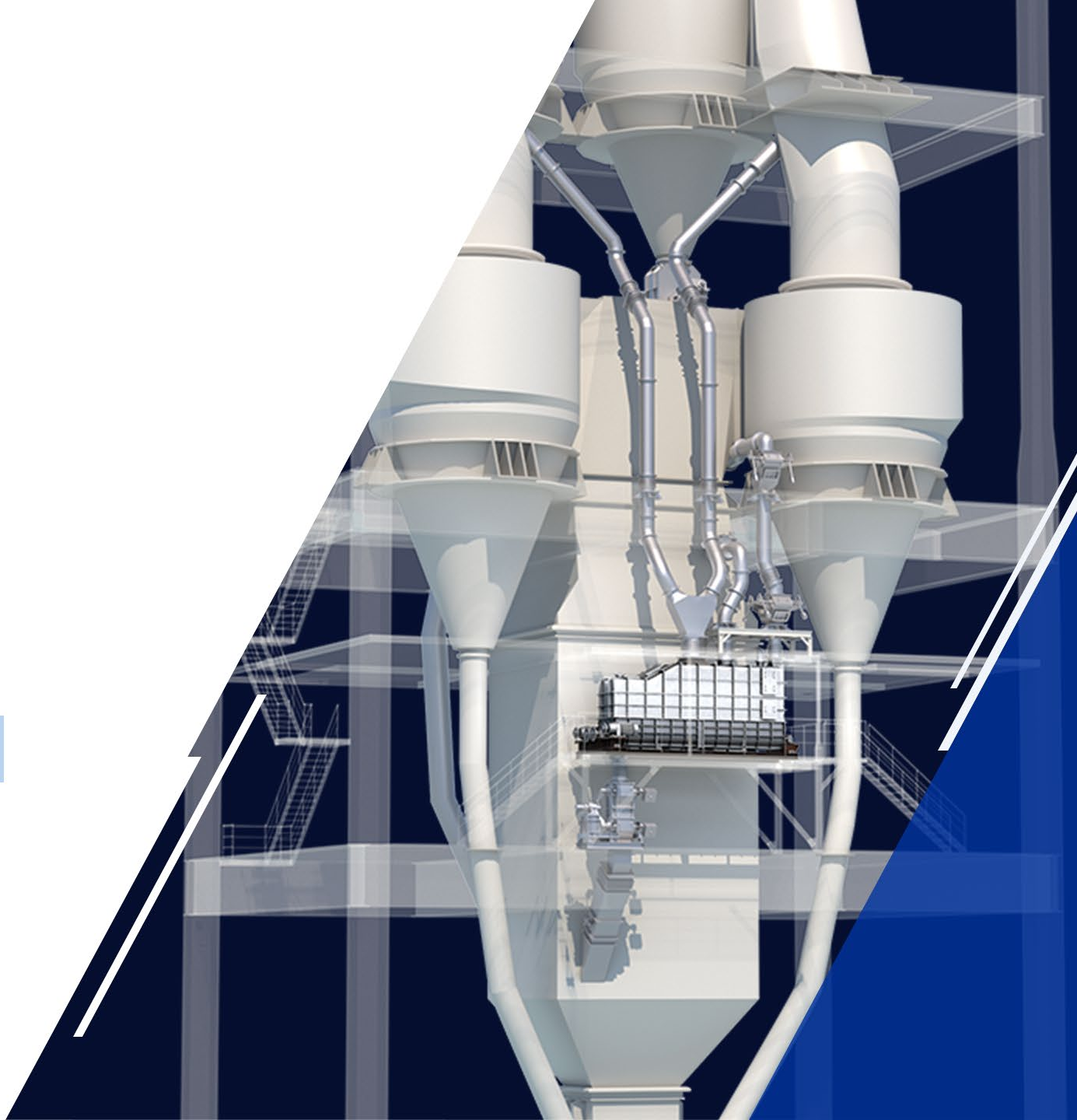


Patent Pending

Overseas Sales Department. Sales Division
Taiheiyo Engineering Corporation
June 6, 2023

WHY INVEST IN

SLUDGE UTILIZATION?



ECONOMIC BENEFIT

SUSTAINABILITY

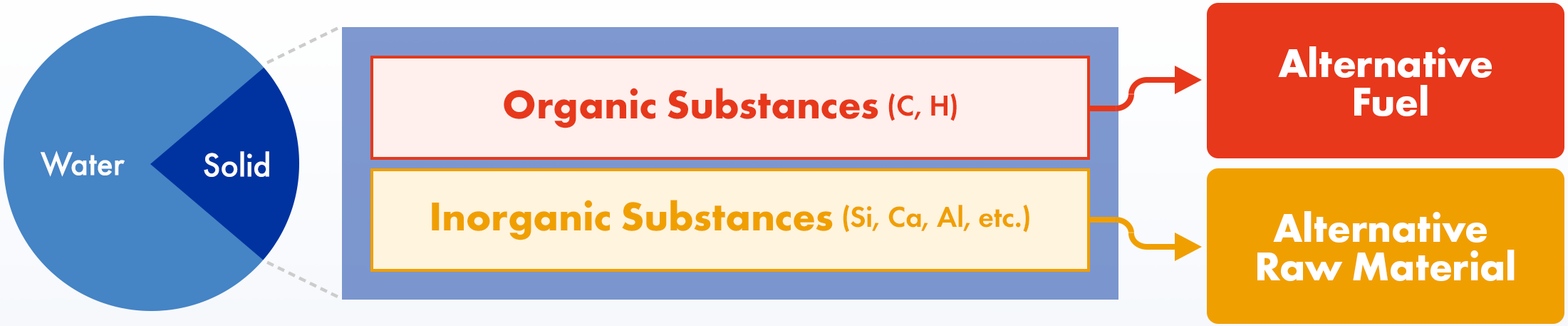
CSR

CORPORATE BRANDING

SLUDGE UTILIZATION PROCESS IN CEMENT PLANTS.

Sludge Utilization Process in Cement Plants

Utilization of Solid Contents



Zero-Emission

The components of sludge are utilized as cement fuel and raw materials, therefore achieving zero-emission

⇨ **Ideal Utilization of Waste Materials**

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Sludge Utilization Process in Cement Plants

Operational problems due to Impact of Water Content

- Unstable Operation
  (sludge accumulation,
  fluctuated water evaporation)
- Production Loss
- Heat Loss

Problem to be solved:

Minimize the impact from the water content

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BECOMING THE NEW STANDARD IN JAPAN.

TTR® for Sludge Drying

TTR® (Taiheiyo Thermal Reactor) for Sludge Drying

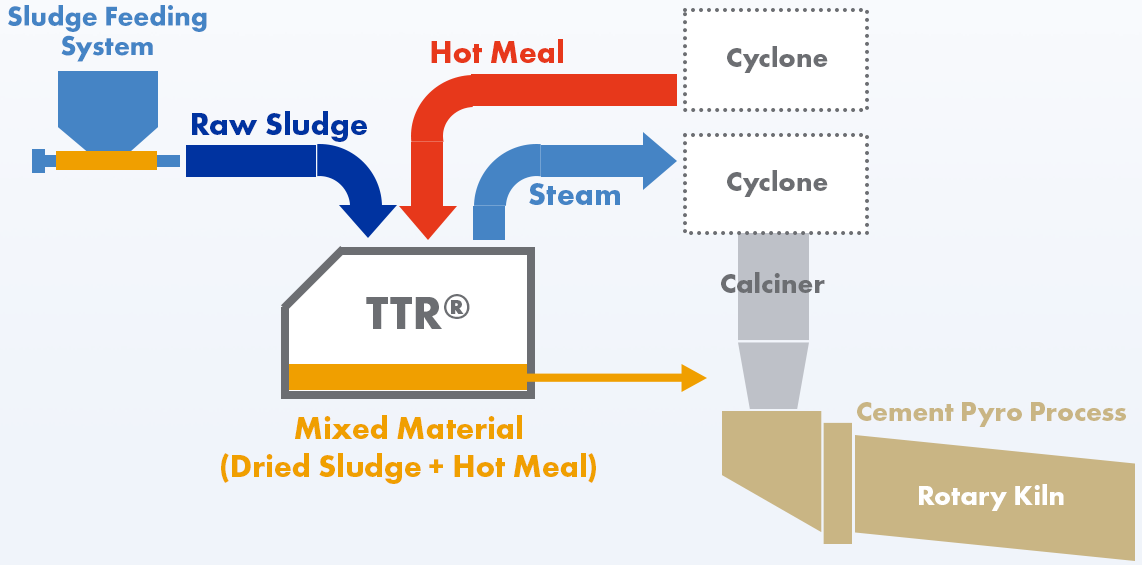
System Description

Equipment	
- Sludge feeding system	- Hot meal diverter
- TTR®	- Steam duct

Equipment Specifications	
Size	3mW x 6mL x 4mH
Weight	approx 10t
Feeding Rate	200 t/d

Advantages

- Effective & efficient sludge drying
- Minimal impact to clinker production process
- Fully enclosed process
- Effective utilization of combustibles in sludge



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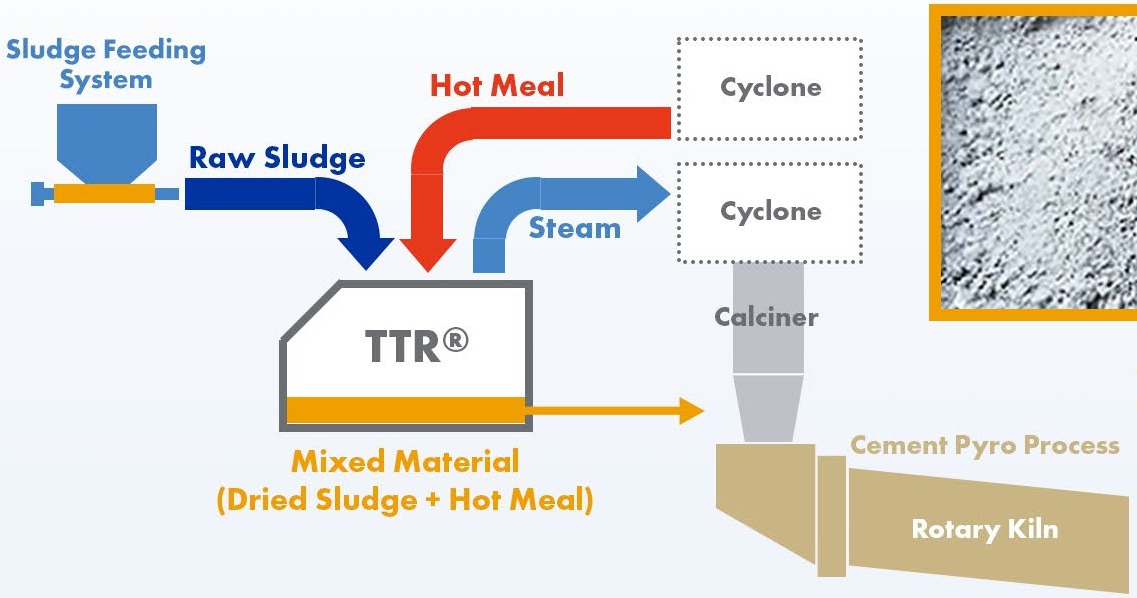
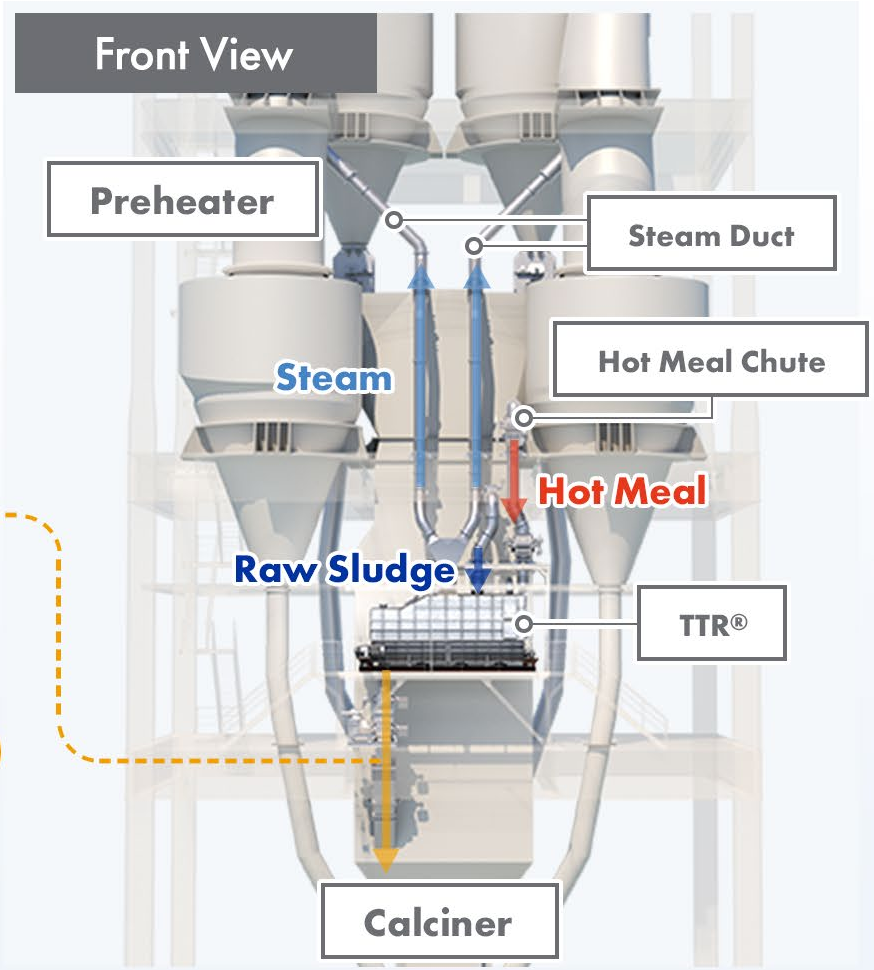
Example result:

- Water content down to 3% from 80% (when 200 t/d [raw sludge])
- Stable operation in cement process



Mixed Material
(Dried Sludge + Hot Meal)



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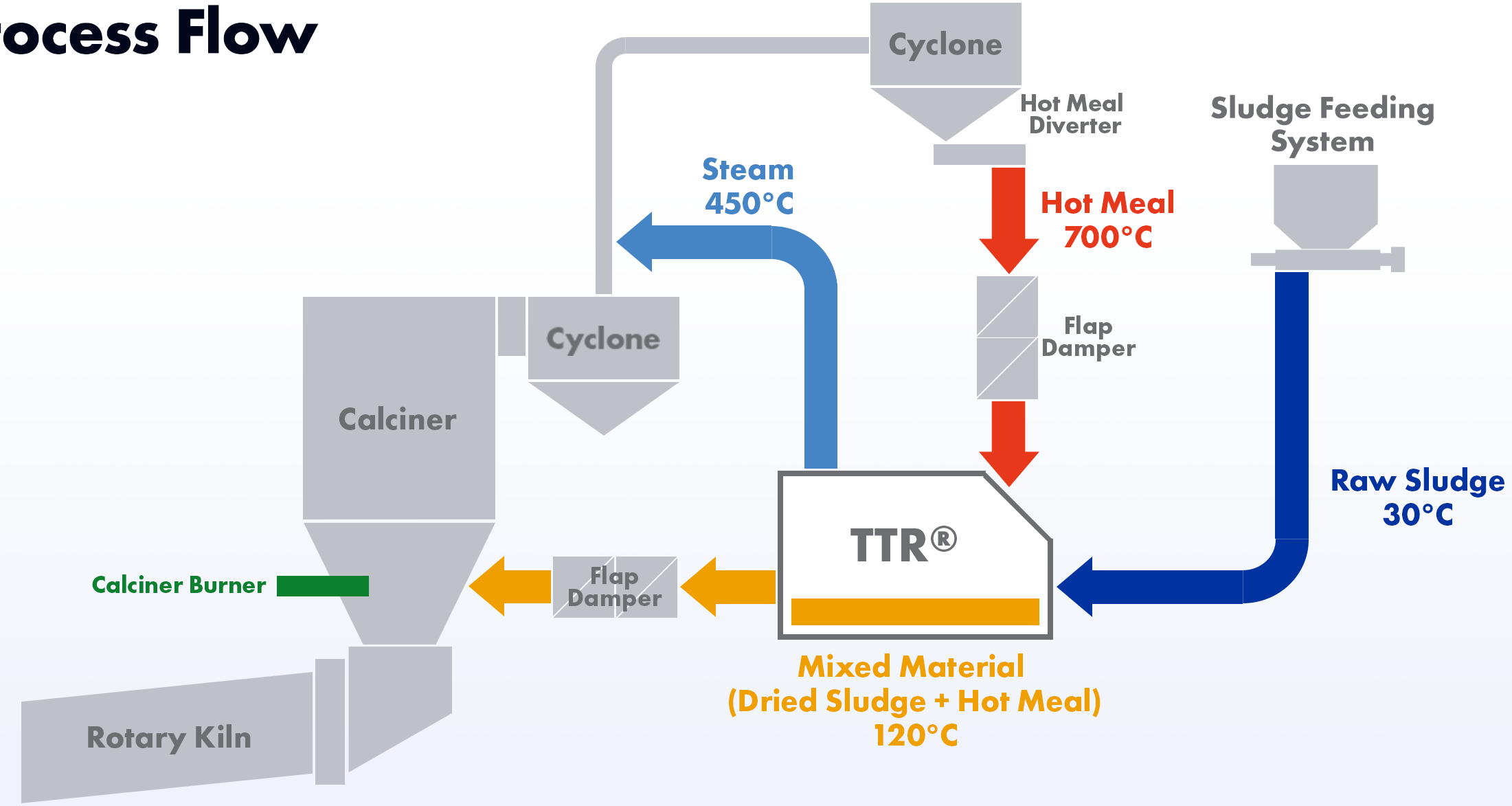
Process Flow



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Performance

Guaranteed Performance of TTR®

Maximum Raw Sewage Sludge Utilization Amount (water content: 80%)	
Direct Feeding System	**TTR®**
90 t /d	200 t /d

Kiln size:
4,000 - 5,000 t/d

Impact to clinker production process

	No Sewage Sludge	Raw Sewage Sludge Direct Feeding	TTR®
	Benchmark	Maximum	Maximum
Sewage Sludge Feeding Rate [t-sludge/d]	0	90	200
Clinker Production [t-clinker/d]	4,370	4,141	4,233
Increase in Heat Consumption [kJ/kg-clinker]	-	148	106

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TTR® (Taiheiyo Thermal Reactor) for Sludge Drying

Comparison among TTR® and existing systems

System for utilization of sewage sludge				
	TTR®	Direct feeding to preheater	Direct heating by hot gas	Indirect heating by hot gas, etc.
Maximum feed rate of sewage sludge	Very good	Poor	Good	Quite poor
Water content after drying	Very good	-	Quite poor	Quite poor
Clinker production	Very good	Poor	Very good	Very good
Energy saving for clinker production	Good	Poor	Good	Good
CAPEX for sewage sludge utilization	Good	Very good	Poor	Quite poor
OPEX for sewage sludge utilization	Good	Poor	Poor	Quite poor
Construction period	Good	Very good	Poor	Poor
Effect on kiln operation	Very good	Poor	Good	Very good
Safety	Very good	Very good	Quite poor	Quite poor
Heat transfer efficiency	Very good	Poor	Good	Poor
Controllability	Very good	Very good	Good	Good

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CONCLUSION

TTR® (Taiheiyo Thermal Reactor) for Sludge Drying

Low investment cost / Less installation space

Compact system can be made thanks to the high-performance heat transfer (by the contact of hot raw meal and sludge with big surface area per unit volume) TTR® can be installed with low investment cost, less space and short time, enables quick cost recovery.

Stable kiln operation / Minimal impact to clinker production

The dried powder is fed from the TTR into the kiln. No sludge adhesion or gas volume increase occurs as the water content is removed from the sludge. When compared with a direct (wet) sludge feeding system, the TTR helps to maintain a stable kiln operation and to minimize the impact of sludge feeding on clinker production.

Less energy consumption

Since no water content is fed to calciner (de-carbonation part), additional fuel consumption can be avoided. Also, heat value from sludge can be fully utilized.

Safety

TTR® is designed not to introduce air (oxygen). Without concern for fire, explosion, safe operation is secured.

Eco-friendly

Prevents emission of hazardous materials and odor to the atmosphere.

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TTR® (Taiheiyo Thermal Reactor) for Sludge Drying

Patent Application Status (as of Jan. 01, 2023)

Country	Application status	
PCT	Apr. 4, 2018 Mar. 12, 2019 Oct. 10	PCT application (Application number: PCT / JP2018 / 14386) Application claiming Priority (Application number: PCT / JP2019 / 10030) International publication
Japan	May. 16, 2019 **May 18, 2020**	Examination claim (Application number: Patent Application 2019-526025) **Registration (Registration number: 6696053)**
China	May. 20, 2019 Dec. 12	Examination claim (Application number: 201980000666.8) Publication
Korea	May 31, 2019 Oct. 15	Examination claim (Application number: 10-2019-7015677) Publication
Taiwan	Apr. 18, 2018 Mar. 15, 2019 Nov. 1 **Mar. 4, 2021**	Application (Application number: 107113229) Application claiming Priority (Application number: 108108822) Publication **Registration**
Thailand	Sept. 24, 2020	Examination claim (Application number: 2001005753)
Malaysia	Aug. 19, 2020	Examination claim (Application number: PI2020004275)
India	Sept. 29, 2020	Examination claim (Application number: 202047042390)

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TTR® (Taiheiyo Thermal Reactor) for Sludge Drying

Patent Application Status (as of Jan. 01, 2023)

Country	Application status	
Indonesia	Sept. 24, 2020 Aug. 2, 2021	Examination claim (Application number: P00202006983) Publication
Vietnam	Oct. 1, 2020 Aug. 2, 2021	Examination claim (Application number: 1-2020-05641) Publication
USA	Sept. 21, 2020 Jan. 14, 2021	Examination claim (Application number: 16/982,894) Publication
Germany	Aug. 5, 2020	Examination claim (Application number: 19782065.7)
Italy	Aug. 5, 2020	Examination claim (Application number: 19782065.7)
France	Aug. 5, 2020	Examination claim (Application number: 19782065.7)
Turkey	Aug. 5, 2020	Examination claim (Application number: 19782065.7)
Others	Processing	

Taiheiyo Engineering

ABOUT OUR COMPANY

TEC in numbers

140+

years of experience in the cement industry through our parent company Taiheiyo Cement

TAIHEIYO CEMENT GROUP

1976

year of foundation of Taiheiyo Engineering Corporation

Taiheiyo Engineering

100+

million dollars in annual sales (FY 2020)

176

employees in total (FY 2021)

2

offices:
Tokyo Headquarters & Fukaya Office

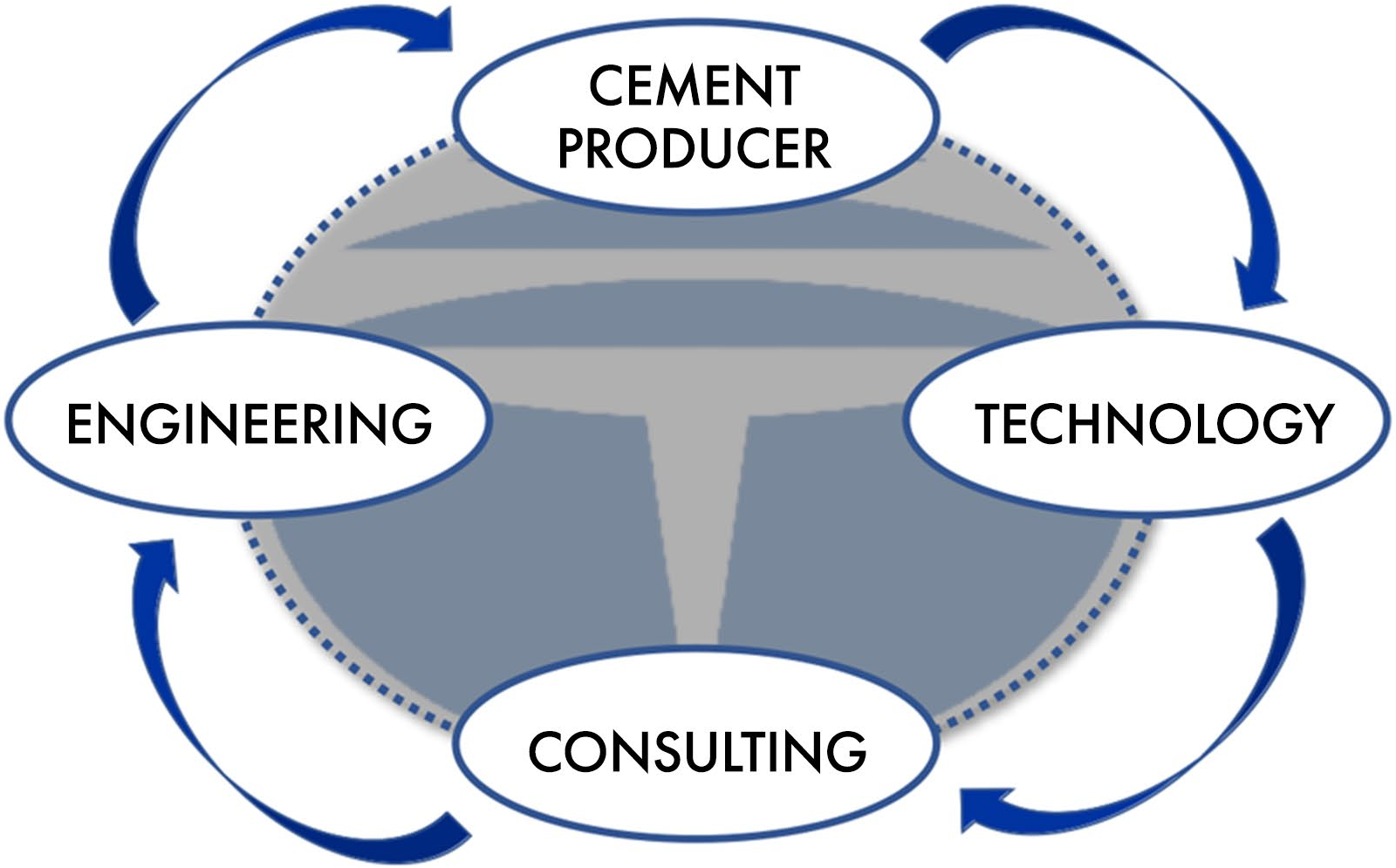
▲Tokyo Headquarters ▲Fukaya Office

2000+

projects delivered in over 80 countries around the world

Taiheiyo Engineering

TEC uniqueness



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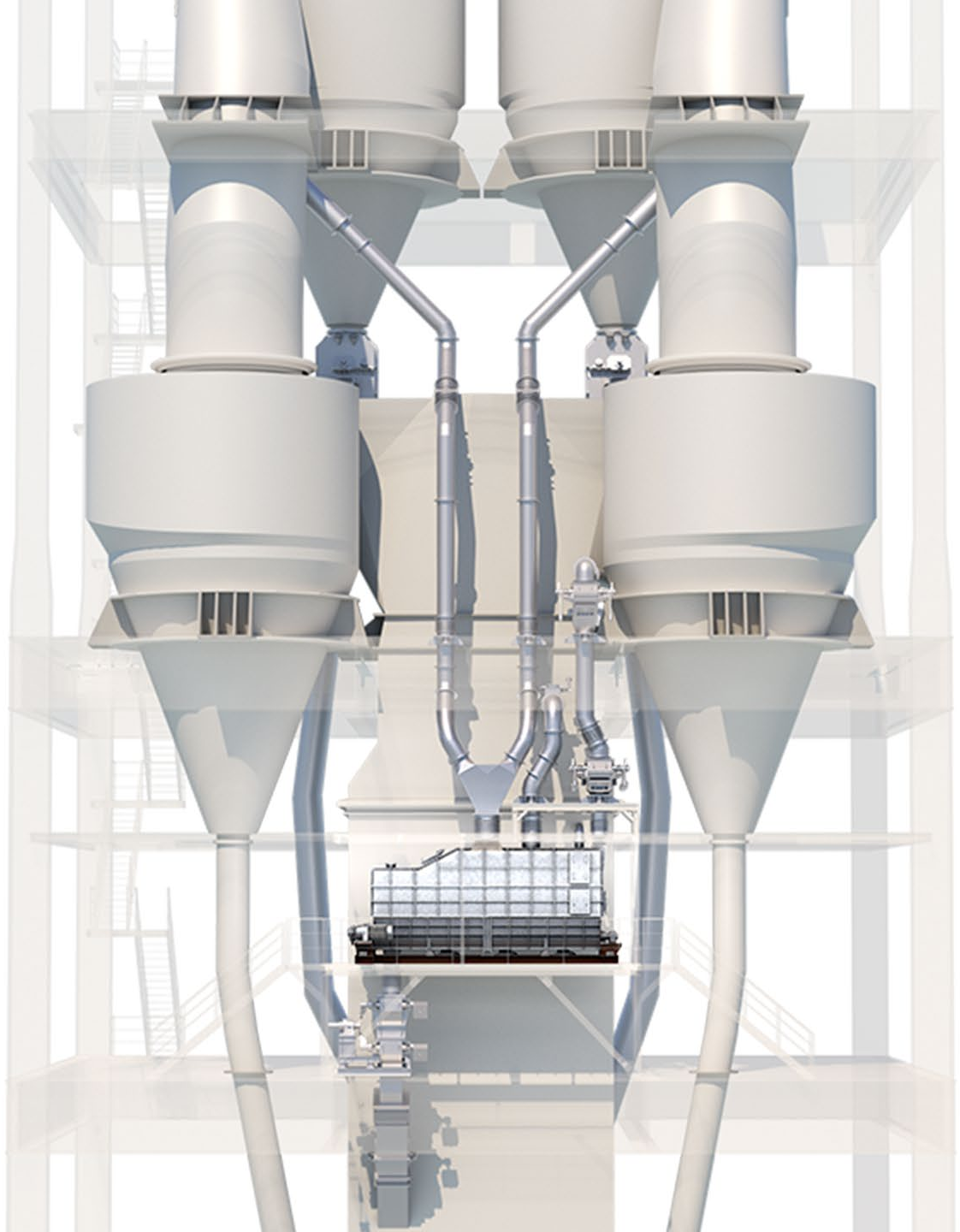

The leading solution you can trust.

Taiheiyo Engineering has set standards in the sustainable combustion operations. We are confident in solving your problems using our competitive edge in efficient factory apparatus.

THANK YOU

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