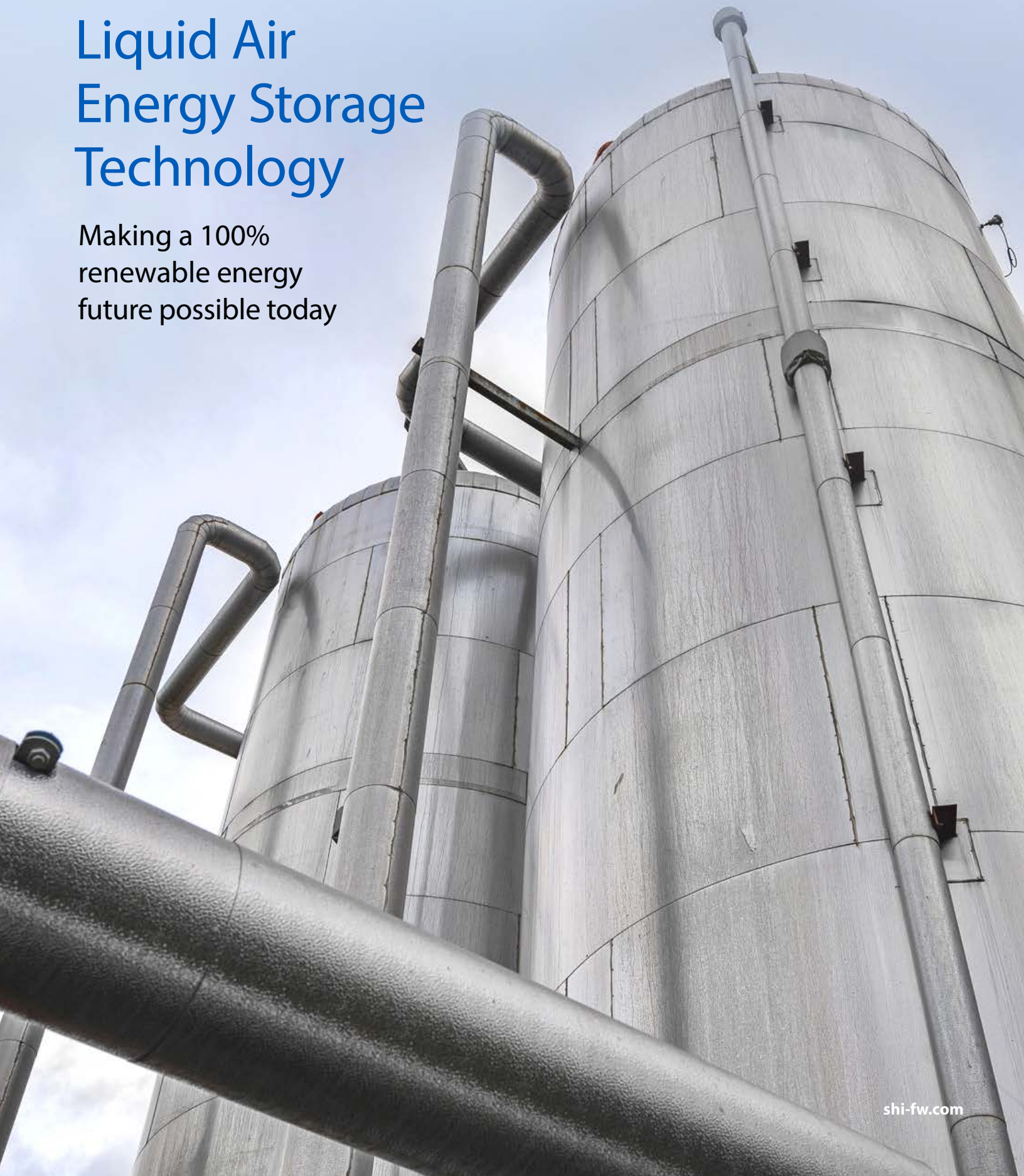
Sumitomo SHI FW | Highview Power

Liquid Air Energy Storage Technology

Making a 100% renewable energy future possible today



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Cryogenic Energy Storage

Clean, cost-efficient, flexible and reliable

CRYOBattery™ technology makes use of a freely available resource—air—which is cooled and stored as a liquid and then converted back into a pressurized gas which drives turbines to produce electricity. Just as pumped-hydro harnesses the power of water, the CRYOBattery unleashes the power of air. It is the only long-duration energy storage solution available today that offers multiple gigawatt hours of storage, is scalable with no size limitations or geographic constraints, and produces zero emissions. Cryogenic energy storage systems are a cost-competitive clean energy storage solution for large scale, long-duration applications.

We believe energy storage technology is the game changer that can truly unlock the full potential of renewable energy by making renewable energy as dependable and affordable as conventional power.

Our partnership with Highview Power will allow us to bring gigawatthours of energy storage to the market with the full flexibility to be built practically anywhere it is needed.

Sumitomo SHI FW will lead the liquid air energy storage business within Sumitomo Heavy Industries, applying our technology development, engineering and global project delivery capability, to help our customers transform the world's energy infrastructure toward a clean and sustainable energy future.

30-40 year lifespan
with mature components

Proven technology
with established supply chain

Zero emissions
and benign materials

50+% efficiency

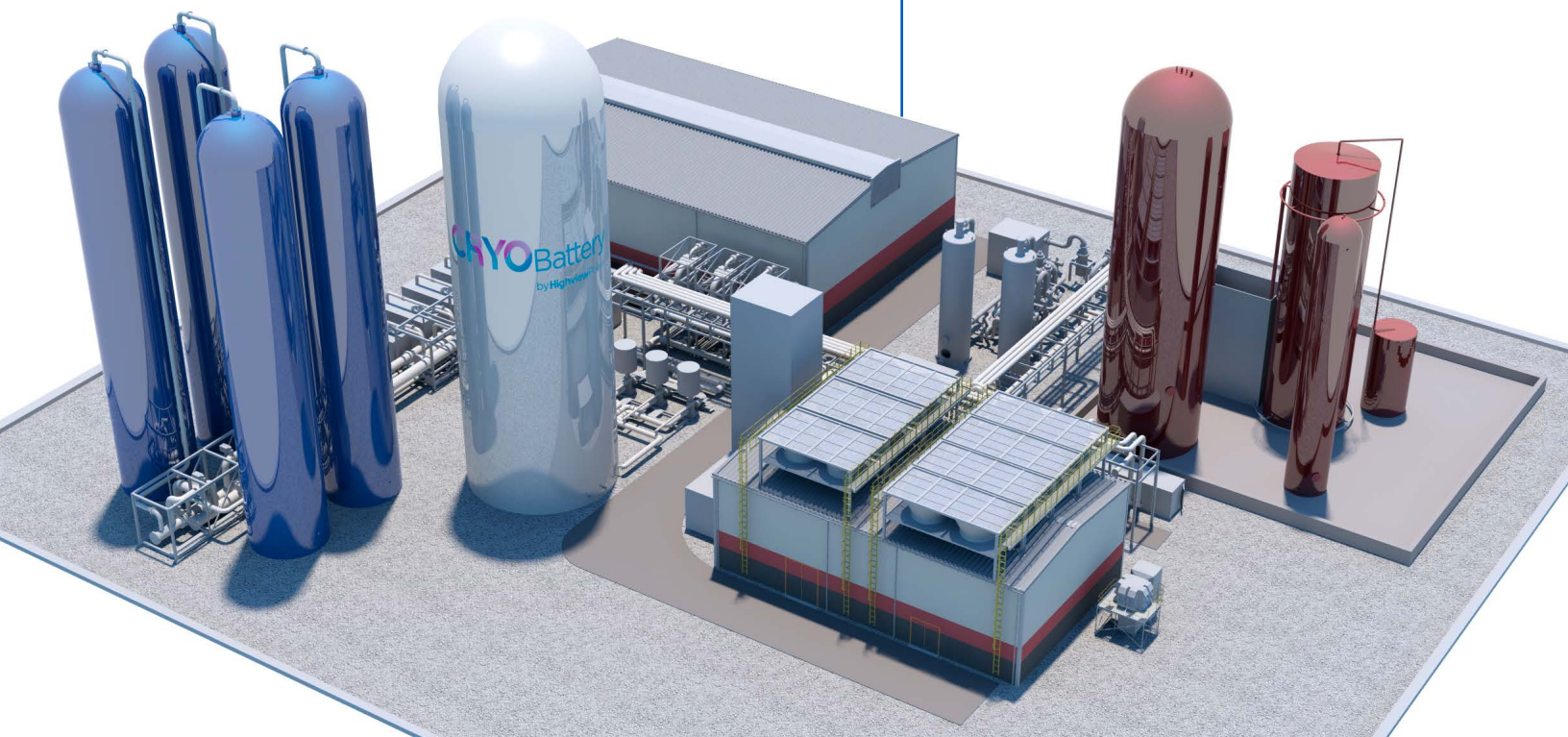
Cost competitive
locatable technology at utility scale

Build anywhere
with no geographical constraints

Zero water impact
no external cooling

Giga-scale
scalable to multiple GWs and GWhs

Symbiotic
Integrates with industrial waste heat/cold sources to further enhance facility efficiency



The energy market is transitioning to renewable power—energy that is clean, but intermittent. Highview Power's cryogenic solution enables this transition by delivering performance and reliability equivalent to traditional sources of power while releasing zero emissions and storing energy for up to multiple weeks.

Long-duration energy storage

Applications of Highview Power's Cryogenic Systems

Highview Power's CRYOBatteries are adaptable and can provide services at all levels of the electricity system: supporting power generation, providing stabilization services to transmission grids and distribution networks, and acting as a source of backup power to end users.

How it works

Our patented cryogenic technology draws on established processes from the turbo machinery, power generation and industrial gas sectors.

Stage 1. Charging the system

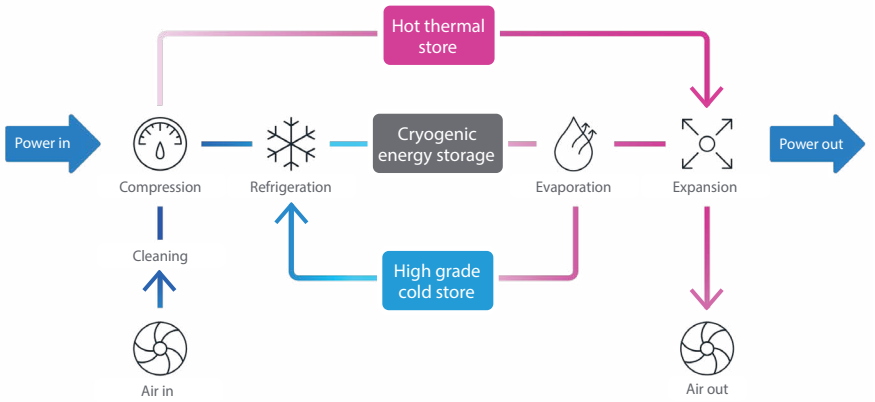
An air liquefier uses electrical energy to draw air from the surrounding environment, the air is cleaned and cooled to subzero temperatures until it liquifies. 700 liters of ambient air become 1 liter of liquid air.

Stage 2. Energy store

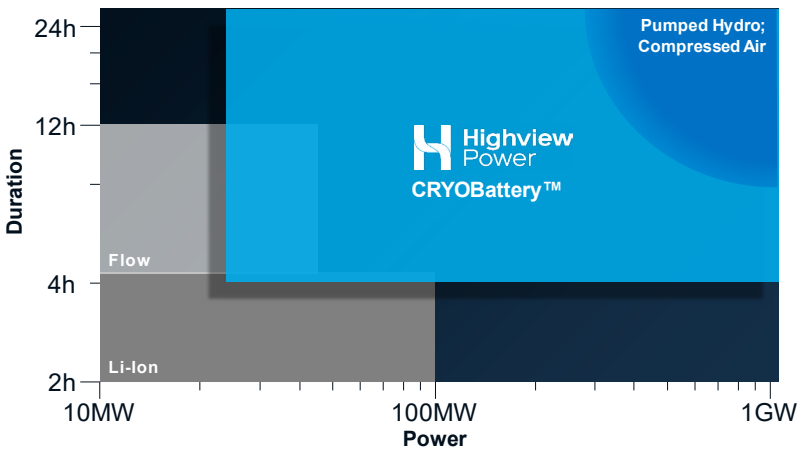
The liquid air is stored in insulated tanks at low pressure, which functions as the energy reservoir. Each storage tank can hold a gigawatt hour of stored energy.

Stage 3. Power recovery

When power is required, stored heat from the charging system is applied to the liquid air via heat exchangers and an intermediate heat transfer fluid. This produces a high-pressure gas that drives a turbine and generates electricity.



Charge	Store	Recover
Turning ambient air into liquid	Storing the liquid air in tanks	When needed, expanding the liquid air into a gas which generates electricity



Power generation

- Firming renewables
- Energy arbitrage
- Peak shaving
- Improved heat rate

Transmission

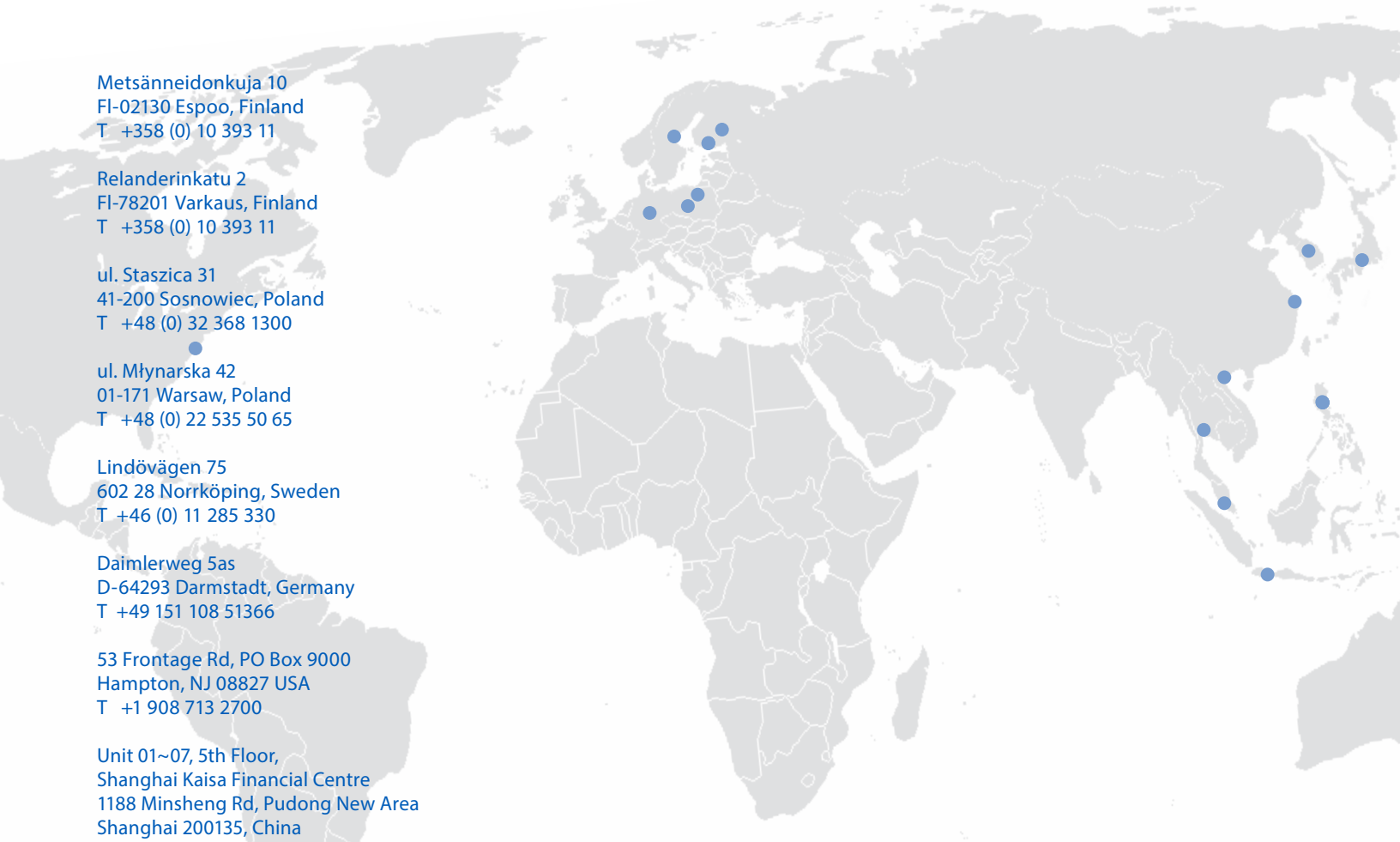
- Transmission constraints
- Inertia services
- Responsive flexibility services
- Voltage support

Distribution

- Reactive power
- Voltage support
- Local security
- Distribution losses

End users

- Power reliability
- Energy management
- Waste heat recovery
- Waste cold usage



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Our vision is to provide sustainable energy solutions through decarbonization, decentralization and digitalization of the energy industry. Our capabilities cover customer needs in the fields of power generation utilizing circulating fluidized bed (CFB) technologies, long term energy storage, and related network services. We continuously broaden our portfolio of products and services by advancing our in-house technologies and developing further alliances with new partners.

Our Values

Respect for people.
Valuing and inviting differing views and ideas

Committed to customers.
Exceeding expectations and providing value

Safety, integrity and teamwork.
Incorporating ethics in everything we do

Ownership of results.
Personally ensuring that success is achieved

Passion to innovate and grow.
Setting challenging goals for growth

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