arabelle solutions
EDF GROUP

Power for the Next Generation

Arabelle Solutions Technology and Services

Low-carbon electricity for today, tomorrow and for future generations

> We are focused on maximising the availability of low-carbon electricity by delivering turbine islands for nuclear power plants and optimizing the installed base to deliver more terawatt hours.
>
> Around a third of the world's nuclear power plants rely on our turbine island technologies and services to generate reliable, uninterrupted power.

Catherine Cornand
Chief Executive Officer
Arabelle Solutions

Arabelle Solutions is at the forefront of the global shift towards reliable, low-carbon electricity production, providing world-class nuclear turbine island technologies and life-cycle services.

Our expertise is built on continuous design innovation and manufacturing turbine island technology, ranging from the world's most powerful steam turbine in operation to modular designs optimized for Small Modular Reactors.

Arabelle Solutions also provides essential services to maintain, maximize and extend the lifetime of nuclear power plants around the world.

Whether servicing existing plants, supplying specialist equipment or delivering full turnkey turbine island solutions – safety is always our top priority as we focus on maximizing the efficiency and reliability of nuclear power plants.

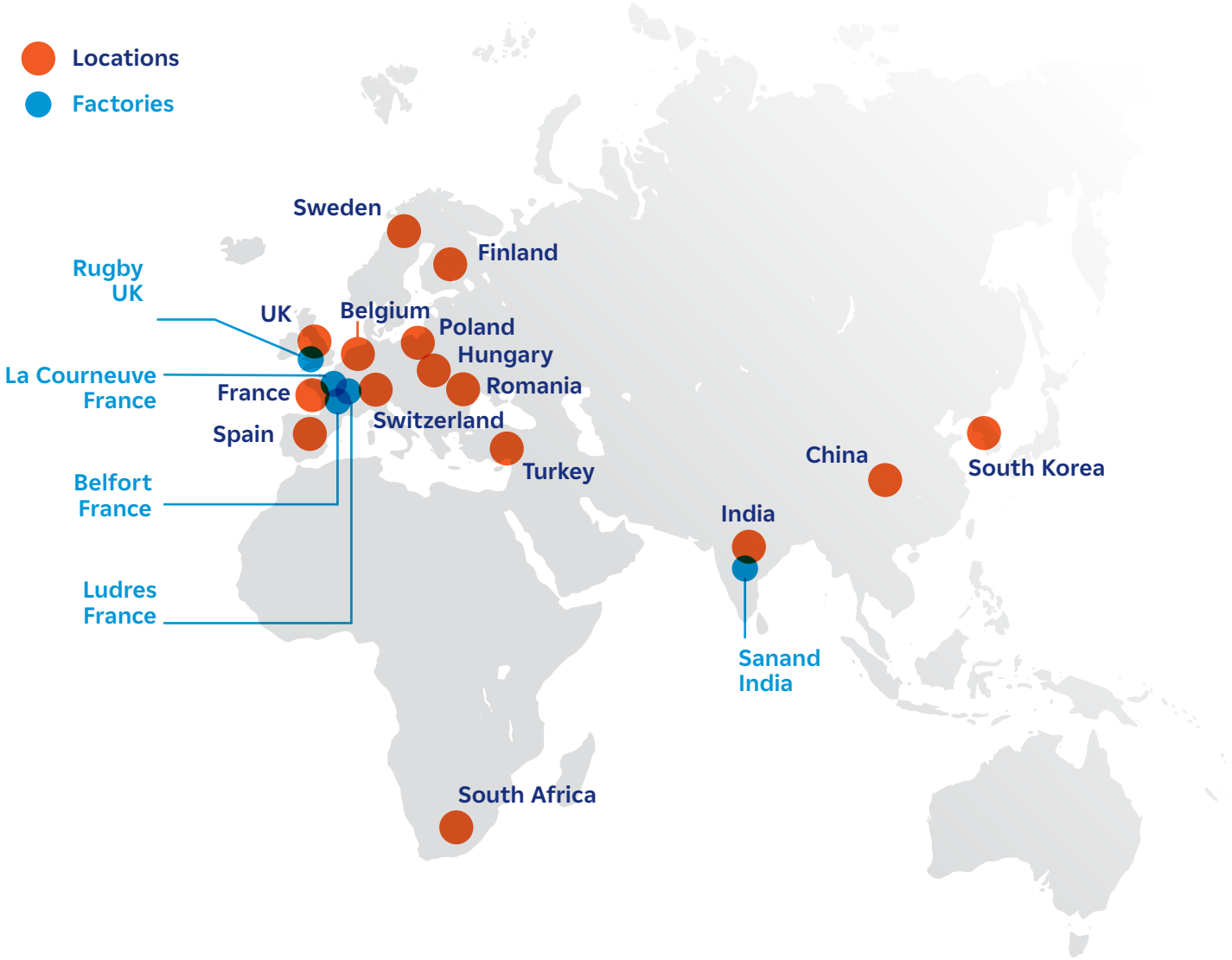
~1/3
Global nuclear installed base

~100
Units serviced annually

1750 MW
Most powerful steam turbine in operation

Strong international expertise

Around 3,500 employees working across 16 countries with unwavering commitment to safety & quality.



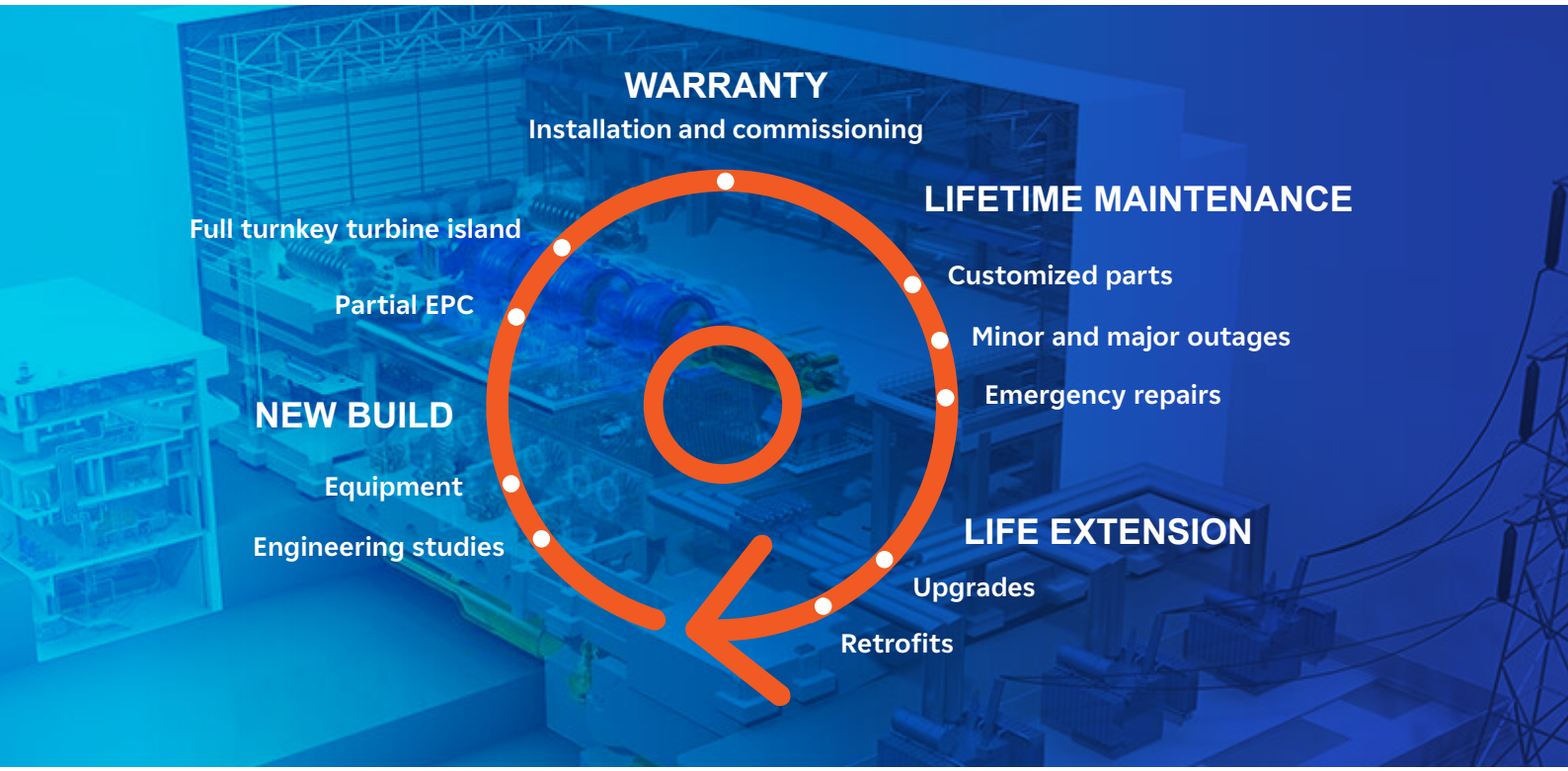
Nuclear safety culture across organization

Safety embedded in supply chain

ISO 9001 & ISO 19443 certificates

Meeting turbine island needs

A multi-reactor approach partnering with customers throughout the turbine island lifecycle.



New build and equipment

From individual components to turnkey turbine islands, our equipment, from steam turbines to generators, heat exchangers to pumps, is suitable for most reactor types.

Multi-year agreements

Tailored multi-year maintenance agreements deploy smart outage scope definitions using digital analytics for anomaly detection and predictive analytics.

Services & lifetime extensions

Our engineers repair, inspect and upgrade power plants across Europe, Asia and Africa, extending their lifetime and improving output. Field services experts are available 24/7 - 365 days a year.

Supplier network

Global network of over 1,300 suppliers providing local knowledge and resilient supply chains.

Our technology

LEARN MORE

Tailored solutions for most reactor types with an electrical output from 50 MW to 1,900 MW.

Turbine hall (900 MW class), Bugey power plant. Source: EDF

Steam Turbines

- Arabelle series for large reactors
- STF-N series for small & medium reactors

Generators

- Water- & hydrogen-cooled for medium & large reactors
- Air- & hydrogen-cooled for small & medium reactors

Heat Exchangers

- Moisture separator reheaters
- LP and HP heaters & condensers

Nuclear Machine Controls

- Turbine and generator excitation control & protection
- Digital solutions & cybersecurity

Pumps & Balance of Plant

- Feedwater, cooling water, extraction & vacuum pumps
- Mechanical and electrical BoP

Turbine Hall Integration

- Tailored solutions aligned for optimal performance and compatibility
- Up to full turbine islands on a turnkey basis

Steam Turbines

LEARN MORE

From our flagship Arabelle steam turbine, the world's most powerful in operation, to modular designs optimized for SMRs.

Turbine blades of an Arabelle low pressure turbine rotor

Suitable for most reactor types from 50 - 1900 MW

- Fully adaptable steam path
- Deployable to any location and 'cold end' condition
- Reaction and impulse blading technology
- Modern and high efficiency last-stage blades optimized for a wide range of back pressures
- Compact modules for reduced footprint

Featuring where appropriate

- Single bearing between each turbine module or integrated pedestals
- Welded rotor for enhanced lifetime

Our portfolio

TURBINE	APPLICATION	STEAM PARAMETERS	OUTPUT RANGE
Arabelle 1700	half speed	Up to 75 bar/ 300°C	1,200 - 1,900 MW
Arabelle 1000	half speed	Up to 75 bar/ 300°C	700 - 1,300 MW
STF-N700	full speed	Up to 75 bar/ 300°C	500 - 800 MW
STF-N600	full speed	Up to 300 bar/ 630°C	350 - 600 MW
STF-N400	full speed	Up to 185 bar/ 600°C	250 - 550 MW
STF-N200	full speed	Up to 185 bar/ 600°C	100 - 350 MW
STF-N100	full speed	Up to 165 bar/ 565°C	50 - 130 MW

Generators

LEARN MORE

Our generators offer reliability, a high operating performance and adaptability to different nuclear reactor power output levels and cooling mediums.

Generator stator core

For small, medium and large reactors

- Versatile air-, hydrogen- or hydrogen & water-cooled generators designed for a power output range from 50 to 2,235 MVA.
- Suitable for 50 Hz and 60 Hz grids.

Decades of innovation

- Proprietary stainless steel cooling tubes and water boxes of the stator winding bars prevent copper oxide build-up.
- Self-retightening and end-winding support for lower maintenance costs
- The concave-convex wedges are uniquely engineered to sustain pressure on the stator bars.

Our portfolio

GENERATOR	COOLING TECHNOLOGY	OUTPUT RANGE
GIGATOP 4P	hydrogen & water	1,100 - 2,250 MVA
GIGATOP 2P	hydrogen & water	510 - 1,400 MVA
TOPGAS	hydrogen	300 - 750 MVA
TOPAIR	air	120 - 400 MVA
TOPACK	air	50 - 170 MVA

Output range for 50Hz & 60Hz combined

Heat Exchangers

LEARN MORE

Our century of heat exchanger expertise is reflected in a global installed base.

Our equipment is adaptable to a wide range of reactor arrangements, system designs and sizes, for nuclear power plants up to 1,900 MW electrical output.

MSR in Chooz power plant. Source: EDF

Moisture separator reheaters

- Track record of high reliability, thermal cycle efficiency and maintenance for a multi-generational product
- Configuration and technical parameters designed for increased power output
- Operational excellence across extensive installed base of 200 units, with the first-generation MSRs still in operation today

Condensers

- Proprietary tube bundle design and performance track record
- Designed to handle turbine and steam generator overloads and variations in cooling water temperature
- Highly efficient tube bundles for any size power plant

Pumps

LEARN MORE

100 years of expertise covering all pumps and pump-module needs.

We are a leading manufacturer of large pumps and pump modules with deep technical expertise, an extensive portfolio and global reputation for delivering to the highest international standards.

With more than 5,000 large pumps installed worldwide, our pumps are designed for efficiency, reliability, and robustness.

Our pump portfolio includes

- Main cooling pumps
- Feedwater pumps
- Extraction & recovery pumps
- Vacuum pumps

Part of the concrete volute pump

Nuclear Machine Controls

LEARN MORE

Fully integrated hardware and software solutions for protection and control - from individual equipment up to the entire turbine island.

Arabelle Solutions offers hardware design and manufacturing, along with software configuration for instrumentation and control systems of steam turbines, generators, generator excitation systems and auxiliaries. Services include troubleshooting, repairs, upgrades, and proactive obsolescence management.

Digital solutions

Combine equipment and nuclear control expertise.

- Diagnostic and predictive maintenance
- Regulation and grid codes compliance with advanced simulation tools
- Increase operational flexibility and reduce outage times

Cybersecurity

Embedded cybersecurity provides a multi-layer protection designed to meet all major standards and regulations, including IEC 62443, IEC 62645 for nuclear facilities, IAEA NSS 17, and the NIS 2 Directive.

Our SMR portfolio

LEARN MORE

Our compact modular turbine island designs leverage six decades of innovation and are suitable for most GEN III+ and GEN IV Reactors, producing between 50 to 600 MW.

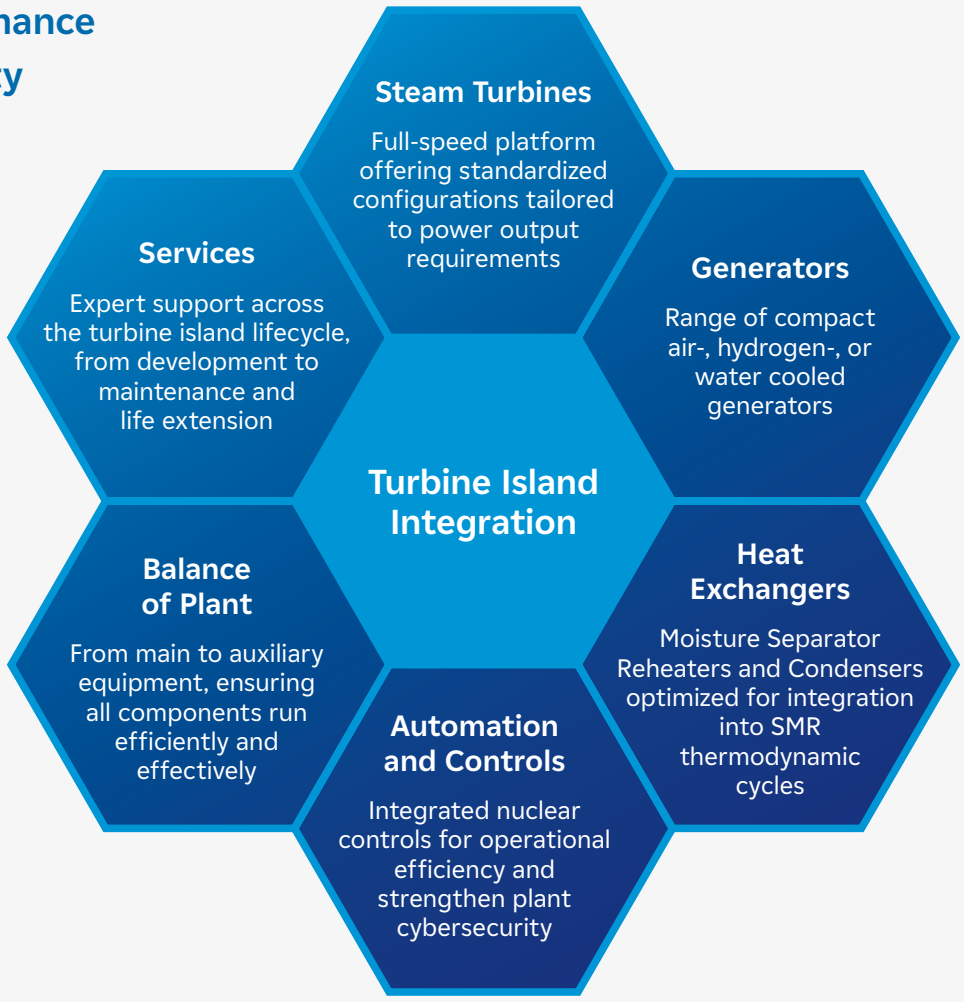
Standardised and compact

High factory pre-assembly levels enable simplified installation, reduced erection times and ease of maintenance.

Reliability and efficiency

State-of-the-art technology enhanced for performance, reliability and optimal efficiency and compatibility across components.

Optimal performance and compatibility



Case Study: A new nuclear power station for the UK

To secure the UK's energy future and meet its legally binding emissions reduction targets, the British government decided to build the first new UK nuclear power plant in a generation.

Challenge

With a significant proportion of the UK's older nuclear power stations expected to close by 2030, the new nuclear power plant Hinkley Point C (HPC) in Somerset is set to provide around six million homes with low-carbon electricity. Arabelle Solutions will supply two turbine islands for HPC, capable of producing a total output of 3.2 GW.

Solution

To meet the required power output, Arabelle Solutions' engineers increased the turbine efficiency and further optimised the backpressure. This included designing a 75-inch last-stage blade, the largest ever built. The Arabelle Solutions turbines, generators, pumps, heat exchangers and other equipment are all integrated and aligned to maximize output and reliability for HPC.

Hinkley Point C

3.2 GW
joint turbine output

75-inch
last-stage blade

30k l/s
Flow rate per concrete volute pump

60 years
anticipated lifespan

Arabelle for HPC (1770 MW) at Belfort factory

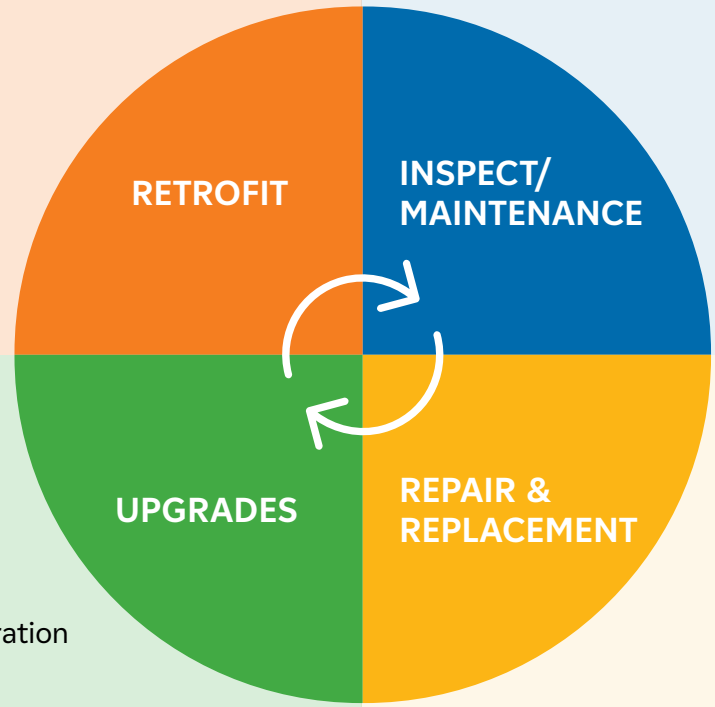
Stator arriving at Hinkley Point C

Our services

LEARN MORE

Arabelle Solutions is committed to servicing, maintaining and extending the lifetime of its own and other OEM turbine island equipment.

- Steam path retrofit
- Generator replacement
- MSR retrofits
- Control systems and more



- Condition based assessments
- Robotic inspection
- Multi-year agreements

- State-of-the-art blading
- Stator stainless steel technology
- Cybersecurity integration

- Workshop & on-site support
- Replacement parts

International field services

- 100+ major and minor outages supported annually
- 160+ nuclear steam turbine modules retrofitted
- International rapid-response teams are available 24/7 - 365 days a year
- 90+ other OEM brands supported by industry experts
- Comprehensive portfolio of specialist parts that are thoroughly tested and backed by warranty
- On-site or in-workshop repairs across Europe, Asia & Africa

Partnering with customers

Nogent-sur-Seine nuclear power plant Source: EDF

Overhaul planning services

- Advanced overhaul planning and execution services for most steam turbine, generator and other nuclear turbine island equipment.
- For planned maintenance or emergency events requiring a rapid assessment the team ensures all components and experts are in place.

Multi-year agreements

- Tailored multi-year maintenance agreements provide customized programs that protect the equipment along its lifetime and improve plant operation.
- Arabelle Solutions deploys smart outage scope definitions, based on the operational history and uses digital analytics for anomaly detection and informing maintenance plans.

Case Study:
Cernavoda outage management

Maintenance and generator rotor replacement at Cernavoda nuclear power plant, Romania completed ahead of schedule in 22 days and 19 hours.

Challenge

Scope included comprehensive inspection, maintenance and new generator rotor, excitation maintenance plus vibration survey and tests as well as coordination with other suppliers providing maintenance at the same time.

Solution

Arabelle Solutions conducted detailed planning ahead of outage with full client engagement throughout the process and a 'team approach' with sub-contractors.

10 months pre-outage: Resource planning, sub-contracts inaugurated as well as desk-top reviews to identify optimization opportunities which continue through to actual delivery.

Inspection of LP turbines and some valves, generator overhaul with rotor replacement, excitation maintenance and more

Rotor replacement at Cernavoda power plant Source CNE

Case Study: Daya Bay retrofit

In 2023/24 extensive work to retrofit the two units was completed in only three months per unit, followed by successful grid synchronization and testing.

Challenge

After three decades of safe operations, the Daya Bay Nuclear Power Plant in China was seeking to boost the electricity output and extend the operational lifespan of their steam turbines.

Solution

Arabelle Solutions designed an improved LP module flow path and manufactured the required equipment, including six sets of rotors, inner casings, blade carriers and complete bearings. Despite the challenges, including the COVID pandemic and supply chain constraints, the equipment was delivered to site on time.

New LP blading, six sets of rotors, inner casings, blade carriers and complete bearings

Turbine hall at Daya Bay power plant

www.arabellesolutions.com