Wärtsilä Energy 2025

Towards a 100% renewable energy future

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Decarbonising the energy sector

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The decarbonisation of energy is accelerating

The world is on a narrowing path to achieving net-zero emissions by 2050. The power sector is pivotal in global decarbonisation efforts, demanding rapid, large-scale transformation.

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Market trends in the energy sector

The energy transition today is shaped by the growing need for electricity, decarbonisation targets and need for flexibility in more complex power systems.

Macro drivers

- Growing need of electricity. Electrification of transport, buildings and industrial sectors
- Increased need for energy security and supply chain diversification
- New regulations and policies to accelerate the energy transition
- Digitalisation to optimise energy use and costs

Need for technologies and solutions

- Growing investment in the energy transition
- Increased need for short-term and longer-term balancing solutions
- Renewables becoming main source of power and gradual replacement of coal
- Energy storage technologies grow and develop rapidly
- Power systems becoming more complex
- Growing sustainable fuel supply

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The energy sector plays a significant role in global decarbonisation

In order to slow down global warming and keep us on track of IPPC's (Intergovernmental Panel on Climate Change) 1.5 °C limit, the world needs to reach net zero by 2050 – only 25 years from today.

Today, the electricity and heat sector stands for 38% of global CO_2 emissions – decarbonisation will need to accelerate rapidly.

The electricity and heat sector's emissions need to decrease by

42%

already by 2030 compared to 2023, if we want to achieve net zero by 2050.

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Source: Emissions Database for Global Atmospheric Research 2024 and IEA World Energy Outlook 2024

As the amount of renewables increases, flexible balancing solutions are needed to ensure stability and reliability.

Renewable energy capacity is expected to grow 8x by 2050. To achieve net zero by 2050, renewables should provide 89% of the world's electricity supply.

As the share of renewables increases in power generation, the volatility of the system will surge. Balancing solutions are needed.

Percentage of renewable generation

* IEA World Energy Outlook 2024 (Net Zero Emissions by 2050 Scenario)

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Balancing power is needed to support renewables

Our recent global power system modelling analysis shows the various benefits of adding balancing power plants to create the optimal power systems of the future, in comparison to a pathway where only renewables and energy storage are added.

When comparing the two pathways, by 2050 we could see:

€65
trillion reduced costs

21%
reduced emissions

88%
less wasted energy

50%
less renewable capacity and land needed

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The blueprint for sustainable, reliable and affordable energy already exists

We already know the solutions needed to transition to optimal and reliable net-zero power systems

- Wind and solar
- Energy storage
- Flexible engine power plants
- Sustainable fuels

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Wärtsilä Energy

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Our vision: Towards a 100% renewable energy future

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We are at the forefront of the transition towards a 100% renewable energy future.

We help our customers and the power sector to accelerate their decarbonisation journeys through our market-leading technologies and power system expertise.

Our solutions include flexible engine power plants, energy storage and optimisation technology, and services for the whole lifecycle of our installations.

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Wärtsilä Energy in numbers

Globally recognised leader

in engine power plant & energy storage installations, with 190 years of experience as a company

180

Countries delivered to

4 900+

Employees

79 GW

Power plant capacity delivered

130+

Energy storage installations

30 %

Of operating installed base under service agreements

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Our market-leading solutions for the transition to a 100% renewable energy future

- Engine power plants
- Energy storage and optimisation
- Services

© WÄRTSILÄ

Our track record in 180 countries around the world

Americas

Power plants delivered:
19.7 GW

Operational plants under service agreement:
32 %

Energy storage*:
13 GWh+

Europe

Power plants delivered:
10.9 GW

Operational plants under service agreement:
18 %

Energy storage*:
2.2 GWh+

Africa

Power plants delivered:
7.6 GW

Operational plants under service agreement:
42 %

Energy storage:
18 MWh

Middle East & Asia

Power plants delivered:
40.8 GW

Operational plants under service agreement:
38 %

Energy storage*:
6.7 GWh+

*contracted, under construction, operational

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Choosing the right flexible technologies for power systems

Ensuring a continuous supply of electricity is a constant balancing act, where every second counts. When balancing becomes key to ensuring a stable and reliable supply of electricity, it is important to use flexible technologies.

Renewables need to be balanced by

Energy storage +

Flexible engine power plants

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How does a high-renewable, optimised and flexible power system work?

1. Renewables provide the bulk of energy. Battery energy storage is recharged when renewable energy is available.

2. But when the sun sets and wind stops blowing, other solutions must plug the gap. Energy storage provides sub-second and minute-level shifting and balancing.

3. Engines are also needed for balancing on a minute, daily and seasonal basis. They provide additional power when neither renewables nor storage are available and when demand is highest.

Continuous balancing is needed from both energy storage and balancing power plants. They work together to cover sub-second, minute, daily and seasonal variations to ensure a steady supply of electricity when renewable output fluctuates.

4. Intelligent energy management software can optimise the whole system and its assets.

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Responding to different flexibility needs with the optimal technology

An energy system based on renewables requires multiple forms of flexibility to manage variability. Flexible technologies, such as flexible engine power plants and energy storage technology, can balance the intermittency of wind and solar power to ensure that power supply always matches demand.

Energy storage technology is designed to respond to grid stability disruptions in milliseconds.

Engines are needed for balancing on a minute, daily, and seasonal basis. They can provide additional power when neither renewables nor storage are available and when demand is highest.

© WÄRTSILÄ

Balancing solutions will provide the necessary balancing power to keep the grid stable

Illustration of high-renewable power system during one day, MW

When the share of renewable energy exceeds 20% in power systems, intermittency becomes a challenge, and this is where grid balancing becomes crucial.

Flexible balancing power capacity, like engines and battery energy storage, can quickly react to the changes in the volatile energy system – providing the needed flexibility and stability to ensure the maximum utilisation of renewables.

Battery energy storage can provide millisecond and second level balancing such as frequency control ancillary services, and smoothing/shifting of renewable energy

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Decarbonising the energy industry with renewables and balancing power

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Decrease running hours of inflexible power plants.

Continue adding renewables supported by flexibility.

Sustainable fuel options become widely available.

1

Adding more renewables into the power mix.

2

Adding flexible engine power plants & storage to balance the intermittency of renewables.

3

Phasing out inflexible power plants running on coal.

4

Accessing sustainable fuels and converting all remaining power plants to run on them.

5

A 100% renewable energy future is here

It is based on renewables, energy storage, and balancing engine power plants running on sustainable fuels.

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Public

Decisive actions from the entire power sector are crucial to achieve a low-cost and low-emission energy transition

Instead of only focusing on the acceleration of renewable build up, a holistic system-level thinking must be in place when investing in and planning power systems. Strategic planning for future power systems and capacity additions should be guided by data to achieve a rapid transition and a cost-optimal technology mix for affordable electricity.

Our calls to action for the power sector:

Enable an accelerated expansion of renewables and balancing technologies

Redesign electricity markets to incentivise flexibility

Choose the right future proof technologies and prepare for sustainable fuels

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Our solutions and services for flexible power

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Engine power plants

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Engine power plants for reliable energy

Our engine power plants offer flexible, efficient and reliable power generation in a changing energy landscape.

Engine power plants are the optimal power generation technology to ensure the stability and reliability of power grids that are using increasing amounts of renewable energy.

Ramp up in just 2 minutes,
no minimum uptime or downtime

High performance can be maintained across a wide range of outputs, even in extreme weather conditions when balancing renewables

Future-proof and can run on sustainable fuels, once they become available – enabling 100% renewable energy systems.

© WÄRTSILÄ

Why engine power plants drive the energy transition

Flexible operations

With unbeatable flexibility, engine power plants can go from start-up to full load in as little as two minutes without minimum uptime or downtime. Unlimited starts and stops have no impact on maintenance.

High performance

We offer the highest available simple cycle energy efficiency of current technologies, 50% or more. With our technology, you can operate your plant on any operating profile without compromising efficiency.

Future-proof solutions

Engine power plants will operate on sustainable fuels to enable the final step towards a 100% renewable energy future. We constantly evolve our solutions offering to include upgrades, conversions and modernisation options.

© WÄRTSILÄ

Our engine portfolio for various applications and industries

Wärtsilä 31 platform

Wärtsilä 32 platform

Wärtsilä 34 platform

Wärtsilä 46TS platform

Wärtsilä 50 platform

© WÄRTSILÄ

Sustainable fuels will unlock a net-zero future

Our engines are already capable of using synthetic carbon-neutral methane and up to 25% vol. hydrogen blend with natural gas. In addition, we have recently launched the world's first large-scale 100% hydrogen engine power plant.

Whichever sustainable fuels become the leading choices in the future, our engines run efficiently and reliably regardless.

100%

Renewable energy future for power generation with sustainable fuels

© WÄRTSILÄ

Set for 30 sustainability targets

- We will become carbon neutral in our own operations by 2030.
- We will provide a product portfolio that will be ready for zero carbon fuels by 2030.

2020

2021: 100% H2 testing started

2023: H2 blending offered for gas engines

2023-25: Power plant concept exploration for methanol/ethanol & ammonia

2023-25: Marine customer deliveries of methanol, ammonia engines

2026: 100% H2-ready power plants ready for delivery

2030

2030: 25% reduction of suppliers' GHG emissions compared to 2024 baseline

2030: Zero carbon fuel product portfolio ready

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Wärtsilä at the forefront of research and development

Wärtsilä's Sustainable Technology Hub (STH) fosters innovation, collaboration, and production of green technologies. In the Technology Hub, we turn our decarbonisation vision into reality.

STH has ensured faster and broader testing capabilities that will cement Wärtsilä's position as the flexible engine technology forerunner. STH enables Wärtsilä to undertake top-notch research and innovate, develop, and pilot new solutions.

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Energy storage & optimisation

© WÄRTSILÄ

Energy storage plays a key role in our vision towards a 100% renewable energy future

Combining **15+ years** of industry expertise with a global footprint, we seamlessly integrate energy storage with our controls and optimisation software to provide visibility into critical energy systems and optimise multiple generation assets.

> We deliver **unsurpassed reliability, flexibility, & safety** to energy asset operators around the world.

Energy storage hardware

Controls & optimisation software

Lifecycle services

© WÄRTSILÄ

Built for excellence: Proven performance, unmatched safety

A legacy of innovation, delivering industry-leading solutions with a relentless commitment to safety and success

Unrivalled industry leadership

Decades of expertise in safe, efficient energy solutions that set the global standard

Unmatched project execution

Best-in-class track record of safe, on-time delivery, even amidst global supply chain challenges

Resilient, future-proof supply chain

Diversified partnerships and streamlined strategies for seamless, reliable delivery – worldwide

Advancing industry knowledge

Equipping customers, first responders, and communities with critical safety education & best practices

Proactive approach to noise mitigation

Advanced, customisable attenuation solutions and operational controls that can be tailored to specific project needs

© WÄRTSILÄ

Our energy storage system portfolio: Quantum

Providing unmatched flexibility and safety no matter your site or project requirements

Quantum

Modular energy storage system for smallest system footprint & deployment ease

Quantum High Energy (HE)

High Energy system with advanced safety features & enhanced energy density

Quantum2

Comprehensive energy storage system with global larger utility-scale application, market-leading safety, & efficient installation/delivery

Quantum3

Advanced AC block in optimal safety & logistics design with increased availability & long-term performance

© WÄRTSILÄ

Unlock the full potential of your energy assets with our industry-leading controls and optimisation software, GEMS

Real-time data and intelligent automation to optimise efficiency, enhance asset control, & maximise revenue streams

Proven at scale
Trusted in 130+ projects globally

Real-time optimisation
Adapt instantly to market shifts and energy prices to maximise returns

Total asset visibility
Monitor & control assets on-site and in the cloud

Unmatched security & reliability
Industry-leading cybersecurity & predictive diagnostics

Seamless integration & control
Manage & optimise individual assets or entire fleets to increase profitability

© WÄRTSILÄ

Lifecycle solutions to ensure the long-term performance of your energy storage system

Maintaining and optimising energy storage system performance is critical for your business success. The right combination of hardware, software, and services will ensure seamless system integration and optimisation for all stakeholders.

Our **Service+** solution is a suite of comprehensive energy storage lifecycle services ensuring returns on clean energy investments with a holistic, system-level approach – providing secured connectivity and guaranteed performance.

- **Software maintenance with remote support**
- **Limited warranty & performance guarantees**
- **Planned maintenance with predictable costs**
- **Comprehensive warranty & performance guarantees**

We are with you, all the way.

© WÄRTSILÄ

Your trusted partner in energy storage, combining proven reliability with future-ready innovation

- Unparalelled safety
- Asset optimisation
- Integrated solutions
- Reliability & maturity
- Bankability

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Lifecycle services

© WÄRTSILÄ

Services to ensure customer success

A reliable partner with best-in-class expertise is essential in securing your investments and optimising your power plant performance.

Lifecycle solutions
Maintain and optimise safe, reliable and sustainable operations:
Customised solutions from transactional services to long-term, outcome-based strategic partnerships

Lifecycle upgrades
Maximise performance and future-proof existing assets:
Fuel conversions and a broad range of engine and power plant upgrades and re-powering solutions to achieve highest possible reliability and fuel efficiency while lowering emissions

Remote operational support & data management
Reduce operational costs and prevent problems from occurring through data management and analysis:
Our Expertise Centres with highly-skilled specialists at your service 24/7, utilising state-of-the-art solutions to enhance your performance

© WÄRTSILÄ

Ensuring performance and competitiveness through our service offering

Increasing Wärtsilä's involvement guarantees optimised performance and secures the investment

Optimisation & outcomes
- Performance-based partnerships
- Decarbonisation services

Guaranteed performance
- Guaranteed asset performance
- Operation & maintenance

Maintenance & operational support
- Parts predict
- Optimised maintenance

Regular **Lifecycle upgrades** maintain reliability and lifecycle performance of the plant.

© WÄRTSILÄ

We want to excel in creating customer value

Lifecycle Services encompass performance and maintenance management as well as operational expertise, leading to safe, reliable, and environmentally sustainable operations.

30 % Of operating installed base under service agreements

1,000+ Upgrade projects delivered to Energy customers

92% of customers agree that Wärtsilä's products, solutions, and services overall provide good value for their business*

73 Net Promoter Score: an index ranging from -100 to 100 that measures whether customers would recommend a company's services to others*

*2024 Customer satisfaction survey results (Agreement customers)

© WÄRTSILÄ

Decarbonisation services: your partner in reducing CO_2 emissions

We leverage Wärtsilä's extensive power system modelling capabilities together with the full range of our market-leading solutions, including flexible grid balancing engines, energy management system, energy storage solutions, and lifecycle services.

- Reduce CO_2 emissions while ensuring power availability, reliability and cost efficiency of the microgrid
- Ensure competitiveness in the evolving energy market
- Achieve your business and sustainability goals with an outcome-based partnership

© WÄRTSILÄ

Power system modelling

© WÄRTSILÄ

Power system modelling expertise

At Wärtsilä, we help our customers to accelerate their decarbonisation journeys through market-leading technologies and power system expertise.

Using PLEXOS® software, we have completed more than 200 country and power system analyses globally, identifying the optimal power system designs to support the integration of renewables and reduce system operational costs and emissions.

© WÄRTSILÄ

Modelling the energy transition around the world

We have modelled over 200 power systems across different countries and regions.
Learn more in our white papers and reports.

Read: Crossroads to net zero – global modelling report

Read: Finland's power system outlook for 2027 & 2030

Read: Europe's energy future

Read: Rethinking energy in Southeast Asia

Read: Navigating the energy transition in Chile

Read: Pathways for Africa's energy future

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Our references

© WÄRTSILÄ

Engine power plant references

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Kazakhstan Caspian Offshore Industries (KCOI) – Kazakhstan

We will supply the engineered equipment for a new 120 MW power plant under construction in Kazakhstan. This will be the first hybrid project of its type to be implemented in Kazakhstan. The engine power plant is essential to enable a stable and reliable supply of electricity, and the Wärtsilä engines will efficiently regulate the frequency and voltage to ensure this reliability is achieved.

The order scope includes six Wärtsilä 46TS-SG gas-fuelled large bore engines, as well as mechanical and electrical auxiliary equipment.

This is a major hybrid power project in the Mangystau region, which in addition to the engine power plant, will comprise a 77 MW wind power plant and a 50 MW solar power plant.

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Tornion Voima – Finland

With a total capacity of about 43 megawatts, the engine power plant will be Finland's first to provide balancing capacity to the power system upon completion. With it, Tornion Voima will be able to guarantee electricity production during various disturbances and varying weather conditions.

© WÄRTSILÄ

Kentucky Municipal Energy Agency (KYMEA) – USA

- The 75 MW plant will operate with four Wärtsilä 50SG engines running on natural gas. The fast starting and stopping feature of the engines will provide the flexibility and rapid response to fluctuations in the availability of wind and solar power.
  - “The flexibility and reliability of the Wärtsilä 50SG engines provide the needed support to the ongoing transition towards a decarbonised power sector....the KYMEA project is a perfect example of this, and we are delighted to provide the technology that can deliver a sustainable energy solution to the utility.”
    - Risto Paldanius, Vice President, Americas at Wärtsilä Energy

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Our engines' grid balancing capabilities will allow seamless integration with increasing share of renewables

Protection from price volatility in electricity markets

The plant serves the current and future electric power and energy requirements of eleven Kentucky municipalities.

Newfound adaptability will make KYMEA Energy Center I a cornerstone in the transition to a more sustainable energy mix

© WÄRTSILÄ

Wärtsilä and AVK collaborate to deliver on-site power generation for data centres

Data centres are essential in ensuring businesses and organisations can store, process, and manage their data and operations securely and efficiently. To be efficient, data centres require a reliable and uninterrupted electricity supply.

Combining AVK's 30-year track record in power system design for data centres and Wärtsilä's leading expertise in designing and manufacturing high-efficiency medium-speed engines, we can ensure a reliable power supply for these critical operations

© WÄRTSILÄ

AGL Energy Limited – Australia

Improving energy reliability in South Australian power system with engine generating sets and energy storage

- The Wärtsilä engine generating sets provide the fast-start capability needed to rapidly respond to the fluctuations inherent to solar and wind power
- The flexible capacity provided by the advanced energy storage system, including the GEMS Digital Energy Platform and Quantum energy storage system, provides an efficient means for balancing the energy supply from renewables, thereby maintaining the grid's stability and reliability

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AGL is replacing old technology with renewables and adding flexible gas capacity and energy storage to ensure energy reliability

Wärtsilä delivered 211 MW flexible engine power plant that uses 28% less fuel and reduced GHG emissions by 25-50% compared to the predecessor turbine plant.

Wärtsilä's 250 MW / 250 MWh energy storage system will support the stability and reliability of the grid

The engine power plant and energy storage system will help Australia to decarbonise and transition towards a 100% renewable energy future

© WÄRTSILÄ

Centrica – UK

We were able to tackle the issues created by intermittent renewables, providing flexible balancing power with engines and stability to the system.

2 x 50 MW flexible balancing power plant

The biggest medium-speed gas-fuelled engine power plants in the UK, offering electricity for about 100,000 households in less than two minutes after they have been switched on.

© WÄRTSILÄ

swb Erzeugung CHP plant – Germany

A revenue-adding transition – Bremen switches from coal to gas

- The new CHP gas engine power plant offers heat and flexible baseload in the winter and shaves peaks in energy demand in the summer, all the while making great economic sense for its owners.
- The new power plant decreases swb's CO2 emissions by up to 75%, helping the state and city of Bremen in achieving its environmental goals.

9 x Wärtsilä 31SG with total output of 105 MW

Output for district heating 93 MW

The modern, clean, reliable and extremely efficient power plant solution provides the flexibility needed in the grid today

© WÄRTSILÄ

A2A Gencogas – Italy

Wärtsilä will support Italy's journey toward more sustainable energy systems with a natural gas fuelled 110 MW flexible power plant.

Our fast-starting engine technology will be used to balance the power system and ensure its stability as the share of renewables is increased.

© WÄRTSILÄ

Omaha Public Power District – USA

We were challenged to:

- Ensure sufficient balancing capability to deal with the intermittent nature of renewables production.
- Enable fast ramping up and down of power to deal with high price volatility and significant periods of negative pricing.

Our results:

- We landed a 10-year performance agreement for a 150 MW power plant that offers balancing power to ensure reliability of supply as the utility increases the share of solar and natural gas.

© WÄRTSILÄ

Mexicali Oriente & Altar – Mexico

600 MW of baseload energy to secure the system stability of the Baja California Peninsula

The 200 MW Altar plant and the 400 MW Mexicali Oriente plant are owned and operated by Comisión Federal de Electricidad (CFE), the Mexican state-owned utility.

Wärtsilä was able to deliver, build, and commission these two very large power plants on time and in well under two years from receipt of the order. The plants were delivered on June 2023.

The Mexicali Oriente plant operates with 24 Wärtsilä 50DF dual-fuel engines fuelled by natural gas

The Altar plant operates with 22 Wärtsilä 34DF dual-fuel engines currently fuelled by diesel

These plants are important for the northwest region of Mexico. Electricity demand during the summer months in the Baja California Peninsula grows significantly as temperatures can rise to as much as 50 degrees C.

© WÄRTSILÄ

Energía del Pacífico – El Salvador

Providing about one third of the country's electricity supply

- The 378 MW power plant is the largest and most efficient power plant in El Salvador and the first in Central America to use liquefied natural gas (LNG).
- This project produces the cleanest thermal electricity in El Salvador, by producing 30% less carbon emissions and 99% less sulphur dioxide emissions.
- EDP is also reducing electricity prices in the country as LNG is cheaper than liquid fuel.
- The power plant comprises 19 Wärtsilä 50SG engines and a steam turbine in a highly efficient Flexicycle combined cycle arrangement.
- The Dry Flexicycle technology with a closed-loop cooling system has zero water consumption, which is a major environmental benefit.

© WÄRTSILÄ

WEC Energy Group – USA

A giant leap towards decarbonisation: World's first-of-its-kind blended hydrogen test

Together with WEC Energy Group we successfully completed hydrogen blend tests on an unmodified Wärtsilä engine. The results were outstanding: engine efficiency improved when running on a 25 vol% hydrogen blend, while also reducing greenhouse gas emissions. This was a world's first, testifying that Wärtsilä's technology can support the decarbonisation of the energy industry.

25 vol%

hydrogen blend with 95% engine load

9.1%

CO2 reductions at 95% load

© WÄRTSILÄ

Ponta Negra – Brazil

Long-standing relationship and commitment to the environment with Wärtsilä engines

- Gas Conversion power plant, a major upgrade that lowers the costs and emissions while improving reliability in the North of Brazil.
- By converting to pure gas and signing up to long-term service agreements the power plants will lower emissions, save fuel costs, and increase engine performance.

5 Wärtsilä 50SG engines delivering 60 MW 24/7 to the system (4+1 configuration)

Engines' high simple cycle efficiency is achieved with minimal water consumption

Operation & Maintenance Agreement to provide technical and operational services with maintenance planning, remote services, spare parts and an on-site inventory

© WÄRTSILÄ

Red Gate – USA

High efficiency and lower emissions with Wärtsilä engines

- Natural gas engines to meet the growing demand for electricity in South Texas
- The high efficiency of the engines result in fewer emissions of CO2 than simple cycle gas turbine solutions

12 Wärtsilä 50SG engines producing 225 MW

Engines' high simple cycle efficiency is achieved with minimal water consumption

Maintenance Agreement to provide technical and operational assistance with maintenance planning, technical advisors, spare parts and an on-site inventory

© WÄRTSILÄ

Lower Colorado River Authority (LCRA) – USA

The economic growth, population increase and increase of blue-chip companies in the area have created the need for additional generating capacity to meet Texas' growing need for power.

Wärtsilä will supply the generating equipment for a new peaker power plant, which will be capable of starting and stopping rapidly to provide dispatchable power to increase reliability and provide power to balance the grid when renewable and other generational resources are not available or are insufficient to meet the needs of Texans.

The new 190 MW power plant will be operating with ten Wärtsilä 50SG engines running on natural gas

Each Wärtsilä engine consumes little to no water every week, which in Texas, an area often affected by drought, is an important feature.

Grid balancing is needed in order to respond to increasing inputs of energy from renewable sources.

© WÄRTSILÄ

Plains end I & II – USA

Gas power generation to support grid stability in Colorado

- The new plant copes with the sudden load swings caused frequently by the high proportion of intermittent wind-driven generating capacity in the area
- Upgrading to Wärtsilä's 0.9% pre-chamber provided extra room for improved efficiency and stable emissions.

The existing power plant is running on 20 + 14 Wärtsilä 34SG engine generating sets, providing up to 231 MW.

Grid black start capability at a very low cost & ability to keep plant online even when the quality of the gas supply suffers.

Revenue from both the energy market and the ancillary service market – simultaneously.

© WÄRTSILÄ

Yamama Cement Company – Saudi Arabia

Yamama Cement Company turned to Wärtsilä for a solution that would maximise the efficiency of their power generation, according to the requirements of the Saudi 2030 vision.

The Saudi Arabia’s largest-to-date engine plant installation produces 198 MW with 12 Wärtsilä 50DF engines, with one redundant engine. The plant’s real benefit lies in a waste heat recovery system that uses excess heat from the exhaust to power a steam turbine and generate electricity, maximising the plant’s efficiency.

© WÄRTSILÄ

IPP4 – Jordan

To fulfil their power production agreement (PPA), IPP4 power plant needed to be commissioned for gas operation within a tight schedule. Wärtsilä prepared procedure documentation and commissioning from HFO to gas operation of 16 Wärtsilä 18V50DF engines in a fast-track project.

Running the plant on gas is more convenient and profitable compared to HFO, and it also reduces the plant's emission levels.

© WÄRTSILÄ

Tokyo Gas Engineering Solutions (TGES) – Japan

Wärtsilä power plant boosts Japan's transition to renewable energy.

Japan is working toward a major shift in its power mix, looking at achieving 40-50% renewable energy by 2040.

Wärtsilä supplied gas engines for TGES' 100 MW power plant in Sodegaura, Japan, which provide the needed flexibility to enable critical grid balancing as the country strives to increase its share of renewable energy.

The main purpose of the utility-scale plant is to hedge market price fluctuations. The plant will also enable participation in the recently launched cross-regional balancing market, that bridges the gap between energy demand and supply during times when much variable renewable energy is being introduced into the system.

The new plant operates with ten Wärtsilä 34SG gas engines, replacing a 100 MW combined cycle gas turbine formerly located on the project site.

The Wärtsilä engine technology delivers the flexibility needed to compensate for fluctuations in the supply from wind and solar.

© WÄRTSILÄ

Pesanggaran Bali – Indonesia

Wärtsilä's 200 MW flexible baseload power plant with 12 Wärtsilä 50DF engines, ensures a ready, reliable electricity supply to the Bali sub system grid. Its low emission capability and reduced carbon footprint as compared to inflexible generation supports Indonesia's path to a cleaner future.

The plant provides operational and fuel flexibility even in challenging conditions. With fast start and stops, as well as seamless control over load fluctuations, this plant allows a greater consistency in the supply of electricity.

© WÄRTSILÄ

Arun – Indonesia

Building an optimum generating system

The peaking power plant was built to address the need for optimum generating system capable of meeting the peak electricity demand, improving the grid stability.

With an output of 184 MW, generated by 19 Wärtsilä 20V34SG engines running on liquefied natural gas (LNG), Arun is one of the largest internal combustion engine plants in Indonesia.

The plant can reach full load in 10-15 minutes. The engines can be switched on and off according to load requirements with the remaining engines running on full power, thus maintaining maximum efficiency over a much wider load range.

Using the plant for peaking purposes optimises the system by enabling more efficient use of baseload plants, lowering the overall operating costs for the whole system.

© WÄRTSILÄ

McArthur River Mine – Australia

Continuing and long-lasting partnership

> McArthur River Mine is one of the world's largest providers of zinc in bulk concentrate form. Wärtsilä has been a trusted partner for the plant's power supplier, EDL for many years, delivering gas engines and providing lifecycle services for condition-based maintenance.

The 53 MW multi-unit plant operates on 6 Wärtsilä 20V34SG gas engines, providing maximum overall efficiency without suffering significant derating at high temperatures

Maximised availability, ensured reliable electricity supply and reduced operating costs of varying quality

A 10-year service agreement for condition-based maintenance, maintenance planning and technical support renewed as needed to meet the customer's changing needs

© WÄRTSILÄ

Malicounda – Senegal

Combining the benefits of a flexible, simple-cycle plant with the outstanding efficiency of a combined cycle plant.

Wärtsilä Flexicycle™ power plants combine the benefits of a flexible, simple-cycle plant with the outstanding efficiency of a combined cycle plant. The Flexicycle™ solution is based on gas, multi-fuel, or liquid fuel power plants combined with a steam turbine.

7 x Wärtsilä 18V50, 130 MW output

Baseload power production for the national grid

A 10-year maintenance agreement

© WÄRTSILÄ

Paras Energy – Nigeria

Long-lasting partnership since 2008: a tailored approach to supporting the growth ambitions of a privately-owned energy supplier

The challenge was to have a dedicated power supply, independent from the grid, capable of supplying the company's steel production needs, and handling load fluctuations. Our solution was supplying the plants with Wärtsilä 34SG gas-fuelled engines, featuring high levels of flexibility and reliability.

Wärtsilä 34 SG based power plant

14 x Wärtsilä 34 SG medium-speed gas engines

132 MW

Paras Energy is a repeat customer of Wärtsilä. The journey together started back in 2008. Years later, the partnership was strengthened by a 5-year Optimised maintenance agreement (2021)

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Sasol New Energy – South Africa

More efficiency and output with new power plant technology

Wärtsilä 34SG based CHP plant

Flexible baseload, steam cogeneration

18 x Wärtsilä 20V34SG

Total output 175 MW

The facility was built to meet SNE's increased electricity needs while, at the same time, replacing old generating equipment with new and more efficient technology.

The gas engine technology allows SNE to reduce their carbon footprint by more than 40%.

"Gas engine technology allows us to reduce our carbon footprint by more than 40%."

Henri Loubser, Managing Director, Sasol New Energy

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Kipevu III – Kenya

Customer :Kenya Electricity Generating Company Ltd. (KenGen)
Type :Wärtsilä 46 power plant
Operating mode :Flexible baseload
Gensets :7 x Wärtsilä 18V46
Total output :117 MW
Fuel :HFO
Scope :EPC
Delivered :2011

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Ubungo – Tanzania

Customer: Tanesco
Type: Wärtsilä 34SG gas power plant
Operating mode: Flexible baseload
Gensets: 12 x Wärtsilä 20V34SG
Total output: 105 MW
Fuel: Natural gas
Scope: EPC
Delivered: 2008

See more in our customer's video.

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Geita gold mine – Tanzania

More efficiency and output with new power plant technology

Wärtsilä 32TS based power plant

4 x W32TS

Total output 40 MW

All four of the plant's performance targets – availability, net heat rate, power capacity and specific lubricant consumption – have been exceeded during the 10-year Operation & Maintenance (O&M) agreement.

The fuel efficiency has improved from 39% to around 43%, leading to approximately $2 million USD of fuel savings in 2019.

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Wärtsilä leads a 200 MEUR collaboration ecosystem: WISE

The Wide & Intelligent Sustainable Energy (WISE) project aims to develop autonomous zero-emission energy concepts. This five-year collaboration involves over 200 Finnish companies, industrial organisations, research institutes, and universities – and is funded by Business Finland.

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Energy storage & optimisation references

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AGL Energy Limited – Australia

Bringing South Australia one major step closer to a 100% renewable energy grid

- The flexible capacity provided by the Torrens Island battery balances the intermittency of renewables, thereby supporting grid reliability
- The energy storage system enables adaptation to changing market needs and provides firming capacity – reducing spinning reserve requirements
- Maintains system strength, network stability, and energy security with the GEMS Digital Energy Platform
- Provides virtual synchronous generation, enabling fast response times and future-proofed assets

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250 MW / 250 MWh energy storage system supports a broad portfolio of generation assets, including thermal & renewable sources

In 2018, Wärtsilä signed an engineering, procurement, and construction (EPC) contract for the Barker Inlet Power Station (BIPS) engine power plant located on Torrens Island

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Energy Australia – Australia

Will enhance Australia's infrastructure by providing essential grid stability and supporting the integration of renewables

- The project was successful in the first round of the Capacity Investment Scheme (CIS), an Australian Government initiative to encourage new investment seeking to deliver 32 GW of renewable generation and dispatchable capacity by 2030
- The system will utilise Wärtsilä's Quantum High Energy BESS and GEMS Digital Energy Platform, helping to secure the state' s energy supply and enabling more renewables to enter the electricity network while providing crucial grid services
- The project is designed to switch to grid-forming mode, offering operational flexibility with faster response times to increase system stability and grid reliability while keeping energy prices low for consumers
- The project includes a long-term service agreement

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350 MW / 1474 MWh energy storage system

Once operational, the system will provide energy to more than 230 000 homes for up to four hours at a time

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Origin Energy – Australia

Australia's largest battery project and one of the largest in the world

- The Eraring battery will connect to Australia's National Electricity Market (NEM), enhancing energy security and reliability in New South Wales as renewable energy supply increases
- A critical aspect of the system is Wärtsilä's GEMS Digital Energy Platform, which monitors and controls the flow of energy, enabling Eraring to provide grid support during periods of instability
- GEMS will provide firming capacity to balance Origin's generation portfolio in support of its retail customer load
- The project comprises Wärtsilä's Quantum and Quantum High Energy BESS solutions
- Wärtsilä has worked closely with Origin to meet stringent noise requirements for the site, resulting in a site-specific noise solution
- The project includes long-term service agreements

The facility's total capacity across three project stages is 700 MW / 2 800 MWh

At 2 800 MWh, when cycled once a day, the Eraring battery will dispatch enough energy to power more than 150 000 New South Wales households annually

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EDF Renewables UK & Ireland – UK

Energy storage projects accelerating a clean electric future in the UK

- The projects contribute to greater UK National Grid stability and flexibility – improving route to market for clean power solutions and reducing carbon footprints
- Offers frequency response, electricity market trading & reactive power services
- Provides additional power capacity to support the installation of electric vehicle (EV) charging networks designed to accelerate the electric transport transition
- Storage, EV infrastructure, grid fluctuations – Wärtsilä's GEMS software optimises various assets & future-proofs resources under a single portfolio

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The project portfolio includes 6 projects totalling 307 MW / 514 MWh

Frequency regulation will enable the integration of greater levels of renewables

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GIGA Storage BV – Belgium

Energy storage system providing grid stabilisation & renewable energy integration

- The energy storage project helps to optimise the power system, regulate energy frequency and reliability on the grid, and improve revenues
- Employs Wärtsilä's Quantum solution and the GEMS Digital Energy Platform, which enables GIGA Storage to remotely monitor, operate, identify, and diagnose equipment with unrivalled safety, reliability, and flexibility
- The system is utilised by Eneco, a leading energy provider, to make the company's services more sustainable and add renewable energy on the grid
- The GIGA Buffalo battery will store the equivalent of the annual energy consumption of more than 9 000 households each year

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25 MW / 48 MWh energy storage system

The system will save up to 23 000 tonnes of carbon dioxide emissions annually

Optimised by Wärtsilä's long-term service agreement, including comprehensive system maintenance with performance guarantees

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Nippon Koei Energy Europe B.V. & Aquila Capital – Belgium

Reliable reserve power & improved grid reliability

- The energy storage system helps to regulate fluctuations and supply peak power with stored renewable energy in the grid
- The GEMS Digital Energy Platform ensures optimal performance for the energy supply across specified use-cases – including reserve power, frequency control response, capacity dispatch & voltage support
- The project includes a long-term service agreement

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25 MW / 100 MWh energy storage system

Supports the Belgian federal government's goal to phase out most nuclear generation by 2025

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Zenobē – UK

Energy storage projects improving the grid's long-term stability and reliability

- Blackhillock is the first in the world to provide stability services to the National Grid Electricity System Operator (NESO) in Scotland, providing crucial grid stabilisation as more renewables are added onto the grid
- The **Blackhillock BESS** is now operational and was the first project to be delivered under the Network Options Assessment (NOA) Stability Pathfinder programme to improve the long-term stability of the electricity system
  - **Kilmarnock South** is also delivered under the Programme
- Wärtsilä's GEMS offers data-based intelligence that enables Zenobē to participate in the most valuable UK electricity markets
- Blackhillock is built with Wärtsilä's Quantum BESS and Kilmarnock South is the first site to include the Quantum High Energy BESS

The two energy storage systems total 500 MW / 1 GWh

According to Zenobē, the site is expected to save consumers over £170 million and the project will prevent approximately 2.6 million tonnes of CO_2 from entering the atmosphere over the next 15 years

Blackhillock
© Zenobē

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Clearway Energy Group – USA

One of the world's largest solar-plus-storage project portfolios

- Essential grid reliability to balance an increasing mix of renewable generation, leading the states' clean energy transitions
- Includes the Quantum energy storage solution
- Features Wärtsilä's GEMS Digital Energy Platform for power system optimisation
- Long-term service agreements, guaranteeing capacity and providing maintenance with performance guarantees

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500 MW / 2 GW project portfolio, comprising five energy storage projects, all tied to renewables

Supporting the energy transition by creating low-cost clean energy at scale

The energy storage system increases the effectiveness of the solar facility by performing ancillary services, primarily solar shifting, for the California Independent System Operator

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Eolian – USA

Two major interconnected energy storage systems for Texas grid services

- The project includes the sophisticated Wärtsilä Quantum energy storage solution and Wärtsilä's GEMS Digital Energy Platform
- The energy storage systems deliver valuable grid support to the Electric Reliability Council of Texas (ERCOT)
- Are the first projects in the US to be financed using the standalone tax credit offered by the Inflation Reduction Act (IRA) of 2022

The interconnected stand-alone systems have a combined rated capacity of 200 MW / 500+ MWh

GEMS Digital Energy Platform monitors and controls the flow of energy, enabling these projects to provide grid support for critical periods during extreme weather or unstable grid conditions

Maximised revenues and flexibility in system maintenance and operation enabled by the 10-year guaranteed asset performance agreements

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RWE Renewables – USA

Solar-plus-storage system improves predictability of intermittent generation at hybrid plant in southwestern US

- Co-located and DC-coupled with a solar system, allowing improved system efficiency, lower balance of plant costs, and clipped solar recapture
- GEMS Digital Energy Platform controls the entire hybrid plant, comprising about 200 MW of solar PV and 80 MWh of Quantum energy storage systems
- The GEMS IntelliBidder market-bidding solution improves the predictability of the intermittent generation
- Enables the subsidiary of RWE Renewables, Hickory Park Solar, to sell nearly 200 MW of generation from solar PV panels to Georgia Power Company

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The storage system delivers 40 MW / 80 MWh of power when operational

GEMS IntelliBidder market-bidding solution enables a day-ahead firming solar+storage profile

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Colbun – Chile

Energy storage system accelerates the transition to renewables

- The energy storage system supports Colbun in integrating additional renewables in their 230 MWp solar photovoltaic facility
- The solution includes the GEMS Digital Energy Platform and the fully integrated Quantum energy storage system
- GEMS co-optimises the utilisation of the storage solution and solar PV facility
- The storage system helps to proactively address constraints on the transmission system to allow shifting of excess energy production to avoid curtailment
- The system also provides frequency response and firming capacity

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The 8 MW / 32 MWh energy storage system helps achieve climate targets

80 000 households are estimated to benefit from from the system

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Lifecycle services references

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7 Expertise Centres strategically located around the world, collectively supporting 250+ power plants globally

Expertise Centre in Houston, Texas delivering 24/7 remote support services for customers

Our newest Expertise Centre delivers 24/7 remote support to our U.S. and Canadian energy sector customers.

In addition, the Expertise Centre helps power plant operators improve asset efficiency and reduce operation costs by utilising the predictive maintenance service Expert Insight.

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Xcel Energy – USA

Long-term service agreements for U.S. power plants

Wärtsilä has signed a ten-year Long-Term Optimised Maintenance Agreement with Xcel Energy, covering two new power plants in Minnesota and Wisconsin.

The Blue Lake plant will operate with three Wärtsilä 34DF dual-fuel engines (29 MW), while the Wheaton plant will use five Wärtsilä 34DF engines (48 MW). These fast-starting engines provide effective grid-balancing power to support renewable energy sources.

“We continue to sign service agreements for our installed power plant base, which indicates the high level of trust that exists between Wärtsilä and our customers. We congratulate Xcel Energy for its commitment to sustainable energy, and we are proud to support them in their decarbonisation efforts,” comments Kees de Grijs, General Manager, Business Development, Agreements & Upgrades, Region North at Wärtsilä Energy.

The agreement includes remote support from Wärtsilä’s Expertise Centers, spare parts, and advisory services during overhauls. For the first two years, Wärtsilä engineers will be on-site to provide assistance.

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Ndola Energy Company Ltd – Zambia

Long-term and successful O&M partnership to ensure reliable power supply in Zambia

Ndola Energy Company Ltd (NECL) and Wärtsilä have renewed their Operations & Maintenance (O&M) agreement, continuing a partnership that began in 2013.

The 105 MW Ndola power plant, operated by NECL, relies on twelve Wärtsilä 32 engines, including six with two-stage turbocharging technology. This plant is crucial for maintaining a reliable electricity supply in Zambia, especially during the current hydropower shortage caused by drought.

"We have worked closely with Wärtsilä for a number of years, and we are confident that they will continue to successfully operate and maintain the plant to ensure a reliable supply of electricity," says Dr. Brian Mushimba, CEO at NECL.

This renewal ensures the plant's reliability and availability, helping NECL meet its Power Purchase Agreement obligations with ZESCO.

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Gas conversions accelerate Brazil's journey towards decarbonisation

Wärtsilä has successfully converted three Brazilian power plants to natural gas. These major upgrades will lower costs and emissions while improving reliability and efficiency.

- The conversions took place in Manaus, in the state of Amazonas in North Brazil, with Rio Amazonas Energia (RAESA) to adapt its Cristiano Rocha power plant, Companhia Energética Manauara (CEM) to convert its Manaura plant, and with Geradora de Energia do Amazonas (GERA Amazonas) for its UTE Ponta Negra plant.

- Conversion is the way to get prepared for the sustainable fuels of the future once they will come commercially viable and locally available.

Wärtsilä converted its 46GD dual-fuel combustion engines to Wärtsilä 50SG gas-fuelled engines, also increasing plants' outputs from 85 MW to 92 MW.

New or updated service agreements to keep the plants operating in great condition.

The gas conversion lowers the price of electricity for Brazilians

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Grupo Puntacana – Dominican Republic

Over 15 years worth of sustainable power generation

Wärtsilä provided an engine cogeneration power plant and O&M agreement tailored to Operation Grupo Puntacana's unique needs

- Shared productivity and profitability goals
- Aiming to maximise the productive lifetime of the power plant and the return on investment.
- Performance and lifecycle cost guarantees – availability, heat rate and response time in case of disruption
- Close partnership with regular communication and audits

Wärtsilä has maintained 99.6-99.9% engine reliability, installed two more engines and optimised the engines for different fuels to improve efficiency.

This long-term cooperation is set to continue, with a gas conversion being proposed as part of a larger trend to move from using oil to natural gas.

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Termocabo S.A. – Brazil

Wärtsilä signed a full Operation and Maintenance (O&M) agreement with Termocabo S.A. The customer’s plant operates with three Wärtsilä 46 engines, and the agreement includes performance guarantees regarding their availability and fuel consumption.

2.7 GW

power plant capacity delivered in Brazil

739 MW

covered by long-term service agreements

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Rehabilitation at Kaloum 5 power plant – Guinea

Power plant overhaul boosts availability and grid stability

The purpose of the station is to improve the power supply on the interconnected network in Guinea

A complete overhaul of the engines and alternators, as well as automation upgrades, including the modification and fine-tuning of auxiliaries to match the plant performance

Results:

- Running all engines at the rated power of 10.4MW
- Increased plant availability to 96%-98%
- Increased grid stability
- Increased reliability
- Increased staff competence levels

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