Royal Caribbean Group

Energy Use and Air Emissions

We're on a journey to achieve net-zero emissions by 2050.

We innovate across Royal Caribbean Group to reduce our energy consumption and greenhouse gas (GHG) emissions. With every class of ship, our teams push the envelope with more fuel-efficient engines, energy-efficiency initiatives and advancements in ship design. As we look forward, we plan to make even bigger leaps in our pursuit of a low-carbon future.

Destination Net Zero℠

A giant step in our sustainability journey, Destination Net Zero is our initiative to achieve net-zero carbon emissions by 2050. Our efforts are currently focused in four main areas:

- Advancements in energy and fuel efficiency
- The development of low-carbon fuels and sustainable technologies
- The pursuit of alternative energy sources
- Supplier engagement to shift to low-carbon processes

KEY MILESTONES

Reduce our carbon intensity by double digits from a 2019 baseline
Target: 2025

Deliver a net-zero-emissions cruise ship
Target: 2035

Achieve net-zero emissions
Target: 2050

Partnerships and Alliances

Achieving net zero by 2050 requires widespread collaboration, as no one company can do it alone. To achieve our objectives, we're forging strong partnerships with shipyards, governments, suppliers and industry associations to develop zero-carbon technologies and solutions.

In 2022, we entered into a formal partnership with the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, committing to a long-term strategic collaboration to develop zero-carbon technologies and solutions for the maritime industry. We also signed a maritime declaration with the public/private pairing of the Finnish Government and shipyard Meyer Turku Oy to chart a path for innovative and sustainable shipbuilding in Finland.

Lastly, we joined a cruise-led collaboration to explore the feasibility of a maritime green corridor between Alaska, Washington and British Columbia.

Energy and Fuel Efficiency Onboard Our Ships

We challenge ourselves to increase the energy efficiency of our fleet each year. Thanks to hundreds of upgrades and our relentless culture of continuous improvement, each new class of Royal Caribbean Group ships is significantly more efficient than its predecessor class. We have completed over 500 energy-efficiency retrofit projects to date, including roughly 15 in 2022, with another 400-plus matured projects in the pipeline through 2027.

Our approach includes initiatives in both the marine and hotel operations of our business.

Marine energy efficiency

Air lubrication systems that create millions of microscopic bubbles to coat our ships' hulls, reducing drag as they move through the water

Optimized hull designs to improve our fuel efficiencies, such as the parabolic bow on our Edge class of vessels

Real-time artificial intelligence to assess weather and currents and optimize timing, route, speed and distances traveled

Hotel energy efficiency

AC chiller and HVAC upgrades that use up to 40% less energy than previous generations

Galley energy management systems, including demand-based ventilation, to benchmark equipment energy usage

Variable Frequency Drive Installations to optimize our ships' power consumption

Alternative Fuels and Energy Sources

We actively research and assess progress on technologies such as solar and wind power, biofuels, natural gas, fuel cells, biomass and shore power to determine their efficiencies and viability for the future.

Ready for Liquefied Natural Gas

In 2022, we finalized the supply chain for our first three liquefied natural gas (LNG)-powered ships: Silversea's *Silver Nova*, which debuts in 2023, and Royal Caribbean International's *Icon of the Seas* and *Utopia of the Seas*, both debuting in 2024.

First Renewable Diesel-Powered Ship

In late 2022, Royal Caribbean International's *Navigator of the Seas* became the first major cruise ship to sail from a U.S. port using renewable diesel to meet part of its fuel needs.

20 Ships

20 Royal Caribbean Group ships were equipped to use shore power by the end of 2022, with additional retrofits on the way as more ports add shore power capabilities. All new builds will have shore power connections. This includes ships owned by our joint ventures.

World's First Net-Zero Cruise Terminal

Our Port of Galveston terminal, which opened in late 2022, is the first cruise terminal in the world to generate 100% of its needed energy through onsite solar power.

Transitioning to Low-Carbon Fuels

We're advancing a multi-phase strategy to move away from heavy fuel oil for new ships in favor of lower-carbon alternatives, many of which are still in the development phase. Our immediate strategy is transitioning new ship builds to LNG, the cleanest-burning fossil fuel currently available. Longer term, we're partnering with governments, suppliers, shipyards and other stakeholders to develop alternative and accessible fuels and technologies.

Collaborating on Green Shipping Corridors

To help address the supply chain challenges of low- or zero-carbon fuels, we're working with a broad coalition of cruise operations, ports, industry trade associations and maritime forums to explore the development of green corridors. These are maritime routes where zero GHG emission solutions are supported and enabled through technological, economic and regulatory collaboration.

Pursuing Shore Power

We are committed to improving air quality and reducing GHG emissions by enabling shore power as an alternative energy source for our ships. Cruise ships traditionally run off their diesel auxiliary engines while at port. Shore power allows cruise ships to "plug in" to electricity at the port, so that the engines do not need to operate when the ship is embarking and disembarking passengers or loading supplies. Depending on the location and regional energy mix, local power grids may use a mix of renewable energy sources in addition to fossil fuels, reducing our emissions.

LEED Zero Energy Certifications

In addition to pursuing net-zero cruise ships, we're also pursuing LEED Zero Energy certification for some of our shoreside operations. This includes the use of onsite renewable energy at select locations.

69%

69% of our ships are equipped with Advanced Emissions Purification systems, which remove roughly 98% of sulfur dioxides from our ships' exhaust.

92%

Currently, 48 of the 52 ships from our wholly owned brands are certified ISO 50001 for energy management.

Reducing Emissions with Abatement Technologies

To help mitigate emissions from our current fuels and reduce related air and water pollution, we invest in and develop state-of-the-art emissions-abatement technologies. To date, 69% of our vessels are equipped with Advanced Emissions Purification (AEP) systems, which help us meet the sulfur emissions requirements set forth by the International Maritime Organization (IMO) globally for 2020 and all emissions control areas. Our ships without AEP systems are too small to accommodate the systems and already operate on compliant fuel.

AEPs work by spraying exhaust with a fine water mist within the ship's funnel and stacks. As the water mist combines with the sulfur dioxide in the exhaust, it causes a chemical reaction, removing the sulfur while producing a clean white plume. As a result, AEPs remove approximately 98% of sulfur dioxides, 40-60% of total particulate matter, and up to 12% of nitrogen oxides. Nine Royal Caribbean Group ships are currently equipped and all future new builds will be equipped with SCR (Selective Catalytic Reduction) systems to reduce nitrogen oxides to greater than 90%.