Royal Caribbean Group

Energy Use and Air Emissions

We're committed to reducing our greenhouse gas (GHG) emissions, with a target of achieving net zero emissions as a company by 2050.

We innovate across Royal Caribbean Group to reduce our energy consumption and 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. These efforts helped us reach our 2020 goal to reduce annual GHG emissions by 35% compared with our 2005 baseline—almost a year ahead of schedule.

As we look forward, we're looking to make even bigger leaps in our pursuit of a low-carbon future.

70% 70% of our ships are equipped with Advanced Emissions Purification systems, which remove roughly 98% of sulfur dioxides from our ships' exhaust.

35% We reached our 2020 goal to reduce annual GHG emissions by 35% compared with our 2005 baseline almost a year ahead of schedule.

First hybrid-powered ship Set to debut in 2023, Silversea Cruises' *Silver Nova* will be the cruise industry's first hybrid-powered ship, reducing overall GHG emissions per double occupancy by 40% compared to Silversea's previous class of ships.

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 at least 20% more efficient than its predecessor class. We have deployed more than 50 energy-saving technologies throughout our fleet, with over 500 projects to date and another 400-plus in the pipeline.

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

MARINE ENERGY EFFICIENCY	HOTEL ENERGY EFFICIENCY
Air lubrication systems that create millions of microscopic bubbles to coat our ships' hulls, reducing drag as they move through the water	AC chiller and HVAC upgrades that use up to 40% less energy than previous generations
Optimized hull designs to improve our fuel efficiencies, such as the parabolic bow on our Celebrity Cruises' Edge class of vessels	Galley energy management system, including demand-based ventilation, to benchmark equipment energy usage
Real-time artificial intelligence to assess weather and currents and optimize timing, route, speed, and distances traveled	Variable Frequency Drive Installations to optimize our ships' power consumption

Harnessing Artificial Intelligence for Energy Insights

Machine learning, AI-derived ship models, and data management systems like these have become integral in our pursuit of energy and fuel efficiency. AI systems get smarter with each data point they take in, helping us pinpoint energy-saving opportunities that can go unnoticed by manual analysis.

Royal Caribbean Group

What's Next: Destination Net Zero

In 2021, we announced Destination Net Zero, an ambitious initiative to achieve net zero emissions as a company no later than 2050. We're moving to establish near- and long-term emissions reduction targets informed by the Science-Based Target initiative's (SBTI) first maritime transport methodology.

Teams across Royal Caribbean Group are mobilizing to advance our decarbonization strategy. **Our approach includes:**
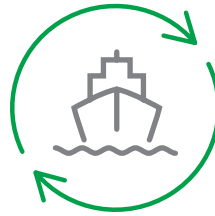
MODERNIZATION:
We're working to modernize our global fleet with the introduction of new energy-efficient and alternatively fueled vessels.
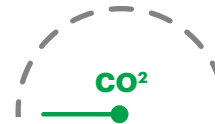
INVESTMENTS IN EFFICIENCY:
We're continuously investing in energy-efficiency programs for our existing fleet, including energy-saving technologies, enhanced data systems, and digitalization.

TWO KEY MILESTONES

Launch a net zero emissions ship
Between 2035-2040

CO²

Achieve a net zero emissions target
By 2050

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.

TRANSITIONING TO LOW-CARBON FUELS
Our immediate strategy is to transition new ships being built to liquefied natural gas (LNG), the cleanest-burning fossil fuel currently available. This includes three ships set to debut in 2023-2024: Royal Caribbean International's *Icon of the Seas*, Silversea Cruises' *Silver Nova*, and Royal Caribbean International's sixth Oasis-class ship, *Utopia of the Seas*. Longer term, we're partnering with governments, suppliers, shipyards, and other stakeholders to develop alternative and accessible fuels and technologies.

PURSUING SHORE POWER
In 2021, we signed an agreement to bring shore power to PortMiami, with a planned launch in late 2023. Cruise ships traditionally run off their diesel auxiliary engines while at port. Shore power allows cruise ships to "hook up" 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, potentially reducing our emissions.

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, 70% of our vessels are equipped with Advanced Emissions Purification (AEP) systems, which help us meet the GHG emissions requirements set forth by the International Maritime Organization (IMO) for 2020 for global operations and 2021 for special emission control areas.

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 to 60% of total particulate matter, and up to 12% nitrogen oxides.