

Building a Green Manufacturing Exemplar to Facilitate Low-Carbon Circular Development

Astronergy



PROJECT OVERVIEW

Astronergy's project "Building a Green Manufacturing Exemplar to Facilitate Low-Carbon Circular Development" has been implemented from August 2023 to the present, covering Astronergy and six of its manufacturing plants.

In green manufacturing, the company proactively implements comprehensive energy-saving, emission-reducing, and consumption-lowering measures. In 2024, the company carried out 184 energy-saving technical upgrade projects, including initiatives such as air compressor waste heat recovery, optimization and adjustment of blast motor operation for fans, hydrofluoric acid recovery, CDA pressure reduction. These efforts resulted in cumulative electricity savings of 122 million kWh, equivalent to reducing carbon emissions by approximately 65,465.2 tCO₂e (tonnes of carbon dioxide equivalent).

Regarding green recycling, the company significantly reduced water consumption in production processes by implementing 17 water conservation projects. These involved replacing the tap water cooling system by using supernatant and RO concentrate, as well as reusing RO concentrated water in cooling towers. These measures achieved cumulative water savings of 2.1 million tons, saving water costs of RMB 8.4347 million. The water resource recycling rate increased to 91.56%.

In green logistics, Astronergy comprehensively promotes the use of recyclable materials and optimizes packaging design, achieving a green and low-carbon transformation in both product packaging and logistics processes. Through systematic green operations and technological innovation, the company will continue to lead the sustainable transformation of the photovoltaic industry and contribute to achieving the goal of carbon neutrality across the entire industrial chain.

COMPANY/ORGANIZATION PROFILE



ASTRONERGY
正泰新能

Founded in 2006, Chint New Energy Technology Co., Ltd. (Astronergy), an intelligent manufacturing enterprise engaged in solar cells and solar modules under Chint Group, is among the pioneering private enterprises in China to venture into the PV sector, and also an early adopter of mass production of n-type TOPCon modules within the industry. Engaged in the R&D, production and sales of high-efficiency crystalline silicon solar cells and modules, the Company continues to launch the ASTRO series high-efficiency, high-quality, high-performance module products with a specific focus on large-size, monofacial-and bifacial series, intending to cater to various applications such as utility-scale power stations, industrial and commercial distributed power plants, household power plants and other multi-scene application scenarios. At present, the business of Astronergy has spread to more than 140 countries and regions around the world.

PROJECT OUTCOME

Centered on the core objectives of green, low-carbon development and efficient resource utilization, this project has established a carbon-reduction manufacturing system covering energy, water, and material circulation through systematic technological upgrades and management innovation.

In the energy sector, the implementation of energy-saving technological transformations—such as waste heat recovery and comprehensive energy utilization rate

improvement—has fully utilized residual heat generated by in-plant system systems and equipment. Measures including waste heat recovery from air compressors and reuse of workshop exhaust air have resulted in annual electricity savings of 24.44 million kWh.

The comprehensive energy utilization rate improvement project involved establishing an energy management system for real-time monitoring and optimization of energy-consuming operations. This project yielded annual electricity savings of 55.64 million kWh.

Economically, the waste heat recovery project achieves annual cost savings of RMB 15.74 million, while the comprehensive energy utilization rate improvement project saves RMB 36.45 million annually. Additionally, the company has actively optimized its energy structure through rooftop PV installations at all manufacturing facilities, adopting a "Self-generation for self-consumption, with surplus electricity fed into the grid" model that enables annual self-consumption of 25.84 million kWh of renewable electricity, significantly increasing the renewable energy utilization ratio.

In water resource management, intelligent regulation and process restructuring substantially reduced pure water consumption per unit output. This achieved annual savings of approximately 4.69 million tons of pure water and cost reductions of approximately RMB 23.05 million, enabling refined management of production water usage.

In materials management, comprehensive green recycling and circular utilization practices were implemented. The adoption of reusable packaging systems including recyclable packaging such as tank trucks and iron pallets combined with establishing collaborative recycling systems with suppliers, has increased ratio of recyclable packaging materials to 50% of total usage.

PROJECT HIGHLIGHTS

- 1.The 3rd Corporate Net-Zero Performance Benchmark: Green Innovation Excellence Award
- 2.2024 Forbes China Sustainable Development Industrial Enterprises Ranking
- 3.2025 North Star Cup- Excellent Practice Enterprise in Zero-Carbon Park
- 4.“Honor Award- 2024 Annual Low-Carbon Operation Pioneer” SRC Social Responsibility Conference
- 5.“ESG Outstanding Enterprise Award” 2024 SMM and Dun & Bradstreet

PROJECT IMPLEMENTATION

Astronergy has deeply embedded the principles of green development into its corporate strategy and entire operational processes. By leveraging innovative technologies and systematic management approaches, the company is building a comprehensive, efficient, clean, and low-carbon green production system. Supported by an intelligent energy and resource management platform, Astronergy enables precise, full-process control over energy use and material circulation. Through continuous optimization of green production techniques, establishment of closed-loop resource systems, and enhanced supply chain collaboration, the company consistently improves its operational efficiency. It is committed to driving decarbonization throughout the industrial value chain and providing robust support for global sustainable development goals.

In terms of green production, Astronergy focuses on reducing resource consumption and enhancing efficiency through technological innovation. Astronergy's energy optimization project primarily addresses critical challenges in the production process, including insufficient resource utilization and relatively high system energy consumption. The company has systematically implemented waste heat recovery and comprehensive energy utilization rate improvement to tackle these issues.

During implementation, the project team focused on the efficient utilization of waste heat resources. By accurately identifying potential heat sources such as the residual heat of the air compressor operation and workshop hot exhaust air, and through multiple rounds of verification, a customized recovery solution was developed. This solution utilizes high-temperature waste heat from air compressors for pure water heating in cell production, effectively replacing traditional electric heating methods. In winter, an innovative mechanism of reusing hot exhaust air and mixing it with fresh air in make-up air unit was introduced, significantly reducing HVAC energy consumption by enhancing fresh air enthalpy and humidity.

Simultaneously, to address the lack of real-time monitoring and precise regulation in energy usage, the project established an EMS smart energy management platform to monitor energy consumption in key energy-consuming units. By identifying and tapping into energy-saving opportunities during system operation, it enables timely adjustments to operational strategies, ensuring the system operates stably under the most economical conditions. Leveraging this platform, when outdoor temperatures are low, air compressor cooling water mechanism is switched to an independent cooling system that utilizes natural cooling sources for free cooling, thereby reducing the operational load on ice machine. Furthermore, by adjusting the operating frequency of

air-conditioning, blast motors, and pumping equipment throughout the year, the system maintains optimal operating conditions, achieving refined, economical, and stable energy utilization.

Additionally, Astronergy implemented a systematic pure water overflow control project. Through smart regulation of the water circulation system and restructuring of water usage processes, the company significantly enhanced pure water utilization efficiency and eliminated hidden waste in production. While ensuring production stability, this initiative notably strengthened green operational capabilities. The project successfully reduced pure water consumption per 10,000 solar cells from 67.22 tons to 22.29 tons, achieving an annualized saving of 4.6907 million tons of pure water resources and reducing costs by RMB 23.058 million.

In terms of green recycling and logistics, by using recyclable materials, lightweight designs, and implementing packaging material recycling and resource disposal methods, Astronergy reduces resource consumption and environmental burden generated during the product packaging process. The company has replaced all chemical container drums with tank trucks and replaced easily damaged wooden pallet with long-lasting iron pallets. Astronergy also collaborated with 4 encapsulation material suppliers to carry out packaging material recycling and resource utilization projects, achieving a 50% ratio of recyclable packaging materials. As of the end of the reporting period, the forklifts used for the internal transfer of module products have achieved 100% electric vehicle replacement, for the broken silicon wafers we achieved a 100% disposal rate and a 100% recycling rate. For the scrapped cells, we achieved a 100% disposal rate for scrapped cells, with a 90% recycling rate for aluminum materials, a 94% recycling rate for silver materials, and an 85% recycling rate for crystalline silicon.

PROJECT IMPACT & SUSTAINABILITY

1.Project Influences

Through the implementation of an intelligent water management system and energy technology improvements, Astronergy has established an intensive and efficient resource recycling model, significantly enhancing energy utilization efficiency and green production standards. These efforts have led to annual comprehensive cost savings in the tens of millions of RMB and a notable reduction in carbon emission intensity, generating substantial positive environmental influence. In the field of green logistics and packaging, the company has strengthened decarbonization efficacy across the entire industrial chain by upgrading recyclable materials and low-carbon transportation systems, contributing significantly to the industry's green and low-carbon transition and extending its influence across the sector.

2.Replicability of the Project

Leveraging the company's mature energy-saving retrofit evaluation mechanism, this project focuses on technological upgrades characterized by short investment payback periods, ease of implementation, and significant benefits, endowing it with strong replicability and scalability. This project aims to provided a referable practical pathway for promoting green and low-carbon transformation in the industry. Actively aligned with China's carbon peaking and carbon neutrality goals, the project accelerates energy-saving and sustainable

development across the manufacturing sector.

3.Sustainability of the Project

The implementation of this project offers an essential practical example addressing common industry challenges, including high resource consumption in production, low collaborative efficiency in recycling systems, and a lack of systematic management tools. It demonstrates significant industry influence and promotion potential.

Expert Comments

This case presents a comprehensive account of the company's systematic low-carbon transition across energy, water resources, and material recycling. Through a series of technological and managerial innovations, including waste heat recovery, the development of a smart energy management platform, refined control of pure water consumption, and cyclic reuse of green packaging, the company has achieved remarkable benefits in energy saving, water conservation, and carbon reduction. The smart energy management platform has enabled real-time optimization and intelligent regulation of energy use, while significant reduction in pure water consumption per unit has demonstrated outstanding precision in operational management. The project has not only generated annualized economic savings in the tens of millions of yuan but also established a replicable and easily scalable solution through mature technical retrofit and evaluation mechanisms, providing a referential practical model for the manufacturing sector, particularly the photovoltaic industry. Supported by an integrated management platform and a closed-loop resource recycling system, the project shows strong potential for continuous optimization and iteration, exemplifying sound industry demonstration effect and sustainability prospect.