

UPM Umwelt-Projekt-Management GmbH

Sichuan Household Biogas Programme

Impact Report 2026

Clean Biogas for Poor Rural Households in
Sichuan China

Gold Standard GS 1239

Project Overview



The Sichuan Household Biogas Programme is one of the world's most ambitious and effective climate protection programmes, providing clean biogas energy to **395,435 low-income rural households** in China's Sichuan province. This programme, jointly developed and managed by UPM Umwelt-Projekt-Management GmbH and its Chinese partner Chengdu Oasis Science & Technology Co. Ltd, has achieved remarkable results in climate change mitigation and sustainable development. Despite a challenging carbon market, the programme continued to channel carbon finance back to local communities, ensuring the long-term operation and maintenance of the biogas systems.

Sichuan Province's rural areas have historically faced challenges including economic underdevelopment, a reliance on polluting fuels, and significant environmental health risks. At the project's start, the target households had an average annual per capita disposable income of USD 390, placing them below the national poverty line. The programme precisely targets these low-income families. It uses carbon finance to lower the financial barrier to purchasing a biogas system.

Sichuan Household Biogas Programme

AT-A-GLANCE

Since its inception in 2012, Sichuan Household Biogas programme has made the following achievements:



All figures are cumulative from programme inception in 2012 unless otherwise stated.

PROJECT LOCATION

Sichuan China



GREENHOUSE GAS EMISSION REDUCED (VERIFIED UNTIL JANUARY 2025)



Reduced approximately 7.77 million tCO₂e of greenhouse gas emissions



400,000
households improved

1.2 million
people benefited

Improved the lives of nearly 400,000 rural households, benefiting over 1.2 million people

CONTRIBUTION TO THE UN SUSTAINABLE DEVELOPMENT GOALS



14 out of 17
UN SDGs
contributed to

6 SDG impacts
verified and certified
by the Gold Standard

JOBS CREATED



10,500
jobs in the local biogas sector

ANNUAL ENERGY COST SAVINGS



CNY 145 million

generated annual energy cost savings of approximately CNY 145 million for participating households.



Project Mechanism

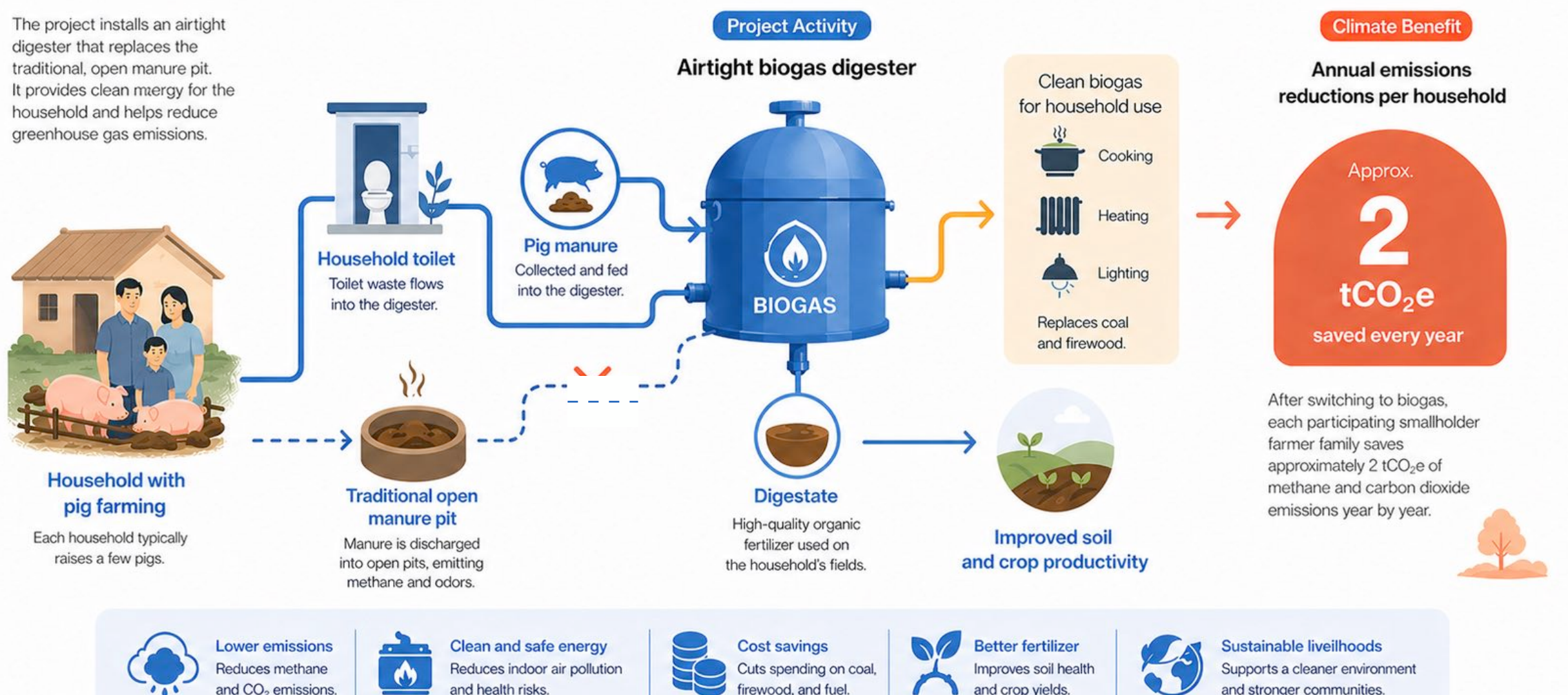
Each household typically raises a few pigs. The programme installs an airtight digester that replaces the traditional, open manure pit. The biogas digesters are fed with pig manure, previously just discharged into open pits, and convert it into clean and affordable biogas to be used conveniently for cooking, heating, or lighting instead of coal and firewood. The byproduct, digestate, is a high-quality organic fertilizer used on the household's fields.

After switching to biogas, each participating smallholder farmer family saves approximately 2 tCO₂e of methane and carbon dioxide emissions year by year.

Biogas Carbon Project

Turning pig manure into clean energy and organic fertilizer

The project installs an airtight digester that replaces the traditional, open manure pit. It provides clean energy for the household and helps reduce greenhouse gas emissions.



Implementation Partners

All biogas equipment distributed under this programme is produced domestically in China and adheres to Chinese quality and safety standards. It is installed and maintained by the Sichuan Rural Energy Office (SREO) via its dense network of local service centres and its many certified biogas technicians all over Sichuan.

The programme's implementation is through the partnership between UPM, OASIS, and the Sichuan Rural Energy Office, directly tackles a potent source of greenhouse gas emissions, while providing clean energy to rural households.

Key Facts

Location	Sichuan Province, China
Project Type	Renewable Energy: Household Biogas
Included Households	395,435 low-income rural households
Beneficiaries	Over 1.2 million people
Annual GHG Reduction	Approximately 725,000 tCO ₂ e
Total Verified Reductions	7.77 million tCO ₂ e (2012-2025)
Certifications	CDM PoA 2898, Gold Standard GS 1239

Certification

The Sichuan Household Biogas Programme meets the highest international standards for carbon offset projects and sustainable development.

Gold Standard Certification

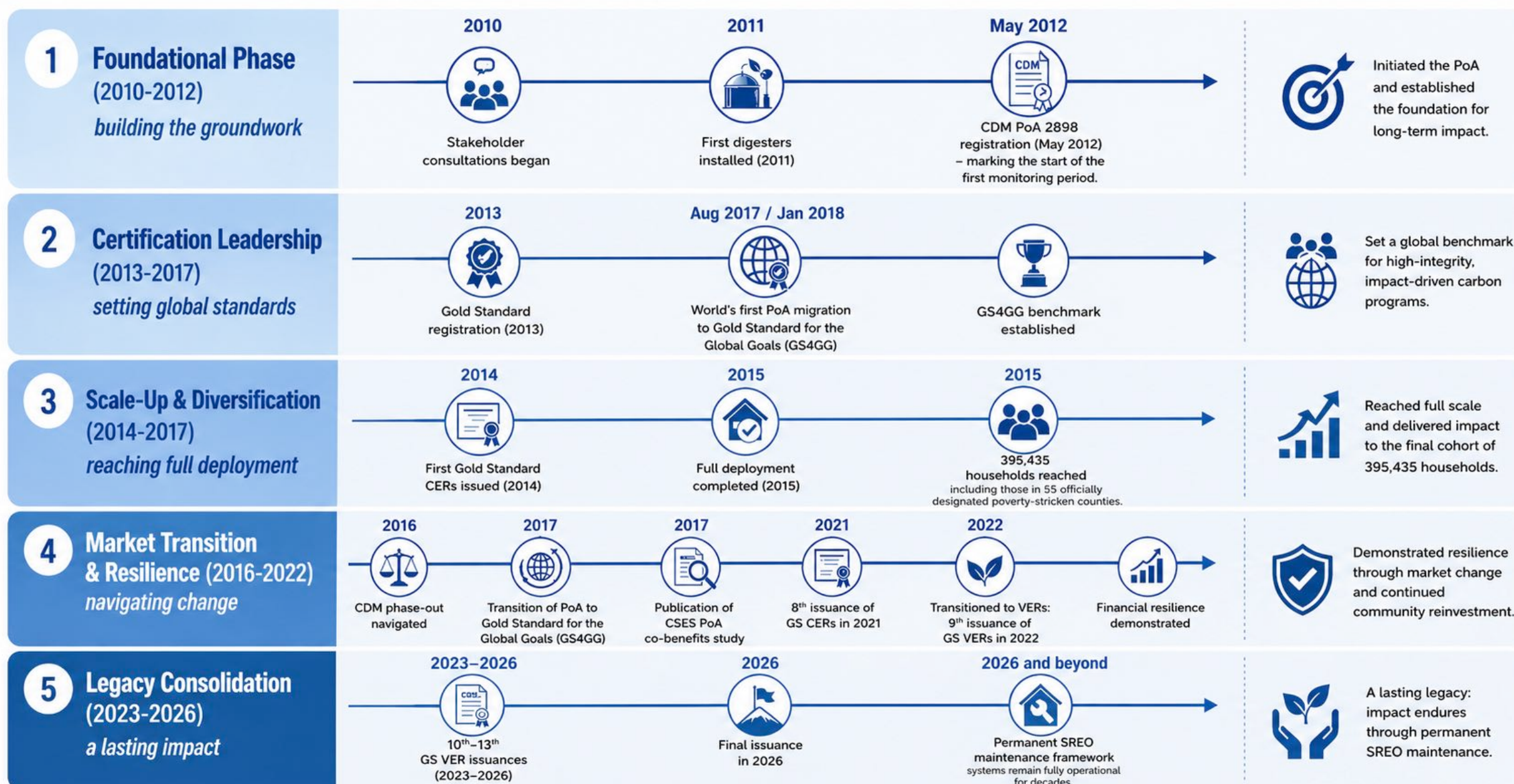
On 31 January 2018, the programme was successfully migrated to the Gold Standard for the Global Goals (GS4GG). According to information from the Gold Standard, it was the first PoA worldwide to have accomplished this transition. The GS4GG certification is effective as of 14 August 2017.

CDM Registration

The programme is registered under the Clean Development Mechanism (CDM) with ID PoA 2898, ensuring compliance with international standards for greenhouse gas emissions reduction projects.

Project Overview

Milestones



From laying the foundation in 2010 to ensuring a lasting legacy beyond 2026, the PoA has delivered measurable climate impact, advanced sustainable development, and empowered rural communities.

Quality Ratings

Calyx Global



GS VERs from UPM's Sichuan Household Biogas Programme have been rated by Calyx Global with a tier 1 **GHG rating of A on its 8-point scale and an SDG rating of 4+ on a 5-point scale, with 5+ being the highest quality**. According to Calyx Global, this PoA does not have any significant environmental, social or governance risks.

This exceptional rating positions the PoA among the top household biogas programmes worldwide, with Calyx Global's analysis confirming that the programme ranks among the few household biodigester projects to achieve a Tier 1 GHG rating.

This very positive rating score of our Sichuan Household Biogas PoA's GS VERs by one of the world's leading rating agencies in the carbon market confirms this project's outstanding quality with respect to credibly and verifiably reducing GHG emissions and contributing to achieving the UN's SDGs for the benefit of local people and communities in rural Sichuan. The high-integrity GS VERs from this PoA can be used with full confidence for voluntary or mandatory climate action purposes.



MSCI

The project has received an "A" rating from MSCI Carbon Markets, placing it in the top 10% of all household devices projects assessed by MSCI so far. The strong result confirms UPM's success in delivering a high-integrity carbon avoidance project that generates verified emissions reductions while providing tangible benefits to low-income rural communities in Sichuan Province, China. This MSCI A rating not only provides further independent evidence of this project's high quality and integrity with respect to achieving real and verifiable climate and SDG impact but also of the low risk associated with a purchase of its GS VERs

The independent MSCI assessment highlighted several areas of exceptional performance:

- **Overall Rating: A (Score 3.8/5.0) - Top 10% of comparable rated projects**, with "medium integrity and low risk" and "no very significant risks identified."
- **Very Low Delivery Risk (4.6/5.0) - Top 10%**, reflecting strong financial, execution and registration security.
- **Strong Quantification (3.6/5.0) - Top 10%**, with transparent methodology and credible monitoring.
- **High Additionality (4.0/5.0) - Top 20-30%**, confirming the project's financial reliance on carbon credit revenues.
- **Significant Positive Co-Benefits (3.9/5.0) - Top 20-30%**, including local employment, support for regional manufacturing, and pollution reduction.

Superpollutant Mitigation: Addressing Near-Term Warming Through Methane Avoidance



Beyond its broad contributions to sustainable development, the Sichuan Household Biogas Programme is increasingly recognized for its critical role in mitigating superpollutants, short-lived climate forcers such as methane that have an outsized impact on near-term global warming. As highlighted in a 2025 joint paper by the Carbon Containment Lab and Calyx Global, superpollutants are responsible for approximately half of all observed warming today, and reducing their emissions is among the most accessible and affordable strategies to "bend the climate curve" immediately (Lee, O'Rourke & Cooper, 2025).

This programme directly addresses a major anthropogenic source of methane: the anaerobic decomposition of livestock manure in deep pits. By installing biogas digesters for 395,435 households, the PoA captures and combusts methane that would otherwise vent into the atmosphere, converting methane, with a global warming potential over 80 times that of CO₂ over a 20-year horizon, into clean energy for cooking and heating. This methane avoidance lies at the heart of the programme's annual emissions reduction of approximately 725,000 tCO₂e.



As corporate climate leaders including Google, Netflix, Workday and Amazon increasingly prioritize superpollutant mitigation in their carbon credit portfolios, projects like the Sichuan Household Biogas Programme offer a proven, high-integrity pathway to achieve immediate and measurable progress against near-term warming, complementing longer-term CO₂ reduction and removal strategies.

Programme Highlights



Integrated Livelihood Systems Approach:

Goes beyond energy substitution by embedding biogas within circular agricultural systems, converting pig manure into clean fuel *and* high-grade organic fertilizer (digestate), thereby boosting farm productivity and resilience.

Long-Term Sustainability Architecture:

Designed with a 20-year system lifespan and post-crediting period support: even after the carbon crediting period ends in 2025, all 395,435 households retain full technical maintenance services via SREO's decentralized service network.

Tripartite Governance Structure:

Co-led by German developer UPM Umwelt-Projekt-Management GmbH, Chinese technical partner Chengdu Oasis Science & Technology Co. Ltd, and government implementing authority - the Sichuan Rural Energy Office (SREO).

Domestic Supply Chain Integration:

100% of biogas digesters, stoves, and accessories are manufactured in China, meeting stringent national safety and performance standards - stimulating domestic green manufacturing and job creation.

Decentralized Technical Service Network

Leveraging SREO's province-wide infrastructure: over 2,000 certified biogas technicians operate through more than 180 local service centres, enabling rapid installation, troubleshooting, and lifelong maintenance.

Community-Centric Capacity Building:

Every participating household receives hands-on training on safe operation, daily maintenance, and digestate application—ensuring long-term functionality and knowledge retention across generations.

Adaptive Monitoring & Verification Protocol:

Implements annual third-party verification under Gold Standard for the Global Goals (GS4GG), with real-time data collection on emissions, health indicators, time savings, and income impacts—ensuring transparency and credibility.

Dual International Certification Framework:

Registered under both the UNFCCC's Clean Development Mechanism (CDM PoA 2898) *and* the Gold Standard (GS 1239), satisfying the strictest requirements for GHG accounting, additionality, and sustainable development co-benefits.

Calyx Global Tier 1 GHG Rating (A):

Rated "A" on Calyx Global's 8-point GHG integrity scale—the highest possible tier—confirming exceptional rigor in baseline setting, leakage prevention, permanence safeguards, and monitoring methodology.

Calyx Global SDG Impact Rating (4+)

Awarded 4+ out of 5 for SDG contribution quality—validating strong, measurable, and equitable outcomes across health, gender, livelihoods, and environmental protection, with no material ESG risks identified.

GS4GG Annual SDG Verification

Each of the six core SDGs (13, 7, 8, 3, 5, 6) is independently verified *every year*, with publicly reported metrics, including indoor air pollution reduction (kitchen smoke index drop from 2.65 to 0.63), time savings (1.5 hrs/day for women), and job creation (10,550 total).

Academic Validation by USTB/CSES

Independent scientific assessment by the Centre for Sustainable Environmental Sanitation (CSES) at Beijing University of Science & Technology confirmed contributions to 14 of 17 UN SDGs, establishing unprecedented breadth of verified impact.

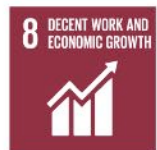
Verified SDG Contributions & Impact



UPM's Sichuan Household Biogas PoA is one of the world's most ambitious and effective climate protection programmes under CDM and Gold Standard. It sets the benchmarks for successful climate action and sustainable development.

According to independent scientific research by the Centre for Sustainable Environmental Sanitation (CSES) at the University of Science & Technology in Beijing (USTB), the Sichuan Household Biogas PoA substantially improves the lives of participating households and verifiably helps achieve 14 out of 17 UN Sustainable Development Goals.

The PoA's impact on six SDGs (SDG 3, 5, 6, 7, 8 & 13) is being monitored, verified and certified under **the Gold Standard for the Global Goals (GS4GG)** on an

 SDG 13 Climate Action ~725,000 tCO₂e annual emissions reduction	 SDG 7 Affordable & Clean Energy 395,435 households Clean biogas access for 395,435 households
 SDG 8 Decent Work & Economic Growth ~10,500 Jobs created in biogas sector	 SDG 3 Good Health & Well-Being Reduced indoor air pollution Improved Sanitation
 SDG 5 Gender Equality Time savings for women, job opportunities	 SDG 6 Clean Water & Sanitation Improved waste management, water quality protection

Climate

13 CLIMATE ACTION



The Sichuan Household Biogas Programme delivers substantial climate benefits through the reduction of both methane emissions from animal manure and carbon dioxide emissions from the combustion of coal and firewood.

The current annual GHG emissions reduction by the PoA with 87 included Component Project Activities (CPAs) is approximately 725,000 tCO₂e. This translates into an annual GHG emissions reduction per household of approximately 1.8 tCO₂e.

Since the start of its emissions reduction period on 10 May 2012 until January 2025, the PoA has achieved verified GHG emissions reductions of approximately 7.77 million tCO₂e. The programme has also reduced annual coal consumption by around 340,000 tons and firewood consumption by approximately 690,000 tons annually.

Impact Category	Annual Achievement
GHG Emissions Reduction	~725,000 tCO ₂ e
Coal Consumption Reduction	~340,000 tons
Firewood Consumption Reduction	~690,000 tons
Chemical Fertilizer Reduction	~98,859 tons
Renewable Energy Generation	~375,663 MWh

Energy

7 AFFORDABLE AND CLEAN ENERGY



All 395,435 participating households gain access to a stable, reliable, and cost-free source of renewable energy.

Economic Benefits: After switching to biogas, participating households experience around 40% higher annual disposable income due to saved energy and fertilizer expenditures, higher agricultural output, and additional income from carbon credit sales. The total annual estimated increase of disposable income per household is approximately CNY 1,056 (USD 151). The project's annual energy cost savings per household amount to approximately CNY 366, for a total annual saving of nearly CNY 145 million.

Benefit Category	Annual Impact
Household Income Increase	~CNY 1,056 (USD 151) per household
Total Income Increase	~CNY 417 million (USD 60 million)
Energy Cost Savings	~CNY 145 million (USD 20.7 million)
Fertilizer Cost Savings	~CNY 138 million (USD 19.7 million)
Renewable Energy Generation	~375,663 MWh

Water & Sanitation

6 CLEAN WATER AND SANITATION



Water Source Protection

The project protects groundwater and surface water from contamination in two keyways: (1) The waterproof digesters prevent untreated manure from leaching into water sources. (2) The reduced use of chemical fertilizers and pesticides prevents agricultural runoff, a major source of water pollution and eutrophication.

Human Development

3 GOOD HEALTH AND WELL-BEING



SDG 3: Good Health & Well-being

The programme replaces inefficient coal and wood ovens with modern biogas cook stoves that deliver clean energy without smoke.

Health Improvement: Switching from coal and firewood to smokeless biogas drastically reduces indoor air pollution. Monitoring reports show a significant reduction in the "kitchen smoke" indicator from 2.65 to 0.63 (on a scale of 0-3). This significantly reduces indoor air pollution with CO, SO₂, PM₁₀ and NH₃, effectively mitigating respiratory diseases such as asthma, cataracts, tuberculosis, and lung cancer. This particularly benefits women and children who spend the most time at home.

Enhanced Sanitation: Replacing open manure pits and unhygienic latrines with sealed, airtight digesters eliminates breeding grounds for flies and pathogens. The improved sanitary conditions from proper manure management also prevent zoonotic diseases and infections. This improves water quality and reduces the incidence of diarrheal diseases and parasitic infections, benefiting all 1.2 million direct beneficiaries.

5 GENDER EQUALITY



SDG 5: Gender Equality

Reduced Workload: In rural Sichuan, cooking is a primary responsibility of women. The new, easy-to-use biogas stoves save women an average of 1.5 hours per day in cooking time. This time is now available for income-generating activities, education, or rest.

Economic Empowerment: Of the 10,550 total jobs created by the programme, over 1,000 (roughly 10%) are held by women, providing them with new economic opportunities and enhancing their role in local development.

8 DECENT WORK AND ECONOMIC GROWTH



SDG 8: Decent Work & Economic Growth

The programme has created significant local employment opportunities across the biogas sector. According to SREO officials, approximately 10,550 jobs, about 8,500 temporary and 2,000 permanent jobs related to digester construction and maintenance, have been created directly by this PoA in its Sichuan target areas.

Other SDG Impacts



SDG 1: No Poverty

Increased Income: By replacing coal purchases and reducing the need for chemical fertilizers, each participating household sees an average annual increase in disposable income of **CNY 1,056 (approx. USD 151)**. This represents a roughly **40%** increase in their annual income. Cumulatively, this translates to an additional **CNY 417 million** injected into the local economy.

Investment Leverage: The programme has stimulated nearly **USD 339 million** in total investment in domestic biogas technology and rural energy infrastructure. biogas technology and rural energy infrastructure.



SDG 2: Zero Hunger

Sustainable Agriculture: The programme promotes a circular agricultural model. Households replace chemical fertilizer with digestate, saving an average of 250 kg of chemical fertilizer per year per household. This amounts to a total annual reduction of 98,859 tons of chemical fertilizer, leading to over 182,000 hectares of farmland being managed under more sustainable and productive practices, thus improving food security.



SDG 4: Quality Education

Training and Skill Development: All participating households receive comprehensive training on safe and effective use of their biogas system. This means at least 395,435 people have gained new knowledge and skills.

Professional Qualification: The programme has trained approximately 2,000 local farmers and bricklayers as certified biogas technicians, providing them with stable, skilled employment and enhancing their long-term career prospects.



SDG 9: Industry, Innovation & Infrastructure

Local Technology & Infrastructure: All biogas equipment is produced domestically, adhering to Chinese quality standards. The project has fostered a local clean-tech industry and improved household infrastructure (kitchens, toilets, pigsties) across vast areas of rural Sichuan.

Other SDG Impacts



SDG 10: Reduced Inequalities

Targeted Support for Vulnerable Regions: The programme actively reaches the poorest areas, including **55 officially designated poverty-stricken counties** in Sichuan and communities still recovering from the devastating 2008 earthquake. This targeted approach helps bridge the development gap between urban and rural regions.



SDG 12: Responsible Consumption & Production

Waste as a Resource: The programme transforms a major source of pollution (animal manure) into two valuable resources: clean energy and organic fertilizer. It prevents the environmental impact of **220,000 tons** of untreated dry matter manure per year, embodying the principles of a circular economy.



SDG 15: Life on Land

Due to the PoA, annual firewood use decreases by approx. 690,000 tons and almost 100,000 tons of chemical fertilizer are replaced p.a. by superior and more eco-friendly natural fertilizer.



SDG 17: Partnerships for the Goals

International Collaboration: The programme is built on a strong, long-term multi-stakeholder partnership between the German project developer (UPM), its Chinese partner (Chengdu Oasis), and the local implementing authority (Sichuan Rural Energy Office). This collaboration demonstrates how international cooperation and public-private partnerships can effectively deliver the SDGs.



Beneficiary Stories



The Sichuan Household Biogas Programme delivers measurable climate benefits alongside profound, verifiable improvements in the lives of participating households. The beneficiary stories presented in this chapter offer direct insight into how the programme translates carbon finance into tangible outcomes on the ground. Families report cleaner indoor environments due to reduced reliance on coal and firewood, leading to improved respiratory health and safer cooking conditions. The transition to biogas systems has also strengthened household hygiene through better manure management and sanitation practices. At the same time, reduced fuel costs and new livelihood opportunities contribute to more stable and resilient incomes. Together, these accounts demonstrate the programme's ability to generate high-integrity carbon credits while delivering meaningful social and health co-benefits.



Zeng Yuying Jian Yang County



Digester installed in 2011



Saving around 120EUR
every year

Zeng Yuying and her family seized the opportunity presented by the programme when constructing their new house in Jian Yang county, one of the poorest districts in Sichuan province selected by the Sichuan Rural Energy Office for a clean energy deployment pilot programme. The household comprises Zeng Yuying, her husband, an eighteen-year-old son, a five-year-old daughter, and the mother of Zeng's husband.

The family keeps production and livestock for their own consumption, including cereals, vegetables, fruits, chickens, and one sow. Their annual income was approximately 1,500 EUR in 2011, with both parents working morning, afternoon, or evening shifts for the commune repairing roads and public facilities, supplemented by selling their sow's piglets once or twice a year. The family saves approximately 120 EUR every year through the use of biogas, a substantial amount given their modest income. The digester, installed in 2011, replaced a traditional cook stove powered by firewood, freeing the family from the burden of fuel collection and the health hazards of indoor smoke.

Since the installation and initial training, the family has been using the digester at its best capacity, saving enough money to cover the cost of the digester in a year and supporting the repayment of their house mortgage.



Xie Guo'An
Jian Yang County



Digester installed in 2011



Reinvesting the money saved
thanks to the digester into
own farming activities

Xie Guo'An lives in Jian Yang County in Sichuan Province with his wife and grown-up son. The family's sole occupation is farming, cultivating two mu of land (approximately 13 acres) for chives which are sold, while the rest of their land is used for vegetables and cereals for family and livestock consumption. Their livestock includes one sow and piglets, chickens, and ducks. Before the digester, the family used a mix of coal and wood for cooking, and their average annual income was approximately 1,500 EUR in 2011.

The digester, also installed in 2011, has enabled the family to reinvest their savings directly back into expanding and improving their farming operations, creating a virtuous cycle of increased productivity and income. The convenience of biogas has also eliminated the need to purchase and transport coal and firewood, saving both money and valuable time.

Since the installation of the digester, the family has been able to cook three meals per day using the biogas generated and was able to invest some of the money saved on fuels and fertilizers to invest in their agricultural activities.



Huang Mingying
Santai County



Digester installed in 2012



Saving around 120EUR
every year

Huang Mingying lives with her husband, her parents, and her eight-year-old son in a small village in Santai county. The grandparents farm the land, while Huang and her husband operate a small business from their home, selling crops and fertilizers. The family is using the cereals and corn to feed the family and livestock and sell most of its production of vegetables and fruits. They also raise chickens, for meat and eggs, and sell the offspring of their sow. Although the family was able to double its total income with the extra revenue generated by the family business, Huang was looking forward to being able to save on cooking fuels.

Her digester was installed in 2012, and she now saves approximately 120 EUR every year on energy costs. The time saved from cooking with clean, instant biogas instead of traditional fuels has been particularly valuable for Huang, allowing her to dedicate more attention to her family's business while enjoying a smoke-free kitchen and a cleaner home environment.

Huang was first acquainted with the household biogas programme when families in her village starting installing biogas digesters in their home. She saw there a solution which could help her saving money, have a cleaner living environment and provide her with a much more convenient cooking fuel, freeing her from long hours in the kitchen and giving her more time to manage her small family business.

The journey continues ...

The Sichuan Household Biogas Programme stands as a testament to the power of innovative climate finance mechanisms to deliver meaningful, measurable impact on both environmental and social fronts. Over its 13+ years of operation, the programme has:

- Demonstrated that carbon offset projects can achieve verifiable, large-scale GHG emissions reductions while simultaneously improving livelihoods
- Created a sustainable model for rural energy access that continues to benefit households beyond the crediting period
- Set benchmarks for household biogas programmes worldwide in terms of climate and SDG impact
- Built capacity and infrastructure that will continue to serve rural communities for years to come

As the programme reaches the end of its crediting period in 2025, the nearly 400,000 participating households will continue to benefit from their biogas systems for their full 20-year lifetime and beyond. The Sichuan Rural Poor-Household Biogas Programme is far more than a carbon offset project; it is a comprehensive model for sustainable development. By integrating climate action with tangible improvements in health, income, gender equality, and environmental quality, it has demonstrated the powerful potential of carbon finance to drive positive change. The programme stands as an exemplary case of how well-designed, community-focused initiatives can deliver lasting benefits aligned with the UN Sustainable Development Goals.



About UPM

UPM Umwelt-Projekt-Management GmbH (UPM) helps turn climate action into impact by supporting GHG emission reduction project development worldwide and delivering trusted, high-quality carbon credits.

Founded in 1991 in Munich, Germany, UPM is dedicated to ensuring that global warming is kept within safe limits and striving to create a better Earth for both present and future generations.

UPM now actively seek high-quality, high-impact projects worldwide, with a strong focus on climate-vulnerable regions in Asia and Africa.

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