UPM's Sichuan Rural Poor-Household Biogas PoA has enormous co-benefits beyond GHG emissions reduction

Executive Summary of the CSES study about the PoA's co-benefits

The Centre for Sustainable Environmental Sanitation (CSES) at the University of Science and Technology Beijing (USTB) was appointed by UPM Umwelt-Projekt-Management GmbH (UPM) to evaluate critically the actual and potential co-benefits resulting from the Sichuan Rural Poor-Household Biogas Development Programme beyond its main purpose, the reduction of GHG emissions.

Rationale and scope of the scientific third-party study about the PoA's co-benefits

The Sichuan Rural Poor-Household Biogas Development PoA (CDM PoA 2898, GS 1239) aims to support up to one million low-income rural households in China's Sichuan province with the installation of advanced biogas digesters and smoke-free biogas cook stoves. The proven and reliable household size biogas digesters avoid methane emissions from animal manure and carbon dioxide emissions from solid fuels, such as coal and firewood, by producing clean, renewable and free biogas to be used conveniently by participating households for cooking, heating, and lighting.

To date, the Sichuan Household Biogas PoA has included nearly 400,000 rural Sichuan households with an average of 4.2 family members. Thus, a total of 1.68 million people are already benefitting from this PoA, thereof 49.36% or around 830,000 women and girls. At current scale, the PoA avoids nearly 900,000 tCO_2e per year.

To verify the PoA's co-benefits, the independent scientific study addresses the following nine key sustainability issues:

Does the PoA have any verifiable co-benefits for

1. natural resources efficiency,
2. biodiversity and habitat conservation,
3. air quality,
4. water quality,
5. soil quality,
6. living conditions and human health,
7. local economic development and employment,
8. energy self-reliance,
9. gender equality and women empowerment,

in the programme's Sichuan target regions, and, if so, to what extent (low, moderate, high)?

The study project was led by CSES director and environmental sanitation expert Prof. Dr. Ing. Zifu Li (scientific supervisor) and German CSES guest professor and leading international biogas technology expert Dipl.-Ing. Heinz Peter Mang (study coordinator), whereas research work was conducted by a team of CSES senior and junior professionals. The timeline for the entire study project ranged from 11 September 2015 to 21 February 2016.

The twofold methodological approach of the study compares the empirical data collected during the field survey carried through in November 2015 at 20 randomly selected PoA households in Sichuan's counties Fucheng and Dongpo with the findings of hundreds of evaluated national and international scientific publications about household biogas programmes.

Robust evidence for the PoA's many advantages for poor rural households in Sichuan

The primary purpose of this mainly explorative PoA co-benefits analysis is to build the basis for future in-depth investigations and quantifications of the programme's sustainability effects. The study does not claim to be representative or deliver statistically significant results. Nonetheless, this programme evaluation provides robust evidence for the PoA's many advantages for the participating poor rural households in Sichuan and delivers a plausible estimate for the extent of the PoA's contribution to meeting some essential sustainability criteria.

These findings prepare the ground for many pragmatic recommendations to the PoA developers and identify urgent needs for additional scientific research that might help to further improve the performance of the Sichuan Household Biogas PoA and enhance its contribution to a sustainable development in rural China.

The next table provides an overview of the most important findings of this PoA co-benefits study.

Table 1: Overview of co-benefits of the Sichuan Household Biogas PoA

A. Environmental PoA co-benefits				
Area	**Indicator**	**Level of PoA co-benefits**		
		Low	**Moderate**	**High**
Natural Resources Efficiency	Reduction of coal use			•
	Reduction of firewood use			•
	Reduction of synthetic fertilizer and pesticide use			•
Biodiversity and Habitat Conservation	Reduction of deforestation	•		
	Use of Invasive Alien Plant Species as biodigester feedstock	•		
Air Quality	Reduction of indoor air pollution			•
	Reduction of outdoor emissions			•
Water Quality	Improved storage of human excreta, animal waste and digestate			•
	Improved disposal and use of human excreta, animal waste and digestate			•
Soil Quality	Improved fertilizing practices and soils			•
	Reduction of soil contamination with harmful substances		•	

B. Socio-economic PoA co-benefits				
Area	**Indicator**	**Level of PoA co-benefits**		
		Low	**Moderate**	**High**
Living Conditions and Human Health	Improved indoor air quality			•
	Improved sanitary situation			•
	Reduction of pesticide use			•
Local Economic Development and Employment	Employment and income generation for biogas technicians and construction workers			•
	Cost savings due to substitution of traditional fuels (mainly coal)			•
	Cost savings due to substitution of electricity and natural gas as cooking fuel	•		
	Additional income from carbon credit sales	•		
	Additional income from digestate sales	•		
	Cost savings due to fertilizer substitution		•	
	Cost savings due to pesticide substitution		•	
	Reduction of medical expenses		•	
	Reduction of cooking time		•	
	Reduction of time for firewood collection	•		
	Productive use of saved time		•	
Energy Self Reliance	Avoidance of increased energy consumption (due to suppressed demand)			•
	Increase of energy self reliance			•
Gender Equality and Women Empowerment	Improved living conditions and health for women and girls			•
	Reduced workload and time savings for women		•	
	New job opportunities for women	•		
	Better education and training for women	•		
	Increased participation and involvement of women		•	
Animal Welfare	Improved living conditions for animals (pigs)		•	
	Improved animal health and welfare		•	

Source: CSES, Co-benefits of the Sichuan Rural Poor-Household Biogas Development Programme beyond GHG Emissions Reduction, Beijing 2016

UPM's Sichuan Household Biogas PoA contributes verifiably to the achievement of 14 out of 17 UN Sustainable Development Goals

The UN Sustainable Development Goals (SDGs), adopted on 25 September 2015, and its set of specific targets and indicators have not been fully available at the start of work for this PoA study. Due to the importance of this emerging global sustainability assessment standard, the present study has added a tentative translation of its results a posteriori into the methodological approach of the new UN SDGs. Thus, it is possible to obtain a preliminary assessment of the PoA's contribution to the achievement of these new sustainable development goals although this attempted alignment, of course, needs to be further substantiated and quantified by additional scientific research (see Table 2).

Table 2: The contribution of the Sichuan Household Biogas PoA to the achievement of the UN SDGs

UN Sustainable Development Goals					
SD Goal No.	Sustainable Development Goal (SDG)	Assessment of PoA contribution to the achievement of SDGs			
		Low	Moderate	High	N/A
1	End poverty in all its forms everywhere			•	
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture			•	
3	Ensure healthy lives and promote well-being for all at all ages			•	
4	Ensure inclusive and quality education for all and promote lifelong learning		•		
5	Achieve gender equality and empower all women and girls		•		
6	Ensure access to water and sanitation for all			•	
7	Ensure access to affordable, reliable, sustainable and modern energy for all			•	
8	Promote inclusive and sustainable economic growth, employment and decent work for all			•	
9	Build resilient infrastructure, promote sustainable industrialization and foster innovation		•		
10	Reduce inequality within and among countries		•		
11	Make cities inclusive, safe, resilient and sustainable				•
12	Ensure sustainable consumption and production patterns		•		
13	Take urgent action to combat climate change and its impacts			•	
14	Conserve and sustainably use the oceans, seas and marine resources				•
15	Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss		•		
16	Promote just, peaceful and inclusive societies				•
17	Revitalize the global partnership for sustainable development			•	

Source: CSES, Co-benefits of the Sichuan Rural Poor-Household Biogas Development Programme beyond GHG Emissions Reduction, Beijing 2016; UN SDG website: https://sustainabledevelopment.un.org/sdgs

The PoA's UN SDG score card shows that the programme achieves a high score for eight UN SDGs and a medium score for six UN SDGs. There are only three UN SDGs in which the PoA has only a minor effect or is not applicable. With this outstanding and well-balanced sustainability performance it ranks among the top household biogas programmes worldwide.

Study contacts

Customer of the study:

UPM Umwelt-Projekt-Management GmbH (UPM), established in 1991 and headquartered in Munich (Germany), is a leading company in the international carbon markets. UPM develops, implements and manages premium quality climate change mitigation, adaptation and sustainable development projects all around the globe with a particular focus on highly innovative Programmes of Activities (PoAs). UPM disposes of a diversified portfolio of more than 20 registered CDM and Gold Standard projects. Altogether, these projects will not only save more than 25 million tonnes of greenhouse gas but will also substantially improve the lives of millions of people.

For more information about the Sichuan Rural Poor-Household Biogas Development Programme, this study or to order this study's full length version, please contact

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Provider of the study:

The **Center for Sustainable Environmental Sanitation (CSES)**, affiliated to the University of Science and Technology Beijing (USTB), was established in 2008 with the objective to build capacity among young professionals (Chinese and international) in the interrelated sectors of sustainable environmental sanitation, food security, bioenergy and climate protection. Today, about 30 master and PhD candidates (about 50% of them female) do their research and project work in the CSES under guidance from Prof. Dr.-Ing. Zifu Li, environmental sanitation expert, German CSES Guest Professor and Dipl.-Ing. Heinz-Peter Mang, ecological sanitation and bioenergy expert, and the two Junior Professors and lecturers Lei Zhang and Shikun Cheng, both PhDs.

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