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9th India International Water Week - 2026

Pollution prevention and efficient water management from Leather & Textile Clusters in India

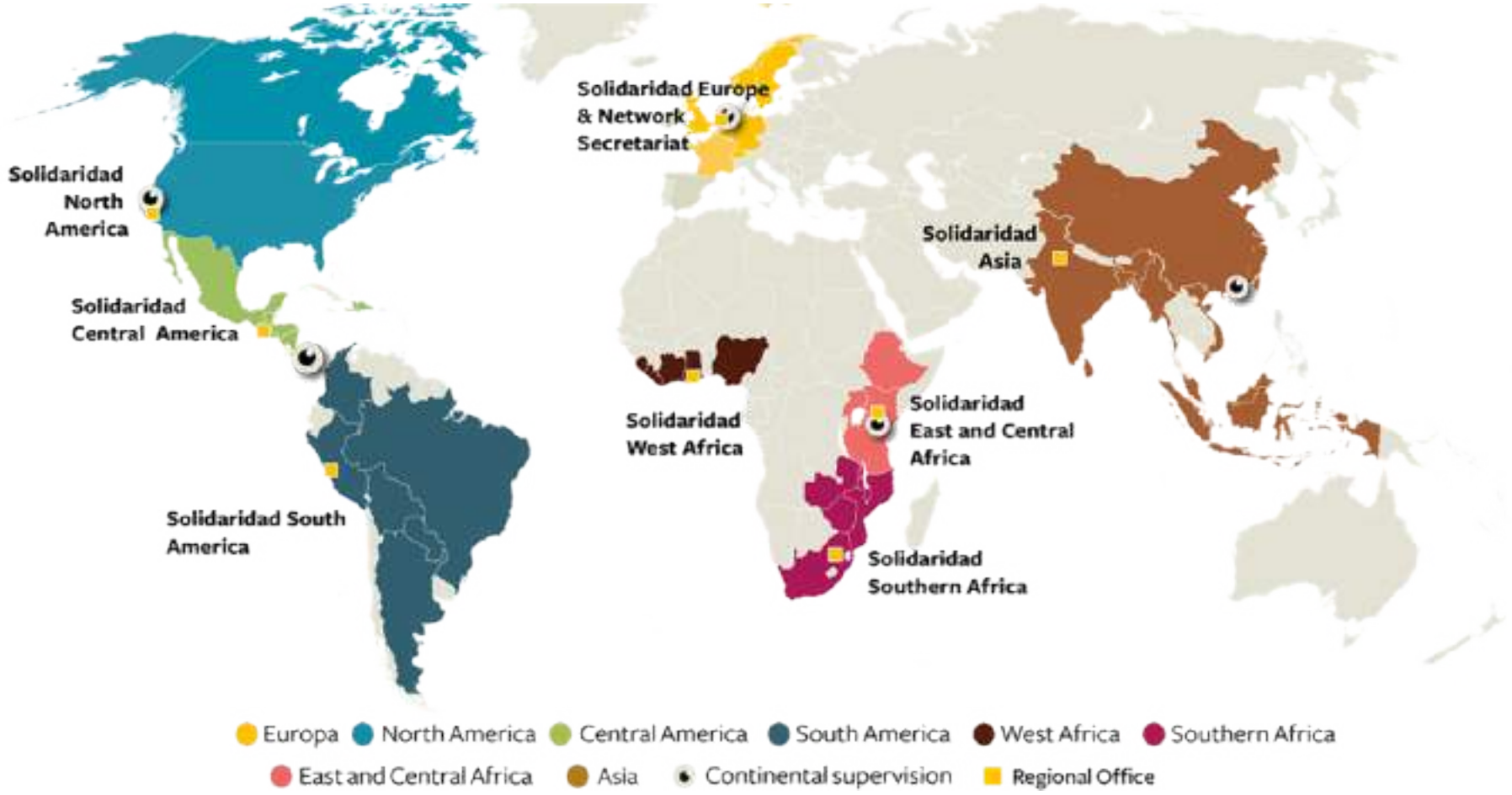
ECO-SCOPE MODEL

connecting people, planet and profit

SOLIDARIDAD IS AN INTERNATIONAL CSO AND NETWORK ORGANISATION

WORKING IN 50 COUNTRIES WORLDWIDE

SREC is registered as a non- profit entity in India from 2008



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WHAT SOLIDARIDAD DOES DIFFERENTLY

Decarbonisation that safeguards jobs, improves worker safety, and strengthens livelihoods—enabling a Just Transition.



- **Shift from end-of-pipe treatment to source-control inside factories.**
- **Integrated model combining water, chemicals, energy, OHS, and GHG reduction.**
- **Proof of concept from India (Kanpur, Kolkata, Tamil Nadu, Panipat) cluster implementation.**
- **Prevent pollution at source is minimum acceptable standard.**

SOLIDARIDAD'S JOURNEY IN THE LEATHER SECTOR

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2017-2021

Kanpur-Unnao, Uttar Pradesh, India

Pollution Prevention and Efficient Water Use

2018-2021

Ethiopia, Africa

Green Tanning Initiatives

2019-2021

Savar, Bangladesh

Promoting Safe Use of Chemicals (PSUC)

2020-2023

Kolkata, West Bengal, India

Effective Waste Management and Sustainable Development of MSME tanning companies in Kolkata Leather Cluster

2020-2023

Sri Lanka

The Leather Initiative for Sustainable Employment Creation

2022-2025

Tamil Nadu, India

Promoting circularity in the leather clusters for solid waste management

POLLUTION PREVENTION AND EFFECTIVE WASTE MANAGEMENT OF PANIPAT TEXTILE CLUSTER



Cleaner Environment
Reduced pollution and better air & water quality

Effective Waste Management
Promoting resource efficiency and circularity

Stronger Communities
Improving health, livelihoods and sustainable growth

DONOR
National Mission for Clean Ganga, Government of India

PROJECT DURATION
4 Years
(January 2023 till December 2026)

TOTAL PROJECT AMOUNT
Rs. 18.95 Cr

FUNDING CONTRIBUTION

NMCG Contribution:	INR 15.16 Cr (80%)
Solidaridad Contribution:	INR 3.8 Cr (20%)

Cleaner Water | Reduced Pollution | Resource Efficiency | Sustainable Future

PROJECT CONSORTIUM & STRATEGIC OBJECTIVES

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Kingdom of the Netherlands

ISO 9001 nitra ORGANISATION

- Reduce pollution in the Panipat Textile Cluster by implementing advanced green technologies.
- Improve workplace conditions with a strong focus on occupational health and safety practices.
- Foster public-private partnerships to enhance waste management systems in the Panipat cluster.

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HISTORIC TRACK RECORD OF SOLIDARIDAD IN TEXTILE

PROVEN – EVALUATED – SCALED

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2001

Kuvichi (2001):
Pioneered the first fair-trade, organic denim brand to prove sustainable supply chains are commercially viable.

2013

BMI China (2013):
Implemented 675 technical measures in 43 mills, saving 6.6 million tonnes of water and 15.2 million kWh of electricity.

2015

PaCT Bangladesh (2015):
Established a national platform for cluster-led decarbonization and resource efficiency in major textile hubs.

2016–2022

BMI Ethiopia (2016–2022):
Applied the BMI model to ensure a "Just Transition" for 30,000 workers in a developing garment sector.

2022

BMI Bangladesh (2022):
Scaled a 6-step model that integrates data robustness and factory-level interventions with buyer engagement.

Integrated Engagement:
Links factory environmental gains directly to brand purchasing.

TWO DECADES OF IMPACT

- **6.6 million** tonnes of water saved
- **15.2 million** kWh of electricity saved
- **675 technical** measures in 43 mills
- **30,000** workers supported for a just transition
- Stronger, more **sustainable** textile supply chains



★ Two decades of Solidaridad leadership in textile sustainability across China, Bangladesh, India, and beyond.

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CLEANER PRODUCTION VALUE CHAIN

VALUE CHAIN MATRIX

TEXTILE PROCESS	CHALLENGES	DEMONSTRATED INTERVENTIONS BY SOLIDARIDAD AND PARTNERS	BENEFITS
Dyeing of polyester/cotton fabrics	Water, temperature parameters controlled manually which leads to inconsistency in dyeing and high resource use	Auto controller on Jet dyeing machine	• Reduced Water Consumption upto 15% • Reduced Process time upto 11-15% • Reduced Manual Errors upto 90%
Drying/chemical finishing of fabrics	Excess water content in the fabric needs higher energy and slow down machine speed.	Vacuum Suction Slit on Stenter Machine	• Saved water picked up in fabric upto 40% • Reduced energy consumption of stenter to process the fabric • Increased stenter productivity upto 20-25%
Polyester Dyeing machines	Lot of energy being lost from the surface of machine which created health hazard due to high steam consumption	Insulation (Cladding)	• Reduced the working base temperature up to 10° C at work place safety of workforce by avoiding contacts with hot surface of machine. • Reduced agro based fuel upto 324 kg/day for a 1000 kg machine
Utility/Boiler	Exhaust through chimney carrying lot of energy into atmosphere and so there is heat loss which must be recovered	Heat Recovery System through Chimney Smoke	• Volume may be up to 23 Lac liter/day depending upon boiler size • Fuel saved – 56250 kgs per year for 15 KLD water
General-cleaning operation	Normal pipes are being used for drum, floor, cleaning purpose with high amount of water	Water Spray Gun	• Reduced Water Consumption for cleaning process upto 60%
Dyeing	Eco friendly chemicals introduced in place of acid/Alcalaries	Chemical Reduction in Dyeing	• Replaced 30% of the traditionally used chemicals with eco friendly Substitutes Reduced the COD load upto 35% • Reduced the cost of ETP treatment upto 40%
Print soaper/ washer	Due to high temperature in chamber's, chemicals consumption was high	Chemical Reduction in the print washer / soaper	• Reduced consumption of Caustic & Hydro upto 30% • Reduced water consumption upto 30% • Reduced COD load upto 35% • Saved Agro fuel upto ~300 kg/day
Chemical finishing	Unused softener in water being sent to ETP	Softener Recycling from Hydro Extractor effluent	• Reduced consumption of 30% softener by reusing • Reduced water consumption upto 17% • Reduced ETP load drastically
Utility / print washer	Heat from hot drains not being recovered	Heat Exchanger in hot drains	• Reduce water (steam) consumption upto 6.2 %. • Savings of agro based Fuel of 1091 kg per day. • Reduction of CO2 emission upto 264 tCO2 per year.
Steam ager / print fixation	Steam after process went of into atmosphere	Recycling of energy from Steam Ager Exhaust Gases	• Saved daily water 1168 liter/day, Saved Agro fuel 33 kg/day. • Annual CO2 emissions reduced upto 206tCO2/year.
Dyeing	Lack of process optimization and high consumption of chemicals	Process Optimization in Dyeing on Jigger Machine	• Reduced Sodium Hydroxide (Caustic) upto 50% • Reduced water consumption upto 24% • Reduced process time and Electricity saved upto 11% per batch. • Reduced agro fuel up to 282 kgs/batch for a 1200 kg machine • Reduced the cost of treatment upto 18%
Utility/dyeing	Steam condensate not being recovered	Steam Condensate Recovery System	• Thermal energy saved 5,67,000 Kcal per day. • Water saved 17,280 liter per day. • Agro fuel saved 189 Kg per day. • Reduction of CO2 emission by 147.6 tCO2 per year. • Risk of scaling reduced due to low TDS feed water
Waste water recycling	High water demand in dyeing, ETP treated water not upto mark for use in dyeing process	Reduce fresh water consumption by using ETP treated effluent in dyeing	• Reduces dependency on fresh water, promoting environmental sustainability • Helps to meet environmental regulations by minimizing wastewater discharge • Approx 60% fresh water consumption reduction by use of recycled water in dyeing process. (very pastel shaded)

SCIENTIFIC IMPLEMENTATION FRAMEWORK

Stage	Implementation Approach	Expected Outcome
Industry Partnership	Formal partnerships established through MoUs with participating textile industries to ensure collaboration and long-term commitment.	Industry participation and ownership of interventions.
Baseline Assessment	Comprehensive assessment of water consumption, wastewater generation, chemical use, energy consumption, production processes, and ETP performance.	Established baseline for measuring project impact.
Technical Assessment	Detailed process audits conducted to identify opportunities for water conservation, cleaner production, energy efficiency, and treated wastewater reuse.	Prioritized interventions based on technical feasibility.
Technology Selection	Appropriate technologies selected considering technical performance, cost-effectiveness, scalability, and industry requirements.	Adoption of suitable cleaner production technologies.
Pilot Demonstration	Selected interventions implemented and demonstrated under actual industrial operating conditions.	Validation of technology performance and resource savings.
Monitoring & Verification	Continuous monitoring of water, energy, chemical consumption, wastewater reuse, and process performance using technical measurements and field observations.	Verified environmental and operational improvements.
Capacity Building	Training programmes conducted for industry personnel on cleaner production, OHS, ETP management, and resource efficiency.	Improved technical capacity and sustainable adoption of best practices.
Documentation & Knowledge Sharing	Project outcomes, lessons learned, and best practices documented and disseminated through workshops, technical reports, and stakeholder platforms.	Knowledge transfer and wider dissemination.
Scale-up & Replication	Successful interventions promoted for adoption across additional textile industries within the cluster.	Wider implementation and long-term sustainability.

KEY INTERVENTIONS IMPLEMENTED IN THE PANIPAT TEXTILE CLUSTER

Integrated Approach Towards Water Efficiency, Cleaner Production & Circular Water Management

Water Optimization	Chemical Optimization	Energy Optimization
❖ Auto Controllers on Jet Dyeing Machines	❖ Chemical Process Optimization	❖ Heat Recovery from Chimney Exhaust
❖ Water Spray Guns	❖ Salt & Soda Reduction	❖ Heat Exchangers on Hot Drains
❖ Cooling Water Recovery	❖ Green Chemical Substitution	❖ Steam Condensate Recovery
❖ Softener Water Recovery	❖ Chemical Management System (CMS)	❖ Steam Ager Exhaust Heat Recovery
❖ Water Flow Optimization	❖ Optimized Dyeing Processes	❖ Cladding/Insulation

Treated Wastewater Re-use	Occupational Health & Safety (OHS)
❖ Recycling of ETP Treated Water	❖ OHS Framework Developed
❖ Process Water Reuse	❖ PPE Awareness & Training
❖ Cooling Water Reuse	❖ Chemical Handling & Storage Training
❖ Water Quality Monitoring	❖ Fire & Emergency Response Training
❖ Circular Water Management	❖ Capacity Building for 8,000+ Workers

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8 CLEANER PRODUCTION INTERVENTIONS

Driving Resource Efficiency in Panipat Textile Cluster

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1 AUTO CONTROLLER ON JET DYEING MACHINE



PLC based auto controller regulates temperature, water input and discharge automatically, optimizing the entire dyeing process.

- Water Saving: Up to 15%
- Process Time Reduced: 11–15%
- Manual Errors Reduced: Up to 95%

2 HEAT EXCHANGER INSTALLATION ON HOT DRAINS



Recovers heat from hot wastewater drains to preheat fresh water for reuse in process.

- Steam Saving: Up to 6.2%
- Fuel Saving: 338 T/year
- CO_2 Reduction: 18 T/year

3 ETP-TREATED WATER REUSE IN DYEING



ETP-treated effluent is reused in polyester dyeing process, significantly reducing freshwater consumption.

- Freshwater Saving: Up to 80%
- Batches with Recycled Water: 80% / month
- Reduced Freshwater Dependency

4 STEAM CONDENSATE RECOVERY SYSTEM



Hot condensate (90–95°C) is recovered and returned to boiler feedwater system, saving energy and water.

- Thermal Energy Recovered: 567,000 kcal/day
- Water Saving: 17,280 L/day
- Fuel Saving: 352 T/year
- CO_2 Reduction: 19.02 T/year

5 SOFTENER RECOVERY & RECYCLING FROM HYDRO EXTRACTOR EFFLUENT



Softener rich effluent from hydro extractor is collected, stored and reused in washing process.

- Softener Saving: Up to 30%
- Water Saving: Up to 17%
- Reduced ETP Pollution Load Significantly
- Lower Production Cost

6 HEAT RECOVERY FROM CHIMNEY EXHAUST



Waste heat from chimney flue gases (150–220°C) is recovered to preheat process water for dyeing and washing.

- Water Heated to: 70–80°C
- Hot Water Generated: Up to 60,000 L/day
- Fuel Saving: 338 T/year
- CO_2 Reduction: 18.27 T/year

7 HIGH-PRESSURE WATER SPRAY GUN



High pressure spray guns are used for equipment and floor cleaning, reducing water consumption and improving cleaning efficiency.

- Water Consumption Reduced: Up to 60%

8 THERMAL INSULATION (CLADDING) ON JET DYEING MACHINE



Insulation with mineral wool and aluminium cladding reduces heat loss, maintains temperature uniformity and improves safety.

- Workplace Temp. Reduced: Up to 10°C
- Fuel Saving: 276 kg/day
- CO_2 Reduction: 4.47 T/year
- Improved Worker Safety

OVERALL IMPACT IN THE CLUSTER

- WATER REDUCTION: Up to 34.11%
- CHEMICAL REDUCTION: Up to 26.71%
- ENERGY SAVING: 12–15%
- CIRCULAR WATER MANAGEMENT: Through ETP Water Reuse
- WORKERS TRAINED ON OHS: 8,000+ (Trained across the cluster)

SUSTAINING RESOURCES | IMPROVING EFFICIENCY | ENHANCING COMPETITVENESS | BUILDING A GREENER FUTURE

www.solidaridadnetwork.org

WORK PACKAGES (TARGET- 45 TEXTILE DYEING UNITS)

WP 2 **Reduce water consumption by 30%** with Best Management Practices

WP 2 Development of in-house Chemical Management System and **reduce 25% of chemicals**

WP 3 Introduce best practices to **reduce GHG consumption up to 15%**

WP 4 Improve occupational health and safety of the textile personnel

WP 5 **Web-portal** (Multi-stakeholder platform for effective coordination and planning)
- Sub WP: Demonstration of 6 pilot project focused at reduction of water and chemical consumption & pollution load.

30%
Water Reduction

25%
Chemical Reduction

15%
GHG Reduction

Safer
Workplace & Healthier people

Stronger
Coordination Better Planning greater Impact



FACTORY LEVEL TRANSFORMATION: PRE-POST IMPROVEMENTS

WATER SAVINGS	CHEMICAL USE	ENERGY USE	GHG / YEAR	WORKERS TRAINED
				
PRE (Baseline) POST (Improvement)	PRE (Baseline) POST (Improvement)	PRE (Baseline) POST (Improvement)	PRE (Baseline) POST (Improvement)	PRE (Baseline) POST (Improvement)
---- 34.11%	---- 26.71%	---- 12- 15%	--- 3,760 tCO2eq	---- 8,000+

The Impact

- Less water used
- Fewer chemical release
- Lower energy consumption
- Reduced carbon foot print
- Safer Workplace
- Strong Collaboration
- Economic Benefits

GHG EMISSION REDUCTIONS ASSESSMENT

Independent Third party Assurance: TUV SUD

Standard: ISO 14064 - 2 : 2019

Validated Climate Impact (Panipat Textile Cluster)

3,760 tCO_2eq / Year GHG Avoided (8 Interventions)

Across 5 textile MSMEs through waste heat recovery, condensate reuse, insulation, process optimization, and ETP efficiency interventions

Baseline & project periods: 2022–2025 (site-specific)



BESCHEINIGUNG ◆ CONFIRMATION ◆ BESCHEINIGUNG ◆ CONFIRMATION ◆ BESCHEINIGUNG ◆ CONFIRMATION

GHG Assurance Statement

TÜV SÜD Validation and Verification Body for 'Environment and Energy'
Assurance Statement No.: VVB-VER-26/0103
Report No.: 3183/01162

Assurance Statement for **SOLIDARIDAD REGIONAL EXPERTISE CENTRE** under ISO 14064-2:2019

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SOLIDARIDAD REGIONAL EXPERTISE CENTRE
A-5, 1st Floor, Shankar Garden, Main Najafgarh Road,
Vikaspuri, New Delhi, Delhi 110018 India

TÜV SÜD Validation and Verification body (here onwards referred as VVB) hereby confirms that it has completed the validation in accordance with the principles and requirements of ISO 14064-3:2019 and regarding compliance with the requirements of ISO 14064-2:2019.

Validation Opinion: Based on our evaluation, we confirm that the project design document and monitoring plan of following locations meet the criteria specified in ISO 14064-2:2019 and are likely to lead to the estimated GHG emission reduction, within the limitations identified.

Place of Implementation & Address	GHG Emission Reduction Projects	Baseline Emissions (tCO2e/yr)	Project Emissions (tCO2e/yr)	Net GHG Reductions (tCO2e/yr)	Baseline Period	Project Period
Mukesh Furnishing(Pvt. Ltd (Plot no – 299 Sector-29 Part II, HSIIDC, Panipat, 132103)	Cladding / insulation of dyeing machines	929.70	154.95	774.80	08.03.2022 to 07.03.2023	08.03.2023 to 07.03.2024
Nikki Blankets Inc. (Plot no 460-461, Sector 29-Part II, HSIIDC, Panipat, 132103)	Condensate recovery system for boiler feed water	378.23	0.00	378.23	28.03.2022 to 27.03.2024	28.03.2024 to 27.03.2025
Aeon Industries (Khet Ghanpur, Dharam Jeevtha Road Panipat, 132107)	GAF system at ETP	338.64	152.33	186.31	15.07.2023 to 14.07.2024	15.07.2024 to 14.07.2025
	Heat exchanger at hot drains (hot drain heat recovery)	756.40	0.00	756.40	17.04.2023 to 16.04.2023	17.04.2024 to 16.04.2024
Silky Overseas Limited, (Jindlitra Pardhan Road-58, Pantheri, Panipat, 132107)	Energy conservation by controlling optimum temperature & pond system	192.00	0.00	192.00	03.07.2023 to 02.07.2024	03.07.2024 to 02.07.2025
	Flash steam recovery from dyer for boiler feed water	602.67	0.00	602.67	01.06.2023 to 31.05.2024	01.06.2024 to 31.05.2025
Shree Laxmi International (Plot no 300, Sector 29, Part-I HSIIDC, Panipat, 132103)	Vacuum suction slit on aerator machine	1368.14	1143.77	224.37	11.01.2023 to 10.01.2024	11.01.2024 to 10.01.2025
	Waste heat recovery from chimney smoke	602.67	0.00	602.67	17.04.2023 to 16.04.2023	17.04.2024 to 16.04.2024

The validation process included the following key steps:

- Review of project documentation, including project design documents, applicable methodologies, and baseline emissions.
- Evaluation of project implementation plans, processes, and procedures as applicable.
- Verification of data collection methods and monitoring systems for greenhouse gas emissions.
- Assessment of the accuracy, completeness, and consistency of greenhouse gas emission calculations.
- Identification and resolution of any non-conformities or areas for improvement.

This assurance statement is issued in accordance with the procedures and requirements specified in ISO 14064-3:2019.

Level of Assurance: Limited
Level of Materiality: 10%
Issued On: 06-01-2026

Head – VVB for 'Environment and Energy'

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OUR WORK IS OUR VOICE





Nirmal Kadyan

Industry Owner
V.N Dyeing House

Audio video Message



Darpan Chawla

Industry Owner
Raj Dyer's

Audio video Message

INNOVATIVE SOLUTIONS FOR SOLID WASTE MANAGEMENT

- Chemical sludge from ETP, CETP can be used to produce paver blocks.
- Bio-sludge can be used as a fuel.

Explored ways to convert textile waste into products like boxes, carry bags, and pouches through up-scaled circular economy which also reduces the tree cuttings.

- Trials underway to replace ETP dosing chemicals with fly ash from boilers.
- A lab-scale pilot for fly ash use in effluent water color removal is in progress.







SOLIDARIDAD HONORED WITH GEEF GLOBAL WATER AWARD 2024

Award Category: Industrial Water Project of the Year-2024

Key Highlights

Our Achievements:

Significant Water Savings: 451,537 liters/day across 36 enterprises

Annual Impact: ~230 million liters saved

Future Potential: Scaling to 50% of Panipat's 400 dyeing units could save 9.03 million liters/day or 2,800 million liters annually

Recognition by: Shashi Shekhar (IAS, Former Secretary) & Rakesh Kumar Verma (IAS, Additional Secretary) *Ministry of Jal Shakti, Government of India*







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TEXTILE CHARTER WITH CPCB, MoEF & CC



UP Pollution Control Board, Lucknow (uppcb.com)

Solidaridad's initiative to develop a charter for textile pollution was included on the official website of the Uttar Pradesh Pollution Control Board.



Textile Pollution Charter Portal (solidaridadasia.com)

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ABOUT C-PEC

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CPEC

Climate Pollution Expertise Center

An Affiliate of Solidaridad Network Asia Limited (SNAL)



C-PEC is a specialist institution in India advancing evidence-based, technically rigorous and scalable solutions for climate action, pollution abatement and sustainable industrial transformation.

- Specialized technical expertise, applied knowledge, and implementation capabilities
- Strategic partnerships across industries, MSMEs, governments, communities, finance and technical institutions
- Locally governed and institutionally independent with full operational autonomy
- Translating environmental and climate priorities into measurable outcomes


CHANGE
THAT MATTERS
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