

Proceeding Report



Technical Training Workshop

BEYOND CO₂
**Emission Calculation, Methane Monitoring &
Sequestration Metrics**

**Thursday, 2nd October, 2025
Peshawar**

Alternate Development Services Islamabad



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Background

Alternate Development Services (ADS), based in Islamabad, is a research, policy, and capacity-building organization dedicated to advancing climate action, environmental sustainability, renewable energy transition, and inclusive development. ADS brings a strong track record of supporting industries and corporate entities in adopting climate-resilient and low-carbon practices through evidence-based research, strategic consultations, and policy advocacy.

Through its flagship initiative “Alternate and Renewable Energy Campaign (AREC)” ADS has actively engaged sectors such as Food and Beverage (F&B), textiles, leather, and sports manufacturing. The organization works closely with corporate stakeholders to facilitate low-emission transitions that are in line with Pakistan’s national climate goals and international environmental commitments.

Greenhouse gas (GHG) emissions continue to drive climate change at an alarming pace, and there is growing urgency to quantify, reduce, and sequester these emissions using science-based methodologies. While CO₂ remains the dominant focus in many climate assessments, methane (CH₄) a GHG with an 80 times more global warming potential than CO₂ over a period of 20-year is increasingly recognized for its outsized role in near-term climate impacts. Yet, methane tracking and mitigation efforts remain under-addressed in local climate strategies.

ADS has been working actively in the field of GHG emissions and aims to strengthen capacity in emission quantification, particularly in real-time emission calculation tools, while also placing a strategic focus on methane. This training aimed to consolidate practical knowledge and technical capacity around accurate emission calculation and sequestration impact assessments, with a goal of advancing actionable climate solutions.

Objectives of the Training

1. Introduce practical methods for calculating GHG emissions across sectors using accessible and real-time tools.
2. Highlight methane emissions as a critical yet often underrepresented aspect of climate accounting.
3. Build understanding of carbon sequestration assessments and how to move beyond qualitative claims to quantifiable impact metrics.
4. Enable participants to develop preliminary emission and sequestration baselines for their operations or areas of interest.
5. Explore opportunities for integrating methane-specific monitoring and mitigation in future programming and policy development.

Venue and Date

The event took place from 9:30 AM to 5:00 PM at Sheleton’s Accommodator, Peshawar.

Stakeholders Participation

The workshop brought together experts, practitioners, and participants from academia, government, NGOs, and industry to strengthen technical capacity in GHG emission calculations, methane monitoring, and sequestration metrics. Participants from diverse sectors actively engaged in discussions, revealing shared challenges in GHG reduction and energy efficiency. This inclusive, multi-sectoral participation enabled constructive dialogue and reaffirmed the need for localized strategies and collaborative action in advancing Pakistan’s climate commitments.

Proceedings

The consultation began with the recitation of verses from the Holy Quran.

Amjad Mehdi

Amjad Mehdi, from ADS, provided an introduction to ADS and its energy transition initiatives. He highlighted the organization's dedication to research, policy, and capacity-building in climate action and renewable energy. He emphasized ADS's work under the AREC initiative in supporting sectors like food and beverage, textiles, leather, and sports manufacturing to adopt low-carbon practices aligned with national and international goals.

Mehdi also highlighted a recent milestone achievement of ADS, noting that the organization's sustained engagement during the NDC 3.0 consultation process in the country, including a consultation in Peshawar earlier this year, played a pivotal role in shaping Pakistan's updated Nationally Determined Contributions (NDCs). Through constructive dialogue and detailed position papers presented to GCISC, ADS's recommendations were well-received and later incorporated into the national framework. This recognition underscores the impact of ADS's evidence-based advocacy and technical expertise in influencing key national climate policies, particularly in advancing mitigation, adaptation, and just transition priorities within Pakistan's NDC 3.0.

Amjad Nazeer

Mr. Amjad Nazeer, CEO of ADS, opened the session by elaborating on the objectives and significance of the workshop. He emphasized that the initiative was designed to strengthen practical understanding and technical capacity in greenhouse gas (GHG) emission quantification and sequestration assessment—especially through the use of accessible, real-time tools.

He reiterated the importance of moving beyond qualitative claims toward quantifiable, evidence-based impact metrics. Underscoring methane's outsized role in near-term climate impacts, Mr. Nazeer stressed that methane remains an underrepresented aspect in local climate strategies and must be integrated into future programming and policy frameworks.

He highlighted that the workshop serves not only as a platform for technical learning but also as an opportunity to cultivate a network of practitioners capable of driving actionable climate solutions in Pakistan.



Dr. Zeeshan Shafiq



Dr. Zeeshan Shafiq presented on GHG Emission Reduction in the Energy Sector: A Case Study of Municipalities. He began by explaining the role of municipalities in decarbonizing energy systems, highlighting key challenges such as grid instability, financial constraints, and lack of localized tools. He emphasized that municipalities, as key energy consumers, have significant potential to reduce GHG emissions through strategic interventions, but face barriers like outdated infrastructure and limited funding.

Dr. Shafiq provided a detailed case study, focusing on a municipal energy system where traditional fossil fuel-based power generation dominated. He presented data showing that municipalities account for a substantial portion of local energy use, particularly in public lighting, water pumping, and waste management facilities. He introduced best practices, including the adoption of solar-powered street lighting, which has shown a 40% reduction in energy costs in similar pilot projects, and the integration of energy-efficient pumps that reduce consumption by up to 25%.

He elaborated on innovative approaches, such as the use of smart grids to optimize energy distribution and demand response systems to manage peak loads, which could cut emissions by 15-20% in urban settings. Dr. Shafiq also discussed the potential of biogas generation from municipal waste, noting that a single ton of organic waste can produce approximately 150-200 cubic meters of biogas, offsetting an equivalent of 300-400 kg of CO₂ annually. He stressed the importance of public-private partnerships to finance such initiatives, citing examples where municipal governments collaborated with private firms to install solar arrays on public buildings, achieving a payback period of 5-7 years.



The session included an interactive exercise/group work/simulation where participants applied concepts to calculate emissions for household scenarios, such as comparing natural gas stoves to induction alternatives, and extended this to municipal-scale applications like fleet electrification. He highlighted challenges municipalities face, including regulatory gaps, lack of technical expertise, and resistance to change from local stakeholders. Dr. Shafiq advocated for capacity building programs to train municipal staff in energy management and the use of real-time monitoring tools to track emission reductions.

The presentation concluded with a Q&A and open discussion, where participants shared experiences from pilot projects in passive cooling and efficient air conditioning. Dr. Shafiq responded to queries about scaling these solutions, suggesting phased implementation starting with high-impact areas like public facilities, and underscored the need for policy incentives to encourage municipal adoption of renewable energy technologies. He also addressed the importance of community engagement to ensure buy-in, proposing awareness campaigns to highlight the co-benefits of reduced energy bills and improved air quality.

Miss Fauzia Rafi

Miss Fouzia Rafi, Researcher at Center for Intelligent Systems and Network Research (CISNR), presented on Reducing GHG Reduction through Green Energy Buildings. She started with the context, noting that the building and construction sector contributes 37% of global CO₂ emissions according to the 2021 UN Global Status Report, presenting a significant opportunity for mitigation.

She outlined learning outcomes, including explaining the buildings sector's role in climate change, listing priority sectors driving the green building movement, describing current green building policies in Pakistan, and proposing recommendations for broader uptake.

In the Pakistan context, she discussed the Energy Conservation Code (2023) and Building Code (2021), their integration into NDCs focusing on clean fuels, passive cooling, and energy efficiency. She highlighted the Montreal Protocol ratification and Pakistan Cooling Action Plan for low-GWP refrigerants, and the need for efficient mechanical appliances.

On certification, she noted a siloed approach with 72 LEED-certified buildings (mainly textiles and corporate offices), the SED rating system since 2016, and national tools based on NECA. For retrofitting, she emphasized the Energy Conservation Building Code's provisions for existing buildings, pilot projects like LED lights and star-rated fans yielding 1.2 GW savings and PKR 18 million financially.



She addressed green public procurement as underutilized, with fragmented labeling regimes between federal and provincial levels. On embodied carbon, she explained it from material extraction to demolition, the need for life-cycle assessment (LCA) using tools like <https://lca.berc.pl/>, and Scope 1, 2, 3 emissions under the GHG Protocol,

with examples like direct emissions from vehicles (Scope 1), indirect from purchased electricity (Scope 2), and supply chain (Scope 3).

Recommendations included promoting alternative fuels for cement, contingency plans for extreme events, nature-based solutions like green roofs and urban forests. The session featured an exercise calculating CO₂ emissions from a natural gas stove versus solar or grid-powered induction stoves, demonstrating 30% energy savings.

The presentation ended with Q&A and open discussion on green building policies, standards, certifications, and renewable integration.

Dr. Khurshid Ahmad

Dr. Khurshid Ahmad from UET Peshawar (USPCASE) presented on Energy Management and Decarbonization in the Industrial Sector of KP. He covered the Pakistan energy scenario, showing



data from energy yearbooks on consumption by sector (excluding thermal power), oil production, sector-wise oil, gas, coal consumption, electricity generation mixes (e.g., 131,275 GWh in 2017-18 with gas 30%, hydel 21%), and by company in 2022-23. He highlighted renewable generation shares like wind 70%, solar 15.6% in 2022-23.

He discussed the need for energy management, emphasizing energy efficiency as the "low hanging fruit" with lower levelized costs than new generation, noting "A MW saved = A MW generated." He explained energy efficiency versus conservation, and benefits to industry (5-30% bill savings, competitiveness) and country (reduced emissions, resource view). He introduced

NEECA's roles in standards, labeling, industrial/building efficiency.

On energy audits, he stressed "We cannot improve what we cannot measure," outlining aims (measure use, identify losses, suggest measures) and 5 steps: walk-through, filling data, measuring, relating to production, benchmarking/suggesting. He listed major energy consumers like processes, compressors, chillers, process heat.

He detailed audit levels (ASHRAE): Level 1 walk-through, Level 2 detailed, Level 3 simulation. Processes: historical data, walk-through (layout, process, equipment, leaks, lighting, HVAC), analysis of consumption/costs, comparative benchmarking, preliminary findings with EMOs.

Instrumentation included power meter, combustion analyzer, infrared/digital thermometers, psychrometer, air flow devices, tachometer, ultrasonic leak detector, and other tools like camera, tape.

Case studies covered beverages (savings from air-fuel ratio adjustment PKR 1.82 million, insulation 0.72 million, leaks repair 2.54 million, total 5.443 million), textiles (near-term measures like compressor waste heat recovery 50-60%, IE3 motors 1.05% savings, cold-pad dyeing 16 GJ/tonne, stenter heat recovery 0.4 GJ/tonne, wastewater heat 1.1-1.4 GJ/tonne), cement (motor to hydraulic 10-15%, auxiliary efficiency 3-5 kg CO₂/t, waste heat ORC 2000+ tCO₂/yr, vertical mill 8-14 kg CO₂/t, alternative fuels reduce direct emissions 30-50 kg CO₂/t but increase thermal energy 0.2-0.3 GJ/t), fertilizer emissions tables.

Barriers included market failures (incomplete markets, imperfect info, adverse selection, principal-agent, split incentives), nonmarket (hidden costs, capital access, risk, heterogeneity), behavioral (info form, trust, values, inertia, bounded rationality with conflicting objectives and rules of

thumb), organizational (power, culture), socio-technical perspectives on knowledge/routines, and others like distorted prices, government policies, infrastructure, codes.



He suggested attracting attention via high prices or crises, implementation at operational/strategic levels with top commitment and paradigm shift. Sources for learning: AEE, CEM, DOE, NEECA.

The session included an interactive session on designing an industrial energy management plan.

Concluding remarks

Mr. Amjad Nazeer delivered concluding remarks, summarizing key insights and emphasizing the importance of applying learned skills for climate action in Pakistan. He commended the active participation of all stakeholders, from academia and government to industry and NGOs, highlighting the collaborative spirit that emerged during the workshop. He expressed gratitude to the distinguished trainers—Dr. Zeeshan Shafiq, Miss Fouzia Rafi, and Dr. Khurshid Ahmad—for their invaluable contributions, noting that their expertise enriched the discussions and provided practical tools for participants.

He highlighted key takeaways from the trainers' presentations, starting with Dr. Zeeshan Shafiq's focus on GHG emission reduction in municipal energy systems. Dr. Shafiq's case study illuminated the potential of solar-powered lighting and biogas from waste, offering a 40% cost reduction and 300-400 kg CO₂ offset per ton, respectively, while emphasizing smart grids and public-private partnerships as scalable solutions.

Miss Fouzia Rafi's session on green buildings revealed the sector's 37% contribution to global CO₂ emissions, advocating for passive cooling, retrofitting with 1.2 GW savings, and nature-based solutions like green roofs, alongside the urgent need for unified certification standards.

Dr. Khurshid Ahmad's industrial decarbonization insights showcased energy efficiency as a “low hanging fruit” with 5-30% bill savings, detailed case studies like beverages (PKR 5.443 million savings) and textiles (16 GJ/tonne reduction via cold-pad dyeing), and the critical role of overcoming market and behavioral barriers through policy and training.



Mr. Nazeer stressed the workshop's success in building technical capacity in emission calculations, methane monitoring, and sequestration metrics, particularly through hands-on exercises like stove emission comparisons and industrial energy plan designs. He underscored the need for localized tools, regulatory coherence, and cross-sector collaboration to tackle financial, skill, and infrastructure challenges. Looking ahead, he encouraged participants to implement pilot projects, leverage partnerships with NEECA and international bodies, and advocate for data-driven policies to shape a sustainable future. He concluded with an inspiring call to action, urging all to carry forward the momentum and transform knowledge into tangible climate solutions for Pakistan.

Deliberations and Challenges

The workshop highlighted several key observations and challenges drawn from the presentations and discussions.



These insights underscore the barriers and opportunities for advancing energy management, green buildings, and GHG reduction in Pakistan, particularly in the building, industrial, and municipal sectors.

1. Cross-Sector Participation and Shared Challenges:

Participants from diverse sectors, including academia, government, NGOs, and industry, actively engaged in discussions, revealing shared challenges in GHG reduction and energy efficiency. For instance, the building sector's contribution to 37% of global CO₂ emissions was emphasized as a significant opportunity for mitigation through strategies like passive cooling, solar integration, and energy-efficient appliances. Similarly, in the industrial sector of KP, reliance on fossil fuels and increasing energy consumption across sectors like textiles and cement were identified as common hurdles. The discussions highlighted how these challenges transcend sectors, calling for collaborative approaches to integrate renewable technologies and nature-based solutions, such as green roofs and urban forests, to enhance ecological sustainability.

2. Financial Constraints:

Financial barriers emerged as a major impediment to implementing energy efficiency and decarbonization measures. Presentations noted the high upfront costs for retrofitting existing buildings under the Energy Conservation Building Code 2023, which includes provisions for insulation, shading devices, and efficient appliances. In the industrial sector, case studies from beverages, textiles, and cement industries showed potential savings (e.g., PKR 5.443 million annually in beverages through leak repairs and insulation), but participants discussed the limited access to capital for SMEs, which constitute substantial number of companies. The levelized cost of electricity comparisons demonstrated that energy efficiency is the "low hanging fruit" with lower costs than new generation, yet funding gaps hinder adoption of technologies like waste heat recovery and motor upgrades.

3. Lack of Locally Available Tools and Databases:

A recurring theme was the absence of localized tools and databases for accurate emission calculations and life-cycle assessments (LCA). In the green buildings session, the need for measuring embodied carbon through LCA was stressed, with references to tools like <https://lca.berc.pl/>, but participants noted the lack of Pakistan-specific data on materials extraction, manufacturing, and demolition. Similarly, for industrial decarbonization, emissions tables for textiles and cement relied on general factors, highlighting the need for tailored databases to track Scope 1, 2, and 3 emissions effectively. This gap complicates precise monitoring of methane leakage and sequestration metrics, as seen in exercises calculating CO₂ from natural gas stoves versus induction alternatives.

4. No Standard Validation Process in Pakistan:

The workshop revealed a fragmented approach to validation and certification in green buildings and energy management. Discussions on certification landscapes, such as LEED (72 certified buildings in Pakistan, mainly in textiles and corporate offices), SED rating system, and national energy building rating tools, pointed out the siloed nature and lack of unified standards. Provincial variations, like PECA's voluntary labeling for appliances alongside NECA's national standards, create inconsistencies. In industries, while energy audits using instruments like combustion



analyzers and tachometers were demonstrated, there is no standardized process for validating savings or emissions reductions, leading to challenges in scaling pilot projects like retrofitting with LED lights and star-rated fans (yielding 1.2 GW savings and PKR 18 million financially).

5. Workforce Skill Gaps in Academia and Industry:

Skill deficiencies in handling advanced tools for emission calculations and energy audits were evident. Presentations on instrumentation for audits (e.g., infrared thermometers, ultrasonic leak detectors) and LCA for embodied carbon underscored the need for training. Participants from academia noted gaps in curricula for socio-technical perspectives on energy efficiency, while industry representatives highlighted bounded rationality and inertia among employees, where routines hinder adoption of new practices. The interactive session on designing industrial energy management plans revealed a need for capacity building to address conflicting objectives within organizations and to implement measures like cold-pad batch dyeing or heat recovery from stenter in textiles.

6. Need for Regulatory Guidance and Industry Frameworks:

Regulatory fragmentation and lack of coordination between federal and provincial entities were key concerns. The green buildings presentation discussed parallel codes like the Energy Conservation Code (2023) and Building Code (2021), with integration into NDCs focusing on clean fuels and passive cooling, but lacking enforcement. Green public procurement remains underutilized due to underdeveloped rules for low-embodied carbon materials. In the industrial sector, barriers like imperfect information, adverse selection, and supply infrastructure limitations were linked to market failures, calling for policies to promote alternative fuels for cement and contingency plans for extreme events. Participants emphasized shifting paradigms in energy policy to prioritize efficiency as strategic, supported by sources like NEECA and international bodies.

7. Hands-On Group Activity - Applied Learning:

The workshop included practical exercises that reinforced theoretical concepts. In the green buildings session, participants calculated monthly CO₂ emissions from a natural gas stove (considering methane leakage with 25x GWP) versus solar-powered or grid-powered induction stoves, demonstrating 30% energy savings with induction. The industrial session featured an interactive activity on designing energy management plans, using case studies from beverages (e.g., adjusting air-fuel ratios for PKR 1.82 million savings) and cement (e.g., vertical roller mills for 10-17 kWh/tonne reduction). These activities applied concepts like Scope emissions and best practices, fostering hands-on understanding of mitigation strategies and highlighting potential for 10-15% reductions in near-term measures.

Participants' Questions and Discussion

The workshop encouraged lively discussions, with participants raising questions that deepened understanding of the topics. Key queries included:

- How can embodied carbon be accurately measured in Pakistan's building materials, given the lack of local LCA databases? (From green buildings session; discussion led to recommendations for developing national tools similar to international standards.)



- What are the practical steps for integrating renewable energy in municipal energy systems, and how to overcome challenges like grid instability? (Dr. Zeeshan Shafiq's session; participants shared experiences from pilot projects in passive cooling and efficient air conditioning.)
- In the industrial sector of KP, how can SMEs access financing for waste heat recovery systems, and what are the typical payback periods? (Dr. Khurshed Ahmad responded with case studies showing 1-3 year paybacks in textiles and cement, emphasizing government incentives.)
- How do Scope 1, 2, and 3 emissions differ in practice for buildings, and what strategies can reduce indirect emissions from purchased products? (Group discussion highlighted examples like company-purchased materials as Scope 3, with suggestions for green procurement policies.)
- What role do nature-based solutions play in decarbonizing urban infrastructure, and are there successful examples in Pakistan? (Miss Fouzia Rafi cited urban forests and green roofs for ecological sustainability, with participants debating adaptability to local climates.)
- How to address behavioral barriers like inertia in implementing energy audits? (Discussions drew from socio-technical perspectives, suggesting training to align routines with efficiency goals.)

These interactions fostered knowledge exchange and identified actionable steps for overcoming barriers.

Post-Activity Technical Questions

Following the hands-on activities, participants posed technical questions for clarification:

- In the stove emission calculation exercise, how does the grid emission factor (0.45 g CO₂/kWh) vary regionally in Pakistan, and what if solar is partially grid-tied? (Explanation involved adjusting for hybrid systems and using local factors for accuracy.)
- For industrial energy plans, how to quantify CO₂ avoidance from measures like cold-pad batch dyeing (16 GJ/tonne reduction)? (Dr. Ahmad provided formulas using emission factors and annual production data.)
- What instruments are essential for initial energy audits in small buildings, and how to calibrate them for methane leak detection? (Recommendations included combustion analyzers and ultrasonic detectors, with tips on calibration standards.)
- How to incorporate clinker calcination process emissions (450 kg CO₂/tonne) in cement LCA? (Discussion focused on integrating with fuel emissions for total Scope 1 calculations.)

These questions demonstrated participants' engagement and desire to apply concepts practically.

Conclusion and Next Steps

The workshop successfully built technical capacities in emission calculations, methane monitoring, and sequestration metrics, emphasizing the buildings and industrial sectors' roles in

Pakistan's climate action. Key takeaways included the urgency of unified policies, localized tools, and cross-sector collaboration to address financial, regulatory, and skill-related barriers.

Next steps include:

- Organizing follow-up webinars on advanced LCA tools and certification processes.
- Developing partnerships with PEDO, NEECA and international bodies like AEE for tailored training in KP and elsewhere in Pakistan.
- Advocating for regulatory reforms to standardize validation and promote green procurement.
- Conducting pilot audits in participant organizations to implement workshop learnings.
- Sharing resources and case studies via ADS platforms for ongoing learning.

ADS remains committed to advancing energy transition initiatives for a sustainable Pakistan.

Annex I: Images











Annex II: Agenda

Time	Agenda Point	Resource Person
9:30 - 9:50	Registration of the participants	ADS Team
9:50 - 10:00	Recitation of Holy Quran	Volunteer/Recording
10:00 - 10:10	Introduction to ADS & Its Energy Transition Initiatives	Amjad Mehdi, ADS
10:10 - 10:30	Significance of the workshop: Contextualizing and Tone Setting	Amjad Nazeer, ADS CEO
10:30 - 12:15	<p>GHG Emission Reduction in Energy Sector: A Case Study of Municipalities</p> <ul style="list-style-type: none"> ● Exercise/Group Work/Simulation (interactive activity to apply concepts) ● Best practices and innovative approaches for reducing emissions ● Key challenges municipalities face in decarbonizing energy systems ● Q&A and open discussion 	Dr. Zeeshan Shafiq
12:15 - 12:30	Tea Break	
12:30 - 2:00	<p>Reducing GHG Reduction through Green Energy Buildings</p> <ul style="list-style-type: none"> ● Green buildings role in climate action ● Integration of renewable energy technologies ● Policies, standards, and certifications for green and smart buildings ● Q&A and open discussion 	Miss Fouzia Rafi
2:00 - 2:30	Lunch Break	
2:30 - 4:30	<p>Energy Management and Decarbonization in the Industrial Sector of KP</p> <ul style="list-style-type: none"> ● Current status of energy use and decarbonization in KP's industrial sector ● Technologically innovative opportunities in major industries ● Interactive session on designing an industrial energy management plan 	Dr. Khurshid Ahmad
4:30 - 5:00	Concluding Remarks	Amjad Nazeer