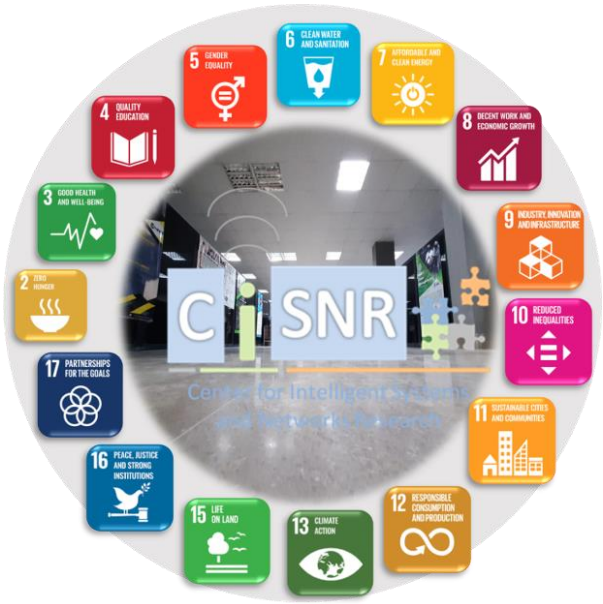
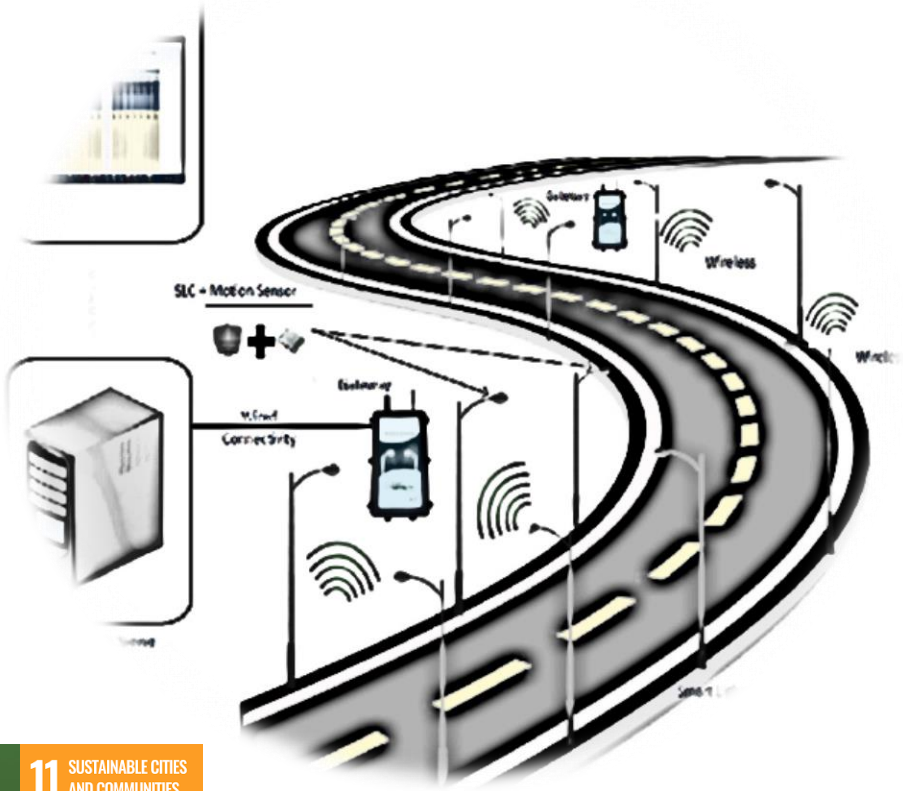


GOVERNANCE TOOL- MANAGEMENT THROUGH TECHNOLOGY

Street Light Management System

Municipal Energy Management via Digitization

A Case Study



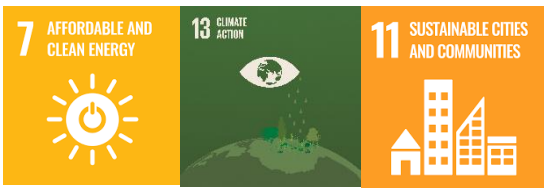


Table of Contents

Street Light Management System

Digital Energy Management System

1. Introduction:

Building upon the success of the Water SCADA system implementation in Khyber Pakhtunkhwa, this annexure delves into the deployment of the Street Light Management System (SLMS) powered by Supervisory Control and Data Acquisition (SCADA) technology in TMA Abbottabad and TMA Mansehra. The integration of this system represents a comprehensive approach towards sustainable urban development and resource management within the region.

1.1. Collaborative Efforts of CISNR:

The Center for Intelligent Systems and Network Research (CISNR) played a pivotal role in orchestrating the collaborative efforts required for the successful implementation of the system. The expertise demonstrated by CISNR in developing, deploying, and maintaining SCADA-based solutions has solidified its position as a key player in advancing smart infrastructure within the province.

1.2. Needs Assessment:

To fulfill the installation requirements, a needs assessment was initially conducted. Team CISNR played a pivotal role in addressing the challenges encountered by municipalities in street light management systems. The team, including skilled field engineers and technicians, specialized in street lights operation and maintenance. Their expertise played a major role in ensuring the successful implementation of these systems based on needs assessment.

1.3. Challenges Identification

As with any large-scale implementation, challenges were identified and effectively addressed. Continuous monitoring and feedback mechanisms, integrated within the SCADA framework, allowed for prompt identification and resolution of operational issues related to street light management. This proactive approach ensured the reliability and efficiency of the system.

2. Surveys of Targeted municipalities

2.1. Abbottabad District Pre-Installation Survey:

Moreover, a survey was undertaken On January 13th, 2023, the Center of Intelligent Systems and Network Research (CISNR) team, which aimed at facilitating the implementation of a Street Light Management System (SLMS) in the Abbottabad District. The major objective of this survey was to assess the feasibility and gather essential information required to regulate street light operations.

This comprehensive report outlines notable observations and provides recommendations that have emerged from our analysis. All these aspects aim to offer well-informed guidance, ensuring the effective and efficient implementation of the SLMS. The ***Fig.1*** shows the initial survey done by CISNR team to TMA Abbottabad.

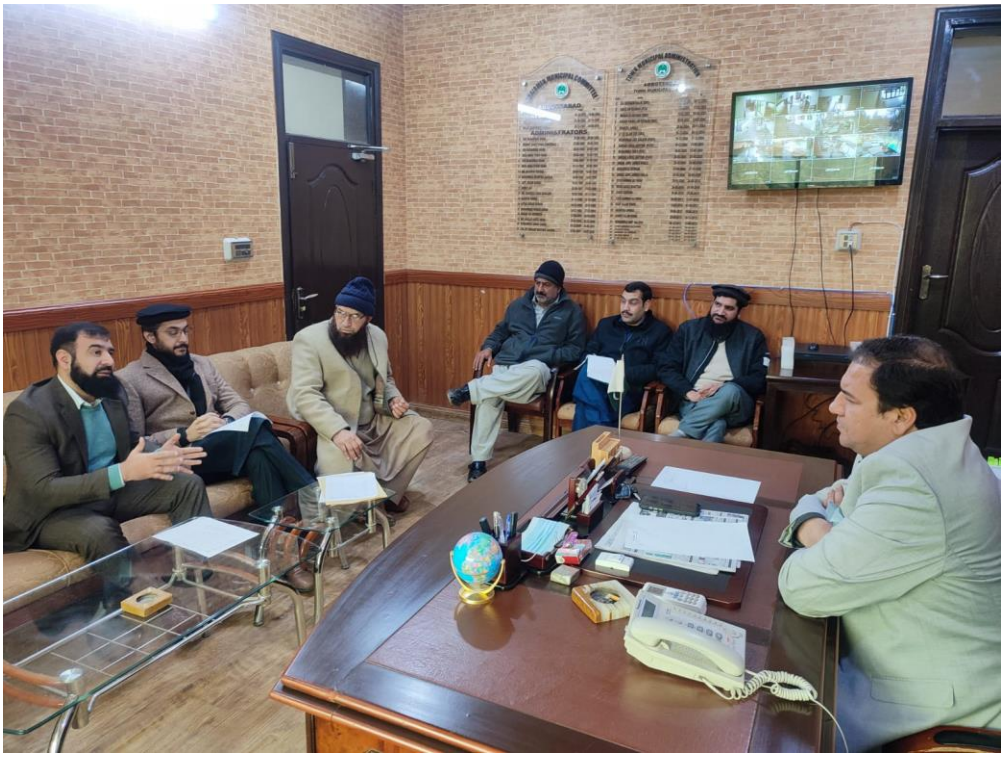


Fig.1 *The Director CISNR providing a project scope briefing to the TMO of Abbottabad*

2.2 Mansehra District pre-installation Survey:

Similarly, On December 23, 2022, a collaborative pre-installation survey was conducted by our CISNR team and the local municipalities of TMA Mansehra District. This effort was generously supported by funding from the GIZ REEE Scale project. The primary objective of this survey was to examine the existing water distribution and street lighting infrastructure regarding the implementation of a street light management system and a water supply management system in the designated area.

Through this comprehensive survey, our goal was to identify key findings, address issues, and propose effective solutions based on insights acquired during interactions with municipal authorities. The ultimate goal was to establish an energy-efficient roadmap using the information obtained from this project. The ***Fig.2*** shows the initial survey done by CISNR team to TMA Mansehra and as shown in ***Fig.3*** a brief overview was given on the project scope and street light management system. After a brief discussion and project overview a group photo were taken with TMA Mansehra team ***Fig.4*** .

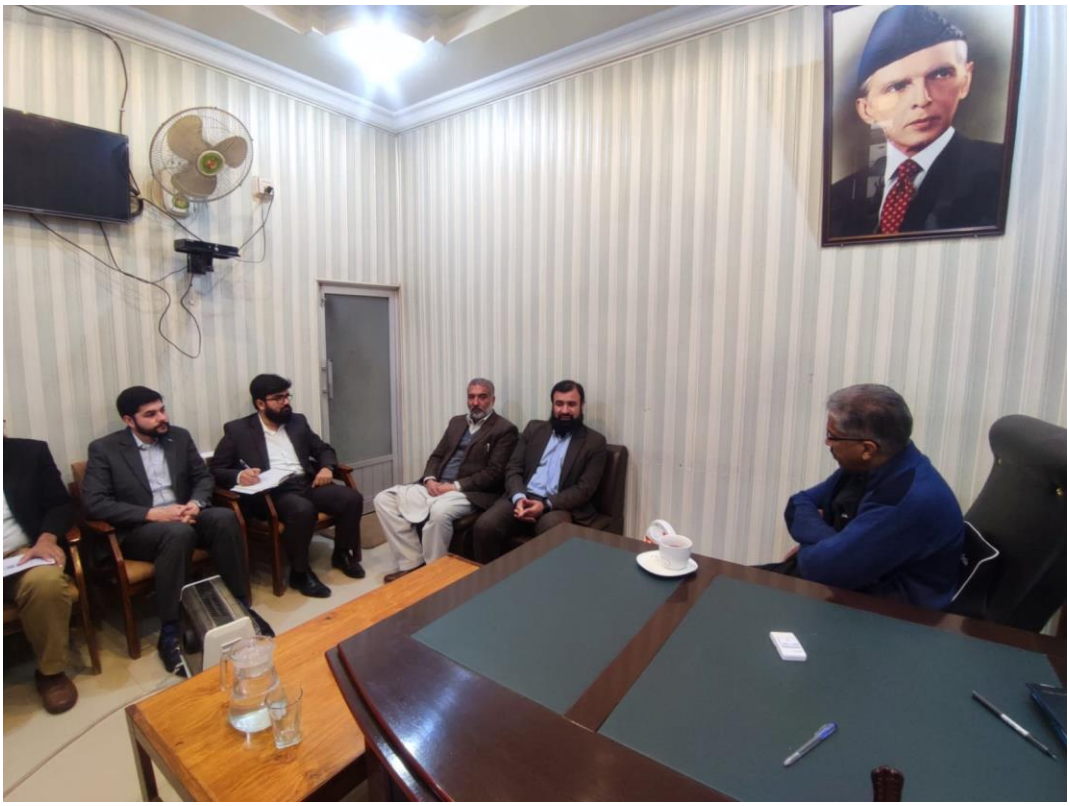


Fig.2 The CISNR team discussing the project scope with Basharat, the TMO of Mansehra

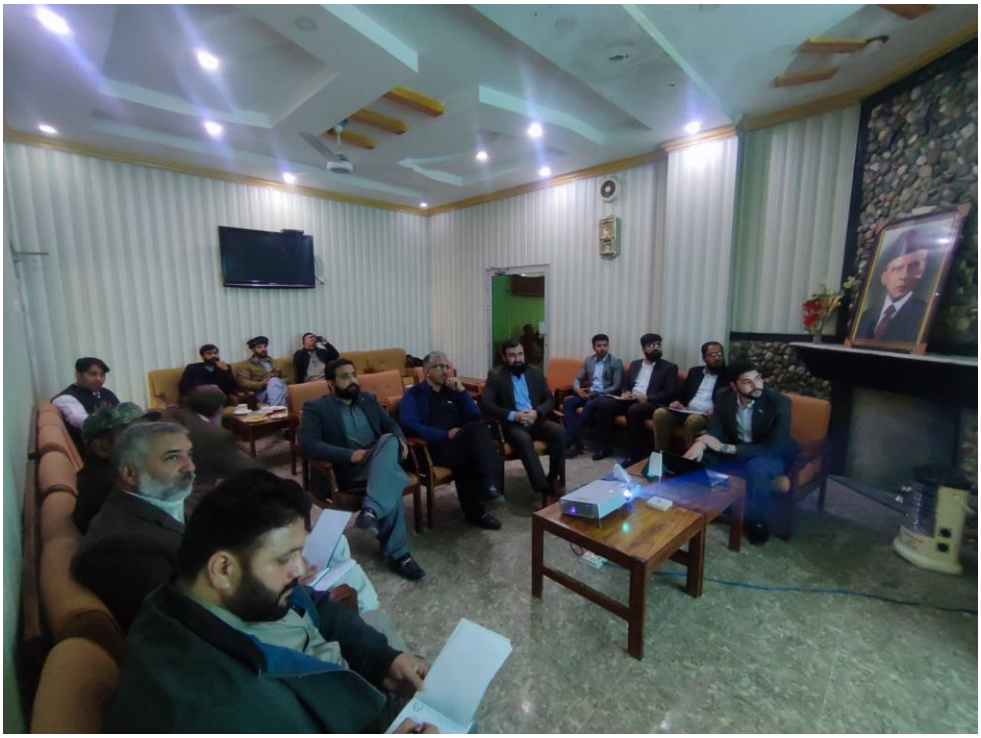


Fig.3 A demonstration by the CISNR team of their SCADA devices

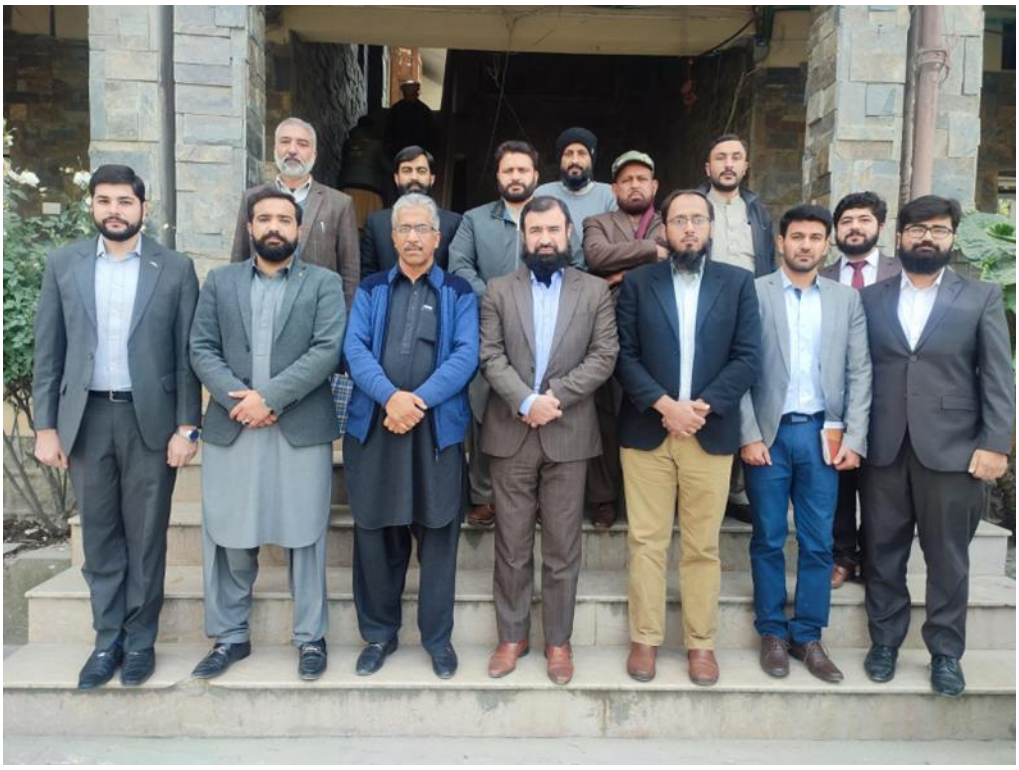


Fig.4 A group photo of the CISNR team with the TMA Mansehra team

Objectives:

The objective of the survey was to comprehensively address issues related to street light management. The goals included to facilitate efficient and real-time monitoring, control, and optimization of street lighting infrastructure. Overall, the objective of the comprehensive surveys in TMA Mansehra and TMA Abbottabad was to identify prevalent issues, collaborating closely with municipal authorities and stakeholders to gain insights into concerns such as inconsistent scheduling, excessive energy consumption, and unauthorized tampering.

Analysis:

During our survey, it was observed that the street lighting system in Abbottabad district follows a traditional operational pattern, where the lights are manually turned on during the evening hours and deactivated in the morning. However, this conventional approach lacks energy efficiency and poses challenges in terms of electricity wastage. The survey was to comprehensively address issues related to street light management. The goals included to facilitate efficient and real-time monitoring, control, and optimization of street lighting infrastructure.

3 Installation in the Targeted Municipalities:

To address and rectify the street lighting issues identified during our initial assessment in TMA Abbottabad and TMA Mansehra, we have implemented a comprehensive solution by installing four Streetlight Management Systems (SLMS) in each TMA. These advanced systems will provide

centralized control and monitoring of streetlights, enabling efficient energy management, reduced maintenance costs, and enhanced public safety. ***Fig.5*** shows a picture of CISNR team during installation of Smart Street Light Management System at TMA Abbottabad site.

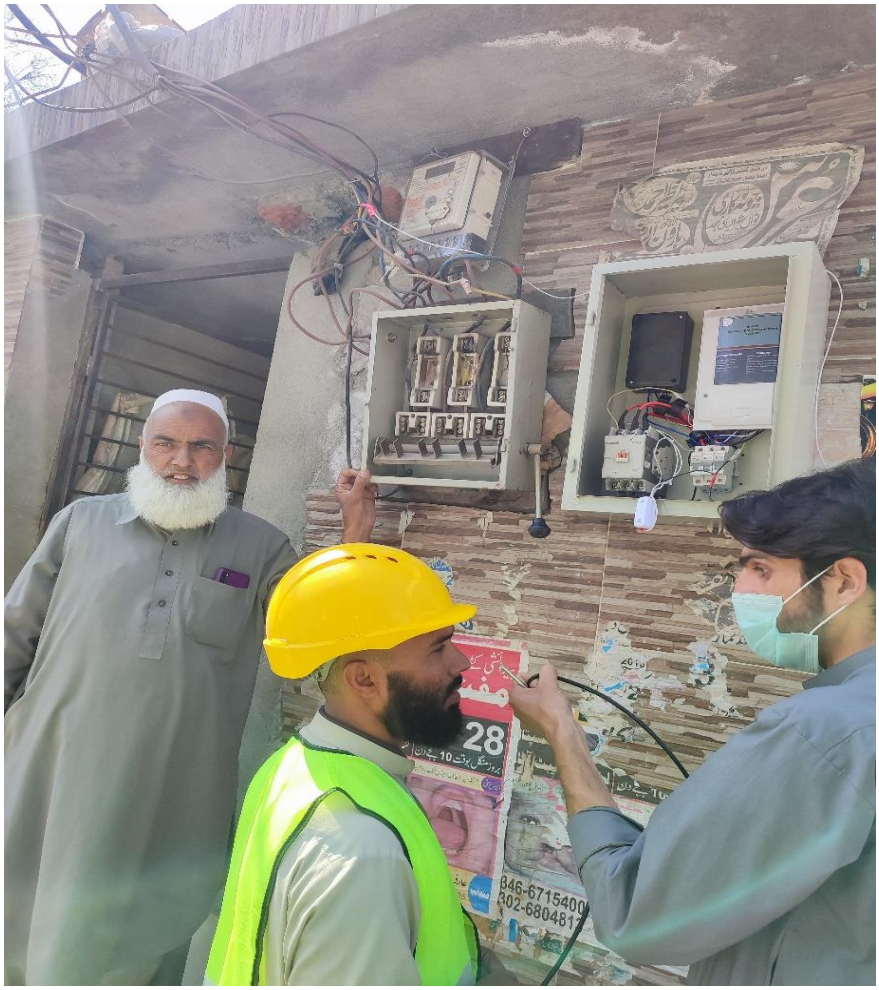


Fig.5 A photo of the CISNR team During Installation of SLMS

3.1 Data Collection:

To comprehensively gather insights, our data collection strategies involved conducting on-site interviews with municipal officials and visually examining the current street lighting infrastructure, its configurations, and operational patterns. The interview process covers queries about current manual practices, challenges faced, and recommendations for establishing a proficient Street Light Management System (SLMS).

3.1.1 TMA Mansehra Report:

Problems and Solutions:

The survey in Mansehra focused on various areas within the district under the jurisdiction of the TMA. It identified concerns such as inconsistencies in scheduling street lights, leading to safety risks due to inadequate illumination during critical hours. Manual operation of street lights was identified as a significant issue, contributing to unnecessary energy consumption. Unauthorized electricity consumption was detected due to inadequate energy monitoring, posing maintenance challenges and endangering public safety. The survey involved interactions with municipal authorities and stakeholders, utilizing on-site inspections, interviews, and data collection to identify key findings and generate recommendations.

3.1.2 TMA Abbottabad Report:

Problems and Solutions:

The survey in Abbottabad covered various areas within the Abbottabad district. Findings included excessive energy consumption due to manual operation of street lights and discrepancies in turning lights 'ON' and 'OFF', leading to confusion. Instances of tampering and theft disrupted connections to transformers, hindering the lighting system. Operating street lights during daylight hours resulted in unnecessary energy wastage. Similar to the Mansehra report, the Abbottabad survey involved interactions with municipal authorities and stakeholders, employing on-site visits, interviews, and discussions to identify issues and gather recommendations.

4 Workshops

Following these survey, Team CISNR organized workshops in both regions focused on staff training and feedback collection. During these workshops, proposed solutions were introduced, practical training was provided, and open discussions were encouraged to address concerns and gather valuable feedback from staff members. The collected feedback played a crucial role in refining the proposed solutions. The ***Fig.6*** and ***Fig.7*** are the group photo with TMA Abbottabad and TMA Mansehra team during workshop.

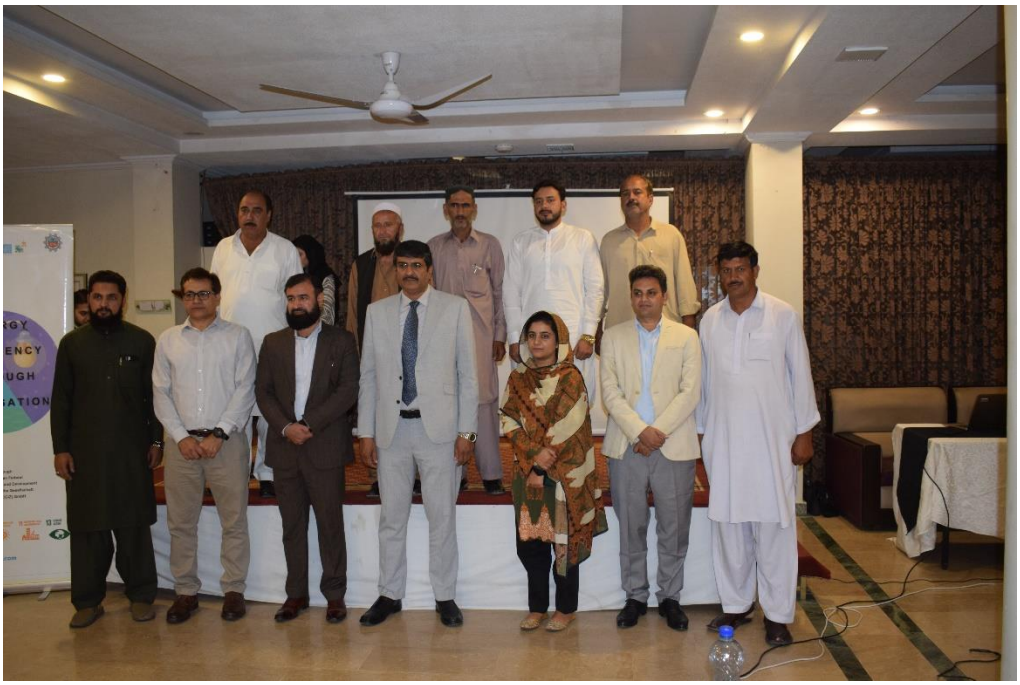


Fig.6 A group photo of the Director CISNR with the TMA Abbottabad team

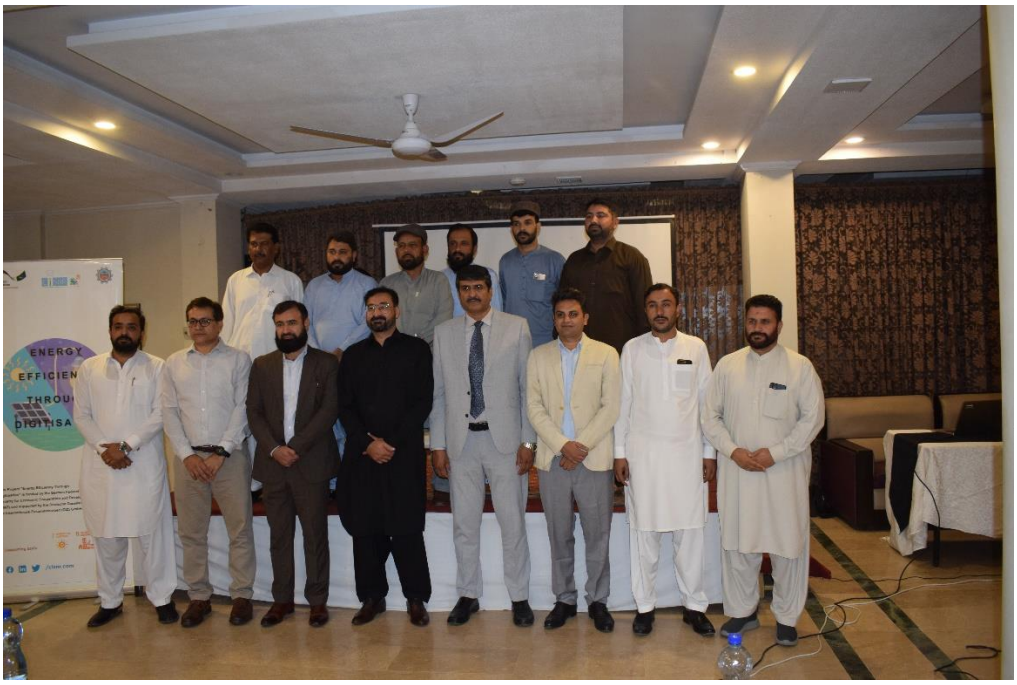


Fig.7 A group photo of the Director CISNR with the TMA Mansehra team

5 Road shows

A roadshow was conducted in collaboration with Tehsil Municipal Administrations (TMAs) in Abbottabad and Mansehra to raise awareness about the implementation of the Street Light Management System. The roadshow aimed to engage key stakeholders, including local

authorities, community leaders, and residents, to communicate the benefits of the system and gather valuable feedback. Interactive sessions, demonstrations, and Q&A segments were conducted to ensure a comprehensive understanding and acceptance of the technology. This proactive outreach played a crucial role in garnering support for the initiative and fostering a sense of ownership among the local communities.

Recommendations:

Both reports emphasize the importance of implementing automated scheduling, energy-efficient practices, and security measures to address the issues related to street light management systems in their respective regions. Recommendations include the implementation of automated schedules based on daylight hours, time-based scheduling for energy savings, and the introduction of energy monitoring for security. The collaborative effort between Team CISNR and the municipalities has paved the way for more efficient and secure street light management systems, aligned with the specific needs and concerns of each municipality.

6 Quantifiable Impact:

Quantifying the impact of the integrated Street Light Management System encompasses a thorough analysis of data pertaining to energy savings and operational efficiency. The implementation of the system has yielded tangible benefits, notably through optimized energy consumption and an overall enhancement in urban service delivery.

Street Light Management Performance Data:

Performance data for street lights in Mansehra from July to November.

Month	Rating (kW)	Usage hours (h)	Web based Unit Consumption (kWh)	Bill Units (kWh) 2023	Bill Units (kWh) 2022
July-August	-	86.3	285	200	-
July-August	-	0	41	200	-
August-September	-	66.8	189	300	300
August-September	-	0	6.8	228	175
September-October	-	33.17	75.5	2,307	200

Month	Rating (kW)	Usage hours (h)	Web based Unit Consumption (kWh)	Bill Units (kWh) 2023	Bill Units (kWh) 2022
September-October	-	-	-	100	-
September-October	-	32.2	73.47	300	300
September-October	-	17.13	19.72	257	404
October-November	-	440.2	994.06	3000	300
October-November	-	-	-	321	0
October-November	-	397.7	872.1	100	299
October-November	-	261.8	253.6	169	509

This table provides a detailed overview of the performance of street lights over the specified months, including their energy consumption, usage patterns, and billing units. It serves as a valuable resource for assessing the impact and efficiency of the Street Light Management System integrated with the SCADA technology in the region. The data can be analyzed to identify trends, optimize energy consumption, and ensure the effective functioning of the street lighting infrastructure.

Environmental Impact and Energy Efficiency:

The integration of the Street Light Management System with SCADA technology has yielded significant environmental benefits. By optimizing energy consumption through intelligent street light control, the region has experienced a reduction in carbon emissions and energy wastage. This aligns with the broader goal of achieving climate action targets outlined in Sustainable Development Goal 13.

Operational Challenges and Solutions:

As with any large-scale implementation, challenges were identified and effectively addressed. Continuous monitoring and feedback mechanisms, integrated within the SCADA framework, allowed for prompt identification and resolution of operational issues related to street light management. This proactive approach ensured the reliability and efficiency of the system.

Policy Implications:

The success of the integrated Water SCADA and Street Light Management System in TMA Abbottabad and TMA Mansehra has laid the foundation for the development of comprehensive policies aimed at promoting the adoption of smart technologies in urban infrastructure. These policies are designed to create an enabling environment for the deployment of similar systems in other regions, emphasizing economic incentives, regulatory frameworks, and support for research and development initiatives.

1. Economic Incentives: The policy framework will include financial incentives to encourage municipal authorities and urban planners to invest in smart technologies for street light management. This could involve tax credits, subsidies, or grants for the installation and maintenance of SCADA-based systems, promoting cost-effective and sustainable solutions.

2. Regulatory Frameworks: Establishing clear regulatory guidelines and standards for the deployment of Street Light Management Systems will be a key aspect of the policy. This includes defining performance benchmarks, energy efficiency standards, and security protocols to ensure the uniform and effective implementation of smart technologies across different regions.

3. Research and Development Support: Encouraging ongoing research and development initiatives in the field of smart urban infrastructure will be vital. The policy will allocate resources and funding to support projects that enhance the capabilities and functionalities of Street Light Management Systems, fostering innovation and continuous improvement.

4. Capacity Building and Training: To ensure successful adoption and implementation of smart technologies, the policy will incorporate provisions for capacity building and training programs. Municipal staff and relevant stakeholders will receive training on the operation, maintenance, and troubleshooting of Street Light Management Systems, enhancing overall system efficiency.

5. Public-Private Partnerships: The policy framework will encourage collaboration between public and private entities in the development and deployment of Street Light Management Systems. This collaboration can leverage the expertise of private technology providers while ensuring that public interests, including affordability and accessibility, are safeguarded.

6. Data Security and Privacy: Addressing concerns related to data security and privacy will be integral to the policy. Clear guidelines on data collection, storage, and sharing will be established to protect the privacy of citizens and ensure the secure operation of Street Light Management Systems.

7. Scalability and Interoperability: The policy will promote the scalability and interoperability of Street Light Management Systems to facilitate their seamless integration with broader urban management frameworks. This approach ensures that the systems can adapt to the evolving needs of urban infrastructure and work cohesively with other smart technologies.

8. Community Engagement: To foster community acceptance and cooperation, the policy will emphasize community engagement initiatives. Municipalities will be encouraged to conduct awareness campaigns, solicit feedback, and involve local residents in decision-making processes related to the deployment and operation of Street Light Management Systems.

By addressing these policy implications, TMA Abbottabad and TMA Mansehra aim to provide a strategic framework that not only ensures the success of their integrated systems but also serves as a model for the widespread adoption of smart technologies in urban infrastructure nationwide.

Recommendations for Future Scaling:

The success of the integrated systems prompts recommendations for future scaling in comparable contexts:

1. **Comprehensive Surveys:** Conduct detailed surveys to understand the specific challenges and requirements of each region, ensuring tailored solutions.
2. **Stakeholder Engagement:** Establish collaborative platforms involving municipalities, local authorities, and technology experts to ensure a holistic approach to system implementation.
3. **Continuous Monitoring:** Implement real-time monitoring and feedback mechanisms to address operational challenges promptly, ensuring the sustained efficiency of integrated systems.

Conclusion:

The integration of the Street Light Management System in Khyber Pakhtunkhwa stands as a testament to the potential of technology-driven solutions in advancing sustainable urban development. CISNR's expertise in deploying integrated SCADA solutions has positioned the region as a model for others seeking to embrace comprehensive, efficient, and environmentally conscious urban infrastructure management. The success of this endeavor underscores the importance of adopting a holistic approach to smart city development, considering the interconnectivity of critical urban services.