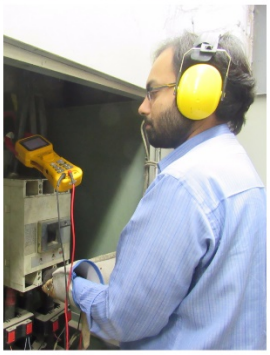
MUHAMMAD ARMUGHAN PROFILE



8/20/2018

Detail Profile & Project References

This Document contains all information about qualification and professional experience of Mr. Muhammad Armughan

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Muhammad Armughan Profile

DETAIL PROFILE & PROJECT REFERENCES

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SECTION 1: SUMMARY STATEMENT

I am Electrical Engineer working in the field, **Renewable Energy Energy Efficiency** and **Carbon Trading** from last eight years. During these years I have developed a diverse skill set such as preparation of **Feasibility Studies for renewable energy projects (especially biomass and PV solar), including Financial Modelling, Electricity Tariff Calculation & Resource Assessment for renewable energy power plants.**

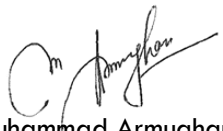
I am member of the Association of Energy Engineers (AEE), USA and Certified Energy Auditor **(CEA®)** & Certified Energy Manager **(CEM®)**. Also one of the founding member of AEE Pakistan Chapter. I have conducted more than 40 energy audits to promote **Demand Side Energy Management** not only in industrial sector but also in commercial building sector. In addition to that I have also provided expert opinion on **Policy Assessment for Renewable Energy and Sustainable Development projects.**

I am an expert for different types of **Carbon Trading Mechanisms** such as **Clean Development Mechanism (CDM)** and **Verified Carbon Standards (VCS), Gold Standard (GS).** I have successfully conducted validation and registration of 5 Project and one Programe of Activitiy (PoA) resulting in approximately 0.6 Million tCO_2/year in Pakistan under CDM protocol. These projects are in different sectors such as, Renewable energy generation (Solar, Wind, Biomass, and Low Head Hydro), Sugar sector (High-pressure cogeneration projects), Cement sector (waste heat recovery and substitution of fossil fuels with alternative fuels), Electricity utility and Power sector (demand side energy management) & Waste to Energy (landfill gas utilization) in Pakistan.

Furthermore, I have expertise on **Carbon Foot Printing** and **Life Cycle Assessment** for products and for organization level. I have also developed a **GHG Inventory projections** for energy sector of Pakistan.

I have a portfolio of working with international firms and donor agencies, governmental organizations and private industrial sector.

Currently I am looking to continue my education and get a master's degree in renewable energy technologies which can supplement my experience and help me grow further as an energy consultant.



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SECTION 2: RESUME

MUHAMMAD ARMUGHAN (CEA®,CEM®)

Address: House # 11, Zeenat Block, Allama Iqbal Town, Lahore, Pakistan
Date of Birth: 21-December-1986
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E-Mail ID: armughan1@hotmail.com
Nationality: Pakistani
Passport Number: AA1957922 (Expiry November 2024)
Marital Status: Married
LinkedIn Profile: www.linkedin.com/in/muhammad-armughan

Summary Statement:

Electrical Engineer with over eight years of work experience as Renewable Energy Consultant in Renewable Energy, Energy Efficiency and Carbon Trading for different industrial sectors. Worked with International firms on foreign funded projects and local Pakistani industries. I am Certified Energy Manager (CEM) and Certified Energy Auditor (CEA) from Association of Energy Engineers (AEE) USA. I have conducted more than 40 industrial energy audits and hundreds of agriculture tube wells energy audits. I am also an expert in carbon trading having registered more than 6 projects with Clean Development Mechanism (CDM) resulting in emission reduction of 0.6 million tCO_2/Year in Pakistan.

Formal Education:

Qualification	Name of Institute	Completion Date
BS. Electrical Engineering	COMSATS Institute of Information Technology (CIIT), Lahore, Pakistan	March 2010
Intermediate (F. Sc. Pre-Engineering)	Government College, Kot Addu, District Muzaffargarh, Punjab Province, Pakistan	May 2004

Memberships and Professional Certification:

Sr. No.	Professional Institute/Certification	Validity
1	Registered Engineer from Pakistan Engineering Council (PEC) Reg. No: **ELECT/35054**	From December 2012 till Present
2	Member of Association of Energy Engineers (AEE), USA., USA (Member International II, (132210)	From December 2017 Till Present
3	Certified Energy Auditor (CEA®) (90655)	From December 2017 Till Present
4	Certified Energy Manager (CEM®) (95196)	From March 2018 Till Present
5	Founding Member of AEE Pakistan Chapter	From July 2018

Work Experience & Expertise:

- **PITCO (Private) Limited, Lahore, Pakistan**
  Project Manager (Energy & Environment) (January 2016 – to date)

Apart from business development, preparation of proposals, tendering and contract negotiations I am also involved the on following projects;

"Implementation of Resource and Energy Efficiency Technologies in the Sugar Sector of Pakistan" Under SWITCH-Asia Project (Funded by European Commission)
I am currently doing energy audits of sugar mills including boilers and electrical system of 70 sugar mills in Pakistan. Life cycle assessment and carbon foot printing of refined sugar.

Renewable Energy Resource Mapping of Nepal and Pakistan (Solar Mapping) (Funded by World Bank)
I installed solar measurement stations to validate satellite based solar data in Pakistan and Nepal under ESMAP solar mapping project. 9 Stations in Pakistan and 5 Stations in Nepal.

Previously I have worked on following project:
High pressure Cogeneration SWITCH-Asia Project Pakistan (Funded by European Commission)
Provided assistance in preparation of technical and financial feasibility study for conversion from low pressure co-generation system to high pressure co-generation system at 60 sugar mills in Pakistan. Also developed a MS Excel® based electricity tariff calculation model for renewable power plants.

Apart from foreign funded projects I have also undertaken following projects with focus on Carbon Foot Printing and Energy Auditing;

- Organizational level foot printing at Indus Motors Company Limited, Karachi (2016)
- Organizational level foot printing at Packages Private Limited, Lahore (2016 & 2017)
- Baseline Energy Auditing at Packages Limited, Lahore (2017)
- Product foot printing for detergent at Packages Private Limited, Lahore (2018)

- **PITCO (Private) Limited, Lahore, Pakistan**
  Senior Project Engineer (October 2011 – December 2015)

Low Carbon Scenario Analysis (Funded by DFID)
Developed top-down projections of GHG emissions inventory for energy sector in accordance with the guidelines of the Intergovernmental Panel on Climate Change (IPCC) for Pakistan till 2030.

Punjab Biomass Power Plant Feasibility Study Project (Agriculture Department Govt. of The Punjab)
Prepared feasibility study report for 5 biomass based (power only) power plants

Biomass + Coal based Power Plant and Waste Heat Recovery Utilization for Power Generation for Pioneer Cement Limited. (USTDA)
Developed a biomass supply chain for sustainable operation of 50 MW Coal + Biomass based power plant

Energy Conservation in Industries: Industrial Motor Replacement Program (USAID)
Conducted energy audits for 38 industries. In addition, converted motors with VFDs for energy efficiency.

USAID LT Capacitor Replacement Project (USAID)
Conducted data analysis of energy audits and calculated energy savings. Also provided support in final report writing.

- **PITCO (Private) Limited, Lahore, Pakistan**
  Junior Project Engineer (April 2010 – September 2011)

Tube Well Efficiency Improvement Program (Funded by USAID)
Conducted energy audits of agriculture tubewells, developed an automatic formula for resizing of energy efficient pumps. Also worked as project coordinator in site office in Multan.

Carbon Services (Private) Limited (CSPL): (CSPL and PITCO are sister concern companies)

I have registered five (5) projects and 1 Program of Activities (PoA) under Clean Development Mechanism (CDM).

Name of CDM Project	Current Status
Solid waste management by landfill and methane capture by Lahore Waste Management Company (LWMC)	At CDM Validation
Low Head Hydro Power Development Projects, Punjab Pakistan	At CDM Validation
Fauji Cement Company Limited Waste Heat Recovery Project (at line 2) **(Ref. # 10330)**	Registered CDM Project
National CFL Project, Pakistan (Program of Activities) **(Ref. # PoA 7811)**	Registered CDM Project
Substitution of coal with alternate/renewable fuels at DG Cement DG Khan & Kallar Kahar plants, and Lucky Cement Karachi plant **(Ref. # 8192 & 6642 & 8780)**	Registered CDM Project
Waste heat recovery and utilization for power generation in DG Cement DG Khan & Kallar Kahar plants **(Ref. # 7845)**	Registered CDM Project

Major activities performed under CDM projects are

- Preliminary assessment of the project activity, selection of methodologies, development of project idea note, emission reduction & energy efficiency calculations, developments of Project Design Documents (PDD) as per CDM methodologies, preparation of financial feasibility studies, preparation and evaluation of CDM monitoring plan, Conducted CDM stakeholder consultation meetings, Host country approval from DNA Pakistan (under Ministry of Climate Change) and Selection of DOE for validation/verification.
- Review of project supporting documents in line with CDM guidelines and provided solutions for discrepancies, e.g. Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), project contracts, financial documents, technical specifications of project equipment, technical and financial feasibility studies.

Trainings & Workshops:

Trainings obtained	Organized by	Dates and Location
"Training in Energy Management System"	International Institute of Energy Training (IIET)	3 Days (9-11 May 2018), Islamabad, Pakistan
Vendor's Training on Market Potential and Business Opportunities for EE and RE Technologies	United Nations Industrial Development Organization (UNIDO)	2 Days (10-11 April 2018), Lahore, Pakistan
"**Energy Efficiency and Energy Management**"	National Institute of Design Analysis (NIDA) Ministry of Industries and Production, Government of Pakistan	3 Days (23-25 May 2017) in Lahore, Pakistan
"**Certified Energy Auditor**"	National Productivity Organization (NPO), Ministry of Industries Government of Pakistan	3 Months (January – March 2013)

Trainings Provided	Audience	Dates and Location
Awareness session on benefits of Carbon Trading	Representatives from Energy Department Government of Punjab, Pakistan	2 Days 26-27 December 2017, Lahore, Pakistan
Conducted trainings on Carbon Trading and Clean Development Mechanism	Representatives from Sugar Sector from Punjab and KPK	1 Day, 12 October 2017, Karachi, Pakistan
Conducted trainings on Carbon Trading and Clean Development Mechanism	Representatives from Sugar Sector from Sindh Province	1 Day, 09 October 2017, Lahore, Pakistan
"Problem & issues faced by the Government Institutes in implementation of CDM projects and their mitigation measures"	Ministry of Climate Change (MoCC) Govt. of Pakistan, Representatives from different governmental organizations.	(24-26 June 2015), Islamabad, Pakistan

Other Skills:

- Technical report writing
- Carbon trading, carbon foot printing, life cycle assessment, emission reduction calculations
- Familiarity with Microsoft® Windows® OS Microsoft® Office® Tools & Desktop Utilities
- Project Management, Project Development, Project Coordination and Client Facilitation
- Conducting training sessions and seminars for clients and different stakeholders for different projects
- Excellent communication skills in English

Extra-Curricular Activities:

Gardening, Tourism, playing cricket, watching sports on TV (Cricket, Tennis & Football)

Reference/ Recommendation:

References will be provided in energy sector when required.

SECTION 3: DETAILS OF MAJOR PROJECTS

Summary of Undertaken Projects under PITCO (Private) Limited

Name of Project:	"Implementation of Resource and Energy Efficiency Technologies in the Sugar Sector of Pakistan" Under SWITCH-Asia Project
Location:	Sugar Sector, Across Pakistan
Client or Funded By:	European Commission (EU)
Main Project Features:	The overall objective of the Action is to "Promote sustainable growth, contribute to economic prosperity and poverty reduction, and mitigation of climate change by enhancing resource efficiency of the sugar sector through adoption of R&EE technologies". The action will achieve this objective by establishment of a conducive regulatory framework, improving project financing opportunities, and enhancing awareness and capacity of the sugar sector, solution/service providers and farmers to ensure indigenization of the technology.
Duration of Activity:	June 2018 – Present
Positioned Held:	Lead Energy Auditor

Activities Performed:

- Provided assistance for the successful inception mission.
- Preparation of TORs, Evaluation and shortlisting for International Energy Auditor which will assist us in energy audits for sugar mills process.

Name of Project:	Renewable Energy Resource Mapping of Nepal (ESMAP) (Solar Mapping)
Location:	Khatmandu, Nepal
Client and Funded by:	World Bank
Main Project Features:	The main purpose of the solar mapping part is to analyze and validate the satellite based solar radiation data for determination of solar power potential in the country. On this basis, the 5 stations (all high precision tier 1 stations) will be installed in 5 different parts of country covering all solar regimes in the country. These stations measure the parameters such as solar radiation Direct Natural Irradiance (DNI) Global Horizontal Irradiance (GHI), Diffused Horizontal Irradiance (DHI), humidity, temperature, wind speed, wind direction. The data will be monitored for the duration of 2 years. Based on measurement a solar atlas will be prepared for the whole NEPAL. The solar Atlas will be used as a bankable feasibility for investors.
Duration of Activity:	March 2018 - Present
Positioned Held:	Site Engineer

Activities Performed:

- Coordination with stakeholders for the Inception mission to Khatmandu such as,
  Alternate Energy Promotion Centre (AEPC), Nepal,
  Department of Hydrology and Metrology (DHM), Nepal
  IOE Institute of Engineering (Sub campus of Tribhuvan University)
  PACE Nepal (Local Partner at Nepal)
- Assessment of satellite base solar radiation data and analysis of solar regimes in NEPAL
- Visited Nepal and supervised the civil works for the site preparation before the installation of 5 high precision solar measurement stations located at Kathmandu, Dharan, Pukhara, Nepalgunj and Jumla.

Name of Project:	Assessment for Floating PV Solar Power Potential for Water Reservoirs
Location:	Across Pakistan
Client and Funded By:	World Bank

Main Project Features:	Preliminary assessment of floating PV-Solar power plants potential at existing dams, natural water bodies, industrial water storage pounds all across Pakistan. After the shortlisting of sites 7 pre-feasibilities (3 industrial pounds, 1 lake and 2 water reservoir, 1 irrigation dam) were prepared.
Duration of Activity:	September 2017 – July 2018
Positioned Held:	PV Solar Expert

Activities Performed:

- Prepared the long list of water reservoirs in the country using Google® Maps along with their names and GPS Coordinates.
- Meeting with relevant stakeholders during inception meeting to verify the desktop base analysis and development of detailed questionnaire for major stakeholders such as, WAPDA, Irrigation department of different provinces and industries with large water pounds.
- Analysis of data received from stakeholders and developed a site shortlisting criteria based on different parameters. Conducted onsite visits of shortlisted sites for data accuracy and verification.
- Prepared feasibility studies for 7 shortlisted sites, including the site selection criteria and financial analysis.

Name of Project:	Feasibility study for conversion of low pressure to high pressure cogeneration system at Digri Sugar Mills
Location:	Hyderabad, Sindh Province, Pakistan
Client and Funded By:	Digri Sugar Mills, Limited
Main Project Features:	To access the feasibility of conversion of low pressure (24 bar) cogeneration system to either 86 bar or 110 bar high pressure cogeneration system at sugar mills. The feasibility report contains the detailed financial analysis and technology comparison.
Duration of Activity:	April 2017 – September 2017
Positioned Held:	Feasibility Expert

Activities Performed:

- Development of three alternatives for the HP-Cogen system
  1) 17 MW Power plant with 86 bar cogeneration system
  2) 25 MW Power plant with 110 bar cogeneration system
  3) 25 MW Power plant with 110 bar cogeneration system (with sale of electricity and steam to sugar mills and purchase of bagasse from the sugar mills)
- Financial modelling for all three alternatives with payback period, IRR and sensitivity analysis.

Name of Project:	"High pressure Co-generation Pakistan" under SWITCH-Asia Project
Location:	Sugar Sector All over Pakistan
Client and Funded By:	European Commission (EU)
Main Project Features:	The specific objective of the project is to promote sustainable production of electricity through replication of high-pressure cogeneration technologies in the sugar sector by supporting sugar mills through technology standardization, enabling access to finance, and mobilizing relevant public sector authorities. The project has three major protons • Development of a Conducive Regulatory Regime and Capacity Building of public sector institutions • Improving Access to Finance • Training and Capacity Building of the Sugar Sector and Technology Providers
Duration of Activity:	March 2014 – February 2018
Positioned Held:	Feasibility Expert

Activities Performed:

- Prepared business model/financial feasibilities for 10 sugar mills planning to convert to high-pressure cogeneration technology.
- Development of MS Excel based "Cost of Power Generation Study" for bagasse based projects toolkit.
- Preparation of Project Design Document (PDD) for Clean Development Mechanism (CDM) registration for the 10 sugar mills.
- Conducted one-day awareness session on Carbon Trading for sugar sector, one in Lahore and one in Karachi.

Name of Project:	Renewable Energy Resource Mapping of Pakistan (ESMAP) (Solar Mapping)
Location:	All across Pakistan
Client and Funded by:	World Bank
Main Project Features:	The project aimed to analyze and validate the satellite based solar radiation data for determination of solar power potential in the Pakistan. Total of 9 solar measurement stations (2 high precision tier-1 stations and 7 medium precision tier 2 stations) were installed in 9 different parts of country covering all solar regimes. These stations measure the parameters such as solar radiation Direct Natural Irradiance (DNI) Global Horizontal Irradiance (GHI), Diffused Horizontal Irradiance (DHI), humidity, wind speed, wind direction and air pressure etc. The data will be monitored for the duration of 8 years. Based on measurement a solar atlas got prepared for the whole Pakistan. The solar atlas could also be used as a bankable feasibility for investors.
Duration of Activity:	March 2014 – Present
Positioned Held:	Senior Project Engineer

Activities Performed:

- Assessment of satellite base solar regimes in Pakistan
- Shortlisting of 9 sites and installation of solar measuring stations in (Bahawalpur, Multan, Kala Shah Kaku, Islamabad, Peshawar, Karachi, Jamshoro, Quetta and Khuzdar)
- Coordination with project consortium and hosts of sites for maintenance.

Name of Project:	Renewable Energy Resource Mapping of Pakistan (Biomass Mapping)
Location:	All across Pakistan
Client and Funded by:	World Bank
Main Project Features:	The project aimed to identify the biomass potential in the country to support sustainable expansion of electricity generation from biomass. • Support renewable energy mapping and geospatial planning for biomass resources • Build knowledge base on location and potential of biomass resources • Analyse relevant legal laws, regulations, issues and legal perspective of the project
Duration of Activity:	December 2014 – March 2016
Positioned Held:	Monitoring and Evaluation (M&E) Expert

Activities Performed:

- Monitoring & Evaluation of crops field survey conducted by third party.
- Analysis of renewable energy policy 2010 and provided recommendations for the government.

Name of Project:	Pakistan Low Carbon Scenario Analysis
Location:	Pakistan
Client:	Climate and Development Knowledge Network (CDKN)
Main project features:	The project involves preparing top-down projections of GHG emissions in the six sectors (energy, transport, industry, agriculture, forestry, and waste management), in five year

	periods up to 2030, in accordance with the guidelines of the Intergovernmental Panel on Climate Change (IPCC). Against this baseline, the a GHG mitigation options analysis will be undertaken to explore opportunities for GHG emissions abatement across the six sectors and the potential to deviate growth from the business-as-usual (BAU) reference scenario to alternate low carbon pathway.
Year:	November 2015 – June 2016
Positions held:	Senior Research Associate

Activities performed:

Phase 1:

- Conducted research to elaborate GHG mitigation options in energy sector, particularly with regard to the respective emission reduction potential and associated cost
- Provision of support for stakeholder engagement

Phase 2:

- Information collection and qualitative and quantitative analysis for the energy supply sector's low carbon scenario analysis.
- Bilateral meetings with energy supply sector stakeholders from government, industry and business associations in order to inform the low carbon scenario analysis for the sector.
- Presentation of Findings at the National Dissemination Workshop

Name of Project:	Punjab Biomass Power Plant Feasibility Study Project
Location:	Punjab Province, Pakistan
Client and Funded By:	Agriculture Department, Government of Punjab, Pakistan
Main Project Features:	The project activity involved the assessment of 21 proposed sites and shortlisting of 5 sites for the biomass based power plant. Preparation of comprehensive feasibility studies for 5 shortlisted sites for biomass based power plants in different parts of Punjab province.
Duration of Activity:	March 2014 – March 2015
Positioned Held:	Senior Project Engineer

Activities Performed:

- Developed a site selection criteria for short listing of 21 sites to 5 sites.
- For 5 shortlisted sites, prepared the following sections of feasibility report;
  - Assessment of biomass availability (only field residues)
  - Development of fuels supply chain for sustainable operation of power plant
  - Preliminary environmental impact assessment
  - MS Excel® based financial models for different scenarios
  - Biomass based power plant tariff calculation

Name of Project:	Biomass + Coal based Power Plant and Waste Heat Recovery Utilization for Power Generation for Pioneer Cement Limited.
Location:	Jouharabad, District Khushab, Pakistan
Client and Funded by:	USTDA (United States Trade Development Agency) for Pioneer Cement Limited
Main Project Features:	Assessment of technical and economic viability of 35-50 MW biomass + coal fired power plant along with 5-7 MW waste heat recovery system at the existing kilns to mitigate and reduce dependence on unreliable grid power at a Pioneer Cement Limited Pakistan.
Duration of Project:	March 2013 – December 2013
Positioned Held:	Biomass Expert

Activities Performed:

- Analysis of the existing grid station conditions and electrical operations of the cement plant, which provided basic information for the power export plan

- Detailed assessment of biomass availability & supply chain mechanism by gathering information from Agriculture Department Government of Punjab, interviews with local farmers, rice millers, poultry farmers and biomass suppliers from field survey with in the 120 km radius from the project plant
- Prepared preliminary environmental overview
- Calculated the impacts of the project technology on GHG emission reductions

Name of Project:	USAID LT Capacitor Replacement Project
Location:	In all electricity distribution companies of PEPCO, Pakistan
Client:	United States Agency for International Development (USAID)
Main Project Features:	The project activity aimed to improve the power factor of agriculture tube wells through replacement of LT capacitors. The project was conducted in 9 Distribution Companies (DISCO)s all over Pakistan except in K-Electric (Karachi). The project activity replaced 21,641 LT Capacitors, which resulted in reduction of reactive power of approximate 32.11 MVA.
Duration of Project	January 2013 – April 2014
Positioned Held:	Senior Project Engineer

Activities Performed:

- Conducted energy audits for power factor improvements of agriculture Tubewells. Energy audit involved the measurement of existing power factor, replace/install a new appropriate sized LT capacitor to achieve 90% power factor.
- Did data verification of energy audits conducted by field teams.
- Coordination with the field teams
- l team building for the project by recruiting the field staff, including engineers, technicians & computer operators.

Name of Project:	Energy Conservation in Industries: Industrial Motor Replacement Program
Location:	In selected Industries, all over Pakistan
Client:	United States Agency for International Development (USAID)
Main Project Features:	Industrial Motors Replacement program was Demand Side Management (DSM) initiative, was funded at 50% cost share with industrial sector. It was being implemented across Pakistan. The program engagement is through three leading efficient motor manufacturers (ABB, SIEMENS and WEG/AVANCEON) in the country. The project aimed to replace 1,055 Motors and 702 Variable Frequency Drives through 1,500 pre-implementation and 300 post-implementation energy audits. The initiative achieved energy saving of 8.01MW. The following industries have been audited for replacement of inefficient motors • Akzo Nobel Pakistan • Al Noor Sugar Mills • Al-Abbas Cement Industries Limited • Amir Cotton Mills Limited • Anjum Textile Mills (Private) Limited • Bilal Fibres Mills • Cherat Cement Company Limited, Nowshera • Colgate Palmolive Pakistan Limited. • Crescent Cotton Products • Crescent Steel and Allied Products Ltd. • Dalda Foods Private Limited • Diamond Fabrics Mills • Ellcot Spinning Mills • Engro Foods Limited

	• Ghani Gas Limited • Guard Agricultural And Research Services • Hazara Phosphate Fertilizer Pvt.Ltd • ICI Soda Ash Khewra • Ittehad Chemicals Limited • Khalid Shafique Spinning Mills • Kohat Textile Mills Limited • Malik Auto And Agricultural Industries Limited • Master Textile Mills Limited • Maple Leaf Cement Factory Limited Iskandar Abad • Mustekham Cement Limited • Nestle Pakistan Limited • Pak-Arab Fertilizer • Pioneer Cement • Quetta Textile Mills Limited Unit No.3 • Qureshi Floor Mills Limited • Rafhan Maize Products • Reliance Cotton Spinning Mill • Saif Textile Mills Limited • Sapphire Fiber Limited • Sapphire Finishing Mills Limited • Sapphire Textile Mills Limited • Thal Limited • Thatta Cement Company Limited • Unilever Pakistan Foods Limited
Duration of Project	May 2012 to September 2014
Positioned Held:	Project Engineer

Activities Performed:

- Determination of measurement instruments and procurement.
- Comprehensive onsite pre-implementation energy audit for collection of information about the motors, electrical parameters (voltage, current, power factor, and input power), and calculations of efficiency and power output of existing motors.
- Developed a sizing methodology to ensure precise resizing of new motors for enhanced efficiency and energy savings
- Implementation of post implementation energy audits, to measure actual energy savings.

Name of Project:	Tube Well Efficiency Improvement Program (TWEIP)
Location:	All across Pakistan
Client:	United States Agency for International Development (USAID)
Main Project Features:	The Program envisaged replacement of 11,000 inefficient agriculture tube wells with energy efficient pump sets, across the country. Pump set were distributed to the farmers at 50% subsidized rate by USAID. Under the project 2,368 agriculture tube wells were replaced which resulted the approximate power savings of 16.09 MW.
Duration of Project	April 2010 – December 2012
Positioned Held:	Project Engineer

Activities Performed:

- Conducted on-site energy audits for agriculture tube wells during the pilot phase of the project and for capacity building of field staff teams.

- Analysis of electrical and mechanical parameters of deep well turbines, centrifugal, and submersible pump sets
- Resizing and selection of appropriate energy efficient tube wells for specific farmer
- Reviewed the test bed reports of the selected pump sets for the project under the ISO 9906e standard.

Summary of Undertaken Projects under Carbon Services (Private) Limited

CDM Project References:

Name of Project:	Low Head Hydro Power Development Projects, Punjab Pakistan
Location:	Different locations in Punjab Pakistan
Client or Funded By:	Punjab Power Development Company Limited (PPDCL)
Main Project Features:	The project activity involves the implementation of 4 low head run of the river hydro power plants at different irrigation canals in Punjab province. The combined capacity of those projects is 19.88 MW. The project is expected to reduce the 56,314 tCO_2 per year. The project is under CDM Validation.
Duration of Activities:	April 2014 - Ongoing
Position Held:	Project Manager
Activities Performed:	In this project, I am working as a senior project engineer. major activities involved are; • Selection of appropriate CDM Methodology and preparation of Project Idea Note • Emission reduction calculation & Development of project CDM Additionality • Hiring and shortlisting of DOEs as per ADB guidelines. • Review of project documents such as (Project contact document, IEE report etc.) • Host Country Approval from DNA Pakistan Ministry of Climate Change CDM Cell • Conducted Local CDM Stakeholder Consultation Meeting • Coordination with project stakeholder • Conducted several training sessions for the project stakeholders

Name of Project:	Lakhodair Landfill Project, Lahore, Pakistan
Location:	Lahore, Pakistan
Client or Funded By:	Lahore Waste Management Company (LWMC)
Main Project Features:	Lahore Waste Management Company (LWMC) has constructed a landfill site near Lahore to dump 2500 tons per day municipal solid waste (MSW) collected from the city of Lahore. Methane collected from the landfill site is recovered and flared. In future the recovered methane will be used for power generation thus resulting in the emission reduction. Carbon Service is providing consultancy services to get this project registered with UNFCCC's CDM Executive Board to get the benefits of carbon credits. For the first 7 years the project is expected to save on average of 70,000 tCO_2/year. The project is under CDM Validation.
Duration of Activities:	April 2015 – On going
Position Held:	Project Manager
Activities Performed:	Major activities involved are; • Preparation of project proposal • Selection of appropriate CDM Methodology & Project Idea Note (PIN) • Emission reduction calculation and Development of project CDM Additionality • Review of project documents such as (landfill construction contract, IEE report, waste analysis etc.) • Host Country Approval from DNA Pakistan Ministry of Climate Change CDM Cell • Conducted Local CDM Stakeholder Consultation Meeting • Global Stakeholder Process and CDM Validation process • Coordination with project stakeholder

	• Conducted several training sessions for the project stakeholders

Name of Project:	Fauji Cement Company Limited Waste Heat Recovery Project
Location:	Jhang Bahtar, District Attock, Punjab, Pakistan
Client or Funded By:	Fauji Cement Company Limited (FCCL)
Main Project Features:	The project activity involved the implementation of Waste Heat Recovery Boiler (WHRB) at the Exhaust of 7,200 kiln 2. The steam from WHRB is fed into steam turbine to generate 12 MW electricity, which will partially replace the grid electricity. The project is registered CDM project having **Ref. # 10330**. The project will result in emission reduction of 286,480 in the life span of 10 years. Further details can be obtained from the following web link. http://cdm.unfccc.int/Projects/DB/KBS_Cert1476851159.75/view
Duration of Activities:	November 2014 to October 2016
Position Held:	Senior Project Engineer
Activities Performed:	Major activities performed; • Preliminary assessment of emission reduction potential • Selection of appropriate CDM methodology AMS-III.Q (Version 6) • Preparation of Project Idea Note (PIN) • Coordinated with the client for successful local CDM Stakeholder, Consultation meeting, • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of project design document • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Selection of Designated Operational Entity (DOE). • Review of project documents such as (WHR EPC contract, IEE report, procurement documents etc.) • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Review of project Validation Report (VR) and submission of final package to DOE. • Training of project proponent on capacity building regarding CDM project activity

Name of Project:	Substitution of coal with alternate fuels at Lucky Cement Limited, Karachi Plant
Location:	Karachi, Pakistan
Client or Funded By:	Lucky Cement Limited (LCL)
Main Project Features:	The project activity involved the collection of renewable/alternate fuels such as biomass, Municipal Solid Waste (MSW) and waste tyres from different sites around the project plant and transformation into refuse-derived fuel (RDF). RDF will be used as a fuel in the kiln which will result in partial substitution of coal. This activity will result in approximate reduction of 191,542 tCO2/Year. The project is registered with UNFCCC CDM Executive Board having **reference # 8780**. Further details can be obtained from the following web link. http://cdm.unfccc.int/Projects/DB/TUEV-SUED1355480166.14/view
Duration of Activities:	November 2011 to July 2013
Position Held:	Senior Project Engineer
Activities Performed:	Major activities performed: • Preliminary assessment of emission reduction potential • Selection of applicable methodology ACM0003 (Version 7) • Coordinated with the client for successful local CDM Stakeholder, Consultation meeting, • Prepared emission reduction calculation Excel spreadsheet and developed project

	additionality as per the applied methodology • Development of project design document • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Selection of Designated Operational Entity (DOE). • Development of project implementation and monitoring guidelines. • Review of project documents including contract with technology supplier, IEE Report, Biomass Availability Study etc. • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Review of project Validation Report (VR) and submission of final package to DOE. • Training of project proponent on capacity building regarding CDM project activity

Name of Project:	The National CFL Project, Pakistan
Location:	Across Pakistan
Client or Funded By:	PEPCO & Asian Development Bank
Main Project Features:	The National CFL project, Pakistan funded by Asian Development Bank (ADB) and Agence Française de Développement (French Agency for Development - AFD) aimed to replace 30 million Incandescent Lamps (ICL)s with the efficient free of cost Compact Florescent Lamps (CFL)s in domestic sector across all Pakistan. The project is the demand side energy management project and is being implemented by Ministry of Water and Power and PEPCO with the coordination of all distribution companies (DISCOs) and KESC. The project is expected to reduce approximately 55,000 tCO2/year and electricity savings of 1024 MW of electricity during peak demand. The project is registered with UNFCCC CDM Executive Board as a PoA having reference number of PoA 7811).
Duration of Activities:	January 2011 – December 2012
Position Held:	Project Engineer
Activities Performed:	Summary of the major activities: • Development of one PoA-DD, CPA Generic and 55 CPA-DDs. • Coordinated with the client for successful local CDM Stakeholder Consultation meeting, • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology, AMS-II.J (Version 4) • Review of tripartite agreement between Ministry of Water and Power, PEPCO and each DISCO, etc. • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Development of project implementation and monitoring guidelines. • Conducted training sessions for all the stakeholders for successful implementation of the project activity. • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Coordination with all project stakeholders.

Name of Project:	Waste heat recovery and utilization for power generation at DG Cement Khairpur Plant
Location:	Khairpur, Kallar Kahar, Punjab, Pakistan
Client or Funded By:	DG Khan Cement Company Limited (DGKCC)
Main Project Features:	The project activity involved the implementation of Kalina cycle based Waste Heat Recovery Boiler (WHRB) at the Exhaust of 6,700 kiln. The steam from WHRB is fed into

	steam turbine to generate 8.6 MW electricity which will partially replace the grid electricity. The project is registered CDM project having Ref. # 7845. The project will result in emission reduction of 285,420 tCO_2 in the life span of 10 years. Further details can be obtained from the following web link. http://cdm.unfccc.int/Projects/DB/TUEV-SUED1350995073.31/view
Duration of Activities:	November 2011 to October 2012
Position Held:	Senior Project Engineer
Activities Performed:	Major activities performed; • Preliminary assessment of emission reduction potential • Selection of appropriate CDM methodology AMS-III.Q (Version 4) • Preparation of Project Idea Note (PIN) • Coordinated with the client for successful local CDM Stakeholder, Consultation meeting • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of project design document • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Selection of Designated Operational Entity (DOE). • Review of project documents such as (WHR EPC contract, IEE report, procurement documents etc.) • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Review of project Validation Report (VR) and submission of final package to DOE. • Training of project proponent on capacity building regarding CDM project activity

Name of Project:	Substitution of coal with alternate fuels at DG Khan Cement Company Limited, Khairpur Plant
Location:	Khairpur, Kallar Kahar, Punjab, Pakistan
Client or Funded By:	DG Khan Cement Company Limited (DGKCC)
Main Project Features:	The project activity involved the collection of renewable/alternate fuels such as biomass, Municipal Solid Waste (MSW) and waste tyres from different sites around the project plant and transformation into refuse-derived fuel (RDF). RDF will be used as a fuel in the kiln which will result in partial substitution of coal. This activity will result in approximate reduction of 132,439 tCO2/Year. The project is registered with UNFCCC CDM Executive Board having reference number 6642.
Duration of Activities:	January 2011 to November 2012
Position Held:	Senior Project Engineer
Activities Performed:	Major activities performed: • Preliminary assessment of emission reduction potential • Selection of applicable methodology ACM0003 (Version 7) • Coordinated with the client for successful local CDM Stakeholder, Consultation meeting, • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of project design document • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Selection of Designated Operational Entity (DOE). • Development of project implementation and monitoring guidelines.

	• Review of project documents including contract with technology supplier, IEE Report, Biomass Availability Study etc. • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Review of project Validation Report (VR) and submission of final package to DOE. • Training of project proponent on capacity building regarding CDM project activity

Name of Project:	Partial substitution of coal with alternate fuels at DG Cement, Khofli Sattai Dera Ghazi Khan Plant
Location:	Khofli Sattai Dera Ghazi Khan, Punjab, Pakistan
Client or Funded By:	DG Khan Cement Company Limited (DGKCC)
Main Project Features:	The project activity involved the collection of renewable/alternate fuels such as biomass, Municipal Solid Waste (MSW) and waste tyres from different sites around the project plant and transformation into refuse-derived fuel (RDF). RDF will be used as a fuel in the kiln, which will result in partial substitution of coal. This activity will result in approximate reduction of **162,135 tCO_2/Year**. The project is registered with UNFCCC CDM Executive Board having **Ref # 8192**. Further details can be obtained from the following web link. http://cdm.unfccc.int/Projects/DB/TUEV-SUED1352797146.84/view
Duration of Activities:	November 2011 to November 2012
Position Held:	Senior Project Engineer
Activities Performed:	Major activities performed: • Preliminary assessment of emission reduction potential • Selection of applicable methodology ACM0003 (Version 7) • Coordinated with the client for successful local CDM Stakeholder, Consultation meeting, • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of project design document • Host Country Approval (HCA) from Designated National Authority (DNA) Pakistan, which is under (CDM Cell) Ministry of Climate Change. • Selection of Designated Operational Entity (DOE). • Development of project implementation and monitoring guidelines. • Review of project documents including contract with technology supplier, IEE Report, Biomass Availability Study etc. • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Review of project Validation Report (VR) and submission of final package to DOE. • Training of project proponent on capacity building regarding CDM project activity

Name of Project:	20 MW Bagasse based high pressure cogeneration system at Shakarganj Mills Limited Bhone.
Location:	Bhone, District Jhang, Punjab Pakistan
Client or Funded By:	Shakarganj Energy Limited (SEL)
Main Project Features:	The project activity involved installation of 2 biomass based high pressure boilers of 100tph each and 2 steam turbines of 20MW each. The surplus electricity generated from the will be exported to the national grid. SEL has the contract with FESCO for exporting 15MW electricity during peak generation. The project expected to reduce 18,000 tCO2/Year.
Duration of Activities:	January 2011 – July 2012
Position Held:	Junior Project Engineer

Activities Performed:	Major activities undertaken by the project • Preliminary assessment of the project activity. • Preparation of financial feasibility of the project activity. • Complete assessment of the financial additionality of the plant as per CDM requirements. • Selection of the appropriate CDM methodology ACM0006 (Ver 11). • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of the CDM project design document (PDD). investment analysis, emission reduction calculation, monitoring plan and establishing of baseline etc. for the project activity. • Assistance provided for grant of host country approval from designated national authority (DNA) Pakistan. • Review of Initial Environmental Examination Report for the project activity. • Oversight of stakeholder consultation meeting for the project activity. • Selection of the designated operational entity (DOE) for the validation of project activity. • Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs). • Complete support provided to the client regarding the communication with the regulatory authorities regarding tariff negotiations. • Complete support provided to the client regarding rationalization of tariff petition.

Name of Project:	FFC Cogeneration Project at Mirpur Mathelo, Ghotki, Pakistan
Location:	Mirpur Mathelo, District Ghotki, Sindh, Pakistan
Client or Funded By:	Fauji Fertilizer Company (FFC)
Main Project Features:	The project activity involved installation of a 15 MW gas turbine based cogeneration plant. The gas turbine was coupled with 30 tph Heat Recovery Steam Generator (HRSG). Natural gas and purge gas were used as a fuel in the HRSG for duct firing. The generated electricity from the project will displace the grid electricity which is expected to reduce 23,828 tCO2/year.
Duration of Activities:	October 2011 to October 2012
Position Held:	Senior Project Engineer
Activities Performed:	Major activities undertaken by the project • Preliminary assessment of the project activity. • Preparation of financial feasibility of the project activity. • Complete assessment of the financial additionality of the plant as per CDM requirements. • Selection of the appropriate CDM methodology AMS-II.D (Ver 12). • Prepared emission reduction calculation Excel spreadsheet and developed project additionality as per the applied methodology • Development of the CDM project design document (PDD). investment analysis, emission reduction calculation, monitoring plan and establishing of baseline etc. for the project activity. • Assistance provided for grant of host country approval from designated national authority (DNA) Pakistan. • Review of Initial Environmental Examination Report for the project activity. • Oversight of stakeholder consultation meeting for the project activity. • Selection of the designated operational entity (DOE) for the validation of project activity.

	• Provision of comprehensive assistance to the project participant during the entire validation process, e.g. submission of supporting documents for the PDD, making response for all the clarification requests (CRs) and corrective action requests (CARs).

Energy Audit References:

Name of Project:	Baseline energy audit at Packages Limited, Lahore
Location:	Lahore, Pakistan
Client or Funded By:	Packages Private Limited
Main Project Features:	The project activity involved assessment of baseline energy consumption and identification of energy efficiency at the factory area of Packages. Packages is a largest tissue paper and packaging manufacturing company of Pakistan, The factory has the electrical load of around 18 MW.
Duration of Activities:	July 2017 – October 2017
Position Held:	Project Manager
Activities Performed:	• Preliminary assessment of the factory (tissue paper manufacturing unit, folding carton plant, flexible printing plant, diesel power plant, oil heaters, HVAC system and consumer product division). • Define the organizational and operational boundaries for baseline energy audit. • Conducted on-site visit to take electrical measurement or large motors, pumps compressors, heaters etc. (>15 kW). • Emission testing of diesel genset exhaust, oil heater exhaust. • Compilation and analysis of energy audit data. • Roof top PV Solar assessment for factory area. • Preparation of detailed excel based calculation sheet for each equipment and calculation of energy efficiency scope. • Preparation of final report and final presentation • Coordination with the client

Carbon Footprint References:

Name of Project:	Carbon footprint assessment of Packages Limited, Lahore
Location:	Lahore, Pakistan
Client or Funded By:	Packages Private Limited
Main Project Features:	The purpose of the activity to calculate organizational (high level) carbon foot prints for Pakistan's largest packaging industry for the year 2017 using the GHG Protocol (A Corporate Accounting and Reporting Standard). The project also involve the calculation of product level carbon foot printing of detergent packaging using PAS 2050 protocol, using cradle to grave approach.
Duration of Activities:	February 2018 – On Gong
Position Held:	Project Manager
Activities Performed:	• Define the organizational and operational boundaries for determination of scopes under GHG protocol • Preparation of methodologies for carbon foot print assessment (Input output diagram for product) • Analysis of data provided for the footprint assessment • Determination of credible sources for calorific values, emission factors and calculation of grid emission factor as per CDM tool • Preparation of detailed excel based calculation sheet for results calculation for each scope • Preparation of final report and final presentation

	• Coordination with the project stakeholders

Name of Project:	Carbon footprint assessment of Indus Motor Company (IMC), Limited
Location:	Karachi, Pakistan
Client or Funded By:	Toyota Indus Motors Company (IMC) Limited
Main Project Features:	The high level carbon footprint calculation was initiated by IMC to calculate and gain an understanding of the direct and indirect greenhouse gas emissions of its organization. An assessment was carried out for the year 2016 (January to December 2016) using "GHG Protocol" (A Corporate Accounting and Reporting Standard) was used for determination of carbon foot printing.
Duration of Activities:	November 2016 – July 2017
Position Held:	Project Manager
Activities Performed:	• Define the organizational and operational boundaries for determination of scopes under GHG protocol • Preparation of methodologies for carbon foot print assessment • Analysis of data provided for the footprint assessment • Determination of credible sources for calorific values, emission factors and calculation of grid emission factor as per CDM tool • Preparation of detailed excel based calculation sheet for results calculation for each scope • Preparation of final report and final presentation • Coordination with the client

Name of Project:	Carbon footprint assessment of Packages Limited, Lahore
Location:	Lahore, Pakistan
Client or Funded By:	Packages Private Limited
Main Project Features:	Packages is a largest tissue paper and packaging manufacturing company of Pakistan. The high level carbon footprint calculation was initiated by Packages Limited to calculate and gain an understanding of the direct and indirect greenhouse gas emissions of its organization. An assessment was carried out for the year 2016 (January to December 2016). The GHG Protocol (A Corporate Accounting and Reporting Standard)
Duration of Activities:	May 2017 – July 2017
Position Held:	Project Manager
Activities Performed:	• Define the organizational and operational boundaries for determination of scopes under GHG protocol • Preparation of methodologies for carbon foot print assessment • Analysis of data provided for the footprint assessment • Determination of credible sources for calorific values, emission factors and calculation of grid emission factor as per CDM tool • Preparation of detailed excel based calculation sheet for results calculation for each scope • Preparation of final report and final presentation • Coordination with the project stakeholders