



**H.E. Mr. Esala Ruwan Weerakoon, Secretary General of SAARC meets
Dr. Nawaz Ahmad, Director SAARC Energy Centre**



**SAARC
ENERGY
CENTRE**

E-mail: info@saarcenergy.org | **Web:** www.saarcenergy.org

Patron-in-Chief
Dr. Nawaz Ahmad

Editor-in -Chief
Mehnaz Khurshid Gardezi (Ms.)

Editor
Mr. Ahmad Talha

About SAARC Energy Centre

Energy cooperation is a driver for sustainable development leading to durable peace in the region. SAARC Energy Centre was created through Dhaka Declaration in 2005, as the Special Purpose Vehicle to realize the vision of SAARC leaders to establish an Energy Ring in South Asia. It started journey from March 2006 in Islamabad. SAARC energy cooperation programme provides a major substantive element for economic prosperity of South Asia through

meeting the energy demand of the countries. SAARC Energy Centre is converting energy challenges into opportunities for development. It is the platform involving officials, experts, academia, environmentalists and NGOs to tap potential of cooperation in energy sector including development of hydropower, renewable and alternative energy, promoting technology transfer, energy trade, energy conservation and efficiency improvement in the region.

Vision:

Energy security for South Asia through development of indigenous, as well as Intra-regional resources by enhancing cooperation and promoting optimal use of resources.

Mission:

Contribute as a regional Centre of Excellence on energy to fulfill the energy needs through sustainable and least cost energy solutions.

Goals:

1. Strengthen South Asia's capacity to collectively address regional energy issues.
2. Facilitate energy trade within the SAARC region, through the establishment of regional interconnections and energy markets.
3. Promote the role of private sector in energy sector (i.e., production, transportation, trade, energy conservation).
4. Enhance regional human capital in energy sector.
5. Promote use of alternative and renewable energies/technologies in the region.
6. Induce the culture of energy conservation in the region.
7. Promote transfer of technology in the energy sector in South Asia.
8. Contribute in providing regional energy data and information.

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Dr. Nawaz Ahmad
Director

Message from the Director

Dear Readers,

Global energy demand is expected to increase substantially in the coming decades driven by industrial and population growth, particularly in the developing countries. In South Asia, there are nearly 100 million people without access to electricity and nearly 800 million without access to clean cooking fuels. The challenges for South Asian countries are to develop sources of cheap energy, increase energy access, reduce energy intensity, enhance energy efficiency and promote conservation to cope with growing energy needs while tackling climate change impacts. Our pathway towards sustainable future needs to include sector-specific transition strategies for energy, transport, industrial, agriculture and urban development. All these challenges are further complicated by the fact that SAARC Member States are developing economies with limited financial resources. In the wake of COP26, it is clear that much more is required to be done in order to ensure a green and prosperous future. However, energy transition with reduced dependency on fossil fuels would require significant financial support and adoption of phased approach for developing countries like the SAARC Member States.

To help and contribute the Member States in their efforts of tackling the challenges on the pathway of sustainable development, SAARC Energy Centre (SEC) is serving as a principal platform for regional energy co-operation, and a repository of policy, technology, resource and technical knowledge on clean energy transition. SEC assists SAARC Member States in planning, developing and implementing effective energy policies and programmes in support of sustainable future.

During the year 2021, SEC assisted the stakeholders in the SAARC region through its efforts of capacity development programmes on cleaner fuels such as LNG, renewable and alternate energy and energy efficient practices. A row of extensive support activities was conducted including but not limited to provision of latest data through its Energy Data Portal, technical knowledge sharing reports/ publications, informative webinars and video conferences. To design such activities, SEC keeps itself abreast of the latest knowledge, technological development and best practices. Throughout the year, SEC effectively collaborates with the stakeholders by engaging them in different programmes and activities. All programmes and activities are timely broadcasted on SEC digital and social media platforms, and can be accessed for free.

This Newsletter highlights the SEC activities conducted during 2021. I extend my sincere thanks to SEC team for contributing their best efforts in conducting outstanding programme activities during 2021. I also extend humble appreciations to SAARC Secretariat for providing effective and conducive support enabling SEC to perform all planned activities in a timely and effective manner during the year. My sincere appreciation to Ms. Mehnaz Khurshid Gardezi, Editor-In-Chief of this issue and all those who contributed towards bringing out this Annual Volume 2021.

Thank you.

Visit of H.E. Mr. Esala Ruwan Weerakoon, Secretary General of SAARC

His Excellency Mr. Esala Ruwan Weerakoon, Secretary General of SAARC and Mr. Tanveer Ahmed, Director Energy, Transportation, Science & Technology (ETS) from the SAARC Secretariat visited SEC office on 22 December 2021. They were accompanied by Ms. Sughra Habib, Director SAARC, Ministry of Foreign Affairs, Islamabad.

Dr. Nawaz Ahmad, Director SEC along with his team warmly welcomed the Secretary General and visiting delegation. Director SEC apprised H.E. Mr. Weerakoon and the delegation with a detailed presentation on activities of SEC. A cake-cutting ceremony was also held at SEC to mark the 37th SAARC Charter Day. The Secretary General of SAARC along with Director ETS cut the cake. SEC hosted a dinner party in honour of His Excellency Mr. Weerakoon at a scenic local restaurant in Islamabad.

The Secretary General of SAARC expressed gratitude and deep appreciation to SEC. He also praised and thanked Dr. Nawaz Ahmad, Director SEC for motivating and vibrantly leading an excellent team in performing the important role in regional energy integration.



Dr. Nawaz Ahmad, Director SEC welcomes honourable H.E. Mr. Esala Ruwan Weerakoon, Secretary General of SAARC and the visiting delegate at SEC Office



Glimpses of Secretary General of SAARC's visit



Director SEC presenting memento to
H.E. Mr. Esala Ruwan Weerakoon, Secretary General of SAARC



Director SEC presenting memento to
Mr. Tanveer Ahmed, Director ETS, SAARC Secretariat



Director SEC presenting memento to Ms. Sughra Habib,
Director SAARC, Ministry of Foreign Affairs, Islamabad



H.E. Mr. Esala Ruwan Weerakoon,
Secretary General of SAARC presenting a souvenir to
Dr. Nawaz Ahmad, Director SEC



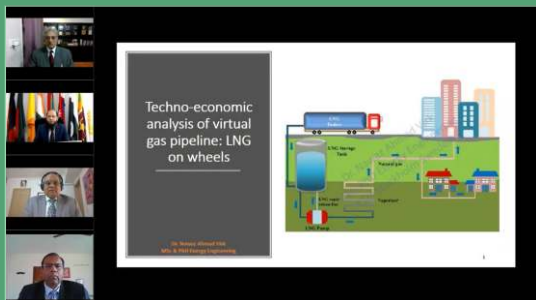
Dinner party in honour of H.E. Mr. Weerakoon and visiting delegate

Policy Dialogue on Regional Cooperation for Sustainable Development in South Asia

Dr. Nawaz Ahmad, Director SEC delivered a talk on Fostering Energy Cooperation during Policy Dialogue on Regional Cooperation for Sustainable Development in South Asia, organized by UNESCAP on 17 November 2021. Tackling the challenges in sustainable development through promotion of regional energy cooperation was the focus of his talk. He recommended that ratification of the existing energy cooperation framework agreement and subsequent steps such as harmonisation of regulations, establishment of competitive markets and open access to transmission and distribution networks need to be taken to build a fair, transparent and integrated regional market.



Techno-economic Analysis of Virtual Gas Pipeline: LNG on Wheels



Dr. Nawaz Ahmad, Director SEC delivered a presentation on Techno-economic Analysis of Virtual Gas Pipeline: LNG on Wheels during Online Training of “SAARC Professionals on LNG Business Strategies” organized by SEC. His presentation included a comparison of LNG pipeline vs. virtual pipeline (transport via trucks), a detailed analysis of capital and operational expenditures of LNG supply chain for varying distances and gas supply volumes. The presentation and recording are available on SEC

website: <https://www.saarcenergy.org/online-training-of-saarc-professionals-on-lng-business-strategies/>

Waste-to-Energy: A case study of Karachi MSW

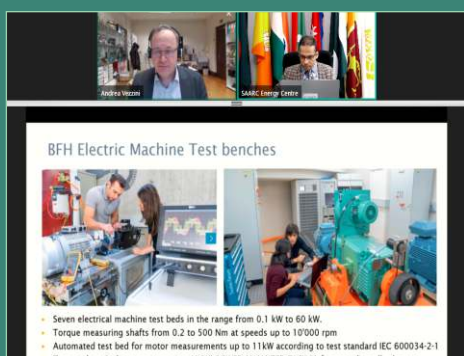
A case study on Waste-To-Energy (WTE), developed by Dr. Nawaz Ahmad, was presented during online training of SAARC Professionals on “Commercial Scale Biogas Plants”, organized by SEC. It included an overview of the municipal solid waste (MSW), MSW status in Karachi and various WTE technologies for MSW. Techno-economic analysis of utilization of anaerobic digestion for MSW management in Karachi was the focus of the study. The presentation is available at:

https://www.saarcenergy.org/wpcontent/uploads/2021/09/26_08.2021_Waste-to-Energy_SEC_Dr-Virk.pdf



Online Training of Stakeholders on Digitizing Industrial Motor Systems for Energy Efficiency

SEC conducted five days Online Training of Stakeholders on Digitizing Industrial Motor Systems for Energy Efficiency from 6 to 10 December 2021. The objective of this online training was to equip the stakeholders of SAARC region with essential skillsets on digitization of the motor systems. In this training, Top 10 China was invited as a team lead. Six prominent experts from around the globe viz. China, Finland, Germany, India, Switzerland and USA, delivered during the training.



The training was attended by industrial stakeholders representing various government organizations, industries, academia and researchers from the SAARC Member States. The training was focused on industrial motor systems efficiency and saving potential, motor system standardization, remote digital live training, demonstration of MEPSY online calculation, Industrial IoT solutions, smart meters application, Industrial communication protocol etc. The contents of the training are available on SEC’s website.

Online Training of SAARC Professionals on Commercial Scale Biogas Plants



As part of Programme Activities for FY-2021, SAARC Energy Centre (SEC), Islamabad organized a 5-day online training for SAARC Professionals on “Commercial Scale Biogas Plants” held from 23 to 27 August 2021. The online training was conducted by trainers from Indian Institute of Technology (IIT) Roorkee, India and was attended by professionals from the SAARC Member States. The aim of the training was to familiarize the participants on various aspects, i.e., fundamentals, construction, operation, maintenance, economics, environmental/social facets, of commercial scale biogas plants. The comprehensive sessions were designed to target a broad audience, ranging from policy/decision makers, prospective biogas plant developers to project managers, researchers, and other stakeholders working on the biogas technology. The participants of training learnt about basic concepts of the biogas technology, global biogas market, types of biogas plants and feedstocks, biogas plant design, its applications, performance assessment, regulations, challenges pertaining to the existing biogas technology and its future potential in SAARC Member States. The recorded lectures and training material are available on SEC’s website.

Online Training on “HOMER Software”

SAARC Energy Centre conducted five days Online Training on “HOMER Software” from 29 November to 3 December 2021. During the training, the experts introduced the design and functionality of HOMER software to the professionals, for enhancing their capacity on using it. The training provided information and tools on the key parameters of this software associated with design and simulation of Renewable Energy projects.

The training was attended by participants from SAARC Member States, representatives of regional organizations, academia and private

sector. All the contents including concept paper, agenda, trainers' profile, software download link and presentations delivered during the event are available on SEC's website. Moreover, training guide and model files of software are also uploaded on SEC's website.

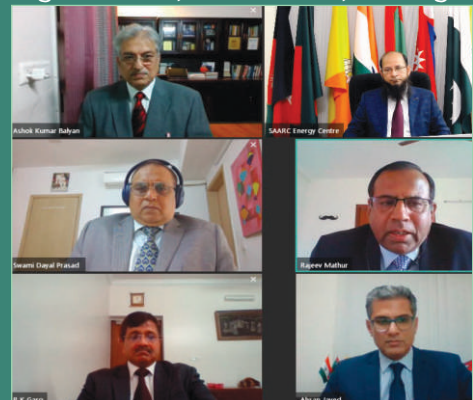


Online Training of “SAARC Professionals on LNG Business Strategies”



SAARC Energy Centre conducted five days Online Training of SAARC Professionals on “LNG Business Strategies” from 15 to 19 November 2021. During the training, the experts covered various aspects of procuring LNG from the international market. The training was focused on fundamentals of LNG, Global markets and trade, Supply chain, Sales & Purchase Agreements, commercial, and legal aspects of the LNG sector etc.

The training was attended by participants from SAARC Member States, representatives of regional organizations, academia and private sector. All the contents including concept paper, agenda, trainers' profile, recording link and presentations delivered during the event are available on SEC's website.



Online Training of SAARC Professionals on Power Purchase Agreements of Renewable Energy Projects

As part of programme activities for FY-2021, SAARC Energy Centre (SEC), Islamabad organized a 5-day online training for SAARC Professionals on “Power Purchase Agreements of Renewable Energy Projects” held from 8 to 12 November 2021. The training was conducted by expert trainers from Indian Institute of Technology, Roorkee, Nepal Electricity Regulatory Commission and Tetra Tech, USA and was widely attended by participants from SAARC Member States. The online training aimed to enhance capacity of SAARC Professionals engaged in RE sector to prepare and negotiate the Renewable Power Purchase Agreements (RPPAs) focusing on competitive energy market regimes. The comprehensive sessions were designed to target a broad audience, ranging from policy and decision-makers, regulators, project developers and project managers, private sector investors, academia/researchers, and independent power producers (IPPs). The five-day technical sessions provided participants an opportunity to learn about basic concepts of RPPAs, different RPPAs models, its strategies of design, skill for analyzing and negotiation of power purchase agreements (PPAs), techniques for risk assessment and mitigations, knowledge of financing structures and bankability of RPPAs and provisions for O&M and decommissioning and dispute settlement mechanisms. The recorded lectures and training material are available on SEC’s website.



Online Training of SAARC Professionals of Small, Mini and Micro Hydro Power Generation



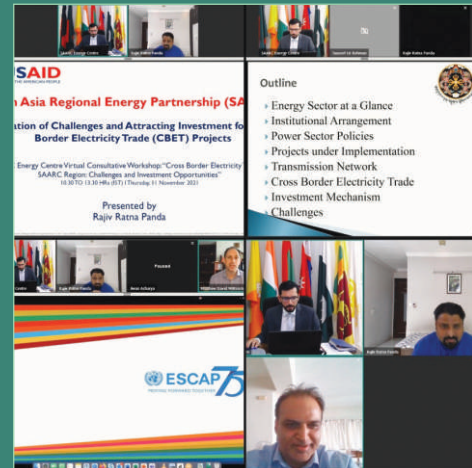
SEC conducted five days on-line training on Small, Mini and Micro Hydro Power (SMMHP) Generation held from 13 to 17 September 2021. The Department of Hydro and Renewable Energy, Indian institute of Technology, Roorkee, India was invited as a team lead for the training.

The aim of the training was to familiarize the participants on various aspects of Small, Mini, and Micro Hydropower, i.e., fundamentals, planning, design, construction, operation, maintenance, economics, regulations and environmental/social aspects. The five-day technical sessions were focused on: site selection, and investigations; design of civil structures; design of electro-mechanical components; technical considerations in planning; selection and dimensioning of major components; construction and operation & maintenance strategies; hybridization with SMMHP plants; socio-economic and environmental aspects; economic, regulatory, policy consideration; maintenance and performance evaluation aspects; online training of laboratories. These comprehensive sessions were designed to target a broad audience, ranging from project developers, researchers, nodal agencies and other stakeholders working on the small, mini, and micro hydropower generation.

The training was attended by professionals representing various government organizations, private sector companies, academia and researchers from the SAARC Member States. The recorded lectures and training material are available on SEC’s website.

Virtual Consultative Workshop on "Cross-Border Electricity Trade in SAARC Region: Challenges and Investment Opportunities".

SEC conducted a virtual consultative workshop on "Cross Border Electricity Trade in SAARC Region: Challenges and Investment Opportunities" on 11 November 2021. Focus of this online workshop was to develop a consultative approach towards the Cross-Border Electricity Trade among SAARC Member States. The purpose of the event was to share the current status, barriers, impact of national electricity sector policies, transmission pricing, challenges and investment opportunities for cross-border electricity trade projects. The workshop was attended by delegates from Member States Afghanistan, Bhutan, Nepal, Pakistan as well as experts from UN ESCAP, ADB and Research Triangle Institute (RTI), India. The presentations delivered by the experts are available on SEC's website.



Virtual Consultative Workshop on "Achieving SDG-7 in South Asia"

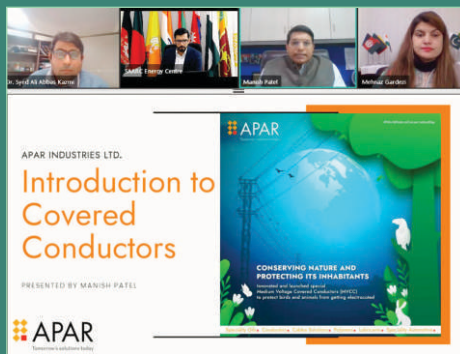


The Sustainable Development Goals (SDGs): "A universal call for action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity". Among these goals, SDG-7 is to ensure universal "access to affordable, reliable, sustainable and modern energy for all". Present progress on SDG-7 falls far behind on all four of its sub targets. In South Asia the situation is alarming as 27% of the population in the region has no access to electricity. Likewise, more than three fifth South Asians are still dependent on traditional biomass for cooking and heating. SEC being the technical arm of SAARC on energy, conducted a virtual consultative workshop on "Achieving SDG-7 in South Asia" 25 November 2021. Delegates from the SAARC Member States and experts from regional/international organizations including UNESCAP, NEECA Pakistan, and Cambridge, England participated in this workshop. Following important aspects were covered during the consultative workshop:

- Role of SAARC Energy Centre towards achieving SDG-7,
- Progress on SDG-7 (South Asia Vs Asia-Pacific),
- Importance of linking SDG-5 with SDG-7 in South Asia and
- Doubling the global rate of improvement in energy efficiency by 2030.

Webinar on "Use of Covered Conductors in Medium Voltage Power Transmission"

Traditionally, medium voltage distribution networks employ bare aluminum overhead conductors for power transmission. The uninsulated bare conductors are vulnerable to line trip-outs and ground faults due to brief electric crosses or contacts with tree branches and oversized vehicles. The use of covered conductors allows for more compact assemblies and lower masts and poles, and helps to minimize the environmental impact of transporting electricity by reducing the visual intrusion of wires, poles and transmission towers. In this context, SEC organized a webinar on "Use of Covered Conductors in Medium Voltage Power Transmission" on 22 November 2021. The objective of the webinar was to share information on the application of the covered conductor system in the distribution network. The speakers discussed all aspects of the covered conductor systems including: types, construction, applications, applicable standards, associated costs, maintenance, performance tests and benefits. The material related to webinar is available on SEC's website.



Webinar on "International Protocols Related to Emissions from Thermal Power Plants"



SEC organized a webinar on "International Protocols Related to Emissions from Thermal Power Plants" on 12 October 2021.

Air pollution has been a major focus of international environmental agreements, and since 1970s over 60 multilateral treaties, protocols, and amendments have been put in place to address this issue. Convention on Long-range Transboundary Air Pollution (LRTAP) Framework was the first attempt being made in 1979 to deal with problems of air pollution on a broad regional basis, followed by the 1985 Helsinki protocol (on SO₂), the 1988 Sofia protocol (on NO_x), the 1991 Geneva

protocol (on VOCs) and Paris Agreement during Conference of Parties (COP21) in December 2015 on global warming to limit the temperature rise.

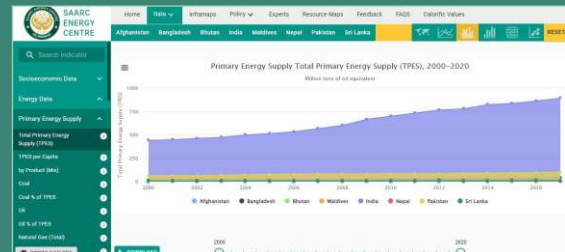
This webinar aimed to discuss various thermal related environmental emissions, relevant international protocols, and their effectiveness in reduction of emissions. Following important aspects were covered in this webinar:

- International protocols on emission from thermal power plants
- Environmental, Health, and Safety Guidelines for Thermal Power Plants
- Emission Regulation for Thermal Power Plants in SAARC
- Paris Agreement and thermal power plants

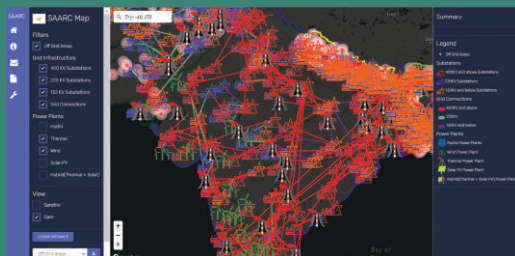
The presentations delivered during this webinar are available on SEC's website.

SAARC Energy Data Portal

SEC is mandated to maintain a comprehensive database dealing with different aspects of energy systems in South Asia to provide a basis for facilitating and promoting regional energy cooperation. From 2019 onwards, SEC developed SAARC Energy Data Portal (available at <https://portal.saarcenergy.org/>) to present the energy information of SAARC region in digitized format. SEC this year updated the portal including updating all energy parameters, the energy trade-flows data, power plants and other energy infrastructure data, policy documents, and energy expert's data. The activity also included further enhancement of the web application frontend and the backend. This also included improvement in various functionalities and features, such as the policy feature, energy trade-flows feature, compare feature etc.



Project on GIS Mapping of Areas not Having Access to Electricity and HV Grid Infrastructure in SAARC Countries



Access to clean, affordable and reliable energy is one of the most important factors in the socio-economic uplift of a country. There are many areas in the SAARC region, which still do not have access to energy whereby, limiting their participation in modern economy and culture. One of the challenges in providing access to energy in these areas through extending the power grid is lack of complete and accurate mapping of the existing electric infrastructure. Therefore, it is imperative to identify these off-grid areas and their distance from the nearby grid or grid-connected areas. This requires a centralized mapping of such off-grid areas and grid infrastructure. In this context, SAARC Energy Centre had undertaken a project in FY-2021 for mapping of off-grid areas and high voltage grid infrastructure in SAARC Region.

The objective of this project is to conduct a thorough mapping of off-grid areas and High Voltage (HV) grid infrastructure of SAARC Member states that would be used as tool by policy makers, investors, grid operators and other stakeholders for effective decision making, strategic power systems planning, cross border electricity trade and to identify alternative means of providing access to electricity in off-grid areas. The tool will also be helpful for tracking the progress on SDG-7.

The current set of results in this tool is developed through using data from secondary sources and applying Machine Learning (ML) algorithms and Artificial Intelligence (AI) techniques to identify and map the off-grid areas and High Voltage (HV) grid infrastructure. This tool is an open access, web-based platform with several useful features such as enabling users to select any region within the SAARC Member States to obtain information about the off-grid areas and nearest grid infrastructure. Users can explore different scenarios through applying appropriate filters to obtain useful contextual information pertaining to off-grid areas, grid stations, Power plants etc. for the selected SAARC Country/Region. The web application can be accessed through <http://saarcemap.com>.

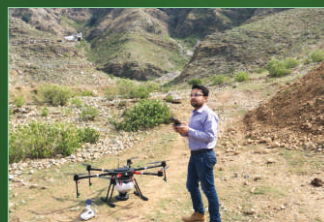


SEC team kicks off World Environment Day (June 5) activities

Every year, SAARC Energy Centre (SEC) celebrates the World Environment Day (WED) on June 05 against a UN set theme for encouraging awareness and action for the protection of our planet and its environment. For 2021, the focus of World Environment Day was the ecosystem restoration, and its theme was “Reimagine, Recreate, Restore.” This year Member State Pakistan officially hosted World Environment Day.

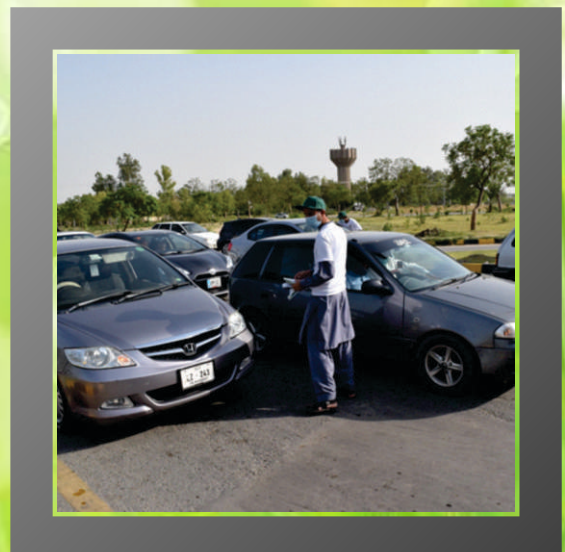
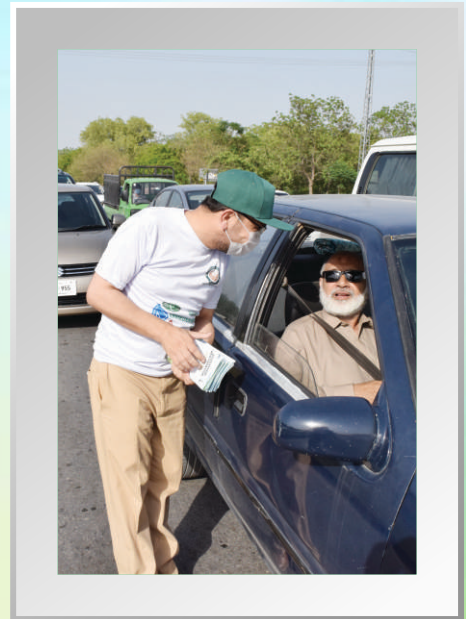
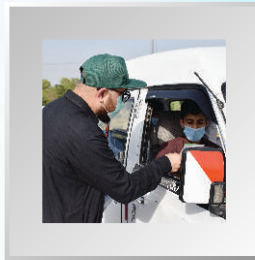
The team of Centre dedicated the whole year to fulfil its obligation, starting with plantation drive in spring season through two approaches (i) by directly planting mature saplings (ii) by dispersing native plants seed on barren mountains and inaccessible areas by using drone technology. On the eve of 5th June banners were hoisted on major road intersections and pamphlets were distributed in public places for the awareness of general public. Considering COVID-19 regulations, SEC couldn't managed to reach out school children and general public for interactive awareness sessions.

SEC is committed towards its obligations in playing its role in providing a healthier environment to our present and future generations. SEC is planning to celebrate World Environment day 2022, in Member State Bhutan being the world's happiest and one of the greenest country. The purpose is to highlight their efforts in climate change and environmental conservation, as success story for Member States and rest of the world.



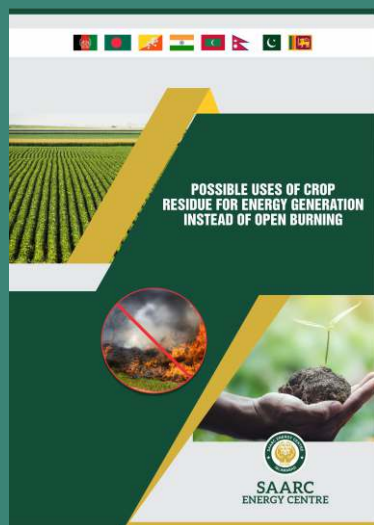
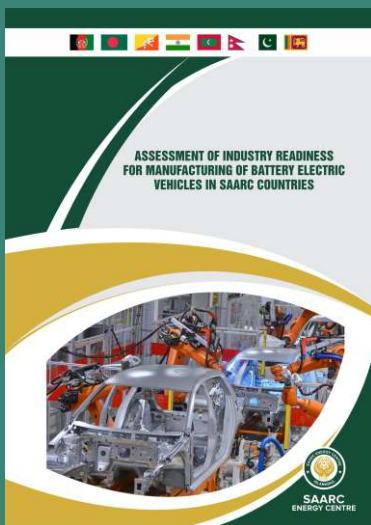
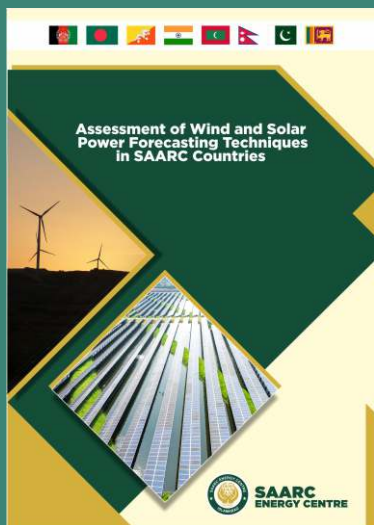
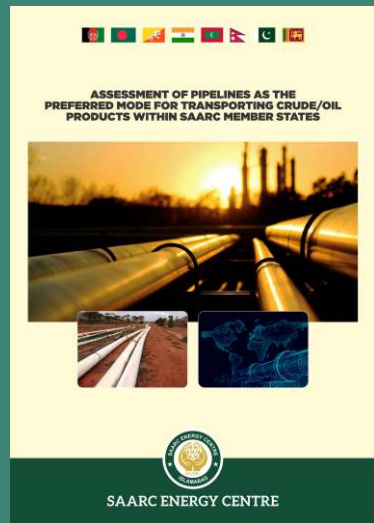
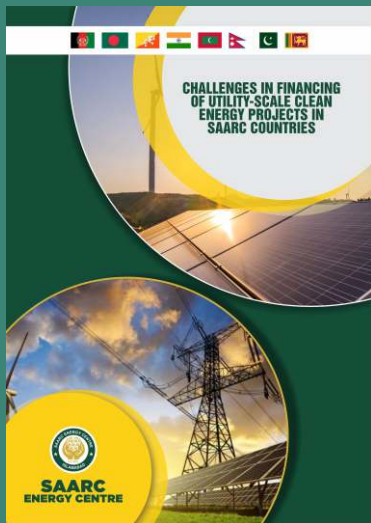
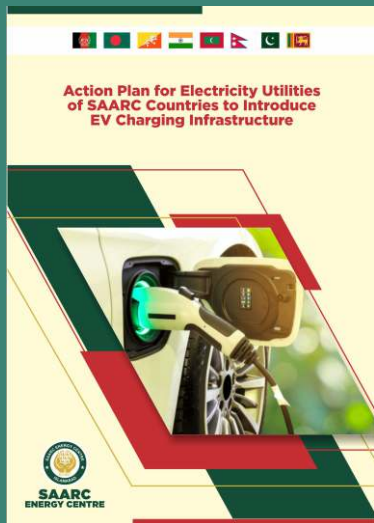
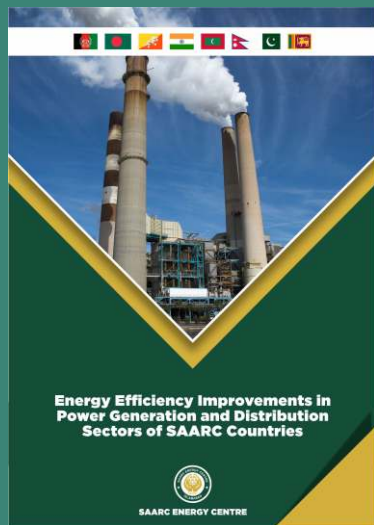
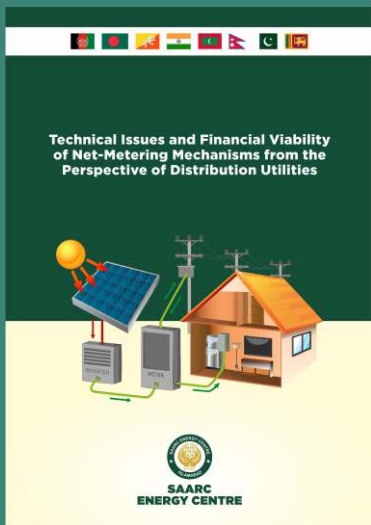
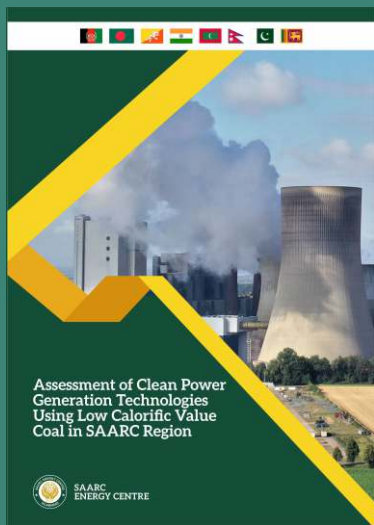
SEC team during plantation drive at schools and public spaces in Islamabad

SEC team distributing environment related informative brochures to the public



28 th January 2021	Video Conference to Disseminate “Action Plan for Electric Utilities of SAARC Countries to Introduce EV Charging Infrastructure”	
2 nd February 2021	Video Conference on “Assessment of Industry Readiness for Manufacturing of BEVs in SAARC”	
15 th February 2021	Video Conference to Disseminate Study on “Energy Efficiency Improvements in Power Generation and Distribution Sectors of SAARC Countries”	
15 th March 2021	Video Conference to Disseminate Study on “Technical Issues and Financial Viability of Net-Metering Mechanisms from the Perspective of Distribution Utilities”	
6 th April 2021	Video Confernece on Assessment of Wind & Solar Power Forecasting Techniques in SAARC Countries	
12 th April 2021	Video Conference on “Challenges in Financing of Utility Scale Clean Energy Project in SAARC Countries”	
24 th May 2021	Video Conference to Disseminate Study on “Possible Uses of Crop Residue for Energy Generation Instead of Open Burning”	

<p>28th January 2021</p>	<p>Webinar on “Techniques to Forecast Long-term Demand of Electricity for SAARC Member States”</p>	
<p>2nd February 2021</p>	<p>Webinar on “Economic Dispatch and Unit Commitment Modelling Using PLEXOS® or Similar Software”</p>	
<p>25th March 2021</p>	<p>Webinar on “Intelligent Lighting Systems”</p>	
<p>16th April 2021</p>	<p>Webinar on “Energy Audit of Residential and Commercial Buildings”</p>	
<p>26th April 2021</p>	<p>Webinar on “Achieving Efficiency Improvements in Trucking Sector”</p>	
<p>3rd May 2021</p>	<p>Webinar on “Use of Drones in Operation/ Maintenance of Power Transmission Lines”</p>	
<p>31st May 2021</p>	<p>Webinar on “High Voltage Direct Current Transmission Systems”</p>	



Power Pricing for Cross- Border Electricity Trade in South Asia

As the magnitude of cross border electricity trade (CBET) continues to grow in the SAARC region and the mode of CBET is shifting from bi-lateral contracts to tri-lateral engagements, it is an imperative for SAARC Member States to devise a coherent approach to design electricity tariffs that could buttress the regional trade while conforming to the constraints of the individual member state.

In the above context, to develop and establish a uniform, transparent power procurement and pricing mechanism for CBET in South Asia consistent with the dynamics of the domestic power sector as well as with regional requirements to promote investment, and trade of electricity, SAARC Energy Centre has conducted the study on “Power Pricing for Cross- Border Electricity Trade in South Asia”. The study has mapped existing power pricing mechanisms, acts, policies relevant to power pricing/ tariff framework, challenges/barriers on power procurement and pricing framework. Besides the CBET scenario within SAARC region, the study has analyzed the power trading model of major international power pools such as South African Power Pool, European Power Market, Greater Mekong Subregion etc. Based on the detailed mapping and analysis, the study has suggested uniform, transparent power procurement and pricing mechanism along-with implementation strategy/plan for the region. The study has also recommended the term wise as well as the resource wise pricing mechanism for South Asian countries.

Hand Book for Setting-up National Power Exchanges in SAARC

An efficiently run power sector requires a well-functioning power market which provides efficient price signals for optimal capacity addition. Also, power market helps the Planning agencies to plan the network capacity addition, generation capacity addition and understand the consumer behaviours with large data sets. These insights from power market help policy makers to create conducive regulatory framework and ensure optimal utilization of assets in the power sector value chain. The power market in turn requires a robust platform to facilitate competitive interaction of buyers and sellers which leads to the discovery of a fair, transparent & most efficient market-based price for electricity. A Power Exchange is a platform through which power can be bought and sold. Power Exchanges facilitate power markets to function more effectively by enabling buyers and sellers to trade in various segments of the market, ensuring price discovery without the interference of any market player. Thus, for development of efficient power sector, development of efficient and well-functioning Power Exchanges is crucial.

This handbook captures the characteristics of a Power Exchange including the role of power exchange in a country's power market, advantages of having a power exchange, primary data of each SAARC Member State (SMS), the status of each SMS in terms of readiness and the way forward for each SMS for setting up a National Power Exchange (NPEX). The handbook outlines the existing gaps and states the necessary prerequisites for setting up the NPEXs in terms of legal, policy, regulatory and technical requirements for each country. Among the SMS, India is already having two power exchanges and all set to have a third power exchange. This report also covers learnings from India's journey towards development of power exchanges.

Minigrids and Access-to-Electricity in SAARC

SAARC Energy Centre (SEC) commenced this study “Minigrids and Access to Electricity in SAARC” to enhance the deployment of minigrid systems in each of the SAARC Member State(s) (SMS). The study seeks to present the up-to date information and analysis of the minigrid status, challenges and trends in the sector and proposes recommendations to overcome the barriers.

The study covers a general overview of minigrid systems detailing the global status of minigrids; technical and operational aspects of a minigrid system; use of conventional and renewable energy technologies; cost trends; business models; and latest innovations in the minigrid sector. The chapter also discusses the operational issues related to minigrid projects and integration of minigrid with the centralised national grid.

Further, assessment of the status of minigrids' deployment in each of the SAARC Member States has been conducted based on the multi-dimensional framework comprising of nine parameters. These include overall status, national strategy for electrification, policies and regulations, technical aspects, business models, minigrid tariffs, financing, opportunities, and barriers. The assessment provides a comparative analysis on minigrids development in each country and provides cross-learning potential that could be exploited in the SAARC Member States for scaling up minigrids' deployment.

Renewable Energy for Food Storage in SAARC Countries

SAARC Region is highly dependent on agriculture as the primary source of income and employment. Growth and technological advancement in this sector can prompt income security, reduce hunger, eradicate poverty and promote sustainable growth in each SAARC country. However, this region faces many challenges related to the agricultural sector, specifically in the post harvesting stages. One major challenge is associated with the lack of adequate food storage facilities, which results in avoidable food loss. Food loss can occur at all stages of agriculture value chain, from harvest until end consumption but for the SAARC Member States, these losses are the highest during the storage stage. Annually, ~250 MMT of food is wasted and 30-40% (amounting to ~USD 300 billion) of this food loss occurs in the post-harvest storage stage of the agricultural value chain.

Integration of Renewable Energy (RE) into the agricultural value chain could be one of the best ways to improve national food and energy security in a sustainable manner. RE based solutions can help overcome the barriers arising from lack of electricity, minimize the food wastage and increase the efficiency of existing food storage methods. In this context, the study on Renewable Energy for Food Storage in SAARC Countries was undertaken by SAARC Energy Centre to determine the application of Renewable Energy technologies and solutions for food storage in Member States. In the study report, each technology and solution have been mapped according to its feasibility, level of maturity and benefit to the individual farmer. The chart compares all the technologies and solutions based on their feasibility and level of maturity. A detailed review of existing policies and case studies from the SAARC Member States have revealed certain barriers to the successful deployment of RE based solutions in the agricultural sector. The study provides tailored recommendations for each Member State on how to address these barriers to enable the largescale deployment of the RE based food Storage solutions.

Economics of Transition to Euro 6/VI Fuel

Transport is a major cause of air pollution globally, and realizing this issue, countries across the globe have adopted either directly, or their own versions of the Euro Emission Standards, formulated by the European Union. Majority of the developed countries, like the EU, USA, China, Japan, Singapore, etc. are already following Euro 6/VI version of emission standards. Rising air pollution is a key concern in the SAARC Region which needs to be controlled. The Euro 6/VI standards are a significant improvement over older standards, reducing emissions of SO_x, NO_x, CO and PM significantly. However, it involves significant costs, which increases the price of fuel as well. Thus, SAARC Energy Centre has conducted this study, to examine the “Economics of transition to Euro 6/VI fuel” in the region.

The study evaluates the current scenario of pollution and emission levels in SAARC Member States, and the current emission standards. The study further evaluates the economic viability of moving to Euro 6 fuel standards for both petrol and diesel, in each SAARC Member State. It takes into consideration, all related factors such as costs/resources for refinery upgradation, impacts on end consumer and vehicle stock, fuel import strategies, and environmental/climate benefits etc. Based on the assessment, the study recommends gradual shift to Euro-6 standard with a detailed roadmap for each Member State taking into consideration its ground realities such as technical, financial, fiscal, and political situation; policy regulations, refinery readiness; pricing mechanism, allied industry; user/vehicle aspects etc.

Efficiency Enhancement and Solarization of Streetlights in SAARC Region

Efficiency enhancement and solarization of street lighting in SAARC Member States helps the cities to reduce energy cost, improve financial status and meet NDCs of the Member States. LED based street lighting and smart controls based on information and communication technologies are becoming standard technology approach for efficiency enhancement in street lighting. Many SAARC Member States have implemented such energy enhancement projects for street lighting.

Similarly, the solarization of street lighting has been of interest to Member States which is seen as an effective solution for areas that have limited or no grid access. The solar based street lighting has matured technologically in terms of performance of individual system components and waiting to be a viable solution with gradual reduction in capital cost as the demand increases, just as was the case with LED based street lighting a few years ago.

This research report presents the techno-financial viability of projects with key technological pathways that are presently pursued by various cities in SAARC Member States and reflects the role of SAARC Energy Center being a regional center of excellence that develops capacity and expertise for the region for the matters relating to energy efficiency and climate change.

Interaction with other organisations

As the regional Centre of Excellence, SEC also participates in the events organized by other regional organisations to build synergy and share the progress achieved by Member States on sustainable development, energy connectivity and access. In 2021, some of the external events that SEC participated in are:

- Third Session of the Committee on Energy of the Economic and Social Commission for Asia and the Pacific (ESCAP) – organized by UNESCAP
- 7th and 8th Meetings of the Expert Working Group Meeting on Energy Connectivity – organized by UNESCAP
- ESCAP-GTI Seminar on Energy Cooperation in North-East Asia: Regional Power Trade and Connectivity in North-East Asia – organized by UNESCAP and Greater Tumen Initiative (GTI)
- Sustainable Development Conference – organized by SDPI Islamabad



Dr. Tanvir Ahmad
Programme Leader
(Technology Transfer)

Dr. Tanvir Ahmad is working as Programme Leader (Technology Transfer) and Deputy Director (Coordination) at SEC. He has been working in SEC since June 2019. Dr. Tanvir holds a PhD degree in Renewable Energy and has more than 15 years of professional experience. He leads the process to design annual programme activities of SEC and guides the execution of these activities.



Mr. Ahsan Javed
Research Fellow
(Renewable Energy)

Mr. Ahsan Javed is presently working as Research Fellow (Renewable Energy) at SEC. He has experience of implementing off-grid Solar PV and Wind energy projects in rural areas of Pakistan. He has conducted policy-based research studies, organized knowledge sharing workshops/webinars and trainings, and implemented projects in South Asian region.



Ihsanullah Marwat
Research Fellow
(Energy Efficiency)

Mr. Ihsanullah Marwat is working as Research Fellow (Energy Efficiency) at SEC. He is a multi-disciplinary professional having core expertise in energy sector with additional experience in the field of environmental management. At SEC, he is mainly responsible for conducting research studies, pilot projects, trainings and workshops. He conducts all environment related activities of the center, including the yearly event "Celebration of World Environment Day".

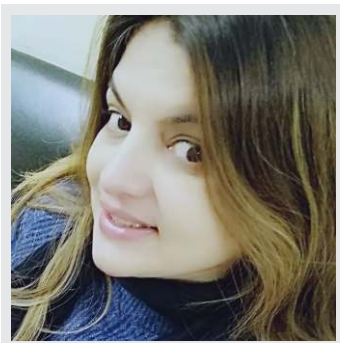


Ahmad Talha
Research Fellow
(Technology Transfer)

Mr. Ahmad Talha is working as Research Fellow (Technology Transfer) for last two years. At SEC, he works on activities related to electricity markets, energy transition, promotion and integration of renewable energy, and increasing energy access. He also manages SAARC Energy Data Portal to share the latest data of Member States on energy sector.

**Tula Ram Pudel**Research Fellow
(Energy Trade)

Mr. Tula Ram Poudel is working as a Research Fellow (Energy Trade). At SEC, he is engaged in cross-border electricity trade related programme activities. Besides, he has been involved in various energy-related webinars and online trainings as a programme coordinator and resource person. His professional interests are in the energy sector energy trade, renewable energy financing, electrical vehicles, and optimization tools.

**Mehnaz Khurshid Gardezi**

Communications Specialist

Ms. Mehnaz Khurshid Gardezi, as Communications Specialist, is spearheading communications and coordination with all the stakeholders in SAARC Member States and across the globe. She provides substantive support to the management in preparation of annual Governing Board and Programming Committee Meetings, consultative workshops, conferences and training programs including identifying speakers/experts, participants, preparation of documents and presentations etc. She ensures circulation of timely information and coordination to relevant stakeholders regarding schedule of programs/activities. She has forged a series of new strategic partnerships with UN and international organizations.

**Mr. Muhammad Ali Qureshi**Research Fellow
(Power)

Mr. Muhammad Ali Qureshi is an energy professional with over 10 years of experience working on power generation, distribution and energy efficiency related projects. At SEC, he is working as Research Fellow (Power) and is currently working on research and field work on topics pertaining to electricity and energy with particular focus on renewable energy, energy efficiency and energy access.



Dr. Nawaz Ahmad
Director



Dr. Tanvir Ahmad
*Programme Leader
(Technology Transfer)*



Ahsan Javed
*Research Fellow
(Renewable Energy)*



Ihsanullah Marwat
*Research Fellow
(Energy Efficiency)*



Muhammad Ali Qureshi
*Research Fellow
(Power)*



Mehnaz Khurshid Gardezi
Communications Specialist



Tula Ram Poudel
*Research Fellow
(Energy Transfer)*



Ahmad Talha
*Research Fellow
(Technology Transfer)*



Jahanzeb Hassan
Administrative Officer



Huma Robin
PS to Director



Nouman Hussain
Senior Finance Officer



Muhammad Saeed
Librarian



Farmanullah Marwat
Accounts Assistant



Abdul Wahab
Data Entry Operator



Khawaja Muhammad Awais
Administrative Assistant

Outgoing SEC Colleagues

SEC has performed exceptionally over the years as it always has attracted bright and talented individuals. Although parting ways is always difficult, however, change is the only constant in life. During the year 2021, SEC bade farewell to much admired and wonderful colleagues who left at the end of their respective tenures or to pursue other opportunities. SEC wishes them well for the future.



Mohammed Naeem Malik



Dr. Shoaib Ahmad



Bhaskar Pradhan



Muhammad Umar Mukhtar



Ammar Hassan

Creates Awareness through



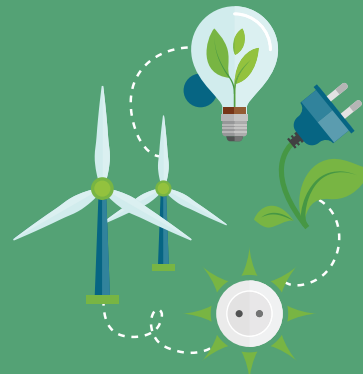
BIO FUEL



CLEAN FACTORY



BIO CAR



RENEWABLE ELECTRICITY

Enhances Cooperation through



SAARC ENERGY CENTRE

E-mail: info@saarcenergy.org
Web Site: www.saarcenergy.org