SAARC ENERGY CENTRE

SEC Biannual Newsletters 2020

Energy for Peace and Prosperity

H. E. MR. ESALA RUWAN WEERAKOON
SECRETARY GENERAL OF SAARC

1st Quarter Newsletter 2020

Editor-in-Chief:

Ms. Mehnaz Khurshid Gardezi

Concept & Design :

Ms. Mehnaz Khurshid Gardezi

Telephone: +92 -51-222 8802 & 04

E-Mail: info@saarcenergy.org

Web: https://www.saarcenergy.org/

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Secretary General of SAARC

H. E. Mr. Esala Ruwan Weerakoon

H. E. Mr. Esala Ruwan Weerakoon of Sri Lanka assumed charge of office as the Secretary General of the South Asian Association for Regional Cooperation with effect from 01 March 2020. He is the fourteenth Secretary General of SAARC.

H. E. Mr. Weerakoon is a career diplomat. Prior to this appointment, he was the Senior Additional Secretary to the President of Sri Lanka. He has also served as the Foreign Secretary and Secretary at the Ministry of Tourism Development and Christian Religious Affairs, Sri Lanka. In his thirty-two years of diplomatic service, he has also served as Sri Lanka's High Commissioner to India and Ambassador to Norway.

H. E. Mr. Weerakoon holds a MSc degree in Economics from the University of London.

MESSAGE OF DIRECTOR SEC

Mohammad Naeem Malik

Since its establishment, the Centre has paved way for the region to pool its vast knowledge and expertise and also bring latest international skills to capitalize on synergies in the energy sector.

The energy needs and priorities of the world have changed with the new economic developments, environmental regulations and political realignments. As the economies develop, we have to adopt more efficient technologies for provision of energy services at affordable prices. In line with the economic evolution, SAARC Energy Center always kept itself abreast with the latest technological development and facilitated Member States in the same spirit.

As envisaged by the leaders of this Region SEC activities are focused on decreasing dependence on imported energy especially solid and liquid hydrocarbons.

SEC programs on Promotion of Energy Conservation, mobilizing International and Regional Financing / Funding for Implementation of Renewable Energy Projects in the Member States, SAARC Energy Outlook 2030, Infrastructure needs and importance of enabling environment for road electric transport and trade etc are few examples.

We are also focused on Training and capacity building of Member States. The work programs of the Centre are demand driven and are decided based on the need of the countries. This edition will bring you an idea of latest energy developments and insight in South Asia. We present a brief look at each story as well as the opportunity where SEC took a proactive approach and emerged as a credible Energy Center in the region. We encourage the reader to give input for next year's programs.

My sincere appreciation and thanks to Ms. Mehnaz Khurshid Gardezi, Editor- In -Chief of this issue and all those who contributed towards bringing out this first edition 2020. Thank you.

SEC WEBINAR ON "MOBILIZING INTERNATIONAL & REGIONAL FINANCES/FUNDING FOR IMPLEMENTATION OF RENEWABLE ENERGY(RE) PROJECTS IN SAARC MEMBER STATES"

SAARC Energy Centre (SEC) organized a Webinar to Disseminate Study on **"Mobilizing International & Regional Finances/Funding for Implementation of RE Projects in SAARC Member States"** on 11th February 2020.

Aim of the webinar was to disseminate findings of a study report among SAARC Member States and to seek their inputs. The study titled "Mobilizing international and regional finances/ funding for implementation of RE projects in SAARC Region", explore ways to seek support for implementation of RE projects and suggests techniques for mobilization of financing from regional/ international agencies and private sector.

Major topics discussed during the webinar included; Overview of Renewable Energy Landscape in SAARC, Key Financial instruments for RE financing, Key Findings and Recommendations and Financial incentives & mechanisms to encourage private investment. The webinar was attended by officials from relevant government departments of SAARC Member States, research organizations, academia, associated industry and entrepreneurs.

Details are available at:

https://www.saarcenergy.org/webinar-to-disseminate-study-on-mobilizing-international-regional-finances-funding-for-implementation-of-re-projects-in-saarc-member-states-on-tuesday-11th-february-2020-from-1030-am-2/

Webinar Presentations:

1. Overview of Renewable Energy Landscape in SAARC -*Mr. Rahul Raizada*
2. Financial Instruments for RE Financing - *Mr. Ankit Vivek*
3. Key Findings and Recommendations - *Mr. Sandeep Kumar Mohanty*
4. Financial Incentives & Mechanisms to Encourage Private Investment In Renewable Energy Sector - *Amer Zafar Durrani*

Director SEC Mr. Mohammad Naeem Malik during his opening remarks

SEC Team during Webinar

WEBINAR ON "CROSS BORDER ELECTRICITY TRADE IN SAARC COUNTRIES"

SAARC Energy Centre (SEC) organized a Webinar on "**Cross Border Electricity Trade in SAARC Countries**" on 9th March, 2020.

Presenters from inside and outside SAARC region shared their insights on Cross Border Electricity Trade (CBET) regulations and guidelines; CBET current status and regional markets. The objective of the webinar was to share the information on the Cross-Border Electricity Trade in South Asia to the participants and sensitize the policy / decision makers on the importance and benefits of such trade.

Following were the important aspects covered during the webinar:

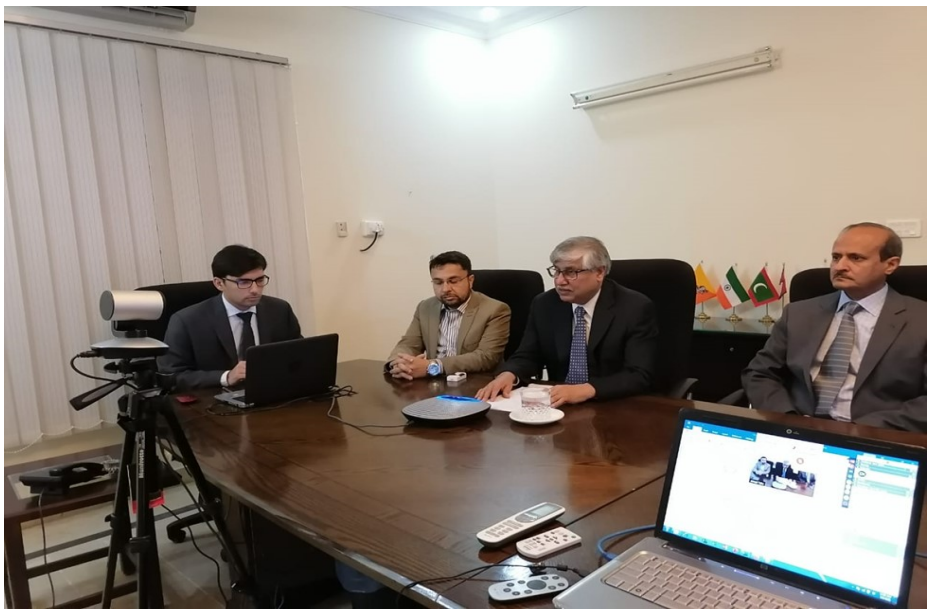
- Current status of CBET in SAARC region
- Policy guidelines currently in place for CBET
- Rationale for CBET and its Benefits
- Initiatives for promoting CBET between SAARC Member States
- European experience of regional markets and interconnections

Details are available at:

https://www.saarcenergy.org/2969-2/

Webinar Presentations:

1. CBET Policy and Regulations, *Mr. Abhijeet Rajendra, TATA Power Trading Company Limited, India*
2. Rationale for CBET Interconnections and Trade in South Asia, *Mr. Salis Usman, National Transmission and Dispatch Company, Pakistan.*
3. CBET in SAARC Region, *Mr. Sher Singh Bhat, Kabeli Energy Limited, Nepal.*
4. Regional Markets: A key innovation in the global energy transition, *Ms. Elena Ocenic, International Renewable Energy Agency (IRENA), Germany.*



Director SEC Mr. Mohammad Naeem Malik during his opening remarks

WEBINAR ON "PROMOTION OF LIGHT ELECTRIC VEHICLES IN SAARC"

SAARC Energy Centre (SEC) organized a webinar on "**Promotion of Light Electric Vehicles in SAARC**" on 17th March, 2020.

Presenters from inside and outside SAARC region shared their insights on the Light Electric Vehicles, especially in the context of SAARC region. The overall objective of this webinar was to highlight and promote the numerous benefits that the use of light electric vehicles brings to the common consumer and the governments. The webinar shared specific economic and environmental benefits, relevant case studies and provided participants with information on how to achieve large scale adoption.

Following were the important aspects covered during the webinar:

- Current Status and Future Demand Projections of Light EVs in India
- Policy Guidelines currently in place for Light EVs in India and Pakistan
- Rationale for Light EVs and its Benefits
- Initiatives for Promoting Light EVs
- Charging Strategies for Effective Promotion of Light EVs
- International Experiences in Smart Charging of EVs
- Global Outlook of EVs

Details are available at:

https://www.saarcenergy.org/webinar-on-promotion-of-light-electric-vehicles-in-saarc-tuesday-march-17-2020-1100-am-130-pm-pkt/

Webinar Presentations:

1. Light Electric Vehicles – Charging Strategy & Implementation, by *Suddhasatta Kundu (Associate Director – India Smart Grid Forum)*
2. Smart Charging for Electric Vehicles: International Experiences, by *Arina Anisie (Associate Programme Officer – RE Innovation, International Renewable Energy Agency)*
3. EVs Global Outlook and Policy Framework in Pakistan, by *Gul Hassan Bhutto (Head of Engineering & Operations – Omni Power)*

SEC Professional during Webinar

WEBINAR ON "INFRASTRUCTURE & ENABLING ENVIRONMENT FOR ROAD ELECTRIC TRANSPORT IN SAARC MEMBER STATES"

SAARC Energy Centre (SEC) organized a Webinar to disseminate the study on "**Infrastructure & Enabling Environment for Road Electric Transport in SAARC Member States**" on 5th May, 2020.

The Study authors from India Smart Grid Forum disseminated the study, its findings and recommendations concerning all the SAARC Member States. Furthermore, prominent EV technology and policy experts from within and outside the SAARC region shared their valuable experiences with the delegates and informed them of the latest trends worldwide. It was suggested to incorporate a feedback session consisting of comments and recommendations from the participants of webinar in the study report, if necessary.

Following important aspects were covered during the webinar:

1. Identification of the pre-requisite with respect to electric road transportation
2. Analysis of the existing EV costs, charging modes, repair & maintenance, market development and regulations
3. Categorization of the critical factors and the challenges
4. Comparison of different charging technologies available in terms of technology, availability and cost
5. Identification and discussion of the relevant opportunities and challenges
6. Estimation of investment / financing requirements and incentives
7. Recommendations to the SAARC policy makers, automobile manufactures, energy utility companies, and various market players on EV transformation
8. Knowledge sharing by EV experts from outside the region pertaining to their countries

Details are available at:

https://www.saarcenergy.org/webinar-to-disseminate-the-study-on-infrastructure-enabling-environment-for-road-electric-transport-in-saarc-member-states/

Webinar Presentations:

1. Study on Infrastructure and Enabling Environment for Road Electric Transport in SAARC Member States by *Mr. Reji Kumar Pillai (President – India Smart Grid Forum)* and *Suddhasatta Kundu (Technical Manager– India Smart Grid Forum)*
2. The Road to Electrification in China by *Dr. Alan Liu*
3. Manufacturing of Battery Electric Vehicles: Discussion on Global Trends and Pakistan by *Dr. Shakeel Sadiq Jajja*

SEC Professional during Webinar

Webinar on "Energy Planning for Cities of SAARC in Future"

SAARC Energy Centre (SEC) organized a Webinar on "Energy Planning for Cities of SAARC in Future" on 12th May 2020.

The objective of the Webinar was to educate the participants on the energy planning for the future cities in SAARC. Presenters shared their insights on many energy related areas and future planning of the cities. Experts from India Smart Grid Forum presented on smart cities in India, leveraging smart grid assets for smarter Cities and sustainable mobility while PwC, India presented on future of power and utilities companies. The Webinar was attended by officials from relevant government departments of SAARC Member States, research organizations, academia, city planners and entrepreneurs.

Following were the important aspects covered during the Webinar:

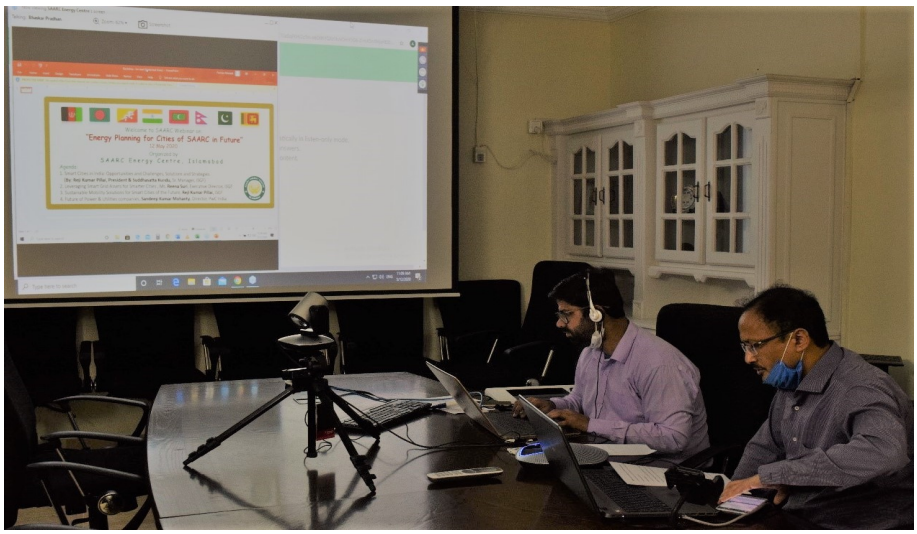
1. Desired features of Smart Cities
2. Smart Cities in India
3. Digitalization of Power Sector
4. Need for standard framework for Smart Cities
5. Planning of Smart Cities in SAARC Countries
6. Energy Efficiency and Emission Control
7. Smart Mobility, Future of Transport- the Evolving Revolution
8. Challenges and Solution for Power Sector

Details are available at:

https://www.saarcenergy.org/webinar-on-energy-planning-for-cities-of-saarc-in-future/

Webinar Presentations:

1. Presentation on Smart Cities in India: Opportunities and Challenges, Solutions and Strategies, *Mr. Reji Kumar Pillai, President and Suddhasatta Kundu, Senior Manager, India Smart Grid Forum*
2. Presentation on Leveraging Smart Grid Assets for Smarter Cities by *Ms. Reena Suri (Executive Director– India Smart Grid Forum)*
3. Presentation on Sustainable Mobility Solutions for Smart Cities of the Future by *Mr. Reji Kumar Pillai (President – India Smart Grid Forum)*
4. Presentation on Future of Power & Utilities companies by *Mr. Sandeep Kumar Mohanty (Director Power and Utilities– PWC India),*



SEC Professional during Webinar

WEBINAR ON "ENERGY SAVING POTENTIAL IN ELECTRIC MOTOR USING VARIABLE FREQUENCY DRIVE"

SAARC Energy Centre (SEC) organized a Webinar on **"Energy Saving Potential in Electric Motor Using Variable Frequency Drive"** on May 22, 2020.

The webinar was attended by the pioneering technology leaders in electric motor and VFD manufacturers and specialists from Industries/Universities. During the Webinar presentations were made focusing on energy savings potential in electric motor system covering the range of electric motors and VFD products including types, size, selection criteria etc. The basis of energy savings in electric motor installation using VFD and the areas of energy savings potential in existing industrial process were uncovered. The objective of the webinar was to share the information on energy efficiency improvement in electric motor systems using VFD and to sensitize the manufacturers, users and energy officers about benefits of such devices.

Details are available at:

https://www.saarcenergy.org/webinar-on-energy-saving-potential-in-electric-motor-using-variable-frequency-drive/

Webinar Presentations:

1. *Presentation on* Energy saving potential using variable speed drive by *Mr. Ghanshyam Shrestha (PhD), Senior Principal Scientist, ABB INC.*
2. Presentation on Motor and VFD for HVAC Application by *Mr. Deepak Singh*

SEC Professional during Webinar

WEBINAR ON "BUILDING TO GRID INTEGRATION"

SAARC Energy Centre (SEC) conducted a Webinar on **"Building to Grid Integration"** on 9 June 2020. The webinar was consisted of presentations from experts from USA and Spain on BtG integration. The motive was to educate participants from SAARC Member States on the importance of building-to-grid integration.

During the webinar, experts shared their knowledge about underlying concept of Grid Interactive Buildings; their characteristics; demand management provided by such buildings; benefits arising from interaction between the grid and the buildings; on-going research. A comprehensive discussion on the evolution of grid to accommodate technological changes; aggregator models; data models and data processing required to coordinate the available resources for grid support was also a part of the webinar.

Details are available at:

https://www.saarcenergy.org/webinar-on-building-to-grid-integration/

Webinar Presentations:

1. Presentation on Grid-interactive Efficient Buildings by *Mr. Jack Mayernik, Sr. Energy Analyst*
2. Presentation on Is The Electrical Distribution Ready fora Revolution? by *Mr. Pablo Arboleya, Associate Professor, University of Oviedo Spain.*

WEBINAR ON "FUTURE OF AIR-CONDITIONING IN BUILDINGS"

SAARC Energy Centre(SEC) organized a Webinar on "Future of Air-conditioning in Buildings" on 16th June 2020.

During the Webinar future interventions and upcoming technologies in A/C systems were discussed by the presenters. The focus was on Next-Generation A/C Systems, Development of Low-GWP A/C Systems, Advances in A/C System Efficiency, and Expected growth in Air-conditioning demand and Global warming contributions.

Details are available at:

https://www.saarcenergy.org/webinar-on-future-of-air-conditioning-in-buildings-on-tuesday-16th-june-2020-from-1400-1600-hrs-pkt/

Webinar Presentations:

1.

2. Presentation on **"Future of Air conditioning in Buildings" by** *Dr.Adeel Waqas*
3. Presentation on **"**Advances in Air Conditioning System Efficiency" by *Mr. Waqas Sulehri*

WEBINAR ON "DESIGNING ENERGY EFFICIENT BUILDINGS IN SAARC REGION"

SAARC Energy Centre(SEC) organized a Webinar on **Designing Energy Efficient Buildings in SAARC Region"** on 23rd June, 2020.

Globally, the buildings and allied construction sectors accounts for 36% of the final energy consumption.[1] With increased urbanization in the SAARC Member States, it is envisioned that the number of buildings will increase in future which shall result in increased demand of electricity. Most of the Member States in SAARC region are energy deficient and rest have very little margin between their existing supply and demand. With the increasing demand of electricity, more investment in new generation sources would be required in future. One of the effective ways of reducing electricity demand is through constructing Energy Efficient (EE) buildings and installing EE appliances in them. The investments in an EE building is 2-3 times less than the cost of investments in the supply side of the energy system.

The proposed webinar was aimed towards enhancing the capacity of the professionals in the SAARC region. This webinar was a knowledge sharing event specifically targeted to measures and interventions which can contribute to the increase in energy efficiency of the Residential / Commercial buildings of the SAARC Region.

Details are available at:

https://www.saarcenergy.org/3164-2/

Webinar Presentations:

1. "Green building in a post Covid-19 India", by *Mr. Mr Shubhashis Dey, Associate Director – Energy Efficiency Program (Industry, Buildings & Cooling), Shakti Foundation India*
2. "Energy Wastage and Recovery Options in Buildings", by *Dr Mohammad Adil, Deputy Director and Co-founder at CIBEA (Center for Industrial and Building Energy Audits), UET Peshawar Pakistan*
3. "Development of Green Building in China and Main Technical Standards", by *Dr Guozhu Li, Deputy Director of the Institute of Science and Technology Research and Development of CABR China*
4. "Promoting Energy Efficient Green Buildings in SAARC Region using EDGE Green Building Rating System", by *Dr. Muhammad Bilal Sajid Assistant Professor USPCAS-E NUST Pakistan*

SEC Representations

SEC Professional Mr. Ahsan Javed, Research Fellow (Renewable Energy) attended the Workshop on "Harnessing Regional Cooperation in Energy Sector and Energy Trade through Partnership between SAARC and USAID/SARI-EI" held on 16-17 January ,2020 in Colombo, Sri Lanka.

Mr. Ahsan Javed during his detailed presentation on energy outlook

Group photo of Workshop delegates

SEC Representations

SEC Professionals, Mr. Tula Ram Pudel, Research Fellow (Energy Trade) and Ms. Mehnaz Khurshid Gardezi, Communications Specialist attended a two day International Seminar on Hydropower Development and Rural Electrification for South Asian Countries was jointly organized by Pakistan Council of Renewable Energy Technologies (PCRET), Hangzhou Regional Centre for Small Hydropower (HRC), China and National Research Institute for Rural Electrification (NRIRE), Pakistan on January 13-Janurary 14 in Marriott Hotel, Islamabad.

Two days program was participated by around 40 persons from Pakistan, China and Nepal. The seminar was scheduled mainly for three Session: Technical Session, Memorandum of Understanding (MOU) Signing and Field Visit. During seminar focused was made on furthering China Pakistan cooperation on renewable energy technologies. Additionally, the status of the small hydropower sector in Nepal and Pakistan was briefed.

During seminar

SEC Representations

SEC Professionals Mr. Ihsanullah Marwat (Research Fellow -Energy Efficiency) and Ms. Mehnaz Khurshid Gardezi, Communications Specialist attended a Consultation Meeting on Gender Resource Group & Annual Meeting of Upper Indus Basin Network Pakistan Chapter (UIBN-PC) (29-31 January 2020, Islamabad, Pakistan)

ICIMOD organized the first general meeting of UIBN-PC in Islamabad on 30-31Januray 2020. The main aim of the meeting was to share the technical progress of the Technical Working Groups (TWGs) .

Group photo of Gender Resource Group delegates

Delegates of Gender Resource Group in the Upper Indus Basin Network- Pakistan Chapter (UIBN- PC)

72nd Independence Day Celebrations of the Democratic Socialist Republic of Sri Lanka

On the festive occasion of the Independence Day of the Democratic Socialist Republic of Sri Lanka, SEC team arranged a special cake cutting ceremony at office to celebrate the occasion on 04 February ,2020.

SEC Team during the Occasion of 72nd Independence Day of the Democratic Socialist Republic of Sri Lanka

During Cake cutting ceremony

MEETINGS

Mr. Mohammad Naeem Malik, Director SEC met Mr. Masao Takekida, Chief, Political Section, Embassy of Japan, Islamabad on 10th February, 2020.

During the above meeting opportunities of mutual co-operation between SEC and concerned counterparts in Japan were extensively discussed for the benefit of 2 billion people of the region.

Director SEC with Chief, Political Section, Embassy of Japan, Islamabad

SEC professional Mr. Ihsanullah Marwat, during a TV talk show on "Impacts of climate change on Human Health and Economic Growth"

MEETINGS

A group of professionals from National Transmission & Despatch Company (NTDC) Pakistan visited SEC to learn about the latest best energy practices in South Asia.

Deputy Director (Coordination) SEC, Dr. Shoaib Ahmad during an interactive session for the visiting NTDC Group

NTDC Group with Director SEC during the visit

SEC and Environment

In fulfilment of its commitment towards sustainable environment, SEC started this year with plantation drive to combat the effect of global warming. Plantation of selected native plants was carried in collaboration with environment wing of local municipality.

SEC Professional Mr. IhsanUllah Marwat kicks off plantation drive

What is Peer-to-Peer Energy Trading?

Dr. Shoaib Ahmed , Deputy Director SAARC Energy Centre

Peer-to-peer energy (P2P) trading is the buying and selling of energy between two or more grid-connected parties. Often in the form of solar energy, any excess energy can be transferred and sold to other users via a secure platform. Peer-to-peer energy trading allows consumers the choice to decide on whom they purchase electricity from, who they sell it to and at what price.

Currently, excess solar energy is exported back to the grid for a small feed-in tariff rate. However, this method is becoming obsolete as more people are looking for flexibility and control in managing how their resources are distributed. In P2P the trading of energy is done through a secure platform, often using a technology like blockchain.

Some benefits of P2P energy trading

The potential for this technology has following benefits:

- Energy can be bought from a known source (which allows you to choose where your energy comes from, e.g. from a specific community project you might like to support). For example, those without solar panels are still able to access renewable energy at a reasonable price from their neighbours, and those that sell their excess energy to grid can do so at a price that is more than they'd receive from electric utility.
- Energy does not have to be transported from centrally located power plants, reducing electricity transportation costs.
- Energy generation from renewables can be boosted.
- Providing a choice for dealing with other consumers and cutting out the middle man (electricity retailers).
- Using blockchain, all transactions are public and once on the blockchain cannot be altered in any way creating full transparency.

Peer-to-Peer Energy Trading

Current Status of P2P energy trading

The first recorded peer-to-peer energy trade occurred in Brooklyn, New York, in 2016. Since then, the idea has circulated the globe. While integration has been slow, here are few of the companies breaking ground in the peer-to-peer trade across the globe:

- *SonnenFlat* in USA
- *Power Ledger* in Australia
- *Grid+* in USA
- *Suncontract* in Slovenia
- *LO3* in USA
- *Eemnes Energie* in Belgiam

While peer-to-peer energy trading may not be at the stage of mass integration just yet, the idea is quickly being adopted as a solution for the future. By revolutionising this technology, consumers won't need to rely on utility retailers for their energy, and can make smart, sustainable choices about how they use and distribute energy.

Source: https://www.infiniteenergy.com.au/peer-to-peer-energy-trading/

Electric Vehicle to Grid Integration

Mr. Ahmad Talha
Research Fellow (Technology Transfer)
SAARC Energy Centre

INTRODUCTION

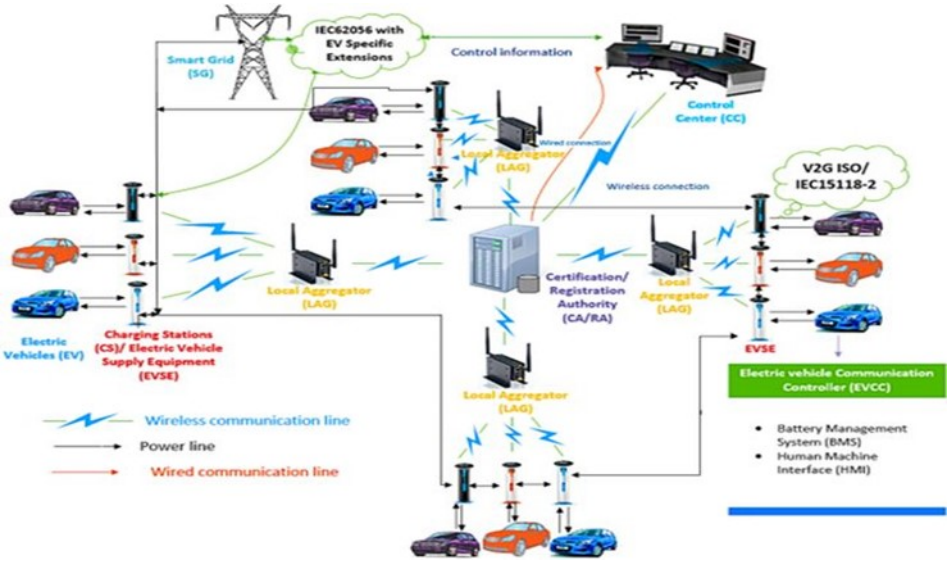
Electric vehicles (EV) have many advantages over traditional ICE vehicles, such as better dynamic and economic performance as well as reduced environmental impact. Increased tendency towards lowering dependency on fossil fuels has made the electric vehicles (EV) relevant again for a sustainable transportation sector. Apart from acting just as a load, electric vehicles have the potential capability to offer grid support services (e.g. smart charging, peak shaving, valley filling etc.). In this article, EV to grid integration (V2G) is discussed with respect to its need, related issues and to offer an overview about the flexibility that the EV can add to the grid.

Vehicle to Grid (V2G)

V2G as defined by (Delaware, 2016)[1] is: "Electric-drive vehicles, whether powered by batteries, fuel cells, or gasoline hybrids, have within them the energy source and power electronics capable of producing the 60 Hz AC electricity that powers our homes and offices. When connections are added to allow this electricity to flow from cars to power lines, we call it "vehicle to grid" power, or V2G".

Why V2G?

Transportation sector is moving in the direction of EVs which have battery storage systems. The continuous efforts to extend the range of EVs and to make their charging time short push the battery in the vehicle to be large which can store high amount of energy. However, most of the time, cars are parked and not using large part of it. On the other hand, the penetration of renewable energy sources to the grid is steadily increasing. Due to intermittent nature of renewables, integrating these sources to the grid affects the stability and efficiency of the grid. To support renewables in future grid and to have better supply to demand ratio, the grid needs some form of energy storage. The progresses of EVs with large energy storage can support the needs of storage in the grid by returning part of the stored energy back. V2G can also be used for distributed spinning reserve, reactive power compensation, black -start, and so on.



1. Vehicle to grid integration and communication between systems (Kate E. Forrest, 2016)[2]

Fig. 1 shows a typical integration of vehicles with the grid. Three types of charging methodologies are available. the first one is Immediate charging, the EVs start charging immediately after arriving the charging point and can charge till the battery gets full or till next trip. There is no communication between the grid and the electric vehicle in this case. The second case is smart charging where the EV communicates information about the charging demand and availability to the grid operator but the energy flow is only from grid to EV. The third method is V2G charging which is the same as smart charging with the exception of bidirectional power flow. Both smart and V2G charging will have constraints such as travel pattern and vehicle range of the EV and load condition of the grid.

Issues related with V2G

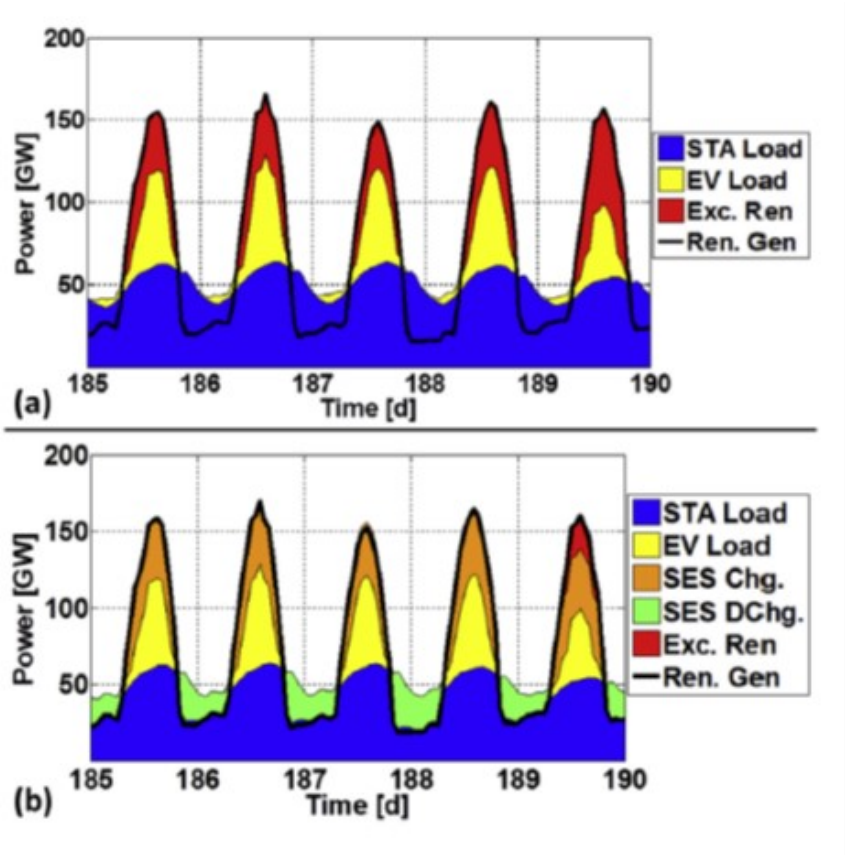
There are many issues that need to be addressed regarding V2G, the first is the need of a bidirectional charger, a converter system which allows a bidirectional power flow between grid and EVs. This bidirectional converter will be expensive and the V2G process will suffer from lower efficiency as compared to unidirectional power flow. There are different bidirectional chargers on market such as Nissan and Tesla chargers. There are also ongoing researches to develop a novel bidirectional charger with high efficiency, for instance refer (Kate E. Forrest, 2016)[2]. Harmonics and load fluctuations are also some of the issues related to V2G.

The working principle of V2G system is charging and discharging of EV battery to maintain supply-demand ratio of the power grid during peak hours. The system is not fully deterministic since when to charge the battery and discharge it for sale is primarily determined by the EV owners. What motivates the owners to sell the energy stored in the battery is the ability to charge their vehicles during off-peak hours at a lower price and then sell the stored energy in EV battery during peak hours of the grid at a higher price. The amount of revenue depends on the energy market and frequency of the EV connection to the grid. However, on the flip side, the limited life cycle and high cost of the battery also needs to be accounted for.

The V2G integration will require a complex control system to manage when to charge and when to discharge the EV according to the market price and grid requirement. The system also should decide on how to aggregate vehicles in the charging stations to achieve the minimum amount of energy required to support the grid. This will require a secure communication link with the EVs to transmit the information on their different modes of operation, charging and storage. In the typical V2G integration shown in Fig. 1, the charging stations send data to local aggregators about the charge status of the EVs and all the data is then passed through certification and registration authority. The grid control centre gets the information via wireless communication for its decision. In literature, the communication between EVs and the grid is based on the IEC 61850 standard (Ricardo J. Ferreira, 2005)[3]. However, in reality, this interconnection needs through research considering the security and privacy issues associated with such an extensive exchange of sensitive data.

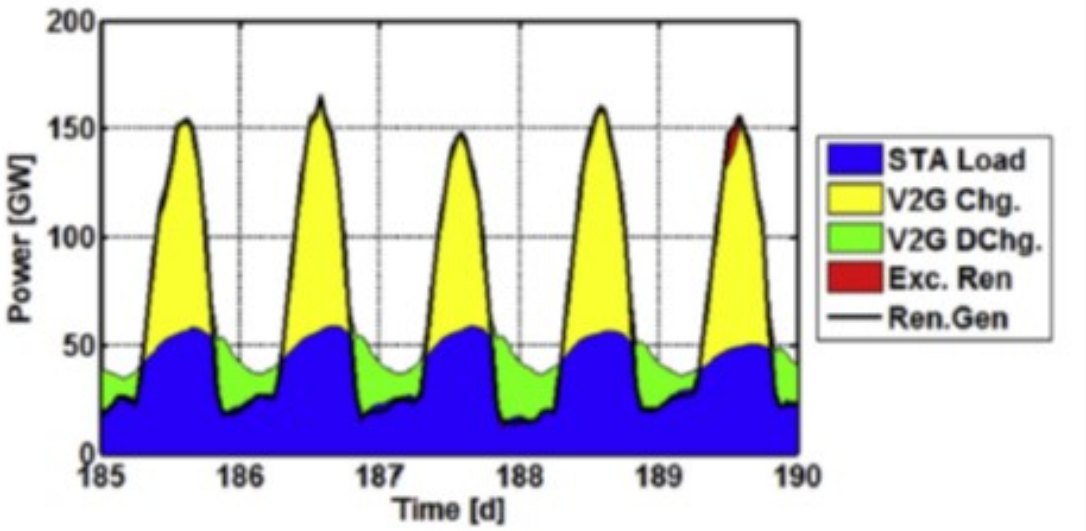
Comparison of renewable supporting capability a V2G and Smart grid

In reference (Delaware, 2016)[1] the renewable supporting capability of a grid with V2G and a smart grid with or without stationary energy storage (SES) is compared in 2050-time series. Fig. 5 and Fig. 6 show the comparison of the supporting renewables capability for the smart grid with and without stationary energy storage, and V2G charging strategies. V2G charging strategy creates better capability of supporting renewable penetration.



5. Year 2050 Time Series Smart Charging (a) without SES and (b) with SES.

SES-stationary energy storage, EV load-electric vehicle load, STA Load stationary load, Exc. Ren-excess renewable generation, Ren. Gen-total renewable generation. (Delaware, 2016)[1]



6. Year 2050 Time Series with V2G Charging. (Delaware, 2016)[1]

Conclusion

Grid integration of EV could bring benefits for both the grid and EV owner. The need for stationary storage in the grid can be substituted by EV storage battery and by that the grid renewable energy supporting capability will increase significantly. Here the EV owner plays a vital role in terms of being active stake holder for V2G integration and there should be reliable and initiative business model to make V2G functional. V2G needs bidirectional converter, complex control system and secure communication protocols for exchange of information between EVs and the grid. Hence, V2G integration needs further research to realise its full potential. The bidirectional charger (power converter) should be able to limit the injection of harmonics to the grid from EV. The communication protocol needs to be secure and reliable. The battery technology should be further improved to increase the life cycle of the battery and to bring down its cost thereby making V2G a feasible option for an EV owner.

REFERENCES

[1]Delaware, U. o. (2016). *The Grid-Integrated Vehicle with Vehicle to Grid Technology*. (University of Delaware) Retrieved December 03, 2016, from http://www1.udel.edu/V2G/index.html

[2]Kate E. Forrest, B. T. (2016). Charging a renewable future: The impact of electric vehicle charging intelligence on energy storage requirements to meet renewable portfolio standards. *Journal of Power Sources*, 7-8.

[3]Ricardo J. Ferreira, L. M. (2005). A New Bi-Directional Charger for Vehicle-to-Grid Integration. *IEEE*, 5.

Impact of COVID-19 in Power System of SAARC Member states

Mr. Tula Ram Poudel
Research Fellow (Energy Trade)
SAARC Energy Centre

Introduction

The novel coronavirus disease (COVID-19) was first identified in December 2019 in Wuhan, the capital of Hubei Province in China. Since then the outbreak has significantly expanded across borders, leading the World Health Organization to declare COVID-19 a pandemic on 11 March 2020.

The COVID-19 pandemic has affected lives of more than 1.8 billion (Atlantic Council, 2020) people in SAARC Member States (SMS). The social distancing and lock down orders of the member states have restricted movement of individuals and brought the activities of many sectors to a halt. The power sector, a significantly important sector in the SAARC countries couldn't remain immune to the adverse effect of pandemic and has also been impacted in many ways. Common impacts have been experienced in construction, operation and distribution activities in all Member States. Difficulties to meet national targets of generation, operational inefficiencies of utilities due to deferred payment of electricity bills, and increased system losses in residential feeders and distribution lines, have all been evident. Similarly, strain on work force, supply chain interruption, cost overrun in under-construction projects, and inadequacy of funds for renewable energy projects have been experienced in the sector. However, in some instances this event has presented opportunities such as exhibiting the unique hydro flexibility during "9 minutes lights-out" event in India, reducing the carbon foot print and temporarily reducing trade deficit due to historic drop in oil price in the world market .

Afghanistan

The power sector of Afghanistan was already facing numerous challenges. Among the SMS, Afghanistan has the lowest electrification rate due to the lack of funds on infrastructure development, Inadequate institutional capacity, imprudent prioritization of investments, lack of regulatory framework and delayed private sector investments. While 89 % of national population has access to electricity including 85.9 % in rural areas and 98.6 % in urban areas, however only 29.7 % of households receive their power from the grid (World Bank, 2018). According to Da Afghanistan Breshna Sherkat (DABS), Afghanistan generates around 300 megawatts of electricity mainly from hydropower followed by fossil fuel and solar. About 1,000 MW more is imported from neighboring Uzbekistan, Tajikistan, Iran and Turkmenistan, and is often subject to outages. These challenges have been further exacerbated by COVID-19 pandemic. However, the government designed some anti- crisis measures by providing Utility subsidy: payment for gas, electricity and utilities for the for households consuming up to 200 kW of electricity and/or up to 200 m^3 natural gas monthly (GEL 170 million) (IMF, 2020).

Infrastructure development work in Afghanistan was going on with huge amount of foreign grant and assistance. Due to the unprecedented crisis, the development partners are themselves in crunch of fund availability. This situation might further delay the development of the power sector in Afghanistan.

Bhutan

Bhutan has the Hydro potential of around 30000 MW while 24000 MW is said to be technically feasible. The projects that are under operation are Tala, Chhukha, Basochhu, Kurichhu, Mangdechhu and Dagachhu while the project under construction are Punatsangchhu I & II, Nikachhu and Kholongchhu. Bhutan has an installed capacity of around 2000 MW and with the completion of the ongoing project there will be an additional generation of around 3000 MW (BEA, 2020).

Due to reduced electricity demand in India with lockdown followed by closure of many industries, it had been estimated that there might be adverse impact on Bhutanese economy as Bhutan's 37 percent of total exports consist of hydroelectricity sold to India. Moreover, the public debt in Bhutan is over 100 percent of GDP and most of it is contractually linked to hydropower project loans from India. However, the situation did not worsen as expected earlier. It is observed that there has not been any significant affect to Bhutan's hydropower sector except some delays in under construction projects and postponement of maintenance works. Bhutan's Hydropower greatly contributed during ramping down and ramping up of Indian power system when India went for 9 PM, 9 minutes lights-out event to show the commitment of the nation towards fighting COVID-19 pandemic. This event has further intensified the importance of cross border electricity trade and resource sharing among the SMS for a win-win situation.

India

In India, new addition of around 10 GW thermal, 11 GW utility scale solar and 4 GW of wind farm by the end of 2020 has been affected. This has further delayed the 40 GW of rooftop solar addition by 2020 and 175 GW of renewable addition target by 2022 (UN, 2020).

Drastic reduction in energy demand has been noticed. For instance, the energy met of 3494 MU on March 16th, was reduced to 2600 MU on 23rd March, 2020 (Pradyumna, 2020). Distribution companies have experienced the loss of revenues due to reduction of demand from the commercial and industrial customers. The utilities still find difficulties to account for the expense to comply with any 'must buy' commitments that they have with generators. Reduced revenue has led to reduced availability of working capital for utilities thereby providing the risk of non-performing assets in the sector.

Another impact of the COVID-19 pandemic on the power markets is in terms market dynamics. The reduction in demand has also been reflected in the volumes traded on the electricity market and the clearing price.

As coal-fired power generation was down 15% in March and around 31% in the first three weeks of April, **the carbon foot print in India has been remarkably reduced in 4 decades** (Rowlatt, 2020).

On 5th April, in order to show the national solidarity against ongoing pandemic Indian Prime Minister Modi declared to light the candles while switching off lights for 9 minutes. The move presented a huge challenge for power sectors operators, who are charged with managing grid stability. They eventually succeeded to manage the situation between 8.45pm and 9.10pm where hydropower generation was quickly reduced from 25,559 MW down to 8,016 MW to match the demand reduction, thanks to hydropower's unique flexibility of around 18 GW in a couple of minutes.

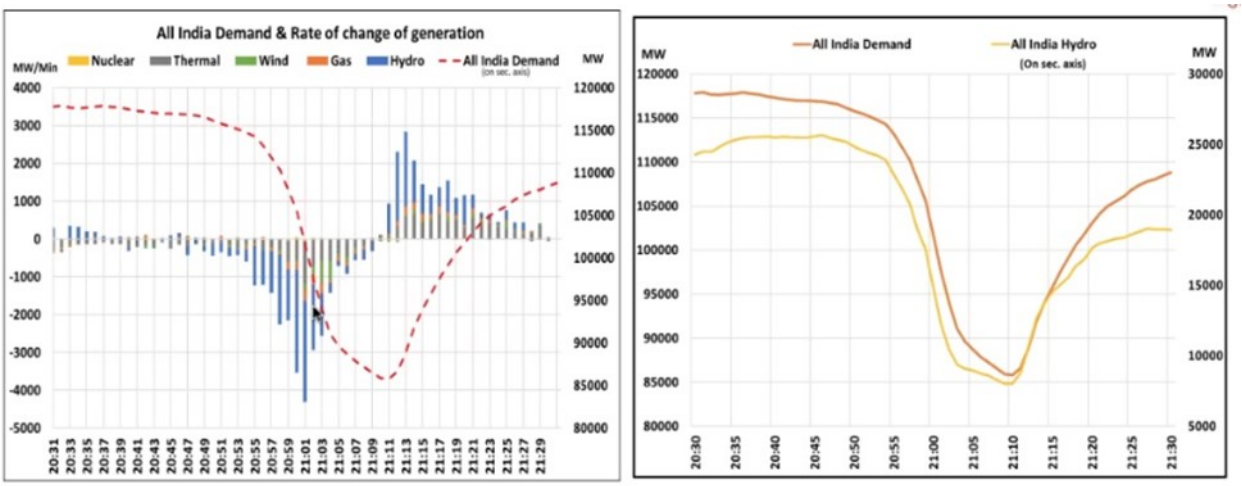


Figure 1 Unique demand flexibility exhibited by hydropower on 5th April (POSOCO, India)

Pakistan

The COVID-19 pandemic reached Pakistan on 26th February 2020. The country implemented a lockdown on 1st April, which was later extended twice. A partial lock down has been continued since then.

This pandemic has affected the ongoing drive against electricity theft across the country that has already recovered RS 1.368 billion and reduced the loss of 1.4 percent in 2019. Energy demand in the commercial and industrial sectors have been reported to be decreased by around 25 percent. The power sector has suffered the revenue shortfall on account of drop in the electricity sales, and by May it has faced a revenue hit of over Rs 300 billion, freezing of power tariffs and putting off bill payments. This effect is said to have affected the entire energy chain due to circular debt. The increase of about 10 percent foreign exchange rate in Pakistan further augmented the foreign debt obligation, putting pressure on Government to increase the tariff of electricity (Bhutta, 2020).

Independent Power Producers (IPPs) of the lower merit have badly suffered as they are paid only the capacity charges of their installation during least generation demand. Critical maintenance activities have also been postponed.

Maldives

In 2008, Maldives became the first country in South Asia to successfully achieve universal electrification. Total electricity consumption amounted to 750-gigawatt hours in 2018 – much higher on a per capita basis than other countries in the region (World Bank, 2020). Today, the Maldives power sector is almost completely dependent on fossil fuels - mostly diesel. The power tariffs in the country are among the highest in the region, even with government subsidies.

Electricity demand has dropped due to the economic slowdown, and bill collection rates for the utilities have reduced by approximately 50-70 percent since the start of the pandemic. Even with oil prices at historic lows, declining revenue and payment shortfalls have led utilities to expect significant cashflow shortfalls in the coming months, imposing further fiscal pressure on already tight public resources. As part of the COVID-19 relief package, the Government has subsidized 40 percent of electricity bills in April and May (World Bank, 2020).

Given the country's ever-increasing demand for electricity, the government is aiming to raise the share of renewable energy in the national energy mix by 20 percent by 2023 and ramp it up to 70 percent by 2030. Investments of up to $300 million will be needed to realize the government's first target for 2023, with a further investment of $1 billion to achieve the 2030 target (World Bank, 2020).To meet such a target, government has encouraged private investment in solar panels through power purchase agreements and feed-in-tariffs. Until and unless the situation bounces back to new normal, the progress to meet target of power sector is expected to remain on hold.

Nepal

The COVID-19 started spreading when Nepal Hydropower development activities were getting momentum in full swing with around 120 under construction projects with total capacity of nearly 3000 MW (DOED, 2020). The progress of these projects suffered because of shortage of labor, delay in import of electromechanical equipment, material unavailability etc. Many operational plants could not carry out their repair and maintenance activities. In an attempt to lessen the impact, Independent Power Producers (IPPs) have made a round of virtual meetings with stakeholder to address the problems regarding time relaxation, financial incentives and for workable environment.

In 2018 Nepal had set the hydro development target of 10,000 MW in 10 years and 15,000 MW in 15 years. Along with these long-term targets, this year target of 1000 MW addition is likely to be suffered due to ongoing pandemic

Sri Lanka

The first confirmed case of the virus was reported in Sri Lanka On 27th January. Then the various measures of curfews and lockdown were started on 18th March, 2020 to limit the spread of COVID-19.

In Sri Lanka's power sector, 4046 MW electricity is generated using three primary sources hydro power, fossil fuels and other non-conventional renewable energy sources with a share of 1793 MW, 2137 MW and 216 MW respectively (CEB, 2020).
Imposition of lockdown presented a unique challenge to the power system operators due to a substantial reduction in the demand in the electricity grid. Under the lockdown, in general, all the offices and industrial & commercial units, except for the establishments which come under the category of essential services were closed. This resulted in steep reduction in electricity consumption and thereby caused a large gap between demand and supply.

Conclusion:

The exact impact on the power sector is difficult to access as the pandemic is evolving differently in the Member States and it is still unknown how long COVID-19 phenomenon will last. A slow but steady recovery awaits the Member States in the months and years ahead. These early impacts will create a basis for future discussion to aid in mitigating adverse impacts and better preparing the power sector for such events in the future in SMS.

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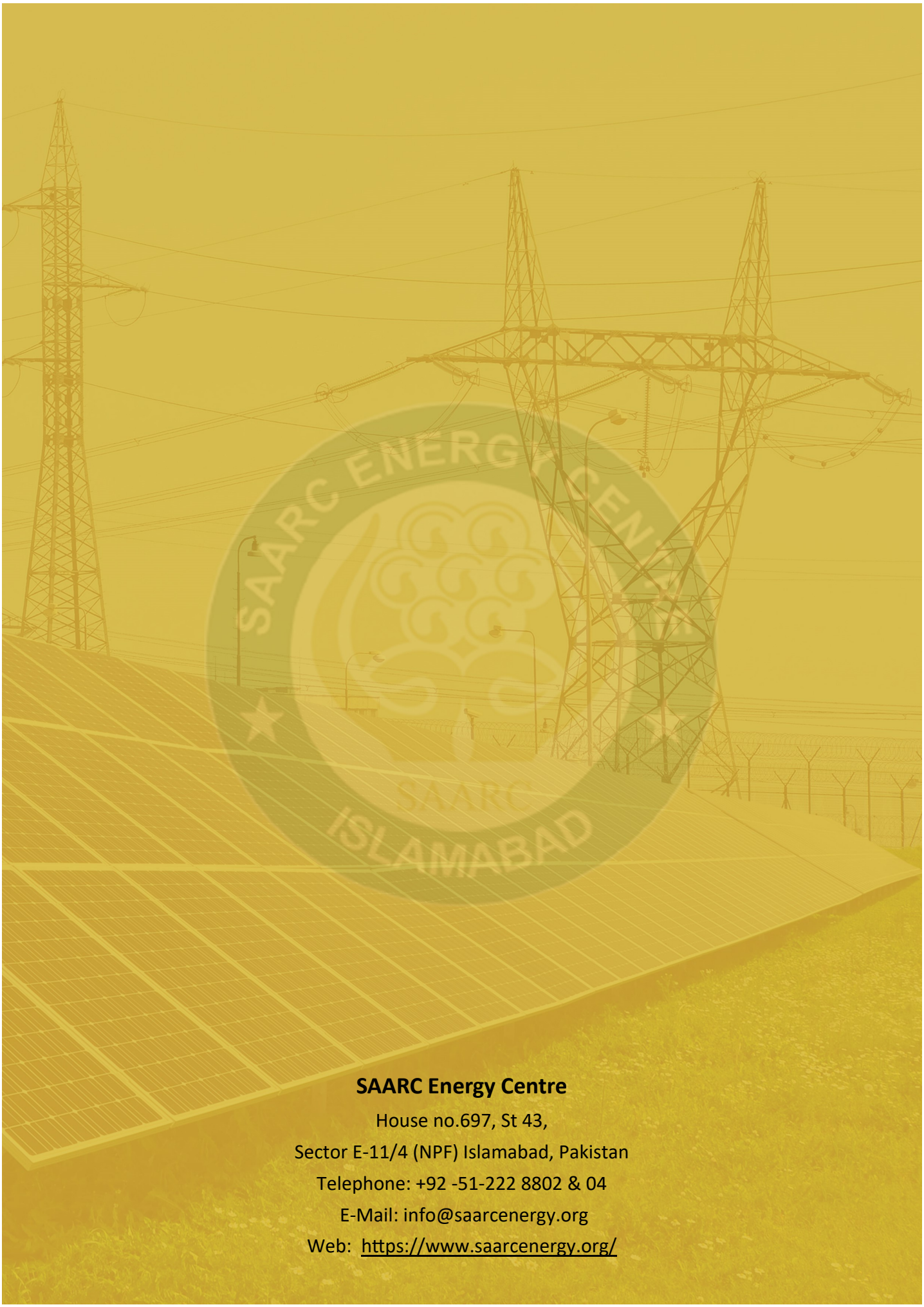

SAARC Energy Centre

House no.697, St 43,

Sector E-11/4 (NPF) Islamabad, Pakistan

Telephone: +92 -51-222 8802 & 04

E-Mail: info@saarcenergy.org

Web: https://www.saarcenergy.org/