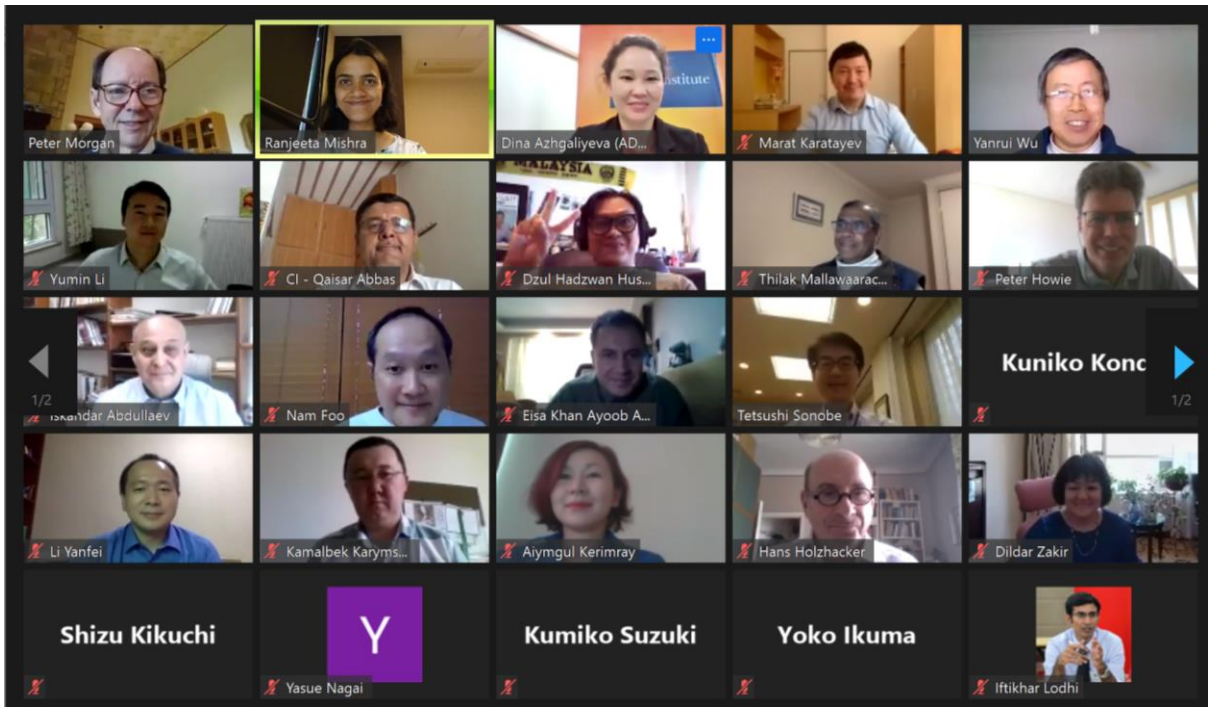
CAREC Institute

Meeting Environmental Objectives through Energy Sector Reforms in Asia and the Pacific: Role of Energy Pricing and Reforms for Emissions Reduction

Virtual Workshop Proceedings Report

22-24 June 2020



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The CAREC Institute workshop proceedings report and policy brief series is a forum for stimulating discussion and eliciting feedback on ongoing and recently completed research and workshops undertaken by the CAREC Institute staff, consultants, or resource persons. The series deals with key economic and development issues, particularly those facing the CAREC region, as well as conceptual or analytical issues relating to program or policy design and implementation.

This proceedings report is one of the outputs of the virtual workshop on "Meeting Environmental Objectives Through Energy Sector Reforms in Asia and the Pacific: Role of Energy Pricing Reforms and Emissions Reduction" jointly organized by CAREC Institute and the Asian Development Bank Institute. The workshop was delivered through three webinar series during 22-24 June 2020. The workshop's aim was to analyze energy pricing reforms and their short- and long-term costs and benefits in developing Asia with emphasis on the CAREC region.

The report is drafted by Dildar Zakir, Capacity Building Specialist, the CAREC Institute, and edited by Eisa Khan Ayoob Ayoobi, Chief of Capacity Building Division, the CAREC Institute. Rovshan Mahmudov, Senior Capacity Building Specialist, the CAREC Institute, Dina Azhgaliyeva, Research Fellow, ADBI, and Ranjeeta Mishra, Project Consultant, ADBI, have contributed to the report.

The views expressed in this paper are the views of the workshop participants and do not necessarily reflect the views or policies of the CAREC Institute, its funding entities, or its Governing Council. The CAREC Institute does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of its use. The terminology used may not necessarily be consistent with the CAREC Institute's official terms.

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Abbreviations

ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AJEM	Australasian Journal of Environmental Management
APEC	Asia Pacific Economic Co-operation
CAREC	Central Asia Regional Economic Cooperation
CEO	Chief Executive Officer
CPM	Carbon Pricing Mechanism
DEA	Data Envelopment Analysis
EKC	Environmental Kuznets Curve
FCEV	Fuel Cell Vehicles
GHG	Greenhouse Gas Emissions
NEM	Australian National Electricity Market
PRC	People's Republic of China
SDG	Sustainable Development Goal
TCO	Total Cost of Ownership Model
WTW	Well-to-Wheel Model

Table of Contents

Welcoming and Opening Remarks

Opening remarks were made by organizing partners: **Dr. Tetsushi Sonobe,** Dean and CEO of the Asian Development Bank Institute (ADBI) and **Dr. Iskandar Abdullaev,** Deputy Director Two of the CAREC Institute.

In his remarks, Dean Tetsushi Sonobe highlighted that tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability is a priority for ADB, as stipulated in its Strategy 2030. He stated that energy accounts for two-thirds of the total greenhouse gases, and energy sector reforms have a strong potential to reduce emissions and mitigate climate change. Energy pricing reforms have emerged as one of the regions' most important policy challenges and opportunities given their potential to advance the climate change mitigation and green growth.

This workshop further discussed research findings on short and long-term costs and benefits of energy pricing reforms for developing economies, including energy prices, subsidies, and reforms of energy pricing. There were nine selected academic papers out of nearly 50 submissions based on a call for papers, Dean Sonobe noticed. In addition to these selected papers, he highlighted the CAREC Institute presentation and its research findings in a paper titled "Climate Vulnerability, Infrastructure, Finance and Governance in CAREC Region," which he believed would enrich the discussion in the workshop. He hoped the workshop will explore how regional lessons can guide the implementation of energy reforms and the realization of environmental objectives in the region.

Dean Sonobe underlined the overall content and structure of the program and encouraged attendees to participate actively, especially during the discussion sessions. He concluded his remarks by expressing confidence that this workshop will bring new insights into the energy pricing reform.

Next, Dr. Iskandar Abdullaev delivered his opening remarks by emphasizing that the energy is a key element of the CAREC Program 2030 and development focus of both national governments and international partners in the region. He highlighted that CAREC is both rich and in need of new energy resources for sustainable development. Growing demand from industries, residential uses, and increased volatility of energy supply due to climate change will require both search for new energy sources and regional energy trade. However, currently, energy sectors of most CAREC countries are heavily state-owned, subsidized and mostly based on non-renewables. Key issues of the energy sector include low energy efficiency, limited regional interconnectedness of energy systems, and limited private financing. It requires further scientific discourse how financial instruments can ease these difficulties considering the climate change impact.

Dr. Abdullaev expressed that the CAREC Institute will produce both research and policy knowledge products for target policymakers, energy sector experts, public and private sectors and will also initiate, facilitate, and lead multi-stakeholder energy-sector workshops, dialogues, bi-annual energy investment conference for the CAREC region. He highlighted the importance of this virtual workshop for experience sharing and for shaping the joint research agenda and capacity building workshop design. He concluded his remarks by thanking Dean Tetsushi Sonobe, organizers, presenters, and all participants, and wished everyone a constructive workshop.

Session 1: Energy Demand and Energy Subsidy

This session was comprised of presentations from three selected research papers and it was chaired by **Dr. Peter Morgan**, Senior Consulting Economist, Vice-Chair of ADBI.

In his moderation remarks, **Dr. Morgan** said he was delighted to moderate the first session on Energy Demand and Energy Subsidy. He highlighted that energy demand is very important, particularly concerning the climate change. In many cases, countries still have energy subsidies due to various political pressures. Energy sources that are based on fossil fuel should be taxed to reflect externalities – global warming and environmental damages. Dr. Morgan went to introduce each presenter and handed the floor to deliver their presentations.

The first presenter was **Dr. Marat Karatayev**, a post-doctorate researcher, Karl-Franzens University of Graz, Institute of Systems Sciences, Innovation and Sustainability Research, Austria. Dr. Karatayev presented the country-specific case study on **"Assessment of Current and Future Water-related Energy Usage and Efficiency in Kazakhstan"** (water-energy nexus for short).

Dr. Karatayev gave an overview of the current water resources in Kazakhstan where demand for water is growing, including for energy generation, with reduced availability. About 44.64 km3 (44%) of the 100 km3 stored water mainly form the cross-border rivers expected to decrease to 32.6 km3 in the year 2020. The agriculture and power sector are the two main dominant users of the water resources which take about 69.1% and 25.7% respectively. He also pointed out that water resources are unevenly distributed. At the same time, over 50% of hydropower generation capacity (accounts for 8.1% of the country's total generating capacity) which contributes to surface water pollution is located in the areas with high water stress. Given the challenges, Kazakhstan is adopting integrated water resource management in the hope to achieve better coordination of its water resources.

Dr. Karatayev also noticed that water problems in Kazakhstan have started receiving international attention, including interest from the neighboring countries who used to share common water resources.

On other sources of energy, Dr. Karatayev said that coal was the main energy source for power and heating generation for households, which adds to environmental pollution leading to increased carbon intensity and low energy efficiency. To change the status, Kazakhstan has set up an energy target for 2050. Based on this target, 50% of power generation is expected from renewable energy sources (hydro (7%), solar, wind, biomass and geothermal) and other 50% from oil, coal, gas and nuclear.

At the end of his presentation, Dr. Karatayev received feedback from peer researchers, particularly the researcher assigned to review his paper. Also, time was given for open discussion. Other participants asked questions and provided comments.

Dr. Yumin Li, Assistant Professor in Economics, SHU-UTS SILC Business School, Shanghai University, Shanghai, the PRC, presented the second paper. His presentation was titled **"China's Electricity Cross-subsidies: Equity, Reverse Ramsey Pricing and Welfare Analysis."**

Professor Li started his presentation by noticing the high industrial and commercial electricity prices and low residential electricity prices in the PRC and different views concerning the pricing. Most of the views consider it inefficient for industrial and commercial sectors to subsidize the residential sector. The government should revisit this pricing disparity according to Ramsey's pricing rule. On the other hand, some others agreed with such pricing arrangements in the PRC. They believe these cross-

subsidies will help improve social equity as an environmental tax for industrial and commercial sectors. Taking these considerations into account, reforms on pricing for the industrial and commercial sectors have been an ongoing process.

Given different viewpoints on pricing reforms in the PRC, Professor Li has undertaken this paper to analyze the overall situation and recommend an optimal pricing mechanism with equity consideration through a theoretical model. Implying model calibration to calculate the objective function and profit constraint, he used this model to arrive at optimal prices quantitatively and simulate the social welfare under different scenarios and weights. Professor Li concluded that reverse Ramsey's pricing rule could be the optimal pricing mechanism in certain circumstances in the Chinese electricity industry. His paper demonstrated that consideration of social equity affects the choice of the electricity pricing mechanism. One of his main recommendations was the electricity consumption-based subsidy, which he believed may help improve efficiency of the industry.

Professor Li received peer-reviewed feedback on his paper. He also engaged with other participants through questions and answers.

The next paper titled **"Household Demand for Energy for Heating in Central Asia: Sustainable Development Goals and Beyond"** was presented by co-authors, **Dr. Aiymgul Kerimray,** post-doctorate researcher, Center of Physical-Chemical Methods of Research and Analysis, Al-Farabi Kazakh National University and **Dr. Kamalbek Karymshakov,** Associate Professor, Kyrgyz-Turkish Manas University, Bishkek, Kyrgyzstan. Their presentations were focused on case studies from Kazakhstan and Kyrgyzstan. According to them, the main pollution source in their research context was fossil fuels. Changes in these circumstances need effective policy interventions that are acceptable by the consumers.

Even though SDG 7 provides to ensure access to affordable, reliable, sustainable, and modern energy by 2030, reliance on coal consumption in Kazakhstan and Kyrgyzstan is high and increasing. Therefore, the objective of this study was to analyze the economic and non-economic determinants of household transition from coal to clean fuels by using the cross-section micro-level household data from the survey carried out in Kazakhstan and Kyrgyzstan. The results of the study show that the economic factors are the main determinants of the selection of the fuel types and at the same time depend on availability of supply infrastructure and stable energy sources.

Dr. Kerimray and Dr. Karymshakov received feedback and comments on their paper. They responded to some of the questions raised by other participants and agreed to incorporate some of the relevant comments to finalize their paper.

Session 2: Energy Subsidies

This session was comprised of two research paper presentations, and it was chaired by **Dr. Qaisar Abbas,** Chief of Research Division, the CAREC Institute. Dr. Abbas gave a brief moderation remark on the role of energy subsidy and moved on to introduce each presenter and handed them the floor for presentation.

The paper was presented by **Dr. Nam Foo,** Lecturer, Curtin University, Australia. His study was titled **"The Political Economy Aspect of Energy Reform in APEC Economies."**

Dr. Foo introduced different aspects of energy subsidies which is widely applied in APEC countries. He pointed out that subsidies are seen as incentives to foster the industrial growth of a given country. In

some cases, subsidies are applied to low-income groups of a population as part of government support policy. On the other hand, the energy subsidy affects the fiscal capacity of the country and causes revenue losses. Taking these different aspects into account, there is a need for energy pricing reform. Economists have different views on energy pricing reforms: some of them render such reforms necessary for fiscal sustainability and equity, others consider them part of political economy.

Dr. Foo suggested more research to find answers to these questions: (1) why political leaders or interest groups find it difficult to adapt to the energy pricing reform once the government has implemented such a policy; (2) which political factors are associated with and which ones influence energy pricing reforms. Dr. Foo himself carried out analysis using different models to examine the influencing factors which, he found, included: relevant laws and regulations, government effectiveness, government accountability, political stability, nation's income, fuel price, etc. The government can cancel the energy subsidy, also may confront high pressure during the reform that affects energy pricing. Dr. Foo concluded that energy reform from the political angle is more complicated, as it entails many economic and social issues. Public acceptance of reforms depends on effective institutional government policies, especially those providing benefits to citizens.

At the end of the presentation, there was a brief response from the designated discussants to provide peer-reviewed feedback to Dr. Foo's paper. Also, there were exchanges of views through discussions as well as questions and answers with participants.

Dr. Dzul Hadzwan Husaini, Lecturer, Faculty of Economics and Business, University Malaysia Sarawak, Malaysia, presented his study titled **"The Relationship Between Energy Subsidy, Oil Price, and Carbon Emission in Selected Asia Countries: A Panel Threshold Analysis."**

Dr. Husaini stated that, through his study, he has tried to find the balance between output growth and global warming in selected Asian countries. Steady population growth has benefited the Asian economy, but also added to environmental challenges. Energy subsidy has contributed to the high-energy consumption and CO_2 emission. Both energy subsidy and oil prices are major parts of the energy pricing dilemma.

Dr. Husaini elaborated that his research has taken 20 oil producing countries in Asia as a sample dataset and applied the EKC model to find relationship of energy subsidy and oil price with the CO_2 emissions. The empirical results show that the higher the subsidy and output growth the higher they contribute to pollution. He came up with a policy recommendation that emission reduction could be reached by applying energy coupons instead of energy subsidy and this should be provided based on the income. Productivity could be increased through technical improvement and the environmental awareness of society.

Similarly, Dr. Husaini received peer-reviewed feedback on his paper. Participants engaged with Dr. Husaini through exchanges of questions and answers. This presentation was the last in the second session.

Session 3: Pricing Reforms for GHG Emissions Reduction

This session included presentations from two authors. The session was chaired by **Dr. Hans Holzhacker,** Chief Economist, the CAREC Institute. In his short moderation remarks, Dr. Hans shed light on the relationship between energy pricing reform and emission reduction from his perspective, having spent decades working in Central Asia. Subsequently, Dr. Hans introduced the presenters and handed them the floor.

Dr. Yanrui Wu, Professor and Head of Economics Department, University of Western Australia, Australia, presented his study titled **"Understanding Gas Pricing Mechanism: Implication for the Asian Market."**

Based on Professor Wu's presentation, the natural gas market can be divided into three specific geographic markets namely: North America, Europe, and Asia. Needless to say, there is a nexus between gas and oil markets in all these continents. Hence, Professor Wu's study aimed to find the causal nexus between oil and gas markets using econometric models. He analyzed coupling, mixed, and decoupling relation between oil and gas in Japan, Europe (as a single market), and the United States of America as sample markets. Additionally, he provided some policy guidance on how much gas and oil nexus could be taken into consideration in the process of energy pricing reform.

The initial results from this analysis show that oil price fluctuations affect changes in the natural gas price. The impact of crude oil price on natural gas price needs to be considered by governments when engaged in policy reforms. Also, there is a need for an independent gas pricing mechanism to avoid the spillover risks from the crude oil market and a need of an integrated natural gas trading system. With this conclusion, Professor Wu received peer-reviewed feedback from discussant as well as questions from other participants. He responded to the questions and agreed to revise his paper based on the feedback provided to his research.

Dr. Muhammad Mohsin, post-doctorate fellow, School of Finance and Economics, Jiangsu University, the PRC, presented a paper titled **"A Way Forward for Energy Pricing and Market Reforms for Emission Reduction: The Case of Top 10 CO_2 Emitter Countries."**

Dr. Mohsin started by stating that the aim of his study was to find the relation between energy pricing reform, energy efficiency, and carbon prices. He had chosen the top 10 energy-consuming countries to assess the carbon emissions, energy consumption, and economic environmental performance. Dr. Mohsin applied the traditional output-oriented DEA model to measure environmental and economic performance, energy prices, and reduction of CO2 emission. He also used a scoresheet to reflect the research findings for each selected country. The PRC, Japan, and Saudi Arabia had scored high, followed by India and Russia. Discussants provided the peer-reviewed feedback to Dr. Mohsin and peer reviewers suggested revisions to the paper to provide more clarity on the model application and the research findings.

Session 4: Fossil Fuel Prices and GHG Emissions

Two authors presented in this session, which was chaired by **Dr. Dina Azhgaliyeva,** Research Fellow, ADBI. Dr. Azhgaliyeva opened the session with the brief moderation remarks to highlight fossil fuel prices and their correlation with the greenhouse gas emission. Shortly after, she introduced two presenters and gave the floor for presentations.

Dr. Rabindra Nepal, Senior Lecturer in Economics, University of Wollongong, presented his study titled **"Impacts of Wholesale Electricity Price under Varying Carbon Price Levels on Carbon Emissions and Economic Output in Australia."**

Dr. Nepal started his presentation by saying that, in Australia, emissions mainly come from fossil fuels (coal and gas) which constitute 77% of total electricity generation. Electricity in Australia is traded through the NEM with more than 9 million customers. To reduce the emissions from the electricity generation, policymakers will need to consider the wholesale electricity price. He also suggested that more research was needed in this area.

Nonetheless, to reduce greenhouse gas emissions, Australia introduced CPM in 2012 which plays an important role in directing investment to the clean energy sector such as, hydro, solar, wind instead of fossil fuels for electricity generation. Concerning the limited experience in carbon pricing in Australia, Dr. Nepal examined the impact of wholesale electricity prices and carbon price on carbon emissions and the effect of economic output through developing a scenario modelling. Dr. Nepal made a conclusion based on the scenario modelling – to reach the emission control objectives the "polluters pay" method should be applied in Australia.

The assigned discussants provided peer reviewed feedback on Dr. Nepal's paper. In addition, other authors and participants provided comments. The floor was also open to questions from all participants. After a few questions and answers, Dr. Nepal assured to take the feedback received into account to revise the paper.

Dr. Yanfei Li, Associate Professor, Hunan University of Technology and Business, presented his study titled **"Energy Prices and the Feasibility of Hydrogen Energy for Road Transport in China."**

According to Professor Li, hydrogen-related technologies became popular because of their application and growth speed together with the supply chain. Chinese cities have started to try this new trend by developing hydrogen energy industrial parks. To this end, they have received support through preferential policies for such initiatives from the central government.

Through economic assessment of hydrogen energy, specifically, FCEV fueled by the hydrogen, Professor Li provided an analysis of the feasibility and applicability of such energy sources and technology on road transport sector in the PRC. In this process, he developed and applied quantitative models, which are WTW and TCO models, to make a conclusion. The results of the two model surveys showed that the current retail hydrogen prices, that received substantial subsidies both from the provincial and central governments, remain uncompetitive compared with vehicles with other powertrains.

The discussant gave Professor Li peer-reviewed feedback and praised his efforts for tackling a whole new research area. Given the appeal of the subject, there were abundant comments and questions from other participants. Professor Li provided answers and concluded his presentation by thanking the discussants and other participants for feedback and comments, which he pledged to use to improve the paper.

Session 5: Economic and Financial Assessment of Climate Change Impact

This session was different from the others, as it was allocated for the CAREC Institute to present its research findings on the economic and financial impacts of climate change on energy. This was to bring the climate change discussion and inform all authors to mainstream climate change aspects into their research. **Dr. Dina Azhgaliyeva,** Research Fellow, ADBI, chaired the session. She opened the session by highlighting the importance of having climate change in mind while providing policy recommendations for energy pricing reforms. She pointed out the CAREC Institute's recent research – **Climate Vulnerability, Infrastructure, Finance, and Governance in the CAREC Region** – is an important source to reflect and mainstream climate change in the presented papers.

Mr. Eisa Khan Ayoob Ayoobi, Chief of Capacity Building Division, the CAREC Institute, presented his presentation titled **"Economic and Financial Assessment of Climate Change Impacts in CAREC Region."**

Mr. Ayoobi started by giving a global outlook on climate change and its economic effect on the global

economy. He went on into details on the impacts and hazards of climate change in the CAREC region. According to the data presented, from 1980 to 2019, climate change and global warming have contributed to drought, extreme temperature, flood, landslide, storm, and wildfire in the CAREC region. The impacts of such climate change patterns have had severe economic consequences for the region's economies. Among others, extremely low precipitation and drying rivers have created great challenges to the CAREC countries' agriculture-based economies.

Modern agriculture has more demand for electricity/energy. Around 70% of energy production in the CAREC region is from nonrenewable sources which in turn contribute to greenhouse emissions. Solar and wind sources of the region need serious attention to decrease emissions and improve the quality of life. Out of 11 CAREC countries, only the PRC, Georgia, Mongolia, and Pakistan have started utilizing the wind sources, with Georgia, Tajikistan, and Kyrgyzstan leading in utilization of hydro power.

Taking the above issues into account, the CAREC region needs to take quick steps and adopt modern ways, technologies, and concepts. The region also needs to develop financial tools and mechanisms to overcome the economic and financial burdens of climate change and to reach sustainable development goals.

Since the session was allocated only for one presentation, there was enough time for discussion as well as questions and answers. Several questions and answers were exchanged. Authors thanked the CAREC Institute for sharing the findings and pledged to strengthen the climate change parts of their papers based on the CAREC Institute research report that was shared with all workshop participants.

Session 6: Remarks on the Australasian Journal of Environmental Management (AJEM)

This session allocated to **Dr. Thilakasiri Mallawaarachchi,** Principal Research Fellow, Risk and Sustainable Management Group, School of Economics, The University of Queensland, Australia, and Associate Editor of the AJEM. This was to provide final guidance and tips to authors, based on which they could revise their papers fittingly as peer-reviewed papers.

Dr. Mallawaarachchi described the publishing requirements by AJEM and provided a sample template. He advised that papers should focus on environmental management related issues with strong academic standards, clear explanation of methods, formal academic English, and the length requirement of 6,000 words.

He also suggested that each author should carry out thorough proofreading before submitting papers and they shall follow instruction guidebook for authors that is provided to them. He advised authors to keep readers/audience in mind to attract interest and advocate for policy changes effectively.

Closing Remarks

Dr. Peter Morgan, Senior Consulting Economist, Vice Chair of ADBI, and **Dr. Iskandar Abdullaev**, Deputy Director of the CAREC Institute made closing remarks at the end of the workshop.

Dr. Morgan briefly thanked the authors for their comprehensive presentations as well as provided peer-reviewed comments. He believed that the workshop achieved its objectives and served the purpose to present preliminary research findings and received constructive feedback. He also thanked the organizers and expressed appreciation to the participants for their active participation.

Dr. Iskandar Abdullaev gave more detailed closing remarks. He started by congratulating all the participants who took the time and interest to participate in all sessions of the 3-day workshop. He declared the workshop as a successful event and thanked the organizers for excellent organization and presenters for high-quality inputs. He observed that all participants had acknowledged the importance of issues related to energy demand, subsidies, pricing reforms, climate change and its impact on the energy sector.

Dr. Abdullaev said that the subsidized energy sector, with the major role of the state and increasing CO_2 emissions, is not sustainable in the long-term and not a solution for the region's future development. The CAREC countries are facing CO_2 emissions and large cities are facing air-pollution problems, making the energy sector of the region both unsustainable and source for environmental degradation. The potential of increasing the share of renewable energy in CAREC is huge. To this end, he stressed the importance of financing renewables and believed that green financing will be a key development challenge for CAREC.

He cited the World Bank report (2018) that estimates for energy infrastructure financing stand at 500 billion USD in Central Asia until 2030. More than 25% of this amount is needed for renewable energy development. Although economies of the CAREC region are having healthy growth, the energy sector financing requirement is much higher than national public financing capacities.

Dr. Abdullaev pointed out the findings of the CAREC Institute's research on Climate Vulnerability, Infrastructure and Governance in CAREC that calls for collective actions in addressing climate change impacts on all sectors including energy. He said that the CAREC Institute puts high importance in this area and has recently developed an energy sector concept highlighting the Institute's research, capacity building and financing of sustainable energy in CAREC. According to this concept, the CAREC Institute will focus on systematic analysis of the energy access, energy diversification potential of the CAREC region, with a special focus on renewable energy development opportunities. The CAREC Institute will develop studies on assessment of the renewable energy potential of the CAREC region and identify institutional and infrastructure bottlenecks/needs for successful implementation of renewable energy projects. Hence, he concluded that the CAREC Institute will continue collaboration with ADBI and other interested entities to implement its energy sector concept.

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Appendices

Agenda

Meeting Environmental Objectives Through Energy Sector Reforms in Asia and the Pacific: Energy Pricing Reforms and Emissions Reduction

Dates: 22-24 June 2020

Venue: online

	Day 1: 22 June (Monday) 14:50 -17:20 (Tokyo time)
14:50 -15:00	Join Zoom webinar
Opening Session	**Welcoming Remarks**
15:00-15:10	Tetsushi Sonobe, Dean and CEO, ADBI
15:10-15:20	Iskandar Abdullaev, Deputy Director, CAREC Institute
Session 1	**Energy demand and energy subsidy** Chair: Peter Morgan, Senior Consulting Economist, Vice Chair, ADBI
	Paper 1: Water-energy-food nexus thinking in Kazakhstan: Choice or necessity?
15:20-15:35	Presenter: Marat Karatayev, Postdoctorate researcher, Karl-Franzens University of Graz, Institute of Systems Sciences, Innovation and Sustainability Research, Austria
15:35-15:45	Discussant: Nam Foo, Sessional Lecturer, Curtin University, Australia
15:45-16:00	Q&A
	Paper 2: China's Electricity Cross-subsidies: Equity, Reverse Ramsey Pricing and Welfare Analysis
16:00-16:15	Presenter: Yumin Li, Assistant Professor in Economics, SHU-UTS SILC Business School, Shanghai University, Shanghai, China
16:15-16:25	Discussant: Yanrui Wu, Professor and Head of Economics Department, University of Western Australia, Australia
16:25-16:40	Q&A
	Paper 3: Household Demand for Energy for Heating in Central Asia: Sustainable Development Goals and Beyond
16:40-16:55	Presenter 1: Aiymgul Kerimray, Postdoctoral Researcher, Center of Physical-chemical Methods of Research and Analysis, Al-Farabi Kazakh National University Presenter 2: Kamalbek Karymshakov, Associate Professor, Kyrgyz-Turkish Manas University, Bishkek, Kyrgyzstan

16:55-17:05	Discussant: Thilakasiri Mallawaarachchi, Principal Research Fellow, Risk and Sustainable Management Group, School of Economics, The University of Queensland, Australia and Associate Editor of the AJEM
17:05-17:20	Q&A

	Day 2: 23 June (Tuesday) 14:50 -17:40 (Tokyo time)
14:50 -15:00	Join Zoom webinar
Session 2	**Energy subsidies** Chair: Qaisar Abbas, Chief of Research Division, CAREC Institute
	Paper 4: What are the determinants of fuel subsidies in Asia Pacific Economic Cooperation (APEC) countries?
15:00-15:15	Presenter: Nam Foo, Sessional Lecturer, Curtin University, Australia
15:15-15:25	Discussant: Peter Howie, Associate Professor, Graduate School of Public Policy, Nazarbayev University, Kazakhstan
15:25-15:40	Q&A
	Paper 5: The Relationship Between Energy Subsidy, Oil Price, and Carbon Emission in Selected Asia Countries: A Panel Threshold Analysis
15:40-15:55	Presenter: Dzul Hadzwan Husaini, Lecturer, Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia
15:55-16:05	Discussant: Iftikhar Lodhi, Assistant Professor, Graduate School of Public Policy, Nazarbayev University, Kazakhstan
16:05-16:20	Q&A

Session 3	**Pricing reforms for GHG emissions reduction** Chair: Hans Holzhacker, Chief Economist, CAREC Institute
	Paper 6: Understanding Gas Pricing Mechanism: Implication for the Asian Market
16:20-16:35	Presenter: Yanrui Wu, Professor and Head of Economics Department, University of Western Australia, Australia
16:35-16:45	Discussant: Muhammad Mohsin, Postdoc Fellow, School of Finance and Economics, Jiangsu University, China
16:45-17:00	Q&A
	Paper 7: A Way Forward for Energy Pricing and Market Reforms for Emission Reduction: The Case of Top 10 CO2 Emitter countries
17:00-17:15	Presenter: Muhammad Mohsin, Postdoc Fellow, School of Finance and Economics, Jiangsu University, China
17:15-17:25	Discussant: Dzul Hadzwan Husaini, Lecturer, Faculty of Economics and Business, Universiti Malaysia Sarawak, Malaysia
17:25-17:40	Q&A

	Day 3: 24 June (Wednesday) 14:50 -17:20 (Tokyo time)
14:50 -15:00	Join Zoom webinar
Session 4	**Fossil fuel prices and GHG emissions** Chair: Dina Azhgaliyeva, Research fellow, ADBI
	Paper 8: Impact of Carbon Price on Carbon Emissions: An Empirical Evidence from Australia
15:00-15:15	Presenter: Rabindra Nepal, Senior Lecturer in Economics, University of Wollongong
15:15-15:25	Discussant: Ranjeeta Mishra, Project Consultant, Asian Development Bank Institute, Japan
15:25-15:40	Q&A
	Paper 9: Energy Prices and the Feasibility of Hydrogen Energy for Road Transport in China
15:40-15:55	Presenter: Yanfei Li, Associate Professor, Hunan University of Technology and Business
15:55-16:05	Discussant: Thilakasiri Mallawaarachchi, Principal Research Fellow, Risk and Sustainable Management Group, School of Economics, The University of Queensland, Australia and Associate Editor of the AJEM
16:05-16:20	Q&A
Session 5	**Economic and Financial Assessment of Climate Change Impact** Chair: Dina Azhgaliyeva, Research fellow, ADBI
16:20-16:35	**Economic and Financial Assessment of Climate Change Impact** Presenter: Eisa Khan Ayoob Ayoobi, Chief of Capacity Building Division, CAREC Institute
16:35-16:50	Q&A
	Chair: Dina Azhgaliyeva, Research fellow, ADBI
16:20-16:35	**Economic and Financial Assessment of Climate Change Impact** Presenter: Eisa Khan Ayoob Ayoobi, Chief of Capacity Building Division, CAREC Institute
16:35-16:50	Q&A
Session 6	**Remarks on the special issue of the Australasian Journal of Environmental Management (AJEM)**
16:50-17:05	Thilakasiri Mallawaarachchi, Principal Research Fellow, Risk and Sustainable Management Group, School of Economics, The University of Queensland, Australia and Associate Editor of the AJEM
17:05-17:10	Q&A
	Closing remarks
17:10-17:15	Peter Morgan, Senior Consulting Economist, Vice Chair, ADBI
17:15-17:20	Iskandar Abdullaev, Deputy Director, CAREC Institute

List of organizers from the CAREC Institute and ADBI

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