Policy Brief: Power Systems and COVID-19: Understanding the Role of Smart Meters in the Kyrgyz Republic

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Sustainable electricity supply is a prerequisite for economic growth. Financial challenges, exacerbated by losses caused by electricity theft are a major obstacle for developing economies. This paper summarises findings for research in the Kyrgyz Republic on the role smart meters can play in reducing such losses.

Key messages and recommendations

- Around one fifth of customers of the 3 Kyrgyz Republic utilities reviewed are connected to the grid via smart meters which are used, amongst other things, to remotely disconnect and reconnect consumers.
- The majority of utility staff interviewed believe that smart meters reduce customer complaints and have helped to mitigate the negative impacts of COVID-19 lockdowns, notably on billing and bill payment.

Motivation and research questions: Access to reliable electricity is crucial for sustainable growth and prosperity, but in low to middle-income countries, fiscal challenges threaten to dampen economic growth [i]. A major cause of fiscal problems is electricity theft, which is estimated to cost utilities worldwide $25 billion [ii]. Prior to 2020, the Kyrgyz Republic suffered from high losses, low cost recovery, and sub-standard electricity service quality. Over the past two years, the COVID-19 pandemic has affected the country in many ways, including posing a new threat to the resilience and functioning of their power systems.

Utilities within the Kyrgyz Republic had been installing smart meters for a number of years, as part of a strategy to reduce losses and improve electricity service quality. We explore how the shock of the COVID-19 pandemic affected the efficacy and resilience of these smart meters in reduce losses and/or increase cost recovery in the power sectors of the Kyrgyz Republic. Better understanding of these interventions will inform decisions for future planning, operation, and maintenance of power supplies in developing economies. In this policy brief, we provide a summary of our main findings.

Local Context and Background: There are 4 electricity distribution companies (DISCOs) serving customers across the seven oblasts that comprise the Kyrgyz Republic. Reducing losses and increasing cost recovery have been priorities for the DISCOs in Kyrgyzstan over the past decade. Smart meters installations have featured heavily in the companies' strategies to attain these goals. As of February 2020, just before the pandemic began impacting the country, an estimated 215,000 electricity consumers had smart meters installed, representing approximately 15% of the country's total electricity connections. There are plans to install more smart meters in the country going forward. As a result, there was variation across the country in the penetration of these metering systems as of March 18, 2020, the time of the first recorded case of COVID 19 in the country. In addition, because the country's four distribution companies drove the smart meter installations – each with a different procurement process - there is heterogeneity across distribution companies in the type of meters installed, as well as the complementary technologies in place. This has led to differences in the functionalities provided by and benefits from smart meters across the country.

Different metering technologies and systems bring a variety of functionalities and benefits. For example, some utilities employ Automated Meter Reading, whereas others install Advanced Metering Infrastructure (AMI). These systems are frequently referred to interchangeably, but they differ in many respects including meter functionalities. For example, these differ in terms

of the system architecture, communications being either one- or two-way between the utility and the customer, the interval of data transmission, and the type of customer service provided. As such, metering technologies also differ in their ability to deter non-technical losses, alert utilities of problems within the distribution system, and permit remote bill payment or pre-payment. Yet the benefits from metering will vary depending on the technological functionalities. For example, if the payment process is a source of vulnerability for the power system, then introducing smart meters may alleviate some of that vulnerability, if the meters' functionalities permit. Some meters require pre-payment for electricity consumption, potentially reducing non-payment of billed consumption. Alternatively, smart metering systems may be integrated with billing systems, making human meter readers unnecessary to measure a customer's consumption and bill them for it. In a pandemic, eliminating such vulnerabilities may increase the resiliency of the power system. Yet little evidence exists on the relative importance of and benefits from different metering systems.

Data and Methodology: Each of the DISCOs within the country has approximately a dozen local offices, called RECs, that each cover the operations for electricity distribution within a given district. There are 43 local distribution offices across the 3 electricity utilities – Osh Electric, Sever Electric and Vostok Electric -- we included in our study. Each REC is comprised of two departments: an engineering department that addresses the supply side and a financial department that manages the billing and payment collection. In the autumn of 2021, we collected data through a web survey of distribution company representatives at the three utilities. We attempted to survey 2 employees – one engineer, one accountant – from each of these 43 offices. This resulted in 57 individuals surveyed across the 43 utility offices. We analyse below the collected data to better understand how the utilities are using the smart meters and whether the installation of smart meters across utility across the country's districts affected the DISCOs' operations and their resiliency to the shock of COVID-19.

Infrastructure upgrades: Smart meter installations: Given the importance of smart meters as a component of the country's infrastructure, we analyse the DISCOs' employee perceptions as to the effects of the smart meters on utility operations. We first look at adoption of smart meters across these 43 utility district offices. Not all district offices have smart meters installed within their service areas: of the 43 surveyed, 7 report having zero industrial consumers with smart meters and 8 report having no residential customers with smart meters installed.

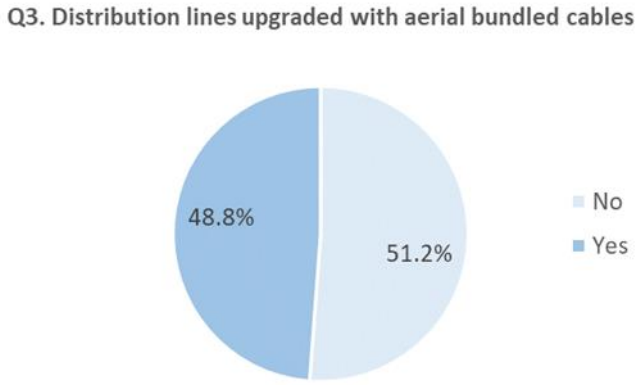
Table 1 shows that these 43 utility offices cover almost 2 million customers – both residential and industrial - approximately 21.4% of which are covered by smart meters. Differences emerge when we compare the coverage by consumer type: of the nearly 1.8 million residential customers in the coverage area, 20.1% are connected to the electrical grid with smart meters. In contrast, 33.8% of industrial consumers are connected via smart meters.

Table 1: Summary of smart meter adoption across utility offices

	(1) Total Customers	(2) With Smart Meters	(3) % of Total with Smart Meters
Panel A Residential Consumers			
Mean	41,859	8,428	20.1%
Median	12,850	1,112	8.7%
Total	1,799,946	362,398	20.1%
Panel A: Industrial Consumers			
Mean	4,299	1,451	33.8%
Median	1,582	215	13.6%
Total	184,867	62,407	33.8%
Residential and industrial combined			
Total	*1,984,813*	*424,805*	*21.4%*

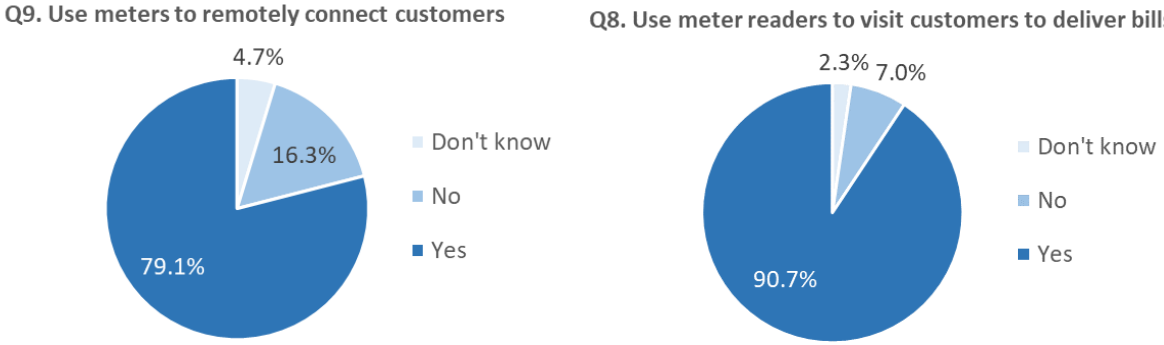
Interestingly, the utilities are not only upgrading the metering technology in their coverage area. Figure 1 shows that just more than half of the utility offices report that Aerial Bundled Cables (ABCs) have been used to upgrade the wiring within their distribution system in their service area. ABCs are upgraded electricity distribution wires with characteristics that impede "weathering, abrasion, tearing, cutting, and chemicals" and make illegal connections to the distribution system more difficult[iii].

Figure 1: Percentage of REC offices report ABCs installed in service area



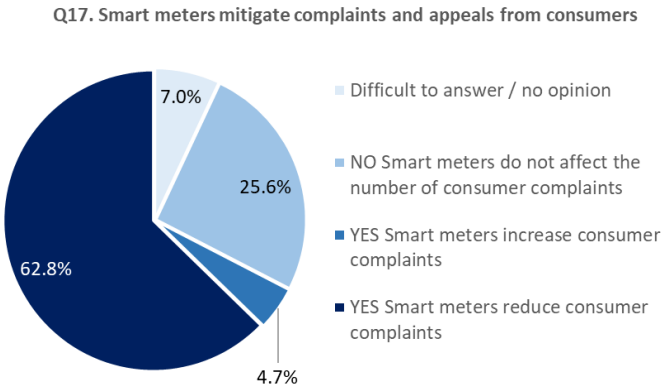
Use of smart meter installations: Smart meters have a number of different functionalities that may or may not be enabled or feasible given the context and complimentary technologies present. We asked the survey respondents questions regarding the meter functionalities they employ and find that, of the utilities offices with smart meters, 79.1% use the smart meters to remotely disconnect/reconnect customers, when needed. Yet 90.7% of these utility offices still use meter readers to deliver monthly bills to consumers, revealing the limits to the technological functions currently in-place.

Figure 2: Percentage of utility offices using smart meter to:



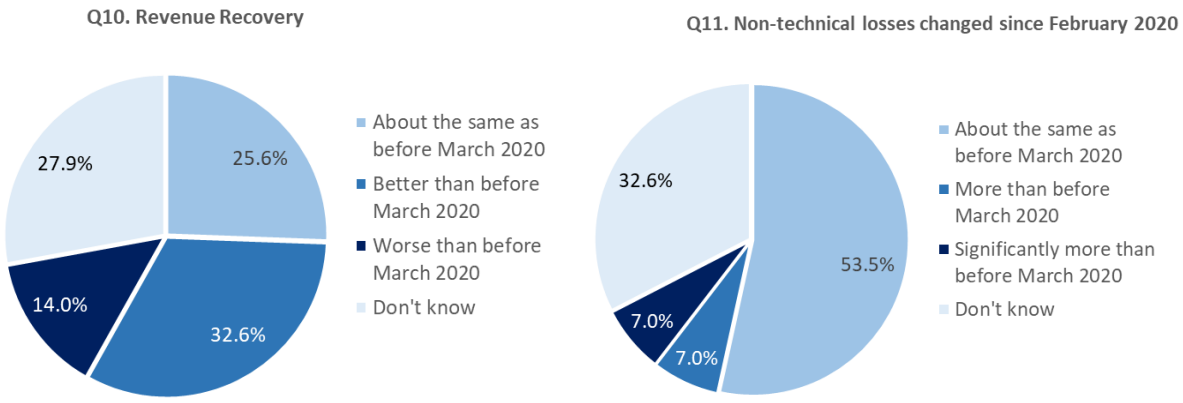
Utility employees believe there is a role for the smart meters in ensuring reliable and high quality electricity services. When asked to what extent they believed that the DISCOs should use smart meter protective settings, 81.4% of respondents reports that smart meters should be used to protect again voltage fluctuations, to protect the grid, or to protect consumer electrical equipment. Further, Figure 3 shows that 62.8% of respondents believe that smart meters mitigated the frequency of complaints and appeals from consumers.

Figure 3: Perception of smart meters and consumer complaints and appeals



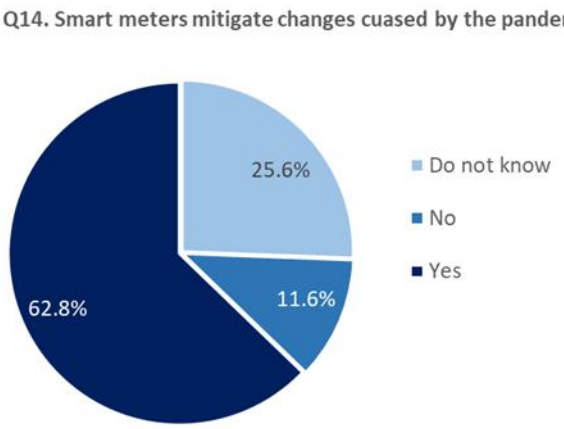
The effects of COVID 19: In March 2020, the first cases of COVID-19 were identified in the Kyrgyz Republic. Like many other countries, everyday life was interrupted by lockdowns and other changes, as people adjusted to life with the pandemic. When asked how the pandemic has changed the utilities billing procedures, 51.1% of utility officer responded that illness prevented workers from their jobs and 72.1% reported that lockdowns affected billing. When asked how the pandemic changed consumers' bill payment, 72.1% of utilities report customers not paying on-time due to government extensions, 65.1% report that consumers had greater difficulty paying due to financial hardship, and 53.5% report having difficulty paying in-person due to illness. How these challenges translated into changes in revenue recovery and non-technical losses are further illustrated in Figure 4.

Figure 4: Percentage reporting changes in revenue recovery and non-technical losses



Interestingly, Figure 5 shows that 62.8% of utilities report that the smart meters mitigated the challenges caused by the pandemic.

Figure 5: Percentage reporting smart meters mitigate pandemic challenges to utility



Concluding remarks: Sustainable electricity supply is a prerequisite for economic growth. Financial challenges, exacerbated by losses are a major obstacle for developing economies. There is then space for good policy interventions to have major impact, and we find encouraging evidence of this in our analysis of smart meter installations in the Kyrgyz Republic. We find that approximately 1/5 of customers across the 3 utilities reviewed are connected to the electrical grid via smart meters. Although a high proportion of utilities use the smart meters to remotely connect and disconnect customers, almost all the utilities are still employing meter readers for bill delivery. This indicates some limitations to the full-use of all the smart meters' technological capabilities. The impacts of COVID-19 on electricity utility outcomes and the ability of smart meters to mitigate those impacts in Kyrgyzstan, may inform policymakers and electricity distribution companies' decisions in the other countries, where smart meters are currently being piloted at smaller scale.

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Citations:

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About the authors:
Ruslan Isaev is an Associate Professor of Renewable Energy at Kyrgyz State Technical University and a Senior Researcher at the RE Lab of Institute of Machine Science and Automation of the National Academy of Sciences of the Kyrgyz Republic

Robyn Meeks is an Assistant Professor at the Sanford School of Public Policy at Duke University, a faculty affiliate of the Duke University Energy Initiative and the Duke Center for International Development, and a member of the Faculty Advisory Committee of Duke University's Energy Access Project.

Arstan Omuraliev is a power distribution engineer based in Bishkek, Kyrgyz Republic.