PROGRAM ECONOMIC ASSESSMENT

A. Introduction

1. This economic analysis reviews the anticipated economic benefits of the policy-based loan of the Asian Development Bank (ADB) to Uzbekistan under its Power Sector Reform Program.

B. Program Components

2. The analysis considers economic benefits resulting from policy reform actions under the following pillars: (i) regulation and restructuring, (iii) financial sustainability, (iii) competition and private sector participation, and (iv) decarbonization. The policy reform actions and resulting benefits directly address the core priorities of the power sector, namely reliable and environmentally sustainable electricity supply. Policy actions under these topics have been, or are in the process of being, initiated by the Government of Uzbekistan. The programmatic policy-based loan of $200 million (subprogram 1), combined with institutional and governance capacity building, is intended to support the government in implementing policy changes in the face of deepening economic uncertainties from a global recession.

C. Economic Context

3. Uzbekistan has been improving its business climate through structural reforms, which had begun to attract investment, until measures associated with the coronavirus disease (COVID-19) interrupted growth. The reforms seek to convert the economy from state-led to market-driven. Historically, Uzbekistan's economy has been heavily dominated by the state, through state-owned enterprises (SOEs). SOEs have enjoyed monopoly operating rights; low prices for electricity, gas, and water; and subsidies.[1] According to a World Bank assessment, Uzbekistan's "poorly performing and ineffectively governed SOEs drain limited budget resources, raising fiscal risks, leading to suboptimal capital investments and high levels of contingent liabilities" (footnote 1). In 2017, the government announced comprehensive reforms toward introducing a market-led economy by eliminating distortions in several key areas, including energy. In response, economic growth improved from 5.4% in 2018 to 5.6% in 2019,[2] after gross domestic product (GDP) had fallen during the previous 3 years.[3] At the end of 2019, Uzbekistan's GDP was $57.9 billion (footnote 3).

4. Unfortunately, the COVID-19 pandemic and global response significantly disrupted the Uzbekistan economy. Restrictions on movement, declining commodity demand, and economic slowdowns among trading partners have taken their toll on the nation. Initial estimates have GDP growth falling sharply in 2020 to 1.5%, compared with previously projected 6.0%. Growth is expected to rebound in 2021 and return to normal patterns in subsequent years.[4]

5. The response to COVID-19 will impact the economy at all levels. The current account deficit is expected to increase in 2020 due to a decline in natural gas demand (meaning fewer exports for Uzbekistan), manufacturing output, tourism, and remittances—all effects of the

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[1] World Bank. 2019. *Project Appraisal Document to the Republic of Uzbekistan for an Institutional Capacity Building Technical Assistance Project*. Report No. PAD3042. Washington, DC. 3 May. p. 6.
[2] B. M. Djalilov. 2020. Uzbekistan. In ADB. *Asian Development Outlook 2020: What Drives Innovation in Asia?* Manila. p. 171.
[3] World Bank. Data on Uzbekistan (accessed 30 April 2020).
[4] United Nations Development Program et al. 2020. *Uzbekistan: Consolidated Multilateral COVID-19 Socio-Economic Response and Recovery Offer*. Tashkent.

COVID-19 response. This may drive a balance of payments gap. Remittances, making up 15% of GDP, are expected to fall by 40%, disproportionately affecting low-income households.[5] About $700 million in tourism revenues will be lost in 2020 (footnote 5). The unemployment rate is expected to rise from 9.4% in 2019 to 16.5% in 2020 (footnote 5). The slowdown will likely stall a significant portion of direct investments scheduled for this year; meaning, the current account deficit will need to be funded by a combination of increased assistance and a drawdown of reserves. The government also faces a fiscal deficit, expected to be 5.6% of GDP by the end of 2020, caused by lower tax revenue and higher spending on anti-crisis policies. Strong international cooperation will be needed to support the state budget and to safeguard national economic stability (footnote 4). Looking beyond the pandemic, growth will likely resume, but risks remain. These include longer than expected COVID-19 effects, extended slowdowns among trading partners, and increases in contingent liabilities from planned public–private partnership (PPP) initiatives (footnote 4).

6. The energy sector has also been affected. Lower demand combined with falling natural gas prices may squeeze revenues to the industry. According to the Ministry of Energy, power demand has decreased by 13% following COVID-19.[6] Furthermore, the International Monetary Fund predicts that natural gas prices will fall. For example, in Europe, natural gas is projected to fall by as much as 26% from 2019.[7] Demand from the People's Republic of China (PRC) has also fallen, hence, fewer imports from Uzbekistan. Since Uzbekistan's power industry relies on gas for much of its generation capacity (about 88%), the variable cost of production will likely fall for some time. However, since the pricing for gas is obscured, the effects of a long-term price decline are difficult to determine.

D. Power Sector Background

7. The Government of Uzbekistan is committed to the transformation and growth of the energy sector, as demonstrated by recent reforms and investments in the industry.[8] These include physical upgrades to infrastructure, and the movement to an electricity market model. Uzbekenergo has recently undertaken an unbundling process, demonopolizing the sector. Now, Joint Stock Company Regional Electric Networks (JSC REN) is the holding company of all regional distribution entities, Joint Stock Company Thermal Power Plants (JSC TPP) is the generation company, and Joint Stock Company National Electric Grid of Uzbekistan (JSC NEGU) is in charge of transmission.

8. Uzbekistan is the largest electricity producer in Central Asia and remains a net exporter of power. Total available capacity in Uzbekistan is about 12,500 megawatts (MW) from 25 power plants. Approximately 88.8% of electricity generated in 2019 was from fossil-fueled thermal power plants (93.5% of thermal power is from natural gas) and the rest was from hydropower (12%). However, sector assets are operating at low levels of efficiency, and energy losses across the system are high. These results are due to (i) a lack of investment, (ii) inadequate governance, and (iii) poor financial performance.

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[5] ADB. 2020. *Report and Recommendation of the President to the Board of Directors: Proposed Countercyclical Support Facility Loan to the Republic of Uzbekistan for the COVID-19 Active Response and Expenditure Support Program*. Manila.

[6] ADB. 2020. Disaster Risk Management Note: Uzbekistan Program Summary. Tashkent.

[7] International Monetary Fund. 2020. *World Economic Outlook, April 2020: The Great Lockdown*. Data Page (accessed 13 May 2020).

[8] Government of Uzbekistan. 2018. *President Decree No. 3981 on Accelerating Development and Ensuring the Financial Sustainability of the Electric Power Industry*. Tashkent.

9. A lack of investment in new and existing assets has led to aging infrastructure and an overloaded system. Nearly 40% of the nation's generation capacity is either past or close to the end of operating life.[9] Line losses are high, approaching 20% of net generation, largely due to aging assets.[10] As a result, operation and maintenance expenses are on the rise, blackouts are becoming more common, and system performance is in decline (footnote 9). The government estimates that costs to repair the system will be much greater than public money alone can provide; to meet them will require private funds. Inadequate governance has also led to inefficiencies. Regulatory decisions have been made among a confusing array of entities and agencies, while tariffs were set at government levels that are out of touch with the immediate sector needs. Furthermore, the vertically integrated Uzbekenergo had no decision-making authority for investment planning, nor a clear framework for introducing private investment into the sector. The consequence being poor returns on investment because decision-making does not pursue least-cost options, nor do investments necessarily align with long-term development priorities. Finally, financial performance has been in steady decline. According to the World Bank analysis, the sector's quasi-fiscal deficit (the difference between actual revenue and full cost and loss recovery) had grown to $550 million, which was 0.7% of GDP in 2016 (footnote 9). The 2017 deficit was higher still, due to a currency revaluation that devalued the Sum by nearly one half against the US dollar.[11] One effect of the devaluation was an effective doubling of external debt. Poor financial performance has been driven by energy pricing that does not cover costs, high technical losses, and inefficient collection practices.

10. In response to the declining performance, the government has initiated reforms designed to improve performance and induce private sector investment. These reforms include (i) demonopolizing the sector, (ii) a new tariff methodology, and (iii) a framework for tendering renewable energy projects. To be successful, these initiatives will require the support of the proposed policies.

E. Transmission Mechanism

11. The program will support national reforms, aimed at restructuring the power supply chain, and leads to several benefits. Together, the policy actions enable competition and create a conducive environment for private investment in the sector, a significant effect given the large amounts of capital required to upgrade the system. Policy actions 1 and 2 lay the legal framework for sector restructuring and regulation. Policy action 1 includes a power sector development program for 2020–2030, developed by the Ministry of Energy, which is the new sector regulatory and policy-making entity. The policy action contains (i) a long-term investment program to decarbonize the sector, (ii) diversification of energy resources, and (iii) a time-bound plan for deregulation and full opening of the power market. These actions consolidate regulation in one agency, enabling a streamlined and transparent regulatory approach, with a focused and strategic approach to sector decision-making. Policy action 2 calls for (i) a power sector reform implementation plan for 2019–2022, (ii) operationalized unbundled JSC TPP, JSC NEGU, and JSC REN to establish separate, financially sustainable entities for power generation, transmission and distribution, and (iii) key performance indicators approved by JSC TPP, JSC NEGU, and JSC REN to establish separate operational targets for the unbundled entities. A clear plan is essential

[9] World Bank. 2016. *Project Appraisal Document on a Proposed Credit and Loan to the Republic of Uzbekistan for a Modernization and Upgrade of Transmission Substations Project*. Report No. PAD1856. Washington, DC. 2 November.

[10] Mott MacDonald. 2019. Uzbekistan Power Sector Masterplan. Final Report. Volume 1. Brighton, United Kingdom (prepared for ADB).

[11] I. Gulamov. 2018. Uzbekistan. In ADB. *Asian Development Outlook 2018: How Technology Affects Jobs*. Manila. p. 161.

to ensure that project adoption is lining up with real sector needs. The separation and corporatization of the entities will hopefully focus decision-making for planning, investment, and operations to the appropriate level of the value chain. The actions directly target the financial and operational issues currently faced by the sector by establishing improvement goals that are self-determined and verifiable. More focused and operational goals will improve overall sector performance, generating benefits of loss and outage reductions.

12. Policy actions 4, 5, and 6 operationalize an autonomous tariff council to set and enforce cost-recovery tariffs (policy 4); implement a single-buyer structure (policy 5); and implement policies designed to attract private investment in the power sector (policy 6) through (i) credit enhancement mechanism to mitigate off-taker risks as interim measure to build market confidence, (ii) seeking private investments in renewable generation using model PPP structure, and (iii) approval of grid interconnection code for nondiscriminative access to the grid. Cost-recovery tariffs are essential for both sustainability of existing entities and also for attracting private investment. Under a cost-recovery regime, investors are assured to receive adequate compensation to cover all costs of operations, including maintenance, as well as financing and investment costs. The single-buyer structure will allow independent power producers (IPPs) to contract directly with one entity, rather than make agreements with many stakeholder agencies, thus streamlining the process. Finally, actions taken to minimize off-taker risks, the use of a PPP structure, and equal access to the grid should result in the creation of a level playing field for IPPs, therefore, serving to attract additional capital to the sector. These steps will help to address the need for significant external investment in the system. The cumulative effect is to crowd in private sector investment, both foreign and domestic.

13. Policy actions 8, 9, and 10 aim to decarbonize the sector. Collectively, they will set the nation on a pathway to mitigate significant amounts of carbon dioxide (CO_2), beginning with the energy sector. Policy action 8 sets national goals to reduce the carbon intensity by 10% from 2010 level, by 2030. Policy 9 approves plans to reduce the carbon intensity in electricity generation specifically by (i) establishing a national renewable energy target to add 5 gigawatts (GW) solar power and 3 GW wind power by 2030, (ii) retirement of old and inefficient fossil-fuel power plants of 5.9 GW by 2030, and (iii) increase hydropower imports from neighboring countries during the summer months. These actions will result in reducing the use of natural gas for electricity, possibly reducing the nation's overall carbon footprint. The investments associated with these goals will also create significant efficiency improvements in generation, helping to correct a problem with aging and inefficient plants, and resulting in both incremental and non-incremental benefits. Policy 10 reduces the carbon intensity of the transmission and distribution networks through the (i) launching of grid expansion and loss reduction plan study in support of renewables, (ii) digitalization and introduction of nationwide supervisory control and data acquisition (SCADA) system, (iii) adoption of an action plan for distributed household or small community-based renewable system closer to consumers, and (iv) distribution network modernization and loss reduction program. This mix of planning studies and project implementation takes important steps toward making the network more reliable, reducing losses, and improving collections.

14. Finally, demand-side efficiency is a key strategic step to reducing the energy intensity of the nation. Policy action 11 approves an energy efficiency roadmap to reduce energy demand across the economy by (i) improving regulatory standards for energy efficiency, (ii) promoting energy balance data management, and (iii) introducing energy savings targets by 2022 for high energy consuming enterprises. Policy 12 reduces electricity consumption for space heating in urban areas and improves the efficiency of heat networks through (i) a billing and advanced metering system for individual households, (ii) energy audits on heat supply system, and (iii) exploring the suitability of the PPP modality. These demand-side efficiencies will result in energy

savings targets for high consumption enterprises, ultimately making important national industries more competitive.

F. Benefits of the Program

15. Fully executed policy changes facilitate a financially sustainable electricity sector, resulting in improved sector performance. These outcomes will drive three economic benefits to (i) loss savings, (ii) carbon savings, and (iii) demand-side efficiency. The benefits are the direct results of solutions to core problems of system unreliability and environmental unsustainability. Several benefits have been estimated as totals over the 10 years from 2020 to 2029, but are presented as indicative only. In most cases, costs have not been calculated; as a result, these are not to be considered *net* benefits, in accordance with the nature of the loan modality.

1. Loss Savings

16. With the program, a financially viable sector will be able to attract the needed investment to update system assets and deliver improved performance, resulting in both incremental and non-incremental benefits. The sector can capture incremental growth by reducing outages and losses across the system. As a related fiscal benefit, the government will be able to reduce its significant subsidies, thereby saving budgetary resources for more strategic uses. Without the program, the sector will continue to struggle to meet growing demand due to inefficient generation, outages, and losses, all of which serve as a drag on the national economy.

17. Power sector performance has deteriorated because of a lack of adequate and appropriate investment, and the sector has struggled to fund new investments because of its poor financial performance. For example, the financial situation of Uzbekenergo has been weakened by high network losses, ad hoc tariff adjustments and pricing policy, and poor collection rates. This was compounded in 2017 by the devaluation of the national currency on its foreign currency debt exposure, leading to a loss of $870 million.

18. With improved sector performance, including financial management, aspects of the value chain will become more attractive for outside investment. The program reform area of financial sustainability promises to ensure that investments can expect a return on capital. The adoption of a new tariff methodology and cost-recovery guarantee provides a means by which cost recovery can be transparently assessed and approved. Further, the introduction of a new collection system that includes smart meters significantly limits collection losses. Finally, policies designed to attract private investments—such as (i) credit enhancements to limit off-taker risk, (ii) adoption of internationally bankable project structure and the government's supporting mechanism to incentivize PPPs, and (iii) non discriminative access to the grid—create a level playing field for private suppliers. These efforts can facilitate a crowding in of the private sector, which can supply needed funding to improve efficiency.

19. **Demand supply forecast.** Load growth is expected to increase at a rate of 2.2% over the next 10 years based on historical demand growth and future macroeconomic growth forecast.[12] At that rate, the 10-year cumulative increase in energy demand, over a 2019 baseline, is 21 terawatt-hour (TWh). However, without the program, loss rates mean that a significant amount of additional electricity must be generated. Therefore, benefits accrue to the economy through reduced loss rates, resulting in both incremental and non-incremental benefits. Since the

[12] The Government of Uzbekistan estimates more robust growth at 4.0% for the next 10 years, beginning 2020. Government of Uzbekistan. 2020. *Concept Note for Ensuring Electricity Supply in Uzbekistan in 2020–2030*. Tashkent

electrification rate in Uzbekistan is nearly 100%, 85% of project benefits are allocated to incremental supply to meet future demand.[13] The remaining 15% is considered non-incremental benefits and can be equated to the resource cost savings from replacing backup diesel generators. Without the program, the incremental demand will be met by the thermal power plants burning natural gases, and transmission and distribution networks will continue to increase significant losses. Non-incremental demand will continue to be met through auxiliary generation. Without the program, the sector struggles to meet incremental demand.

20. **Fully captured growth.** Inefficient generation and aging system assets have increasingly led to an inability for the sector to meet growing demand. Though Uzbekistan is fully electrified, the quality of service is poor and unreliable because of transmission bottlenecks and aging power plants. Unreliable power supply negatively impacts livelihoods and the profitability of many businesses. According to the World Bank Enterprise Survey 2019, electrical outages happen twice a month, on average, and each episode lasts 2.3 hours.[14] Business losses due to outages amount to 3.0% of annual sales of enterprises, which is worse than the regional average. The issue is even more pronounced in rural areas, and during winter, when demand surges. In these cases, blackouts are common and last 2–6 hours a day. The policy actions will help the sector respond to this increased demand through deployment of large-scale solar and wind projects. Investment in efficient combined-cycle gas turbine (CCGT) generation and improved transmission and distribution will also help to reduce this unserved energy.

21. **Reduced losses.** Transmission and distribution line losses have grown to nearly 20%, largely offsetting government attempts to modernize the system. Enhancing financial stability of the sector is one of the key reform areas. Modernization of the network, paid for by sustainable revenues, will allow the joint-stock companies (JSCs) to address technical and operational inefficiency problems, and improve loss rates. Several policy actions focus especially on reducing losses and expanding the grid system to accommodate the increasing renewable energy integration. These include the digitalization of grid system by introducing a modern SCADA system and measures to green the distribution networks while improving service quality and reducing losses—(i) village solarization program and (ii) distribution modernization and loss reduction program to invest in critical infrastructure.

22. Reducing loss rates in the network can result in significant savings for the industry. Under the reforms, the transmission network is expected to improve from loss rates of 2.4% (of energy supplied to the network) in 2020 to 2.2% by 2025 (footnote 10). A more significant improvement is expected at the distribution level, where nationwide losses averaged 15.1% in 2017 (of delivered energy)—a figure five times higher than high-income nations (footnote 100). By 2019, losses were 14.5% of supply and, with the reforms, are expected to fall to 8.9% by 2030 (footnote 10). The total energy savings over 10 years would be 21.9 TWh.[15]

23. Table 1 illustrates the results and quantifies the benefit. Row 1 shows expected generation without the program. The figures are based on a net energy demand forecast that begins with a baseline of 2019 generated electricity in the amount of 58,070 gigawatt-hours (GWh). Demand increases by 2.2% per year through 2029. Network loss rates, which are built into the generation figures, are high, averaging 17.1% (over 10 years) for the combination of transmission and

[13] ADB. 2019. *Report and Recommendation of the President to the Board of Directors: Proposed Loan, Technical Assistance Grant, and Administration of Technical Assistance Grant to the Republic of Uzbekistan for the Sustainable Hydropower Project*. Economic Analysis (accessible from the list of linked documents in Appendix 2). Manila.
[14] World Bank. 2020. *Uzbekistan - Enterprise Survey 2019*. Washington, DC.
[15] See economic model for full calculations.

distribution. Row 2 shows generation with the program. The same starting point and growth rate apply, but loss rates are lower, averaging 14.6% over 10 years. Row 3 shows the gains from reduced losses: the without-scenario minus the with-scenario. Row 4 shows the incremental energy benefit, capturing 85% of the added efficiency. Row 5 shows a willingness-to-pay (WTP) rate per kilowatt-hour (KWh).[16] Row 6 multiplies rows 4 and 5 to yield the value of the incremental benefit. Row 7 shows the non-incremental energy benefits (in GWh), which can be valued at resource cost savings from replacing backup diesel generators. Row 8 shows the actual value of the non-incremental benefit, when multiplied by the fuel savings for diesel generators, a constant $ 0.32/KWh.[17] Using this method produces an incremental benefit of $2.26 billion, and a non-incremental benefit of $1.05 billion, over 10 years, for a total benefit of $3.31 billion (5.8% of 2019 GDP).[18]

Table 1: Generation Forecasts and Energy Efficiency Savings
(2019 Generation Baseline: 58,070 GWh)

	Item	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
1	Generation without program	GWh	58,774	60,068	61,389	62,740	64,120	65,530	66,972	68,446	69,951	71,490	649,480
2	Generation with program	GWh	58,427	59,339	60,267	61,212	62,174	63,154	64,174	65,213	66,271	67,349	627,580
3	Efficiency: (w/o – with)	GWh	348	729	1,122	1,527	1,945	2,377	2,798	3,232	3,680	4,142	21,900
4	Incremental benefit (85%)	GWh	296	619	954	1,298	1,654	2,020	2,378	2,747	3,128	3,520	18,615
5	Value of energy (WTP)	USD million/ GWh	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-
6	Value of incremental benefit	USD million	35.9	75.3	115.9	157.8	201.0	245.6	289.1	334.0	380.2	427.9	2,263
7	Non-incremental benefit (15%)	GWh	52.2	109.3	168.3	229.1	291.8	356.5	419.7	484.8	552.0	621.3	3,285
8	Value of non-incremental benefit	USD million	16.7	35.0	53.8	73.2	93.3	114.0	134.2	155.0	176.5	198.6	1,050

GWh = gigawatt-hour, USD = United States dollar, WTP = willingness-to-pay.
Source: Asian Development Bank.

24. **Net present value.** Benefits are then compared with the costs needed to achieve the savings. Costs for the network upgrades that would produce these results total $1.8 billion. These

[16] WTP amounted to $0.10/KWh in 2016. Figure was taken from ADB (2017) Economic Analysis, and converted to 2020 constant prices. ADB. 2017. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Technical Assistance Grant to the Republic of Uzbekistan for the Power Generation Efficiency Improvement Project*. Economic Analysis (accessible from the list of linked documents in Appendix 2). Manila.

[17] Calculations for that analysis were based on diesel generators with an efficiency factor of 28% and diesel price of $1 per liter, according to ADB WTP survey (footnote 16). That study estimated the cost of generators to be SUM700–SUM6,000 in 2016, which is expected to have increased by 2–3 times because of the sharp devaluation of the sum in 2017.

[18] Uses World Bank 2019 GDP for Uzbeksitan: $57.9 billion.

can be broken into transmission costs of $470 million,[19] and distribution costs of $1.8 billion.[20] The net present value of the loss reduction is $344 million (discounted at 9%).

25. As an additional fiscal benefit, the national budget may experience added fiscal space due to the reduced need for subsidies. Fiscal savings result from the financial sustainability of the sector, which creates more independent sector entities. Operational efficiencies, including lower loss rates, mean fewer expenditures for fuel to produce energy that that cannot be billed. Financial efficiencies include investments that are more targeted at actual market needs, which in turn leads to better returns on capital. These outputs create a growing pool of investors willing to step in where previously only government could supply funds. Budgetary surpluses can be applied to other important endeavors, including for COVID-19 recovery, job creation, and programs for vulnerable citizens. With the program, the need for government support of the sector will diminish; Uzbekenergo's 2017 losses of $870 million that were absorbed by the government provide an example of possible savings. Without the program, the sector requires continued central government support.

2. Carbon Savings

26. The second benefit to Uzbekistan emanates from carbon savings. The replacement of electricity sourced from natural gas with electricity from renewable sources (including renewable energy targets) will save significant amounts of gas that would normally be consumed by domestic power production, resulting in a mitigation benefit from lower levels of CO_2 emissions.

27. **Carbon reduction.** With the program, annual consumption of natural gas by the electricity sector is expected to fall from 12.3 billion cubic meters (bcm) in 2019 to 5.8 bcm by 2030, from the modernization of the generation fleet and the introduction of renewable energy.[21] Without the program, high levels of gas consumption remain. Power sector decarbonization (Reform Area 3) will reduce greenhouse gas emissions across the supply chain, beginning with generation. The following policies are especially targeted: (i) develop renewable energy sources to account for more than 25% of the total volume of electricity generation, (ii) decommission old and inefficient thermal power plants to allow room for private investments, and (iii) increase regional trade with hydro-rich countries.

28. With the program, renewable installations will gradually replace much of the thermal generation fleet. As a result, the total carbon produced by the sector is expected to fall from 22 million tons (MT) per year in 2020, to approximately 17 MT in 2028 and beyond. Due to the timing of various installations, the transition does not occur in a straight line; rather, carbon output is expected to fall slowly as old plants are decommissioned and new plants are built. Applying the values per ton of carbon yields a cumulative $383 million.[22] A caveat to this mitigation benefit is whether exported natural gas will be used to produce electricity elsewhere. If it is, then the mitigation effect will be muted by thermal electricity production among trading partners.

29. A schedule of savings is provided in Table 2. Rows 1 and 2 show projected gas use with and without the program, respectively. Row 3 shows the savings, row 4 converts saved gas into carbon volumes, and row 5 assesses a value to the carbon.

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[19] The European Bank for Reconstruction and Development (EBRD) approved in 2019 a €71.5 million worth of project, while World Bank is preparing to approve, in 2020, a $300 million project.

[20] ADB. CIP spending schedule, "1Assump$Inputs" line 43, beginning in 2020.

[21] Footnote 10, p. 40.

[22] The social value of carbon is measured as $36.3 beginning in 2016; an inflation factor of 2% is added for subsequent years.

Table 2: Anticipated Natural Gas Savings, Available for Sale
(2019 baseline: 12.3 bcm)

	Item	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
1	Gas used without program	bcm	10.9	11.0	9.7	8.6	8.8	8.3	8.4	8.6	8.9	9.2	92.4
2	Gas used with program	bcm	10.8	10.8	9.3	8.1	8.0	7.3	7.1	7.1	7.3	5.8	81.7
3	Gas savings (w/o – with)	bcm	0.1	0.2	0.4	0.5	0.8	1.0	1.2	1.5	1.6	3.4	10.7
4	Carbon saved	MT	0.3	1.0	1.6	1.9	3.5	4.3	5.3	6.2	6.8	14.2	45.0
5	Value of carbon	USD million	39.3	40.1	40.9	41.7	42.5	43.4	44.2	45.1	46.0	47.0	383.3

bcm = billion cubic meter, MT = million tons, USD = United States dollar.

Sources:

a. Projected use of natural gas for both scenarios from Mott MacDonald. 2019. Uzbekistan Power Sector Masterplan. Final Report. Volume 1. Brighton, United Kingdom (prepared for the Asian Development Bank).
b. Natural gas forecast from the World Bank Commodities Price Forecast, released on 23 April 2020 (1 bcm is equivalent to 36,000,000 million British thermal units).
c. Value of carbon from Asian Development Bank. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.

30. **Additional benefits: gas saved and foreign direct investment.** As shown in Table 2, significant volumes of gas may be saved through the program; the value of these volumes is projected at $1.3 billion over 10 years, based on World Bank's commodities price forecast.[23] Additionally, many of the policy actions are designed to promote private investment. If fully applied, these will result in the attraction of foreign direct investment to the sector (though delays due to the COVID-19 pandemic are expected). Many aspects of the sector may eventually be attractive for private investment but, overall, this set of policy actions steers private investors toward low-carbon generation. Also, the government is seeking independent power producers for a series of installations. These projects are being put out to bid for private developers under a PPP structure. If foreign developers bring outside investments to the sector, the investments accrue as an economic benefit. To quantify the benefit, an assumption is made that the IPP would supply the equity investment for a project, while the government supplies the debt. The total capital expenditure required for the approved list of projects is $4.5 billion (7.8% of 2019 GDP).[24] Often, the equity portion of total project cost is 30%—meaning that $1.4 billion would come as foreign direct investment. If other facilities are also approved as IPPs, benefits would be higher.

3. Demand-Side Efficiency

31. Demand-side efficiency is directly addressed by Reform Area 4 through regulatory standards and energy savings targets. A current government program aims at reducing energy intensity (energy per unit of GDP) by 8%–10% annually in key sectors. For example, advanced energy savings technologies will be introduced from 2020 through 2030, including the replacement of heating boilers in thousands of buildings, upgrading electric motors and water

[23] World Bank. 2020. Commodities Price Forecast. 23 April. European natural gas process are used.
[24] ADB, Mott MacDonald. "Break-down of investment capex for MOE1 scenario." (Excel Workbook) 2019.

pumps operated by the Ministry of Agriculture, and outlawing the importation of inefficient household appliances. Demand-side efficiency benefits will accrue to the commercial sector as, over time, these initiatives will help to modernize energy-intensive industries, allowing for cost savings and increasing global competitiveness.

G. Program Risks and Mitigation

32. The policy actions under the proposal are complex and carry potentially high economic and social adjustment costs, if poorly implemented. It follows that the program features several key risks, mostly associated with delays in implementation or incomplete reforms.[25] Several policy actions have been completed; however, delays on unfinished supporting reforms will dilute the benefits listed above, possibly eliminating one or more altogether. To mitigate these risks, the verification arrangements included in the policy-based lending proposal will be critical.

33. The verification mechanisms that accompany the policy actions are specifically targeted to address the risks outlined above. Most of the mechanisms are objectively clear and can be easily verified (published decrees, ratified reforms, and project closure). Still, the policy actions target some of the most critical reforms in Uzbekistan's transition to a competitive, market-based economy. Many of the reforms are difficult to ensure and could result in high economic and social adjustment costs, if they are not implemented properly. Current indications are that the authorities consider these changes to be critical at this time. The government has worked closely with development partners, aggressively mitigating design risks and minimizing negative outcomes, especially for vulnerable citizens (footnote 25). If delays occur or incomplete implementation takes place, benefits will diminish. If, however, reforms are taken with urgency and completeness, the benefits that accrue will serve not only the sector, but the entire national economy.

H. Conclusion

34. The implementation of reforms will result in significant, targeted improvements in the electricity sector in Uzbekistan. The combination of policy actions can help to address the country's overarching development objective, which is the achievement of sustainable, inclusive, and market-led power sector development. As part of the process, the policies will enable competition, facilitate private investment, and enhance governance, accountability, and financial sustainability, while driving operational efficiency. These outcomes are vital to sustaining long-term economic growth, especially in the face of a difficult post COVID-19 environment. As small businesses struggle to regain their footing, system failures that are experienced with increasing frequency add to enterprise costs and exacerbate the difficulties in implementing COVID-19-related adjustments. A self-sustaining electricity sector that supplies reliable and low-cost service will provide an essential support for enterprises and families alike, who are trying to climb out of a global recession. Furthermore, the electricity sector provides a national platform by which to invite external investment to help jump-start the economy that has been badly affected by the pandemic.

[25] World Bank. 2018. *International Bank for Reconstruction and Development Program Document for a Proposed Loan to the Republic of Uzbekistan - Reforms for a Sustainable Transformation toward a Market Economy Development Policy Operation.* Washington, DC.