ADDRESSING CLIMATE CHANGE IN TURKMENISTAN: INVESTMENTS REQUIRED IN THE WATER AND ELECTRICITY SECTORS

http://www.undpcc.org/en/turkmenistan

The electricity sector in Turkmenistan is a crucial sector of the economy, as the availability of electricity determines the degree of socio-economic growth. Photo: http://alternativesourcesofenergy.net/

→ More than US$ 7.7 billion is necessary up to 2030 in Turkmenistan to implement priority actions to mitigate greenhouse gas (GHG) emissions from electricity supply and demand as well as to adapt to climate change in the water sector. According to a national assessment of investment and financial flows (I&FF) that was finalized in September 2010 in Turkmenistan, US$ 2.1 billion is necessary to reduce the GHG emissions from electricity production and demand. Additionally US$ 5.6 billion is necessary to adapt to climate change in the water sector to avoid water shortages.

The assessment of investment and financial flows was carried out under the global UNDP project, *Capacity Development for Policy Makers to Address Climate Change*, in which 20 countries participate. The project is funded by the governments of Norway, Switzerland, Spain, Finland, UNDP and the United Nations Foundation.

Selection of sectors

The **electricity** sector in Turkmenistan is seen as a crucial segment of the economy, since it is linked in national plans to the acceleration of socio-economic growth. The energy sector as a whole accounts for 87% of greenhouse gas (GHG) emissions (2004 national GHG inventory); of this, the electricity sub-sector accounts for 15.7%. There is considerable untapped energy conservation potential.

Water management is also an essential in Turkmenistan. The Initial National Communication noted that: "Turkmenistan is one of those regions that may be most affected by global warming." A key impact will be on agriculture is strongly based on irrigation and accounts for more than 90% of total water use in the country. Water demand is also increasing, even as water supply is projected to decrease as a result of climate change.

Institutional arrangements

The I&FF assessments for electricity supply and demand were conducted by the Ministry of Energy and Industry of Turkmenistan and its subdivision, "Turkmenenergo". The water sector assessment was carried out by representatives of the Ministry of Water Facility of Turkmenistan, and its provincial production associations for Water Management and Scientific-Research, and the Project Exploration Institute "Turkmensuvylymtaslama". The national experts were appointed officially by their ministries.

Institutional cooperation between various departments was discussed at the beginning of the project during an inter-ministerial meeting that included the participation of numerous key line ministries and departments of Turkmenistan.

ASSESSMENT OF INVESTMENT AND FINANCIAL FLOWS

Objectives of the I&FF assessment

The main objective of the I&FF assessment is to determine the amount of necessary investment and financial flows to address climate change at the national level. The assessment builds on previous studies. plans and strategies carries out by the government of Turkmenistan and aims to answer the question: *From a development perspective. what does my country have to do to address climate change in specific key sectors. and which financial means are necessary to reach that objective?*

In this context. the national team examined the following questions:

- Which are the main adaptation / mitigation options for the selected sectors in the next 25 years?
- Who invests in the sector / who are the principal stakeholders and sources?
- Which changes / increase of I&FF will be necessary in the sector?
- Which will be the overall additional I&FF need to address climate change in those sectors?

The I&FF assessment has a time horizon of 2008-2030 for the baseline and adaptation/mitigation scenarios. The values are given in constant 2005 US$. The three investment entities that were analyzed are households, corporations (NGOs and private), and the government.

The main objective of this work was to prioritize measures to mitigate and adapt to climate change in the electricity demand, electricity consumption and water management sectors, and to evaluate the costs of implementing these measures. It is to be highlighted that it was the first time that an analysis of investment and financial flows addressing climate change was carried out in Turkmenistan.

Electricity supply (mitigation of greenhouse gases)

- Implementing the mitigation scenario will require total additional financial means of US$ 2.02 billion. The existing power plants will be converted to combined cycle, and new co-generation power plants will be built.
- Potential energy savings for the years 2010-2030 amount to 40.3 billion m^3 of natural gas; total CO_2 emissions reductions from energy savings are 75.5 million tonnes of CO_2. In 2030, emission reductions in the mitigation scenario will reach 6.24 million tons of CO_2 per year.
- As the government of Turkmenistan is a major investment entity for electricity production, these investments will require public funds or foreign credits guaranteed by the government.

Electricity demand (mitigation of greenhouse gases)

- The total additional cost of implementing measures is US$ 45.37 million from 2010-2013. Emission reductions over the period 2010-2030 will amount to 20.89 million tonnes of CO_2 equivalent.
- There is significant potential for conserving electricity in lighting, air conditioning and heating of 13.8-14% of the total electricity demand, leading to a total saving of natural gas of 11.2 billion m^3. This will reduce CO_2 emissions by almost 0.75 million tons per year by 2030.
- Costs incurred by the energy consumption sector include both public and private funds needed to purchase incandescent air conditioners, electrical appliances for heating, as well as public funds for the construction of gas-fired boilers and heating devices.

Water management (adaptation to climate change impacts)

- The total additional investment amount needed is US$ 5.6 billion.
- The predicted water shortage of 5 km^3 for irrigation needs will be eliminated through the proposed measures.
- The only source of investment for the water sector is public funds. Hence, the implementation of the required adaptation measures will only be possible with public funds or foreign loans.

EVALUATION OF POLICY IMPLICATIONS

For electricity supply (mitigation)

- For 2010-2030, the country will receive about US$ 8 billion from exports of the gas that would otherwise be domestically consumed in the mitigation scenario, which entirely covers the additional I&FF needed in the mitigation scenario.
- Policies in energy conservation should focus on improving the norms and standards, such as target setting standards for the efficiency of power plants and a fuel rate for electricity.
- A number of energy saving measures can be implemented through the Clean Development Mechanism, which will attract additional investment.
- The legal basis for implementing energy efficiency measures should be an energy law to promote energy conservation and development of renewable energy. To stimulate the introduction of renewable energy sources, the law may provide tax incentives for investment in

renewable energy and exemption from import duties on equipment for renewable energy.

For electricity demand (mitigation)

- Energy conservation measures in lighting, air conditioning and heating can bring additional revenue to the state budget by allowing export of the gas that would otherwise be domestically consumed; this can amount up to US$ 2.24 billion.
- Mandatory measures include energy efficiency standards to remove outdated and inefficient technology from the market. Financial incentives can be, for example,reducing import tariffs for energy-efficient technologies, reduction of VAT for energy-efficient products.
- It will be necessary to establish a leading state agency with the capacity and authority to execute, monitor, and control these measures.
- To finance measures for the efficient use of electricity, a state fund can be established, and replenished with funds from the export of natural gas and savings on energy conservation.

SUMMARY TABLES OF INCREMENTAL INVESTMENT COSTS

Table 1: Additional annual IF, FF and O&M implementation scenarios for mitigation and adaptation sector (million 2005 US$)

Year	Electricity production						Electricity consumption						Water management					
	Additional expenses			Discounted incremental costs			Additional expenses			Discounted incremental costs			Additional expenses			Discounted incremental costs		
	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2009	-	-	0.79	-	-	0.72	-	-	-	-	-	-	64.40	0.40	3.70	64.40	0.40	3.70
2010	-	0.12	-	-	0.10	-	1.42	-	0.00	1.18	0.00	0.00	82.90	0.50	4.70	75.40	0.50	4.20
2011	55.70	0.24	0.08	41.85	0.18	0.06	17.42	0.22	-1.25	13.09	0.17	-0.94	95.80	0.60	5.40	79.20	0.50	4.40
2012	81.30	0.30	2.52	55.53	0.20	1.72	16.43	0.13	-2.53	11.22	0.09	-1.73	103.00	0.70	5.80	77.40	0.50	4.40
2013	55.70	0.22	2.60	34.59	0.14	1.61	16.13	0.13	-3.79	10.02	0.08	-2.35	111.20	0.70	6.30	75.90	0.50	4.30
2014	57.70	0.26	4.88	32.57	0.15	2.75	15.51	0.03	-5.09	8.76	0.02	-2.87	120.20	0.70	6.80	74.70	0.50	4.20
2015	55.70	0.32	4.96	28.58	0.16	2.55	15.07	0.03	-6.37	7.73	0.02	-3.27	130.40	0.80	7.50	73.60	0.40	4.20
2016	81.30	0.40	7.40	37.93	0.19	3.45	11.02	0.03	-7.30	5.14	0.01	-3.41	141.80	0.90	8.10	72.80	0.40	4.20
2017	55.70	0.37	7.48	23.62	0.16	3.17	11.02	0.03	-7.67	4.67	0.01	-3.25	154.50	0.90	8.90	72.10	0.40	4.20
2018	207.70	0.37	9.77	80.08	0.14	3.77	11.01	0.03	-7.84	4.25	0.01	-3.02	168.70	1.00	9.80	71.60	0.40	4.10
2019	205.70	0.38	9.85	72.10	0.13	3.45	11.01	0.03	-8.01	3.86	0.01	-2.81	184.60	1.10	10.70	71.20	0.40	4.10
2020	254.70	0.56	11.12	81.16	0.18	3.54	11.00	0.03	-8.18	3.51	0.01	-2.61	202.40	1.20	11.80	70.90	0.40	4.10
2021	15.70	0.45	17.55	4.55	0.13	5.08	5.19	0.01	-8.33	1.50	0.00	-2.41	247.80	1.50	14.30	79.00	0.50	4.60
2022	97.70	0.39	19.91	25.73	0.10	5.24	5.42	0.01	-8.48	1.43	0.00	-2.23	270.00	1.60	15.60	78.20	0.50	4.50
2023	15.70	0.41	19.91	3.76	0.10	4.77	5.64	0.01	-8.63	1.35	0.00	-2.07	294.80	1.80	17.10	77.60	0.50	4.50
2024	121.30	0.53	22.35	26.40	0.12	4.86	5.87	0.01	-8.78	1.28	0.00	-1.91	318.80	1.90	18.50	76.30	0.40	4.40
2025	15.70	0.48	22.43	3.11	0.09	4.44	6.09	0.01	-8.94	1.21	0.00	-1.77	345.50	2.00	20.10	75.20	0.40	4.40
2026	97.70	0.06	24.71	17.57	0.01	4.44	5.09	0.01	-9.10	0.92	0.00	-1.64	368.90	2.00	21.50	73.00	0.40	4.30
2027	39.30	0.55	24.95	6.43	0.09	4.08	5.31	0.01	-9.26	0.87	0.00	-1.51	408.50	2.20	23.80	73.50	0.40	4.30
2028	103.40	0.43	27.33	15.37	0.06	4.06	5.53	0.01	-9.42	0.82	0.00	-1.40	439.10	2.30	25.60	71.80	0.40	4.20
2029	11.40	0.06	27.49	1.54	0.01	3.71	5.75	0.01	-9.59	0.78	0.00	-1.30	480.50	2.50	28.10	71.40	0.40	4.20
2030	85.00	0.12	27.81	10.44	0.01	3.42	5.97	0.01	-3.84	0.73	0.00	-1.20	545.90	2.90	31.70	73.80	0.40	4.30
Total	**1,714.10**	**7.02**	**295.89**	**602.88**	**2.46**	**70.91**	**192.90**	**0.75**	**-142.30**	**84.29**	**0.44**	**-43.68**	**5,279.80**	**30.10**	**305.90**	**1628.90**	**9.60**	**93.80**

IF = Investment Flows, FF = Financial Flows, O&M = Operation and Maintenance costs
ΔI&FF = gradual change in investment and financial flows
Negative values mean net savings
Source: Results of I&FF assessment

For water management (adaptation)

- Integrated Water Resources Management (IWRM) to be implemented, encouraging the introduction of new technologies that use irrigation water more efficiently, making use of experiences from water user associations and farmers associations. Also improving regional water policy and strengthening the legislative framework to effectively manage transboundary water resources
- Increased work on the cultivation of drought-and salt-resistant crops
- Gradual introduction of paid water use
- The evaluation also showed the economic benefits of adaptation activities. Given an annual average income obtained in Turkmenistan from 1 hectare of irrigated land is about US$ 350, the elimination of the water shortage will increase irrigated area by 0.5 million hectare and bring benefits in the order of US$ 175 million.

Table 2: Incremental Annual IF, FF and O&M for All Investments in Each Sector. Incremental Annual Sectoral Investments (million 2005 US$)

Year	Electricity production						Electricity consumption						Water management					
	Government			Private owners			Government			Private owners			Government			Private owners		
	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2009	0.00	0.00	0.79	-	-	-	-	-	-	-	-	-	64.40	0.40	3.70	-	-	-
2010	0.00	0.12	0.00	-	-	-	0.33	0.00	0.00	1.10	-	0.00	82.90	0.50	4.70	-	-	-
2011	55.70	0.24	0.08	-	-	-	11.27	0.22	-0.63	6.15	-	-0.62	95.80	0.60	5.40	-	-	-
2012	81.30	0.30	2.52	-	-	-	10.95	0.13	-1.27	5.48	-	-1.26	103.00	0.70	5.80	-	-	-
2013	55.70	0.22	2.60	-	-	-	10.86	0.13	-1.89	5.28	-	-1.90	111.20	0.70	6.30	-	-	-
2014	57.70	0.26	4.88	-	-	-	10.68	0.03	-2.55	4.84	-	-2.54	120.20	0.70	6.80	-	-	-
2015	55.70	0.32	4.96	-	-	-	10.54	0.03	-3.19	4.53	-	-3.18	130.40	0.80	7.50	-	-	-
2016	81.30	0.40	7.40	-	-	-	9.47	0.03	-3.47	1.55	-	-3.83	141.80	0.90	8.10	-	-	-
2017	55.70	0.37	7.48	-	-	-	9.47	0.03	-3.58	1.55	-	-4.09	154.50	0.90	8.90	-	-	-
2018	207.70	0.37	9.77	-	-	-	9.46	0.03	-3.63	1.55	-	-4.21	168.70	1.00	9.80	-	-	-
2019	205.70	0.38	9.85	-	-	-	9.45	0.03	-3.67	1.56	-	-4.33	184.60	1.10	10.70	-	-	-
2020	254.70	0.56	11.12	-	-	-	9.45	0.03	-3.72	1.56	-	-4.46	202.40	1.20	11.80	-	-	-
2021	15.70	0.45	17.55	-	-	-	5.43	0.01	-3.77	-0.24	-	-4.56	247.80	1.50	14.30	-	-	-
2022	97.70	0.39	19.91	-	-	-	5.49	0.01	-3.81	-0.07	-	-4.67	270.00	1.60	15.60	-	-	-
2023	15.70	0.41	19.91	-	-	-	5.54	0.01	-3.85	0.10	-	-4.78	294.80	1.80	17.10	-	-	-
2024	121.30	0.53	22.35	-	-	-	5.60	0.01	-3.89	0.27	-	-4.89	318.80	1.90	18.50	-	-	-
2025	15.70	0.48	22.43	-	-	-	5.66	0.01	-3.94	0.43	-	-5.00	345.50	2.00	20.10	-	-	-
2026	97.70	0.06	24.71	-	-	-	4.60	0.01	-3.98	0.49	-	-5.12	368.90	2.00	21.50	-	-	-
2027	39.30	0.55	24.95	-	-	-	4.66	0.01	-4.03	0.65	-	-5.23	408.50	2.20	23.80	-	-	-
2028	103.40	0.43	27.33	-	-	-	4.72	0.01	-4.07	0.81	-	-5.35	439.10	2.30	25.60	-	-	-
2029	11.40	0.06	27.49	-	-	-	4.77	0.01	-4.12	0.98	-	-5.47	480.50	2.50	28.10	-	-	-
2030	85.00	0.12	27.81	-	-	-	4.83	0.01	1.75	1.14	-	-5.59	545.90	2.90	31.70	-	-	-
Total	1,714.10	7.02	295.89	-	-	-	153.21	0.75	-61.32	39.70	-	-81.04	5279.80	30.10	305.90	-	-	-

IF = Investment Flows, FF = Financial Flows, O&M = Operation and Maintenance costs
ΔI&FF = gradual change in investment and financial flows
Negative values mean net savings
Source: Results of I&FF assessment

Knowledge Platform in Russian *The project website www.undpcc.org contains information on the activities in Turkmenistan. the I&FF methodology as well as numerous other resources. May 2010*

More information on activities in Turkmenistan

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