Information Brief:
Energy Prospective in North and Central Asia

The energy sector has been catapulted to the forefront of the global dialogue on sustainable development. While enjoying abundant energy reserves, both traditional fossil fuels and renewable energies, the North and Central Asia (NCA) subregion has a markedly uneven distribution of energy resources across countries.

The present information note has been prepared to provide a statistical snapshot of the energy situation as well as ongoing trend in the NCA subregion. It should be read together with its forthcoming companion note (which will include an analysis of renewable energy and energy efficiency. The note will discuss policy actions needed, including those related to regional connectivity, to unlock the subregion's sustainable energy potential.

Introduction

Dominated by traditional fossil fuels, the energy sector is the overwhelming contributor to rising global CO2 emissions, accounting for more than 70 percent of total emissions. Furthermore, significant portions of the population, particularly in the least developed countries, still have no access to modern energy services. This was estimated at 2.8 billion people in 2015, of which over 1.1 billion do not have electricity and around 4.3 million people die prematurely every year due to indoor pollution resulting from cooking and heating with fossil fuels[1].

The increased attention to such issues has catapulted energy to the forefront of global dialogue on sustainable development, as changes are sought to the way energy is produced, traded and consumed. The United Nations Secretary General's Sustainable Energy for All (SE4All) initiative mobilized action from all sectors of the society to support clean and accessible energy. Furthermore, the recently adopted 2030 agenda for sustainable development has a standalone goal on energy (SDG-7) aimed at ensuring ensure access to affordable, reliable, sustainable and modern energy for all.

North and Central Asian (NCA) countries are actively pursuing subregional and national initiatives to promote renewable energy and energy efficiency, the twin pillars of sustainable energy. Most NCA countries have laid ground work for enhancing energy efficiency and renewable energy share through establishing legislative mandates and outlining national strategies. A number of countries have assumed active roles in the global dialogue. For instance, the 2017 EXPO to be held in Kazakhstan's capital of Astana will focus on "Future Energy" to promote the adoption, implementation and use of the best energy practices for inclusive and sustainable development by exploring the sub-themes: reducing CO_2 emissions, enhancing energy efficiency, and increasing access to energy for all[3].

Table 1: 2012 Key energy statistics of North and Central Asian countries

Country	TPES* *(Mtoe)*	TPES/ GDP (PPP) *(toe/thousand 2005 USD)*	Net imports *(Mtoe)*	Electricity consumption *(TWh)*	$C0_2$ emissions *(Mt of CO_2)*	$C0_2$ per capita *(kg of CO_2 /capita)*
Armenia	2.97	0.14	2.21	5.12	5.42	1.83
Azerbaijan	13.69	0.17	-44.27	15.40	29.27	3.14
Georgia	3.71	0.16	2.65	8.16	6.81	1.56
Kazakhstan	74.85	0.37	-88.02	69.21	225.78	13.88
Kyrgyzstan	4.13	0.36	2.52	9.59	9.51	1.74
Russian Federation	756.59	0.35	-564.94	740.42	1659.03	11.59
Tajikistan	2.27	0.15	0.63	13.87	2.74	0.34
Turkmenistan	25.57	0.54	-42.03	9.70	63.82	12.34
Uzbekistan	48.28	0.52	-8.46	43.32	111.14	3.89
North and Central Asia	**932**	**0.35**	**-740**	**915**	**2114**	**9.47**
Asia and the Pacific	**6579**	**0.22**	**386**	**8838**	**16849**	**3.95**
World	**13371**	**0.19**	**-**	**18915**	**31734**	**4.48**

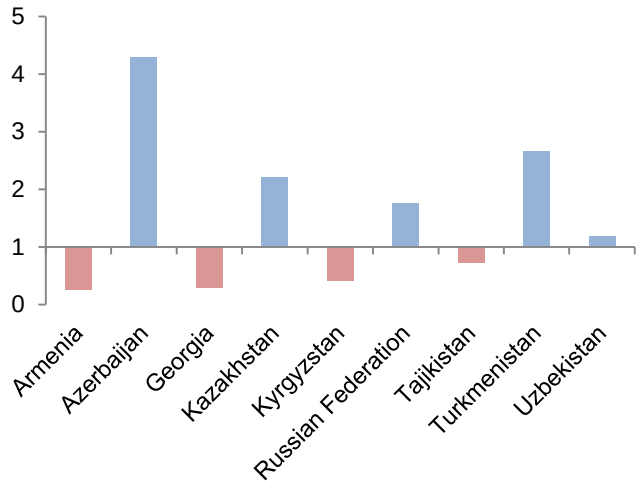
*Note: *Total Primary Energy Supply*[4]
Source: Asia Pacific Energy Portal, ESCAP Statistical Database, IEA

This Information Brief is issued without formal editing. It is prepared by Hong Pum Chung under the overall guidance of Tiziana Bonapace, Head, Subregional Office for North and Central Asia (SONCA), ESCAP with contributions from Nikolay Pomoshchnikov of ESCAP SONCA and Sergey Tulinov of ESCAP Environment and Development Division.

Energy in North and Central Asia

The NCA subregion as a whole is a net exporter of energy led by the Russian Federation, the 2013 world's top exporter of natural gas, second exporter of oil and third exporter of coal. Kazakhstan and Turkmenistan are also perennial top ten exporters of coal and natural gas, respectively.[5] Azerbaijan and Uzbekistan are net energy exporters as well. On the other hand, Armenia (74% of TPES[4] is imported) and Georgia (71%) rely heavily on energy imports. Tajikistan and Kyrgyzstan are also net importers but import comparatively less by utilizing their significant hydroelectric potential. The varying endowment of energy resources is also reflected in the energy self-sufficiency ratios (total energy production/TPES) for the NCA countries.

Figure 1: 2012 energy self-sufficiency ratios for North and Central Asian countries



Source: Asia Pacific Energy Portal

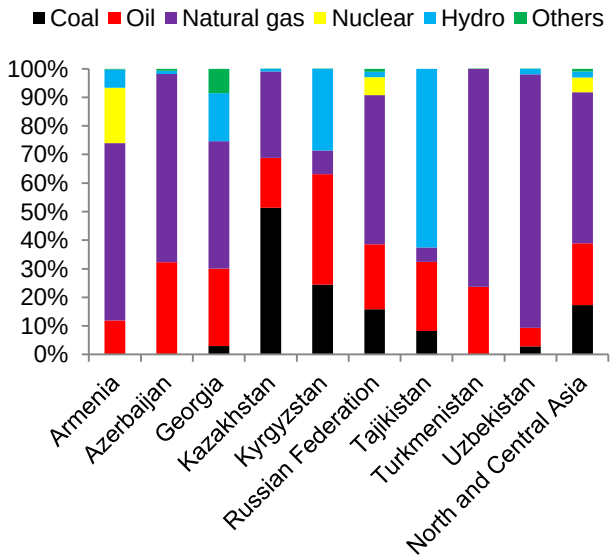
The NCA subregion accounts for around 7 percent of the global TPES while representing only 3 percent of the total world population. NCA's Energy intensity (0.35 toe/thousand 2005 USD) is almost double of that of the World (0.19) and significantly higher than the Asia Pacific region (0.22) including China (0.29). Likewise, the CO_2 emission per capita (9.47 kg of CO2 per capita) of NCA is significantly higher than the Asia Pacific (3.95) and the World (4.48).

Energy industry is one the main contributor to this high energy intensity and emissions levels. Production of energy including extracting and refining are energy intensive, accounting for more than 30% of global energy consumption[5]. While the economic structure (i.e. industrialized), climate, geographic size also contribute, the high energy intensity is also attributable to low energy efficiency from lack of regular investments[6].

Energy efficiency can be defined as the output of economic activity relative to the input of energy. It is often referred to as the "invisible fuel" as it has a significant impact on the consumption of energy as well as carbon emissions. Improving energy efficiency can have a remarkable impact on reducing energy consumption. A study of 11 OECD countries has shown that since the 1970s energy efficiency improvements saved 1 337 Mtoe in 2011 or 743 billion USD in monetary terms.[7]

The fuel share profile of the subregion and the NCA countries as shown in Figure 1 are marked by a dominant share of combustive hydrocarbon fuels namely natural gas coal and oil. Since such fuels, especially coal and heavy oil products emit relatively more CO_2 per energy unit (emission factor) than other types of fuels, the high shares combustible fuels of TPES contribute to higher CO2 emissions in NCA countries.

Figure 2: 2012 fuel shares of TPES for North and Central Asian countries



Source: Asia Pacific Energy Portal

Non-hydro renewable energy is notably absent in the fuel shares of most NCA countries, accounting for less than 1% of the subregion's TPES.

Table 2: Renewable energy capacity of North and Central Asian countries

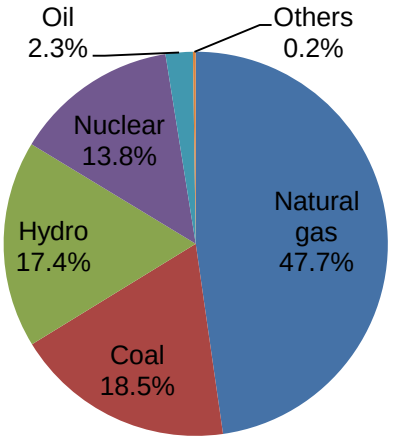
	Solar PV *(MW)*		**Wind** *(MW)*	
Country	Installed	Potential	Installed	Potential
Armenia	< 1	39,700	2.6	500
Azerbaijan	1.8	115,200	2.7	4,500
Georgia	< 1	9,6900	< 1	2,300
Kazakhstan	< 1	3,760,000	2.0	354,000
Kyrgyzstan	0.0	267,000	0.0	1,500
Russian Federation	< 1	n/a	15.4	n/a
Tajikistan	< 1	195,000	0.0	2,000
Turkmenistan	0.0	655,000	0.0	10,000
Uzbekistan	< 1	593,000	< 1	1,600

Source: UNDP in Europe and Central Asia and IRENA

As shown in Table 2, many NCA countries have considerable solar photovoltaic and wind energy potential. For instance, both Kazakhstan and Turkmenistan have the potential to produce electricity from renewable sources many times the current and even forecasted electricity demand. Besides solar and wind energy, Kyrgyzstan and Tajikistan have substantial potential for small hydro power plants (those less than 10 MW).

In NCA, 84% of the total electricity is generated from hydrocarbon fuels with natural gas (47.7%) constituting nearly half of the total. The national electricity generation fuel mix is diverse: Turkmenistan relies entirely (100%) on natural gas for electricity generation while almost all of Tajikistan's electricity is generated from hydropower (99.7%). Three quarters of Kazakhstan's electricity is generated from coal; nearly 30% of Armenia's generation comes from nuclear power.

Figure 3: 2012 fuel shares of electricity generation for North and Central Asian countries



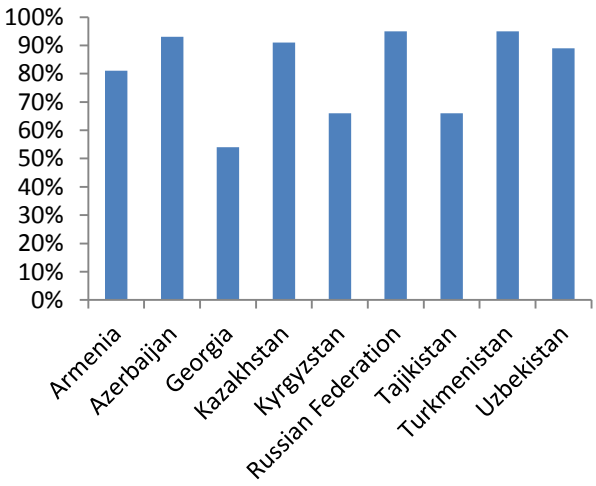
Source: Asia Pacific Energy Portal

In the subregion, national transmission lines perform on par with world average of around 10% transmission losses[8]. Given the massive size of the subregion (it is the largest subregion by land mass) and relatively low population density, national grids are well functioning despite adverse conditions. The grid stability is partly due to the subregion's integration in the Unified Power System (UPS). A legacy of the former USSR, the system is a wide-area synchronous transmission grid with shared technical standards and centralized operations. The integrated system offers other potential benefits such as trade of electricity that can help countries diversify their generation portfolio.[9]

However, after independence in 1991, the UPS of Central Asia came to experience severe difficulties in its joint management and operation. In 2003, Turkmenistan disconnected its electricity lines from the Unified Power System. In 2009, Uzbekistan, which houses the central dispatch unit, disconnected its electricity lines from Tajikistan which leaves Tajikistan isolated from the UPS, unable to import and export electricity to the UPS via Uzbekistan's electricity networks.[10]

The subregion fares notably well in terms of access to energy. According to the Asia-Pacific Energy Portal, nearly 100% of the rural populations have access to electricity in 2010 for most NCA countries. Access to non-solid fuels, which tend to be cleaner (less emission) and more efficient than solid fuels such as coal and charcoal, has potential for further improvements.

Figure 4: 2010 access to non-solid fuels for North and Central Asian countries



Source: Asia Pacific Energy Portal

The heavy reliance on hydrocarbon fuels, high energy intensity, elevated emissions levels and low share of renewable energy simply reflect the current economic realities of the NCA subregion and should not be interpreted as discouraging signs for the future. On the contrary, the current state can be viewed as a significant potential for energy efficiency improvements and renewable energy growth.

Regional Energy Integration

The notable differences in the endowment of natural resources throughout the subregion make energy trading a priority in enhancing energy security. Energy trading is currently taking place within the subregion, but limited mainly to bilateral agreements between neighboring States. The need to strengthen multilateral power connectivity and trade frameworks in order to optimize the allocation of energy resources through a more efficiently accessed and distributed system using integrated energy planning and trading will be discussed in information note no.3. Suffice it to note in this information brief that various initiatives on

power trade are under consideration of such subregional intergovernmental bodies as Eurasian Economic Commission and Electric Power Council of the CIS. It is important to note the CASA-1000 flagship project of Central Asia-South Asia Regional Electricity Market aimed at trading surplus summer month hydroelectricity from Kyrgyzstan and Tajikistan to Afghanistan and Pakistan[11].

The Asian Energy Highway concept, developed by UNESCAP, plans to enhance energy security through power connectivity by integrating regional power grid and electricity markets through intergovernmental energy cooperation. The concept is focused on optimizing all resources including renewable energy. This presents an opportunity for integration of renewable energy resources, as larger grids are typically more robust in managing and balancing intermittent energy supplies such as wind and solar energy. Furthermore, harmonized regional energy investment and institutional development would naturally enable more efficient yet flexible integration in the longer-term.[9]

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[1]Ómarsdóttir and Lindner. United Nations University (2015). *We Need Concrete Targets for Sustainable Energy.* http://unu.edu/publications/articles/concrete-targets-sustainable-energy.html

[2]United Nations (2015). *Sustainable Development Goals.* https://sustainabledevelopment.un.org/topics

[3]EXPO-2017 ASTANA (2014). *The key concepts of Astana EXPO2017.* https://expo2017astana.com/en/energy/klyuchevyie-ponyatiya

[4]Total Primary Energy Supply is calculated by adding production and imports, subtracting exports and accounting for stock changes. It is an indicator of the total supply to be consumed within the defined boundaries (countries, regions, etc.)

[5]International Energy Agency (2014). *Key World Energy Statistics 2014.* Paris, France

https://www.stratfor.com/analysis/central-asian-energy-special-series-part-1-problems-within-region

[11]Information on CASA-1000 projected. http://www.casa-1000.org/ accessed 20 October 2015.