STREACS Strengthening Energy Transition Research in Armenia

Energy Security in the South Caucasus

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Overview of the presentation

- Energy security: an elusive concept
- Historical roots of present challenges to energy security in the South Caucasus – from an integrated (regional) energy system to national energy systems
- Energy balances of the countries of the South-Caucasus today
- Policies for the future

Energy security: a multidimensional concept

- Defining energy security is an elusive task. Sovacool (2010) identifies 45 different definitions of energy security utilized in practice.
- All these definitions emphasize the importance of *continuity and reliability of energy trade relationships* as well as the *importance of reasonable prices.* Other dimensions of energy security mentioned in the literature are (among others) sustainability, technical and regulatory aspects.

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ES for energy importing and for energy exporting countries - 1

- One of the main lines along which energy security definitions differ is whether the country is an **energy importer** or an **energy exporter**.
- In the first case, the main emphasis would be on **security of supply**, while for the latter the emphasis would be **security of demand** (although the satisfaction of domestic energy demand at affordable prices remains important).

ES for energy importing and for energy exporting countries - 2

- Net energy importers can increase their energy security by increasing domestic energy production (when possible), increasing energy efficiency, and diversifying their suppliers.
- Net energy exporters, on the other hand – especially when the energy sector represents a large share of GDP and exports – may want to save some of their revenues (buffer) and diversify their customers and their economy.

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South-Caucasus energy systems under the Soviet Union - 1

- Under the Soviet Union, the energy infrastructure of the region was developed in an integrated manner.
- In particular, the TransCaucasus electrical grid was designed as regional integrated power system within the Soviet energy system, and not as three independent energy systems.

South-Caucasus energy systems under the Soviet Union - 2

- Dispatch and planning decisions ensuring the smooth functioning and the stability of the electric grid for all three countries were integrated within the planning decisions of the regional system.
- The structure of the regional integrated power system was shaped taking into account the availability of energy sources in the three countries.

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Armenia within the integrated Transcaucasus power system

- In Armenia Soviet planners built a nuclear power plant - that delivered the base load - complementing it with gas and hydro power plants.
- Gas and nuclear power plants, however, were running on imported fuel, with significant amounts of gas coming through Azerbaijan, and nuclear fuel coming exclusively from Russia.

Azerbaijan within the integrated Transcaucasus power system

- Azerbaijan was a net supplier of fossil fuels to the rest of the region and of the Soviet Union.
- Its contribution to the TransCaucasus electrical grid came mostly from fossil-powered thermal power plants, providing medium-load. Thermal power generation was complemented by limited hydropower generation.

Georgia within the integrated Transcaucasus power system

- Georgia, with the largest hydropower potential, contributed with the electricity generated by its hydropower plants to cover the peak-load supply.
- Hydropower generation was complemented to a limited extent by thermal power generation, relying – as in the case of Armenia – on imported materials

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Collapse of USSR and disintegration of the TC energy system

- In the early 90’s, the SC countries found themselves facing serious challenges in securing a stable and reliable provision of energy services to the population and to the economy.
- This was due to the cessation of Soviet planners’ coordination, and to the internal and external conflicts occurring in the 1990s, leading to political instability and to the disruption of critical infrastructure.

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From the end of the 90’s to today - 1

- The three countries of the SC pursued different paths to ensure their energy security.
- **Armenia,** due to the closure of the borders with Türkiye and Azerbaijan, could receive energy supplies only through Iran and Georgia (gas from Russia) to cover the gap between internal production (renewables and nuclear) and demand. To reduce dependency and increase its energy security, Armenia aimed to develop its renewable energy base and increase energy efficiency.

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From the end of the 90’s to today - 2

- **Azerbaijan** capitalized on its large fossil fuel endowment. It established international partnerships to develop its oil and gas fields, extract the fossil fuels and bringing them to the international markets. Two key steps in this direction where the construction of the South Caucasus Pipeline and of the the Baku-Tbilisi-Ceyhan Pipeline.
- Internally, the abundance of cheap fossil fuels supported the expansion of TPP generation capacity and helped satisfy the increasing energy demand.

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From the end of the 90’s to today - 3

- **Georgia’s** strategy to increase its energy security in the early 2000s has been focusing mainly on two directions: 1) expanding its hydropower installed capacity; 2) becoming a transit country for energy flows (fossil fuels and electricity).
- This allowed Georgia to cash transit fees in USD, to cover a substantial part of its gas needs through the gas provided by transit agreements, and to increase its geopolitical relevance.

The SC today: 3 countries facing heterogeneous challenges

- The three countries of the SC differ significantly in terms of their energy resources endowment and the the structure of their economies, therefore, their energy security concerns differ as well.
- In the coming slides we will be reviewing the energy balances of the three countries and discuss their main challenges.

Today: Armenia

Armenia, remains an **energy importer (80% of TPES)**. Only renewables are available domestically, covering approximately 8.5% of TPES.

Unit of measure is KTOE	**Coal**	**Oil and oil products**	**Natural Gas**	**Renewables**	**Nuclear**	**Electricity**	**TOTAL**
Production				338.9	741.6		1080.6
Imports	11.5	727	2450.6	14.2		10.6	3213.8
International Aviation bunker		-103.4					-103.4
Exports		-0.4		-0.4		-135.1	-135.9
Stock changes		-28.5	-23.3				-51.7
TPES							4003.4
DEP. RATIOS	100%	100%	100%		100%		

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SOURCE: Scientific Research Institute of Energy, 2024 – year 2022 values

Today: Azerbaijan

Azerbaijan is an **energy exporter.** Oil and gas make up for more than 90% of total exports (with gas exports concentrated among a limited number of countries) and the energy sector contributes to about one-third of GDP.

Unit of measure is KTOE	Oil and oil products	Natural Gas	Renewables	Nuclear	Electricity	Other fuel products	TOTAL
Production	33,593.2	32,613.5	245.1				66451.8
Imports	1,412.7	1,449.9			11.8	13.4	2887.8
Exports	-28,395.5	-21,118.4			-257.8		-49771.7
International bunkers	-454.0						-454
Stock changes	-523.8	64.7	0.6				-458.5
TPES							18666.9

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SOURCE: AZSTAT, 2024 – year 2022 values

Today: Georgia

Georgia, **energy importer, transit country for gas and oil** from Azerbaijan to Türkiye and EU. Domestic production of energy covers approximately 22% of TPES.

Unit of measure is KTOE	**Coal**	**Oil and oil products**	**Natural Gas**	**Hydro**	**Geoth. Solar wind etc.**	**Biofuel and waste**	**Electricity**	**TOTAL**
Production	59.4	37.2	12.5	926.2	27.8	208.7		1271.8
Imports	158.6	1534.3	2872.9				403.6	4969.4
Exports		-52.8				-0.6	-355.2	-408.6
International bunkers		-139.3						-139.3
Stock changes	18	19.5						37.5
DEPENDENCY	79.3%	97.3%	99.6%					
TPES								5730.8

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SOURCE: GEOSTAT, 2024 – year 2022 values

Strategies for increasing energy security: Armenia

- Given its high level of energy dependency, and the fact that imports are concentrated among a limited number of countries, Armenia's pursuit of energy security needs to move simultaneously on different fronts:

1. Energy efficiency
2. Development and exploitation of renewable energy sources
3. Diversification of suppliers

Strategies for increasing energy security: Georgia

- Despite a slightly better situation in terms of energy dependency, and its key role as an energy transit country, also Georgia's pursuit of energy security needs to move simultaneously on different fronts:

1. Energy efficiency
2. Development and exploitation of renewable energy sources
3. Diversification of suppliers

Strategies for increasing energy security: Armenia and Georgia - 1

- Each of the necessary actions presents challenges and require substantial investments.
- Increasing energy efficiency will require the progressive implementation of stricter efficiency standards in the various sectors of the economy, both among businesses and the public, as well as the design of incentives (including the proper pricing of energy) for the pursuit of energy efficiency.

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Strategies for increasing energy security: Armenia and Georgia - 2

- Increasing the contribution of renewable energy sources to the energy system raises issues related to their stability, security, and reliability, and requires the implementation of additional measures to address these challenges (such as the development of commensurate baseload capacity and peak load capacity and an improvement in demand management practices).

Strategies for increasing energy security: Armenia and Georgia - 3

- The plans to develop additional nuclear power installed capacity (in Armenia), together with pumped hydro (in both Armenia and Georgia) and or additional dams with reservoirs (in Georgia), and stronger interconnections with neighboring power grids (in the case of Georgia, potentially even with the EU grid), go in this direction and look promising, especially if coupled with an upgrading of the power grid and the introduction of demand management practices.

Strategies for increasing energy security: Armenia and Georgia - 4

- Finally, the attempt to diversify the suppliers of imported energy sources appears more challenging, especially for Armenia, given the current geopolitical situation.
- However, both countries should continue their efforts in this direction.

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Strategies for increasing energy security: Azerbaijan - 1

- The energy security concerns for Azerbaijan, differently from those of Armenia and Georgia, are more heavily skewed towards the dependency of its economy from the revenues associated with the energy sector and, therefore, its vulnerability to shocks affecting global energy markets and to the increasing efforts to reduce carbon emissions at the world level.

Strategies for increasing energy security: Azerbaijan - 2

- Another important challenge faced by Azerbaijan is reducing the negative environmental impacts associated with the functioning of its energy system and encourage the diversification of the economy.
- For this purpose, the Azerbaijani government is pursuing a diversification strategy in terms of customers, but also attempting to accelerate investments in the renewable energy and energy efficiency, anticipating the decline in fossil fuels.

Strategies for increasing energy security: Azerbaijan - 3

- By reducing the growth of internal energy demand and both generating and freeing more “clean electricity” for exports, the hope of the Azeri government is that this may help Azerbaijan reposition itself as a “green energy” exporter and help cushion the negative impacts caused by the transition of the world economy away from fossil fuels.

Conclusions/reflections

- All SC countries are facing substantial energy security challenges over the medium term, that require substantial transformations in the energy system structures as well as in their economic structures.
- On the positive side, all SC countries have the potential to overcome their challenges, given their natural resources endowment.
- The adjustment could be also facilitated by the stabilization of international relations among them and by increased cooperation.

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Thank You

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