

The independent development of renewable energy resources — and especially solar energy production, in the short term — may present the best opportunity for both intrastate and interstate autonomy in the South Caucasus

Energy Security in Armenia and the South Caucasus

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The independent development of renewable energy resources — and especially solar energy production, in the short term — may present the best opportunity for both intrastate and interstate autonomy in the South Caucasus, and may particularly benefit the Republic of Armenia, whose current energy portfolio is almost entirely supplied, owned, and, until recently, operated by Russia.

BACKGROUND

Surrounded by the present-day regional powers of Turkey, Russia, and Iran, the South Caucasus has long been a strategic area of conquest and conflict. Once part of the Silk Road, the ancient region was governed by small kingdoms alternately subjected to occupation by various empires throughout the centuries. The existing borders dividing the tiny republics of Georgia, Armenia, and Azerbaijan were drawn when all three nations were under Soviet rule.

Following the dissolution of the USSR, breakaway territories and ethnic identity conflicts have dominated state-level politics in the region. Historically tense relations and triangulated alliances continue to foster a tenuous peace, pockmarked by regular acts of violence in conflict zones, and a normalized, heightened state of anxiety over the looming possibility of seemingly spontaneous and exponential escalation of violence permeates the borders of each country. Particularly along the Line of Contact in Nagorno-Karabakh, the site of the first ethnically motivated territorial conflict in the post-Soviet era, sniper attacks remain common, with occasional shelling that claim civilian casualties (usually villagers).

CURRENT GEOPOLITICAL REALITY IN THE REGION

Although popular sentiment regarding Western and Russian influence in Georgia has vacillated since its Rose Revolution in 2003, Georgian civil society actors

continue to invite Western interest and support, and Tbilisi remains the regional hub for Western institutions. Azerbaijan receives substantial Turkish military support and Western financial investment, and it recently entered into a \$5 billion arms deal with Russia, financially and politically empowered by its years of hydrocarbon exports to the West, mere months before President Aliyev escalated military campaigns against Armenians in Nagorno-Karabakh, with Russia subsequently re-entering the stage as the region's longstanding peacekeeper.¹

Russia also boasts the largest Armenian diaspora community in the world and retains its Soviet-era popularity among many Armenians as the only major power in the region with both the interest and the capability to defend Armenia's borders. Thus, Armenia's participation in various Russian-led political and economic agreements has earned it continued Russian military support.² This participation has also led to Russia's near-total ownership of Armenia's utilities, including hydropower, gas-powered thermal, and nuclear-energy production and, until widespread opposition led to a change in ownership in 2015.³ Despite Armenia's close relationship with Russia — and, perhaps, in part because of it — the U.S. invested heavily in its modern embassy in Yerevan, which was the largest U.S. embassy in the world upon its completion in 2005 and is now second in size only to the U.S. embassy in Baghdad.⁴

Turkey, at once a formidable regional power and an extensively criticized, stalled European Union-member candidate, had ostensibly kept its border closed in solidarity with its "little brother," Azerbaijan. However, it has been widely noted that energy demand for domestic consumption, as well as the potentially significant economic benefit in developing the country as a regional "energy hub," is likely influencing Turkey's policy decisions in the region.⁵ Since then, Turkish President Erdogan's regime has fostered a sharp rise in hyper-nationalism and human-rights violations following a failed coup.⁶ Thus, despite international interest to see the



Sevan, Armenia. Lake Sevan (ReflectedSerendipity / CC BY-SA 4.0)

Turkish-Armenian border opened, it appears that optimism for a new age of mutually beneficial political and economic development has all but expired, with Armenian leadership recently declaring that existing negotiations are invalid and that Armenia will only revisit such discussions under “new conditions.”⁷

Whereas Armenia may have once enjoyed the options of appealing to U.S. institutions as leverage against Russia’s control or hedging against the ever-present possibility of increased aggression along either of its two closed borders, relations between current U.S. leadership and leadership in Russia and Turkey, respectively, have largely confounded previously established presumptions regarding U.S. diplomatic intentions in the region, especially as they would pertain to Armenian interests.⁸ Likewise, the last several years of cautiously warming U.S.-Iran relations have given way to uncertainty under the new U.S. administration, and any strategic advantage that Armenia might have contemplated in its negotiations with the U.S. owing to its strong relationship with Iran has likely dissipated, as well — at least for the moment.

Similar to major foreign investment in nearby countries, such as Ukraine, Western interest in the South Caucasus has largely been tied to the control of natural resources, with the most significant projects centered around hydrocarbon exploration and exploitation and

the development of necessary transit infrastructure (i.e., oil and gas pipeline construction).⁹ Additionally, not unlike the geopolitical implications of natural-resource exploitation efforts in Ukraine over the long term, significant Western investment in Azerbaijan to develop oil deposits in the Caspian Sea has shaped the power dynamic in the region.¹⁰ This development has allowed Azerbaijan to leverage control over its pipelines to stunt Turkish-Armenian rapprochement discussions aimed at opening the Turkish-Armenian border.¹¹

EXISTING ENERGY SOURCES AND PRODUCTION, AND GROWING PUBLIC CONCERN

One-third of Armenia’s electricity is currently produced by large hydropower plants utilizing Armenia’s rivers and famed Lake Sevan. Environmental degradation of water resources has been exacerbated by agricultural runoff and insufficient wastewater treatment, but large-scale hydropower continues to supply roughly one-third of the country’s power and is generally considered a reliable, relatively safe energy resource.

Metsamor, the Chernobyl-era nuclear power plant that had been decommissioned due to safety concerns shortly after the dissolution of the USSR, then re-commissioned in 1994 in response to the energy crisis

during the war over Nagorno-Karabakh, continues to be fueled and operated by Russia. Spent rods from decades of energy production, which were originally expected to be returned to Russia for disposal, remain onsite in the seismically active country. Despite multiple upgrades to keep the plant running, Metsamor has earned a widespread reputation as one of the most dangerous nuclear power plants in Europe and possibly the world.¹²

In February 2009, Armenian authorities announced that Australia would construct a new plant with 1,000 to 1,200 megawatt (MW) capacity at a cost of \$5 billion, with construction to begin in 2011.¹³ In December 2009, a Russian-Armenian joint venture was agreed upon for a reactor with 1,060 MW capacity at the current Metsamor site (also for \$5 billion), and in May 2010, plans to begin construction in 2013 were arranged. In May 2015, the Armenian parliament agreed to a \$30 million grant from Russia and a loan of \$270 million to upgrade from 376 MW output to 435 to 440 MW and to extend the operation of the existing plant from 2016 through 2026.¹⁴ Current projections estimate that construction will commence in 2018.¹⁵ While some experts claim that Metsamor complies with international operational safety standards, most Armenians acknowledge that the plant has outlived any reasonably extended timeframe but point out that there are no viable energy alternatives to replace it.¹⁶

The remaining one-third of the Armenia's energy supply comes from Russian natural gas. In December 2013, Armenia and Russia reached an agreement that gave Russia's Gazprom full ownership of Armenia's gas utility company in exchange for a reduced gas price to Armenia from 2014 to 2018.¹⁷ The agreement was immediately considered controversial, as the price was only "reduced" from an unexpected and unexplained increase in gas and electricity prices, which were announced in June 2013 and followed almost immediately by the announcement that Armenia would join the Eurasian Economic Union.¹⁸ Electricity prices continued to increase as Gazprom announced a reduction in end-user tariff prices in Europe.¹⁹

As a particularly brutal winter wore on into 2014, public discontent over the Russian gas deal continued to gain momentum.²⁰ Finally, the electricity-rate hike that followed the decision of the Public Services Regulatory Commission (PSRC) to dismiss claims of misuse of funds by the Russian state-owned Electric Networks

of Armenia (ENA) culminated in June 2015 over a two-week period of public demonstrations, collectively referred to as #ElectricYerevan. There seemed to be two separate, but concurrent, motivations among the demonstrators — to protest the decision either as a product of local corruption or as a symptom of chronic overdependence on Russia.²¹ The government then announced an "internal audit" of the PSRC's rate decision and an interim "subsidy" to cover the difference in end-user cost, an amount paid by a wealthy Russian-Armenian businessman, Samvel Karapetyan, and matched by the government by borrowing from other parts of the official budget. Karapetyan eventually purchased ENA and received full government approval to operate the country's electricity distribution grid in 2017. The move was generally seen as a compromise between those who opposed Russian-state control of the utility and those who prioritized a more pragmatic financial approach in response to protests. In October 2017, the Armenian Oil and Gas Company LLC was registered and traced back to Karapetyan.²² In February 2018, the same company was reportedly granted exploratory permits for oil and gas reserves in locations throughout the country.²³

Some within the Armenian government have also pointed to the July 2015 sale of the Vorotan hydropower project in Syunik Marz to Contour Global, a U.S.-owned firm, as an indicator that the country's leadership is committed to diversifying its energy portfolio.²⁴ This was followed by Russian-controlled RusHydro's 2017 announcement of intentions to sell Armenia's largest hydropower facility, the Sevan-Hrazdan Cascade, although no such sale has since been reported.²⁵

Armenia is particularly well suited for the adoption of solar technologies, and advancements have been made in both private-sector onsite photovoltaic (PV) systems and public-sector initiatives to test utility-scale installations for domestic consumption as well as for export.²⁶ In early October 2015, Yerevan hosted an international conference focused on energy efficiency and renewable energy policies.²⁷ Following this conference, the U.S. Department of State's Office of Global Partnerships hosted a U.S.-based delegation of energy experts, academics, and entrepreneurs to meet with Armenian government officials, faculty of local academic institutions, and various private-sector representatives, in order to explore international options for private investment in Armenia's energy sector and specifically in renewable energy options.²⁸ Emerging solar-industry actors in

Armenia have also highlighted the role of solar in reducing greenhouse-gas (GHG) emissions to mitigate climate-change impacts in the country as well as to reduce the country's carbon footprint, a popular issue among the majority of Armenians.²⁹

As of March 2018, three 1 MW commercial solar plants and a 55 MW plant have reportedly been installed with substantial foreign funding, and they will soon be under construction, according to Hayk Harutyunyan, Armenia's Deputy Minister of Energy and Natural Resources.³⁰ Grid integration has the potential to effect large-scale shifts in existing political paradigms with an acceptable rate of return for private investors. It is no coincidence that several international banks and development agencies have prioritized regional grid integration and electricity exports among their funding goals in the South Caucasus.³¹

However, while distributed generation schemes can offer a number of benefits, they are necessarily integrated into existing delivery infrastructure. Thus, they are susceptible to globally recognized vulnerabilities including network security, aging materials and costly maintenance, dependency on finite and environmentally unsafe fuel sources, service problems due to privatization, and the political manipulation of ownership, operations, and

end-user pricing schemes.³²

By contrast, increased private funding to promote a diversified profile of solar-energy technologies and products — including potential major investment in off-grid projects — would be more likely to reduce political dependence on Armenia's aging nuclear power plant, Metsamor, and on natural gas imports than relying solely on grid-integrated projects funded by and for conventional development and state actors. The Ministry of Energy and Natural Resources has already publicly supported a solar-panel manufacturing facility, which is currently under construction, and has announced that its imported materials will be tax-exempt.³³ Expansion in the type of solar-industry production could attract other private-sector investors, such as Tesla, to operate a fully independent, large-scale, off-grid, zero-emissions solar-power factory, which could eliminate grid transmission losses via battery production and export for residential and commercial buildings, and could even feed other burgeoning industries such as electric vehicle production. Such an industry expansion could establish Armenia's role as not just an energy exporter, but as a regional industry hub.

Tesla, which has already begun production at its Gigawatt 1 Factory in the American Southwest, projected



Cooling towers of the Armenian Nuclear Power Plant, also known as Metsamor (Buoar / CC BY-SA 4.0)

an initial annual output capacity of fifty gigawatt hours (GWh) and a 150 GWh output capacity upon completion in 2020.³⁴ The Gigawatt 1 project cost is \$5 billion — identical in cost to the new nuclear power plant that Armenia has been looking to construct within the next ten years.³⁵ Granted, Elon Musk may have recently waded into historically linked political controversy following his visit with Erdogan in Turkey, separate from Tesla's stock values and ongoing debates about the company's resiliency.³⁶ But, where any good controversy exists, so exists an opportunity. An invitation to discuss investment in Armenia could balance public reaction to Musk's apparently limited understanding of Atatürk's legacy and could afford Armenia a potential additional avenue for solar industrial development, the implementation of which would not require the government to procure additional loans to be eventually repaid by end users.

Additionally, increasing the number of community-scale installations and energy-efficiency measures in residential and commercial buildings could further empower grassroots efforts toward economic stabilization and growth, especially in marginalized populations. While electrification reaches most rural areas, other important resources, such as water pipelines in some towns, and otherwise depressed localized economies create significant challenges for end users to maintain payments for even basic amenities. Depending on whether an installation is commissioned for profit or if its operation and maintenance is community-based, small-scale solar projects funded by philanthropic organizations and foundations could be designed to decrease or eliminate end-user costs and could even power small-business growth in targeted areas.

As the presence of grid-connected Armenian solar energy production increases, it is imperative to keep in mind that it is entirely possible that end-user prices will once again become untenable for the average Armenian resident, especially as investment loans for new solar facilities become due. Rather than simplistically paint the tens of thousands of #ElectricYerevan protesters as young and aimless troublemakers, a portrayal unfortunately supported by the refusal of self-described leadership of the massive and extended demonstrations to negotiate with the government, the Armenian government could instead undertake a more forward-thinking, proactive, and inclusive approach to encourage public acceptance of rate changes.³⁷

LOOKING FORWARD: A VARIETY OF OPTIONS

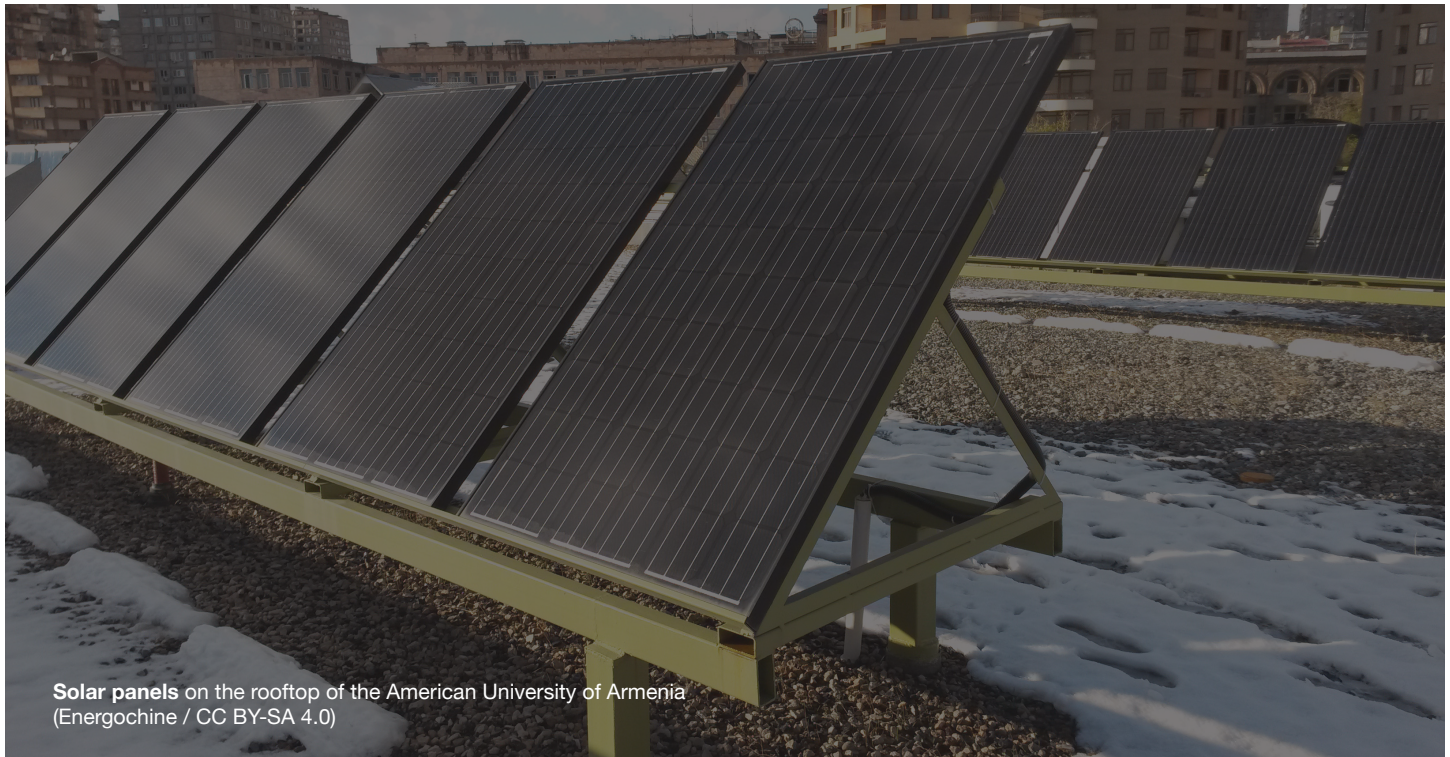
The adoption of a transparent public comment mechanism — widely considered a central function of utility regulatory commissions — could certainly help the government avoid hurriedly announced, awkwardly opaque, and privately matched emergency “subsidies.” Such an adoption would also help facilitate the subsequent transfer of the entire electricity distribution grid to private ownership in response to future and ostensibly routine rate changes. Likewise, a functionally transparent regulatory commission would preclude future need for the government to hire private consultants to conduct emergency “internal audits” following commission approval of rate changes.

If Armenia were to successfully attract independent, private-sector investment for an independently operated solar-technology production focused on off-grid products for domestic use and for export, the resulting economic benefit could offer an opportunity to shift away from political dependence on Russian fuel imports.³⁸ This would eventually strengthen Armenia's autonomy while increasing opportunities for market-based and private partnerships throughout the region.

CONCLUSION

Energy security considerations present both a challenge and opportunity for Armenia's political independence. While plans to increase solar-energy production in the country are just beginning to take shape, there appears to be widespread government and public support for its expansion.

As one Armenian official has pointed out, the successful establishment of solar-energy production in Armenia will depend on the competitiveness and reliability of tariff schedules.³⁹ If recent events are any indication, reliable collection of payment from end users (i.e., Armenian residents) will require more than flooding the market with foreign investment in solar projects and must include improved governance measures, such as public outreach and engagement mechanisms that offer regular access to information regarding important policy changes. Given the current transition of the Armenian government to a parliamentary system, which is widely expected to support an indefinite extension of power to the current leadership, support for an informed, en-



Solar panels on the rooftop of the American University of Armenia (Energochine / CC BY-SA 4.0)

gaged, and empowered public is as important as ever.

The adoption of renewable energy, and particularly solar energy in the short term, offers Armenia an opportunity to achieve at least one aspect of political independence in an otherwise complex nexus of geopolitical interdependency mired in multiple longstanding feuds and questionably beneficial alliances.

¹ Enjoli Liston, "Azerbaijan's president threatens war with Armenia via Twitter," *The Guardian*, August 7, 2014, <<https://www.theguardian.com/world/2014/aug/07/azerbaijan-president-threatens-war-armenia-twitter>> (accessed April 8, 2018); Matthew J. Bryza, "Two Surprising Proposals for Peace in the Nagorno-Karabakh Conflict," *Atlantic Council*, August 18, 2016, <<http://www.atlanticcouncil.org/blogs/new-atlanticist/two-surprising-proposals-for-peace-in-the-nagorno-karabakh-conflict>> (accessed April 8, 2018).

² Robert Coalson, "News Analysis: Armenia's Choice Stirs Competition Between Moscow, EU," *Radio Free Europe/Radio Liberty*, September 4, 2013, <<https://www.rferl.org/a/armenia-russia-customs-union-eu-analysis/25095948.html>> (accessed April 8, 2018); "102nd Military Base," *GlobalSecurity.org*, <<https://www.globalsecurity.org/military/world/russia/102-military-base.htm>> (accessed April 8, 2018).

³ "Tashir Group to Acquire Armenian Electric Networks from Inter RAO," *Asbarez*, September 30, 2015, <<http://asbarez.com/140291/tashir-group-to-acquire-armenian-electric-networks-from-inter-rao/>> (accessed April 8, 2018).

⁴ "USA Embassy Complex in Yerevan, Armenia," *MLL Industries*, <<http://www.mllindustries.com/en/projects/usa-embassy-complex-yerevan-armenia>> (accessed April 8, 2018); "New U.S. Embassy in Iraq cloaked in mystery," *NBC News*, April 14, 2006, <http://www.nbcnews.com/id/12319798/ns/world_news-mideast_n_africa/t/new-us-embassy-iraq-cloaked-mystery/#.WsqQHdPwY3E> (accessed April 8, 2018).

⁵ Serkan Demirtas, "Turkey as an Energy Hub?," *Hürriyet*, April 29, 2009, <<http://www.hurriyet.com.tr/turkey-as-an-energy-hub-11533899>> (accessed April 8, 2018); Hakob Chakryan, "Turkey's Policy Towards Armenia and Energy Security in the South Caucasus," *Turkish Policy Quarterly* 9 (2) (Summer 2010): 117-120.

⁶ "Turkey 2017/2018," *Amnesty International*, <<https://www.amnesty.org/en/countries/europe-and-central-asia/turkey/report-turkey/>> (accessed April 8, 2018).

⁷ Nathalie Tocci, Burcu Gültekin-Punsmann, Licinia Simão, and Nicolas Tavitian, *The Closed Armenia-Turkey Border: Economic and Social Effects, Including Those on People; and Implications for the Overall Situation in the Region* (Brussels: European Parliament, 2007); "Armenia Scrapping Protocols to Normalize Relations With Turkey," *Radio Free Europe/Radio Liberty*, March 1, 2018, <<https://www.rferl.org/a/armenia-turkey-yerevan-scrapping-protocols-normalize-relations/29071069.html>> (accessed April 8, 2018).

⁸ Conor Finnegan, "Trump Wants to Work with Putin Despite US Accusing Russia of Meddling Worldwide," *ABC News*, March 27, 2018, <<http://abcnews.go.com/International/trump-work-putin-us-accusing-russia-meddling-worldwide/story?id=54046980>> (accessed April 8, 2018); Ben Jacobs, "Turkish president: Trump Apologized for Indictment of Security Staff in Brawl," *The Guardian*, September 19, 2017, <<https://www.theguardian.com/us-news/2017/sep/19/turkey-trump-erdogan-apology-washington>> (accessed April 8, 2018).

⁹ Andrew E. Kramer, "Ukraine Looks to Texas for an Energy Path," *The New York Times*, May 4, 2011, <<https://www.nytimes.com/2011/05/05/business/global/05shale.html>> (accessed April 8, 2018).

¹⁰ Samuel Ramani, "Three Reasons the U.S. Won't Break with Azerbaijan Over its Violations of Human Rights and Democratic Freedoms," *The Washington Post*, January 20, 2016, <<https://www.washingtonpost.com/news/monkey-cage/wp/2016/01/20/3-reasons-the-u-s-wont-break-with-azerbaijan-over-its-violations-of-human-rights-and-democratic-freedoms/>> (accessed April 8, 2018).

¹¹ Barçın Yinanç, "Outreach to Armenia Prompts Azeri Threat," *Hürriyet*, April 2, 2009, <<http://www.hurriyet.com.tr/gundem/outreach-to-armenia-prompts-azeri-threat-11343529>> (accessed April 8, 2018).

¹² Marianne Lavelle and Josie Garthwaite, "Is Armenia's Nuclear Plant the World's Most Dangerous?," *National Geographic*, April 14, 2011, 1, <<http://news.nationalgeographic.com/news/energy/2011/04/110412-most-dangerous-nuclear-plant-armenia/>> (accessed April 8, 2018).

¹³ "New Armenian Nuclear Plant to be Twice as Powerful as Metsamor," *Asbarez*, May 18, 2009, <<http://asbarez.com/62581/new-armenian-nuclear-plant-to-be-twice-as-powerful-as-metsamor/>> (accessed April 8, 2018).

¹⁴ "Nuclear Power in Armenia," *World Nuclear Association*, March 2018, <<http://www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Armenia/>> (accessed April 8, 2018).

¹⁵ *Ibid.*

¹⁶ Lavelle and Garthwaite, 2.

¹⁷ "Russia to Supply Armenia Gas at Low Prices," *New Europe*, December 8, 2013, <<http://neurope.eu/article/russia-supply-armenia-gas-low-prices/>> (accessed April 8, 2018).

¹⁸ "Armenian Lawmakers Ratify Controversial Russian Gas Deal Amid Protests," *Radio Free Europe/Radio Liberty*, December 23, 2013, <<http://www.rferl.org/content/armenia-russia-gas-deal/25209474.html>> (accessed April 8, 2018).

- ¹⁹ Eurasianet, “Trouble Brewing as Russia Increases Natural Gas Prices to Armenia,” *OilPrice.com*, June 11, 2013, <<http://oilprice.com/Energy/Natural-Gas/Trouble-Brewing-as-Russia-Increases-Natural-Gas-Prices-to-Armenia.html>> (accessed April 8, 2018).
- ²⁰ “No Decrease in Price for Gas and New Monopolies for ‘Gazprom Armenia,’” *Lragir.am*, August 20, 2015, <<http://www.lragir.am/index/eng/0/country/view/34552>> (accessed April 8, 2018).
- ²¹ Richard Giragosian, “This is Not Armenia’s Maidan Moment – yet,” *Al Jazeera*, June 26, 2015, <<http://www.aljazeera.com/indepth/opinion/2015/06/armenia-maidan-moment-150625112125114.html>> (accessed April 8, 2018); See Lori Baitarian, “#ElectricYerevan: Anatomy of a Movement,” *CIVILNET*, July 1, 2015, <<http://civilnet.am/2015/07/01/electricyerevan-anatomy-of-a-movement/#.VmVJU3v1hDE>> (accessed April 8, 2018); and Karena Avedissian, “The Power of Electric Yerevan,” *OpenDemocracy*, July 6, 2015, <<https://www.opendemocracy.net/karena-avedissian/electricified-yerevan>> (accessed April 8, 2018).
- ²² Kristine Aghalaryan, “Billionaire Samvel Karapetyan Looking for Oil and Gas Reserves in Armenia,” *Hetq Online*, November 26, 2017, <<http://hetq.am/eng/news/83836/billionaire-samvel-karapetyan-looking-for-oil-and-gas-reserves-in-armenia.html>> (accessed April 8, 2018).
- ²³ See “Positive Opinion to ‘Tashir Capital’: Company Will Search for Oil and Gas in Shirak, Lori, and Tavush,” *EcoLur*, February 12, 2018, <<http://www.ecolorg.org/en/news/mining/positive-opinion-to-tashir-capital-company-will-search-for-oil-and-gas-in-shirak-lori-and-tavush/9914/>> (accessed April 8, 2018); and Kristine Aghalaryan, “Billionaire Samvel Karapetyan Exploring for Oil and Gas Around Yerevan,” *Hetq Online*, February 2, 2018, <<http://hetq.am/eng/news/85400/billionaire-samvel-karapetyan-exploring-for-oil-and-gas-around-yerevan.html>> (accessed April 8, 2018).
- ²⁴ Al Jazeera English, “The Stream - #ElectricYerevan: Bringing Power to the People in Armenia,” YouTube video, July 1, 2015, <https://www.youtube.com/watch?v=eGvE1_9lAck> (accessed April 8, 2018).
- ²⁵ Gregory B. Poindexter, “RusHydro Plans to Sell its 560-MW Sevan-Hrazdan Cascade Located in Armenia,” *HydroWorld*, June 6, 2017, <<https://www.hydroworld.com/articles/2017/06/rushydro-plans-to-sell-its-560-mw-sevan-hrazdan-cascade-located-in-armenia.html>> (accessed April 8, 2018).
- ²⁶ Republic of Armenia Scaling Up Renewable Energy Program, *Investment Plan for Armenia* (Yerevan: Republic of Armenia, 2014); G. Ayvazyan, V. Buniatyan, and A. Vardanyan, *Optimal Design and Use of PV Water Pumping Systems in Armenia* (Yerevan: State Engineering University of Armenia, 2008); See Becky Beetz, “Armenia on Track to Commission 10 MW, Announce New Utility-Scale PV Quotas,” *PV Magazine*, December 15, 2017, <<https://www.pv-magazine.com/2017/12/15/armenia-on-track-to-commission-10-mw-announce-new-utility-scale-pv-quotas/>> (accessed April 8, 2018); and Tamara Babayan, Areg Gharabegian, Artak Hambarian, Morten Sondergaard, and Kenell Touryan, “Report: Renewable Energy Potential in Armenia,” *The Armenian Weekly*, December 3, 2011, <<https://armenianweekly.com/2011/12/03/report-renewable-energy-potential-in-armenia/>> (accessed April 8, 2018).
- ²⁷ “Sixth International Forum on Energy for Sustainable Development,” *United Nations Economic Commission for Europe*, September 29, 2015, <[http://www.unece.org/index.php?id=39915#/#](http://www.unece.org/index.php?id=39915#/)> (accessed April 8, 2018).
- ²⁸ “U.S. State Department’s Renewable Energy POD Visits AUA,” *American University of Armenia*, October 8, 2015, <<http://newsroom.aua.am/2015/10/08/u-s-state-departments-renewable-energy-pod-visits-aaa/>> (accessed April 12, 2018).
- ²⁹ “Expert Accuses Armenian Authorities of Preventing Development of Solar Energy,” *Asbarez*, August 24, 2015, <<http://asbarez.com/139058/expert-accuses-armenian-authorities-of-preventing-development-of-solar-energy/>> (accessed April 8, 2018); Joseph R. Masih and Robert O. Krikorian, *Armenia: At the Crossroads* (Amsterdam: Harwood Academic Publishers, 1999), 1.
- ³⁰ Steve Hanley, “Using Solar Power As A Political Tool In Armenia,” *Clean Technica*, December 28, 2017, <<https://cleantechnica.com/2017/12/28/using-solar-power-political-tool-armenia/>> (accessed April 8, 2018).
- ³¹ Denzel Hankinson, *Republic of Armenia: Energy Sector Assessment, Strategy and Road Map*, (Massachusetts: Asian Development Bank, 2013), 3-4.
- ³² Brian Naylor, “Russia Hacked U.S. Power Grid — So What Will The Trump Administration Do About It?,” *NPR*, March 23, 2018, <<https://www.npr.org/2018/03/23/596044821/russia-hacked-u-s-power-grid-so-what-will-the-trump-administration-do-about-it>> (accessed April 8, 2018); Plan to Phase Out Dilapidated Power Plants,” *Financial Tribune*, November 12, 2017, <<https://financialtribune.com/articles/energy/75983/plan-to-phase-out-dilapidated-power-plants>> (accessed April 8, 2018); Arturo Massol-Deyá, “Why privatizing Puerto Rico’s power grid won’t solve its energy problems,” *Chicago Tribune*, February 9, 2018, <<http://www.chicagotribune.com/sns-why-privatizing-puerto-ricos-power-grid-wont-solve-its-energy-problems-91179-20180207-story.html>> (accessed April 8, 2018).
- ³³ Emiliano Bellini, “Armenia Builds Third 1 MW PV Plant Under Special Tariff Regime, Announces Plans for Module Factory,” *PV Magazine*, March 16, 2017, <<https://www.pv-magazine.com/2017/03/16/armenia-builds-third-1-mw-pv-plant-under-special-tariff-regime-announces-plans-for-module-factory/>> (accessed April 8, 2018).
- ³⁴ Michael Graham Richard, “Tesla’s Gigafactory Will Produce as Much Renewable Energy as it Uses (Net Zero Energy),” *TreeHugger*, November 16, 2015, <<http://www.treehugger.com/renewable-energy/teslas-gigafactory-will-produce-much-renewable-energy-it-uses-net-zero-energy.html>> (accessed April 8, 2018).
- ³⁵ Michael Graham Richard, “Tesla Reveals Details About its Game-Changing Battery ‘Gigafactory,’” *TreeHugger*, February 26, 2014, <<http://www.treehugger.com/clean-technology/tesla-reveals-details-about-its-battery-gigafactory.html>> (accessed April 8, 2018).
- ³⁶ Benjamin Harvey and Asli Kandemir, “Elon Musk’s Most-Liked Instagram Post Touches a Nerve in Turkey,” *Bloomberg*, November 10, 2017, <<https://www.bloomberg.com/news/articles/2017-11-10/elon-musk-s-most-liked-instagram-post-touches-a-nerve-in-turkey>> (accessed April 8, 2018).
- ³⁷ Roland Oliphant, “Armenia’s ‘Electric Yerevan’ Protests Enter Seventh Day,” *The Telegraph*, June 25, 2015, <<https://www.telegraph.co.uk/news/worldnews/europe/armenia/11699692/Armenias-Electric-Yerevan-protests-enter-seventh-day.html>> (accessed April 8, 2018).
- ³⁸ Michael Graham Richard, “Tesla Powerwall: Game-Changing Batteries for Homes and Businesses, Starting at \$3,000,” *TreeHugger*, May 1, 2015, <<http://www.treehugger.com/clean-technology/tesla-powerwall-game-changing-batteries-homes-and-businesses-starting-3k.html>> (accessed April 8, 2018).
- ³⁹ “Hayk Harutyunyan: Competitive Tariff Needed for Creating Solar Energy,” *EcoLur*, May 24, 2016, <<http://www.ecolorg.org/en/news/climate-change/hayk-harutyunyan-competitive-tariff-needed-for-creating-solar-energy/8293/>> (accessed April 8, 2018).

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