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# Armenia's Yeraskh Metal Smelting Plant

## (Lack of) Readiness to Mitigate CO2 and Reduce Social Costs

*Nazrin Baghirova and Orkhan Nadirov*

The mining and metal industry is generally considered one of the world's most economically viable industries—not only because it provides significant employment opportunities but also because it provides essential raw materials without which entire sectors of the global economy would grind to a halt. However, it is also one of the biggest contributors to global CO2 emissions, as it is one of the most energy-intensive industries, with iron and steel manufacturing classified as the largest contributor of Global Greenhouse Gas Emissions (GHG). A recent study indicates that "steel products are responsible for 11 percent of all CO2 emissions" and leave a carbon footprint of between 1.4 tons per produced ton of steel (IEA figure) and 1.85 (McKinsey and the World Steel Association figure). Another recent study indicates that 0.3426 tons of CO2 is emitted per 1 ton of produced steel rebar.

It is against this background that the construction of a metal smelting plant in the Yeraskh village of Armenia, which borders Azerbaijan, is raising serious concerns among international and local ecological civic activists, as well as the authorities of Azerbaijan, over the negative externalities that will result in social cost for Azerbaijan. These concerns led Armenia's Ministry of Environmental Protection to claim in June 2023 that it will compel the modernization of the plant's operations, such as using induction furnaces, which use only electricity to process the metal black scrap, thus reducing the amount of CO2 released in the atmosphere.

***Nazrin Baghirova*** *is a Non-Resident Research Fellow at the Institute for Development and Diplomacy (IDD) of ADA University and a Lecturer at ADA University.* ***Orkhan Nadirov*** *is an Assistant Professor at the School of Public and International Affairs at ADA University.* *This work was supported by Azerbaijan Science Foundation within the project "Smart cities in Karabakh: from concept to reality (Project number: AEF-MQM-QA-1-2021-4(41)-8/08/5-M-08). The views and opinions expressed herein are solely those of the authors.*

This IDD Analytical Policy Brief will analyze the economic feasibility of the plant by applying the cost-effectiveness approach, which considers production cost and the cost of negative externalities projected in the social cost for Azerbaijan.

## *Cost-Effectiveness Analysis: Calculations of CO2 as a Social Cost*

The Yeraskh Metal Smelting Plant aims to produce 200,000-250,000 tons of rebar from black steel annually and will cost an estimated $70,000,000 to complete. There are already 200 workers at the building site, and once the facility is fully operational, the plant will directly employ 1,000 people. On average, a worker produces one to two tons of product per seven hours on a job site. In contrast, a factory worker produces five to seven tons per seven hours. To estimate the average production cost per worker and project the figure for a year, we have used the average worker's worst-case scenario of 1 ton per day and the best-case scenario of 5 tons per day for an average worker.

*Table 1. Rebar Cost Information*

| size of rebar | kg/m | meters per 1 ton | price ($) for 1 meter | cutting price ($/cut) | bending price ($/bend) | Total Price ($) |
|---|---|---|---|---|---|---|
| 8mm | 0.395 | 2,532 | 0.23 | 0.0126 | 0.0130 | 0.26 |
| 10mm | 0.62 | 1,613 | 0.33 | 0.0126 | 0.0130 | 0.35 |
| 12mm | 0.89 | 1,124 | 0.47 | 0.0126 | 0.0130 | 0.50 |
| 14mm | 1.21 | 826 | 0.64 | 0.0167 | 0.0130 | 0.67 |
| 16mm | 1.58 | 633 | 0.83 | 0.0167 | 0.0142 | 0.86 |
| 18mm | 2 | 500 | 1.08 | 0.0167 | 0.0161 | 1.11 |
| 20mm | 2.47 | 405 | 1.29 | 0.0167 | 0.0181 | 1.32 |
| 22mm | 2.98 | 336 | 1.55 | 0.0251 | 0.0181 | 1.60 |
| 25mm | 3.85 | 260 | 2.01 | 0.0251 | 0.0218 | 2.05 |

Table 1 contains several fundamental details. Material cost, cutting cost, and bending cost are the three main costs involved in producing rebars. Since data from Armenia could not be retrieved, the primary costs from the Iranian market were used as an actual example to forecast the average cost of rebar production in Armenia. The cost of materials for rebar manufacturing was reported per 12 meters for the Iranian market. To determine how much it may cost overall for 1 and 5 tons, respectively, we converted this cost measurement to 1 meter. Therefore, material prices are all set at 1 meter prices. These costs can be used to estimate the price of producing rebar for each diameter.

Table 1 lists the different rebar diameters and their weight per meter. For example, rebar with an 8 mm diameter weighs 0.395 kg per meter. This comes out to roughly 2,532 meters when we calculate it for 1 ton and 12,658 meters when we compute it for 5 tons. We can estimate the average amount spent using the aforementioned instances of 1 and 5

tons. This expense is calculated to be around $648 per ton (2531× (0.23+0.0126+0.0130)) and $3,241 per 5 ton (5×648.14).

Table 2 shows the results for annual rebar quantity and CO2 emissions in Armenia. In our example, we use an 8 mm diameter rebar to keep things straightforward. Panel A in Table 2 corresponds to what the Armenian side reported, whereas Panel B refers to what it should be. We have also estimated the worst-case and best-case scenarios in Panels A and B. As noted above, a recent study indicates that 0.3426 tons of CO2 is emitted per 1 ton of produced steel rebar. Moreover, the social cost of carbon (SCC) is estimated to be $51 per ton, and both the Biden and Obama Administrations have consistently used this figure as a benchmark.

The Armenian-American company that is building the Yeraskh Metal Smelting Plant has stated that it intends to produce between 200,000 and 250,000 tons of rebar annually, as depicted in Panel B of Table 2. These sums yield a range of 2,667 to 3,333 employees when divided by 1 ton and then by 75 days, as we assume that the average worker only works 75 days per year. As can be seen, choosing 5 tons per day results in between 533 and 667 employees.

*Table 2. Forecasted annual rebar quantity and CO2 emissions of rebar in Armenia.*

| scen-arios | rebar (ton) | workers (in number) | forecasted daily rebar | forecasted yearly rebar production (ton) | forecasted yearly CO2 emission (ton CO2) | social cost of carbon ($) | average yearly total cost of rebar ($) |
|---|---|---|---|---|---|---|---|
| Panel A: Forecast based on the report from Armenia | | | | | | | |
| worst | 1 | 200 | 75 | 15,000 | 5,124 | 261,324 | 9,720,000 |
| best | 5 | 200 | 375 | 75,000 | 25,620 | 1,306,620 | 48,600,000 |
| | | | | | | | |
| worst | 1 | 1,000 | 75 | 75,000 | 25,620 | 1,306,620 | 48,600,000 |
| best | 5 | 1,000 | 375 | 375,000 | 128,100 | 6,533,100 | 243,000,000 |
| Panel B: Forecast based on author's calculation | | | | | | | |
| worst | 1 | 2,667 | 75 | 200,000 | 68,320 | 3,484,320 | 129,600,00 |
| best | 5 | 533 | 375 | 200,000 | 68,320 | 3,484,320 | 129,600,00 |
| | | | | | | | |
| worst | 1 | 3,333 | 75 | 250,000 | 85,400 | 4,355,400 | 162,000,000 |
| best | 5 | 667 | 375 | 250,000 | 85,400 | 4,355,400 | 162,000,000 |

According to information provided by the Armenian side, if there are 200 people, their annual rebar production will, in the worst case, be close to 15,000 tons, with a cost of $9,720,000 on average. This process produces around 5,124 tons of CO2, with an estimated societal cost of $261,000. This demonstrates that the social cost of producing $1 of (input cost) rebar is approximately $0.03 (social cost). On the other hand, in

the best-case scenario, they will create roughly 75,000 tons of rebar, which will cost $48,600,000. About 25,620 tons of CO2 would be produced in this projection, at a cost to society of $1,306,620. Again, this conclusion is predicated on the estimate of $0.03 for the social cost of carbon. When there are 1,000 persons present, the same technique can be calculated. However, a recent analysis revealed that the value of 1 ton of CO2 in the United States should be $185, over four times the present cost of $51. This means that the social cost of creating $1 of rebar is equal to $0.11, when we consider this number.

When each employee produces, on average, 1 ton of rebar per day (worst case scenario), Panel B demonstrates that the company's goal of producing 200,000-250,000 tons of rebar annually with 1,000 employees is not feasible. If the daily production of rebar is 5 tons per worker, the company needs a maximum of 533 or 667 workers. This indicates that the plant's workers will produce around 2.5 tons per day. This number is plausible and shows why the Yeraskh Metal Smelting Plant will work with less productivity.

## *CO2 As Negative Externality and its Social Cost*

Among the most globally concerning negative externalities contributing to the social cost is toxic emissions. The toxic gases that furnaces emit in high quantities during steel production are air pollutants like carbon dioxide (CO2), nitrogen oxide (NO), and sulfur dioxide (SO2). All these result in damage to the environment and negatively affect human health (causing cancer, damaging nerve system, etc.). Research shows that the toxic materials emitted from such and similar plants travel far, reaching people living hundreds of kilometers away through the air, water streams, and the food chain. Hence, by building this pollution-producing complex very near the border with Azerbaijan (a mere 800 meters from its location), the Yeraskh Metal Smelting Plant shares its negative externalities with the environment and population located in that area.

As noted above, Armenia's Ministry of Environmental Protection claims that there will not be any adverse transboundary environmental impact, since "the planned activity is the processing of black metal scrap in the village of Arazdayan (Yeraskh), Ararat Province, Armenia, which is not included in the 1st Annex defining the types of activities" of the 1997 Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), and the planned activities of "blast furnaces and open-hearth furnaces and non-ferrous metallurgy enterprises" included in the 1st Annex of this document are in "no way related to the intended activity under question, since the process of casting black metal scrap will be carried out using an induction furnace, which works exclusively with electricity."

Although research does indicate that induction furnaces reduce emission of CO2 in the atmosphere, the engineers-metallurgists from Baku Steel Company (BSC) whom the co-authors consulted have indicated that "these consume more electricity, which, at the end of the day, doubles CO2 emissions." In addition to the statement of the engineers

from BSC, various research findings confirm that operating an induction furnace with electricity increases the release of CO2 into the atmosphere, as power is mostly supplied by burning coal. Moreover, neither the Armenian authorities nor the owners of the Yeraskh Metal Smelting Plant have provided any information on how power will be supplied to the complex. On the other hand, the IEA's 2023 Armenia energy profile indicates that 44 percent of the country's electricity is generated by coal.

The bottom-line assessment regarding the above is that the more scrap that is processed, the more steel ends up being produced, the more electricity is used for the induction furnace, and the more CO2 is emitted.

## *Concluding Thoughts*

The foregoing quantitative analysis indicates that Armenia will put a burden of $0.11 (i.e., the SCC figure) per $1 of production of rebar produced by the Yeraskh Metal Smelting Plant on Azerbaijan.

It is with this in mind that we offer three ways in which remedial measures can be taken.

*Alternative 1*. Exert various forms of pressure to ensure full compliance with the Net Zero Benchmark Three Goals indicated in Climate Action100+ in the production process. To quote from this document: "investors will work with the companies in which we invest to encourage them to work towards the global goal of halving GHG emissions by 2030 and delivering net zero GHG emissions by 2050, in line with the goals of the Paris Agreement to pursue efforts to limit warming to 1.5°C."

This involves, particularly, reducing greenhouse gas emissions, improving governance, and strengthening climate-related financial disclosures.

*Alternative 2*. "As it is registered in America, the Armenian-American Smelting Plant Company is a legal entity that needs to comply with the law of the United States (particularly the National Environmental Law of the United States (NEPA) and legally binding cases that build the precedent as a reference point)," says professor of law at ADA University Azad Talibov, with references to the 1969 law. This needs to be understood in light of NEPA's stated purpose. The following language is taken from the legislation itself:

> to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality. [...] The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial

> expansion, resource exploitation, and new expanding technological advances, and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with state and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

It is useful in this context to refer to the following legal precedent that was established in 2008, as reported by Kevin Rennert and Cora Kingdon in a paper published in February 2022: "the Center for Biological Diversity took the U.S. government to court over new fuel economy standards, arguing that by not accounting for future costs [i.e., SCC] from climate change, policymakers had implicitly valued the costs of damages from climate change to be zero. The courts ruled in favor of the Center for Biological Diversity. They required the U.S. government to account for the costs and benefits of changes in greenhouse gas emissions in its economic analysis. The federal government employs the SCC to satisfy this requirement."

*Alternative 3*. There is no clear policy in place regarding the actual application of global carbon pricing. According to a recent analysis conducted by the Oxford University Centre for Business Taxation, a multilateral agreement on a worldwide carbon tax with a uniform tax rate (such as $75 per ton of CO2 emissions) may eventually be possible. According to the cost-effectiveness analysis we conducted earlier, the Yeraskh Metal Smelting Plant should pay approximately $648 for one ton of produced rebar. At this production level, the risk of carbon leakage from Armenia to Azerbaijan is estimated to be around $71.28 per ton of CO2 emissions. This result demonstrates once more how consistent our findings are with earlier research. That being said, the absence of an agreed tax model indicates that international tax law has not yet become environmental law. Thus, the issue at hand is political rather than legal in nature.