Industrial N_2O Projects Under the CDM: The Case of Nitric Acid Production

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Introduction

Industrial gas projects implemented under the CDM have come under increased scrutiny due to concerns related to high profit margins, potential perverse incentives, and implications for environmental integrity. Given such concerns, the European Union is currently considering banning the use of credits generated by industrial gas projects for the third phase of the EU Emissions Trading Scheme, the largest market for CDM credits.

All industrial gas projects involve the destruction of gases with high global warming potential (e.g. HFCs, N_2O, or PFCs), yet the project types vary considerably in terms of mitigation technologies, market circumstances, and accounting methodologies. Prior studies have addressed issues related to HFC-23 destruction and nitrous oxide (N_2O) destruction in adipic acid plants. N_2O is also an unwanted by-product in the production of nitric acid. Nitric acid is used most commonly to make fertilizers and explosives. This new study by the Stockholm Environment Institute is among the first to consider the merits and drawbacks of N_2O abatement projects at nitric acid plants and the associated emission crediting methodologies.

The study suggests that the CDM has successfully fostered innovation and emission reduction in the nitric acid sector which previously had not engaged in abatement practices. The authors judge the risk of leakage to be relatively low for this project type, particularly at current credit prices. The study also finds no evidence to indicate widespread gaming for the purpose of maximizing emission credits.

At the same time, complex methodologies are partly to blame for long delays in the issuance of nitric acid project credits. Two CDM methodologies for nitric acid projects are currently in use: AM0028 for end-of-pipe N_2O destruction technology and AM0034 for N_2O destruction within the nitric acid manufacturing process (inside the oxidation reactor). There is currently no methodology for new nitric acid facilities, and the current approach does not necessarily incentivize the lowest emitting activities (high emitting processes have more abatement potential, and thus generate more credits per unit of nitric acid produced). To address these and other issues, the authors ***recommend the introduction of a benchmark factor for baseline emissions for all nitric acid CDM projects, in order to further strengthen the mitigation potential of this project type.***

Comparison of Nitric and Adipic Acid CDM Projects

N_2O is also emitted in the production of adipic acid. SEI recently released a study that examined CDM adipic acid projects and identified the risk for carbon leakage in this project type[1]. While for both adipic and nitric acid projects the revenues from credits (CERs) far outweigh abatement implementation costs, the profit margins are considerably higher in the case of adipic acid projects.

In the case of nitric acid, estimated profits from CERs are about in the same order of magnitude as the profits from the primary product. In the case of adipic acid, CER profits may exceed the profits from the primary product by as much as an order of magnitude.[2]

[1] See http://sei-us.org/publications/id/353

[2] The study cannot provide precise estimates comparing profits from CERs with profits from the sale of the primary product because of a lack of data on the current profit margins of nitric and adipic acid production. Also production costs are based on best-guess estimates from industry experts and are not based on any data analysis. For the estimates, profit margin of 15-20% were assumed.

If CER profits are high, carbon leakage may occur: production may shift from non-CDM plants to CDM plants. Leakage can undermine mitigation goals and pose economic risks for industries in countries that are ineligible to generate credits under the CDM. According to industry experts, nitric acid plants are often locally operated and much of the product is sold locally which would reduce the risk of leakage. The authors judge the current risk of carbon leakage, i.e. at current CER prices, for nitric acid projects as limited. However, for adipic acid projects the risk of carbon leakage may be considerable. The table below compares the estimated impact of CDM revenues on nitric and adipic acid projects.

Policy makers are currently debating how to address the shortcomings of industrial gas projects. The authors stress the importance of distinguishing among different industrial gas project types when designing possible policy remedies. ***Only separate and well-designed measures that target the specific nature of each project type can ensure that risks are minimized for each individual project type, that overall mitigation benefits maximized, and the positive elements of market mechanisms are reinforced.***

Estimated Impact of CDM on Revenues For Nitric and Adipic Acid

	Nitric Acid	Adipic Acid
Number of operating plants worldwide	400-600	23
Estimate of plants abating N_2O voluntarily prior to carbon markets	Close to 0%	60-80% of production capacity
CERs produced per tonne of product	2 (range 0.5-4)	82
Abatement and CDM transaction costs per CER (t of CO_2e)	EUR 3-4	EUR 0.75
Price per secondary CER	EUR 13	EUR 13
Estimated net profit from CDM per tonne of product[3]	average EUR 18-20 (range EUR 4-38)	EUR 1009
Production cost per t of product	N/A	EUR 900-1300
Sales price per tonne of product	EUR 100-225 per tonne of ammonium nitrate[4]	N/A
Extent of estimated leakage	Risk presumed to be low	About 20% of the CERs issued from this project type for 2008 and 2009

Key Findings about Nitric Acid CDM Projects

1. **The carbon market was very effective in fostering technology development and innovation in an industry that had not abated N_2O emissions previously**
   Before the implementation of CDM, JI and the EU-ETS, N_2O abatement in nitric acid plants was not practiced, except for a few pilot projects in Europe. With CDM support, new N_2O abatement technologies and monitoring standards were introduced in 63 plants in 11 Non-Annex-1 countries.

2. **No evidence of systematic baseline manipulation was found**
   Nitric acid project developers determine baseline emission rates *after* establishing intent to develop a CDM activity. In principle, such a situation could create moral hazard, where project developers might manipulate the baseline in order to maximize N_2O production and thus generate more CERs during the crediting period. However, the new study finds no evidence that manipulation has occurred, and furthermore finds that the incentives for such manipulation are limited.

3. **Baseline emission rates vary significantly between monitoring periods and between plants**

[3] Project proponents are unlikely to capture the full differential between the costs of creating a CER and their market price: In order to reduce risk and get advance payment, project developers often sell "primary" CERs on a forward basis, i.e. in advance of CERs actually being issued. Generally, primary CER prices are often below the secondary CER price (the 13 EUR value represents a secondary CER price). In addition, some countries tax CER revenue from N_2O projects (e.g. China 30%, Uzbekistan 80%) this further reduces profits for project developers.

[4] Nitric acid is usually not sold directly but used in the production of ammonium nitrate (primarily for use as fertilizer). Prices for ammonium nitrate, which contains approximately 75% nitric acid, vary by region and fluctuate according to market conditions.

CDM methodology AM0034 uses a single campaign[5] to establish baseline emissions for all crediting periods. Variability in baseline emission rates among monitoring periods (for a given project) puts into question whether this methodological approach is appropriate. If baseline emissions are highly variable over time, the use of a single campaign may not provide an adequately representative measure of baseline emissions: depending on when the baseline campaign was conducted, emission reductions may be significantly under- or over-estimated.

Baseline emission rates vary even more significantly between plants (by up to a factor of four). Variation in plants age, type and operating conditions results in very different levels of N_2O emissions per unit of nitric acid produced. Under current methodologies, plants with higher baseline emission rates can receive more credits than plants with lower baseline emission rates, assuming similar N_2O destruction efficiencies. It could be argued that rewarding plants with high baseline emissions is counter-productive – since it may encourage keeping baseline emission high – and unfair since well-managed plants with lower baseline emissions receive fewer credits. This situation is not unique to this project type.

4. **Both methodologies, but especially AM0034, are complex and projects are experiencing significant delays in credit issuance**
   Nitric acid projects are facing long credit issuance delays: Project developers are still awaiting issuance for over 60% of all monitoring reports. Only 25 of the 50 projects that have submitted monitoring reports have received credits at all.

Recommendations for Nitric Acid CDM Projects

Given these findings, ***the authors recommend introducing a benchmark factor for baseline emissions***[6]. Such a common benchmarking approach for all nitric acid projects (including both AM0028 and AM0034) could:

- Greatly simplify the methodology and the requirements for project developers.
- Help reduce issuance delays and transaction costs.
- Greatly reduce any potential risks of carbon leakage.
- Enable inclusion of abatement projects at new nitric acid plants in the CDM.
- If well designed, enhance the environmental benefits of N_2O projects while providing sufficient incentives to project developers.

The study recommends that the CDM Methodology Panel, with input from stakeholders and industry experts, work to come up with a precise benchmark level. Taking into account IPCC emissions factors, the benchmark figures used for the EU, and the baseline emissions that have been reported for CDM nitric acid projects, a suitable baseline emission rate might be in the range of 4 to 5 kg N_2O per tonne of nitric acid. Such a baseline emissions benchmark should also decline over time to reflect autonomous technology improvements.

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[5] Nitric acid is produced during so called production “campaigns.” The duration of the campaign is expressed in tons of pure nitric acid produced until the primary catalyst has reached the end of its design life. At the beginning of each campaign a new primary catalyst is installed. A campaign usually lasts 3–12 months, depending on the type of plant.

[6] It is important to note, that a revised version of the methodology would only apply at the renewal of the crediting period of each of the nitric acid CDM projects.