

## ENVIRONMENTAL PROFILE FOR RICE EPD: FROM FIELDS TO TABLE

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### Abstract

Rice is a major crop in Krasnodar Krai, Russia's key rice region. Flooded cultivation consumes excessive water, fuel, and fertilizers. A life cycle assessment of 1 kg of cooked rice reveals significant environmental costs: 54.5 m<sup>3</sup> eq of water scarcity (mostly during growing), 0.025 kg PO<sub>4</sub> eq of eutrophication from nutrient runoff, and 1.4 kg CO<sub>2</sub> eq of global warming potential — over half from fields, with drying contributing nearly half. Energy depletion reaches 15.4 MJ per kg, mainly from post-harvest processing. The findings confirm global rice "hot spots": cultivation drives water and nutrient impacts, while processing shapes energy and climate tolls. Results support EPD development under ISO 14025.

### Keywords

Life cycle assessment, rice, Krasnodar Region, water scarcity, eutrophication, global warming potential, EPD.

## ЭКОЛОГИЧЕСКИЙ ПРОФИЛЬ ДЛЯ EPD РИСА: ОТ ПОЛЯ ДО СТОЛА

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### Аннотация

Рис — значимая культура Краснодарского края, ключевого рисоводческого региона России. Традиционное затопление полей требует чрезмерного расхода воды, топлива и удобрений. Оценка жизненного цикла 1 кг вареного риса выявила значительные экологические издержки: 54,5 м<sup>3</sup> экв. водного дефицита (преимущественно на этапе выращивания), 0,025 кг PO<sub>4</sub> экв. эвтрофикации от стока питательных веществ и 1,4 кг CO<sub>2</sub> экв. потенциала глобального потепления — более половины приходится на поля, почти столько же добавляет сушка. Истощение ископаемой энергии достигает 15,4 МДж на кг, в основном на этапе послеуборочной обработки. Результаты подтверждают глобальные «горячие точки» рисоводства: выращивание определяет нагрузку на воду и эвтрофикацию, переработка — энергопотребление и климатическое воздействие. Полученные данные служат основой для разработки EPD в соответствии с ISO 14025.

### Ключевые слова

Оценка жизненного цикла, рис, Краснодарский край, водный дефицит, эвтрофикация, потенциал глобального потепления, EPD.

The Krasnodar region accounts for over 70% of Russia's total production of rice, which is of major strategic importance among agricultural crops in Russia [1]. Rice is the most water-intensive product in an agricultural plant because it requires huge amounts of water - up to 5,000 cubic metres per ton - for traditional field flooding [2]. The process of drying rice requires a significant amount of fuel, mostly natural gas, and fertilizer runoff releases harmful substances like nitrogen oxides and excess nutrients into the air and water. All stages of cultivation are highlighted by reports from around the world, specifically from the IPCC [3,4]. Methods like non-flooded planting cut liquid needs sharply, yet struggle in Kuban due to earth types and climate quirks that demand updated watering designs. A detailed environmental scan

tailored to local rice cycles now offers clarity, mapping damage zones and guiding labeling rules compliant with global standards set forth in ISO 14025 [5].

Cooked rice, one kilogram at a time, guided the study using a life cycle approach stretching from growing fields to dining tables. Regional benchmarks shaped inputs like fertilizer, irrigation, and fuel - combined with data pulled from Ecoinvent and processed through SimaPro, relying on the EPD method dated 2018. The outcomes reveal uneven environmental effects across categories. In the category of water scarcity — which indicates the volume of freshwater deprived relative to the local water availability — each kilogram of cooked rice accounts for 54.5 m<sup>3</sup> eq. This impact is almost entirely tied to farming practices involving flooded paddies and canals that deliver only 71–77 percent efficiency. The global warming potential reaches 1.4 kg CO<sub>2</sub> eq per kilogram of cooked rice. This indicator aggregates emissions of various greenhouse gases — such as carbon dioxide from fuel combustion, methane from flooded fields, and nitrous oxide from fertilized soils — into a single equivalent value. Gas drying contributes nearly half of the total climate impact. When it comes to fossil energy, each kilo takes about 15.4 megajoules, most of it burned during processing steps. The machinery and methods used shape where these impacts land - heavy on water issues out in crops, while factories pull harder on carbon and power tallies.

Krasnodar rice farming shows multifaceted impacts: fields drive water scarcity and eutrophication, while processing leads GWP and fuel use. Processing burns fuel, that much shows clear in the numbers. Each phase plays its part, yet totals rest on how farms report inputs. Factories using gas feel the weight when tallies add up. Better records on fertilizer matter if standards must align. Proof sits in recent findings, not assumptions. Tracking drops and flows per farm could sharpen future reports. Rules like ISO 14025 need real figures, not estimates [5]. Rice here shapes environmental costs in ways once overlooked.

### Literature

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