

Cheese Carbon Footprint Calculator

Unit Process	Your custom calculation, running total	Average for US Cheddar Cheese, running total
<p>Milk Production Impact: Average US Dairy Farm (values are based on Fat and Protein Corrected Milk, FPCM, units are “kg CO₂ eq per kg FPCM” (Thoma et al.).</p> <p>FPCM = $[(0.0929)(\text{fat}\% \text{ tested})+(0.05882)(\text{protein}\% \text{ tested})+0.192]/[(0.0929)(4\%\text{tested})+(0.05882)(3.3\%\text{tested})+0.192]$</p> <p>GHG emissions calculated by the “Green Cheese” Project in Wisconsin were in average 0.75 kg CO₂-eq per kg ECM (Energy Corrected Milk). The major differences in emissions are because the Green Cheese study considered best management practices for manure handling (e.g. collection and application), crop production (e.g. minimization of chemical fertilizer through manure application) and feeding efficiency; while the Thoma et.al. study used survey data to assess actual practices on farms.</p> <p>When considering the existence of a digester that uses manure to produce biogas, GHG emissions were further reduced up to 25%. This reduction was due to the avoided natural gas production and combustion, and to avoided CH₄ emissions from manure storage. When maximizing DDGS (dried distillers grains with solubles) in the diets, the reductions in GHG emissions could reach up to another 25% due to the avoidance of gasoline production and combustion by ethanol use.</p>		1.2
<p>Cream Removal Impact: If you are removing (or adding) cream, we need to convert standard producer milk into kg CO₂ eq per kg milk solids (US average producer milk is 3.66% fat and 12.31% solids):</p> <p>kg CO₂ eq per kg milk solids = $1.2/0.1231 = 9.75$ kg CO₂ eq per kg milk solids.</p>		1.2+0= 1.2

<p>For each 1% cream (37% fat content) removed, this removes 0.432% solids from milk. Therefore:</p> <p>Solids milk after cream removal = $12.31 - [(\text{___}\% \text{ cream removed}) \times (0.432)]$</p> <p>Adjust kg CO₂ eq per kg milk solids after cream removal = $(9.75 \text{ kg CO}_2 \text{ eq per kg milk solids}) \times (\text{Solids milk after cream removal})$</p> <p>Cheddar cheese will remain at 1.2 kg CO₂ eq per kg FPCM.</p> <p>Typical mozzarella cheese milk will have 3.25% cream removal from the producer milk before, so mozzarella cheese milk contains 10.91 solids. 1.06 kg CO₂ eq per kg will be mozzarella cheese milk.</p>		
<p>Shipping Impact: Shipping impact is based on miles milk traveled from farm to processing plant:</p> <p>US average is 86.75 miles (Newton 2007). Tanker holds 40,000 pounds. Semi mileage rate average is 7.3 mpg. CO₂ eq per gallon diesel fuel= 22.38#. (EPA 2010)</p> <p>Example: Farm to plant shipping CO₂ eq per kg FPCM = $[(86.75/7.3) \times (22.38)] / (40,000)$</p> <p>Then convert to kg (1 lb = 0.454 kg)</p>		$1.2 + 0.003 = 1.203$
<p>Processing Plant Impact: There are a number of major factors with processing impacts. Main contributors are: Electric use, fuel use, caustic use, refrigerant loss, packaging use, and aging time.</p> <p>The majority of the emissions are related to energy use, which is mainly in the forms of electricity for cooling, refrigeration, lighting and mechanical applications; and natural gas for thermal applications. Generally, thermal energy use will result in less “net emissions” because</p>		8.3

the energy embedded in the production of natural gas is lower than electricity (producing electricity has lower efficiencies than generating heat, therefore more primary fuel is needed to produce the same amount of energy). Also, the emissions will be affected depending on the mix of fuels that is used to produce electricity. For example, in systems where coal is the main fuel to produce electricity the emissions will be higher than in systems that have a bigger inclusion of cleaner energies such as wind, solar, or hydro.

We do not have yet all the appropriate in-factory contributions for cheese manufacture. However, we do have total factory contributions, concentration factors for making cheese and whey from milk, and energy allocations from cheese and whey.

We are recommending that 0.086 kg CO₂ eq per kg FPCM (FAO 2010) as the amount contribution from dairy processing and the cheese and whey allocation percentage (Feitz et al.).

Cheddar manufacture kg CO₂ eq per kg FPCM = (0.086 kg CO₂ eq per kg FPCM) X (5.1 cheese energy factor) = 0.4386 kg CO₂ eq per kg FPCM

0.4386 kg CO₂ eq per kg FPCM + 1.203 kg CO₂ eq per kg FPCM = 1.64 kg CO₂ eq per kg FPCM.

(10 raw milk)/(1 finished cheese) X 1.64 X 50.4% solids used from milk for cheese = 8.3 kg CO₂ eq per kg cheddar

Whey manufacture kg CO₂ eq per kg FPCM = (0.086 kg CO₂ eq per kg FPCM) X (7.6 whey energy factor) = 0.6536 kg CO₂ eq per kg FPCM

0.6536 kg CO₂ eq per kg FPCM + 1.203 kg CO₂ eq per kg FPCM = 1.87 kg CO₂ eq per kg FPCM.

(17.76 raw milk)/(1 finished whey) X 1.87 X 43.2% solids used from milk for whey = **14.3 kg CO₂ eq per kg whey powder**

<p>Shipping Distance to Retail Impact: Shipping distance to average US retail (consumer):</p> <p>Geographic center of Wisconsin is Pittsville.</p> <p>Geographic population center of density for the US is Edgar Springs, MO, which is 600 miles from Pittsville, WI.</p> <p>Distance from Edgar Springs, MO to New York City is 1079 miles and to Las Angeles, CA is 1735 miles. We will credit shipping miles as not having to ship to Edgar Springs but rather as direct as ½ the distance of each leg:</p> <p>Average distance to average US customer = $(600/2) + [(1079/2)+(1735/2) / 2] = 1003$ miles.</p> <p>Semi mileage rate average is 7.3 mpg. CO₂ eq per gallon diesel fuel= 22.38#.</p> <p>Cheddar shipping CO₂ eq per kg cheddar = $[(1003/7.3)X(22.38)]/(40,000) = 0.077$</p>		$8.3+0.077 = 8.377$
<p>Total Carbon Foot Print of Cheddar Cheese: Total CO₂ eq per kg cheddar delivered to retail sale.</p> <p>It is not given here, but refrigeration, consumer travel and storage, and the disposal of the package in the landfill would also contribute to the CO₂ eq per kg cheddar impact with the completion of the cradle-to-grave analysis of cheddar cheese consumption. Estimates are up to another 0.05 CO₂ eq per kg cheddar cheese could be added (Berlin 2002).</p>		8.377