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Sustainability and the Better Chicken Commitment

"Safeguarding the highest standards of health and welfare for production animals must be recognised as a key sustainability objective."

British Veterinary Association

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Executive Summary

The Better Chicken Commitment (BCC) is a set of scientifically based criteria designed to address the most significant welfare concerns in commercial chicken production. Although there is no one definition of sustainability, there is growing recognition of the importance of animal health and welfare in sustainability goals. Despite this, incompatibility with sustainability is often cited as a reason for companies not to commit to the BCC. Here we will challenge the widely held belief that more intensive production is inherently more sustainable, and demonstrate that the BCC - rather than being counter to sustainable production - can be part of the solution. We will demonstrate how adoption of the BCC can contribute to environmental, human and animal health through reduced mortality and morbidities, antibiotic use, water usage and feed related emissions. We also include the ethical dimension of sustainability, considering the significant reduction in suffering as a consequence of adopting BCC standards. We will explore areas that can be implemented alongside the BCC to improve sustainability - and economic viability - even further: carcass utilisation, food wastage, and renewable energy. Finally the report will focus on a commercial example of how the transition to more sustainable, higher welfare production can be achieved. The BCC can be sustainable.

Limitations

This report does not constitute a full Life Cycle Analysis (LCA), but demonstrates the areas in which the BCC helps to improve sustainability indices - including animal welfare - in ways not possible in standard commercial chicken production.

Box 1. Key highlights:

Animal Health

- Approximately 1 in 20 conventional faster growing birds dies, or is culled, before ever reaching slaughter
- Slower growing breeds experience significantly lower levels of lameness, cardiopulmonary disorders and thermal stress
- Slower growing breeds have a significantly lower incidence of muscular myopathies such as white striping and wooden breast

Human Health

- Overuse of antibiotics in poultry production is the leading cause of resistance developing in bacteria
- Faster growing breeds use 3 to 5 times more antibiotics than slower growing breeds, including over 6 times more critically important antibiotics

Environmental Health

- Reduced mortality rates in slower growing birds results in lower emissions
- Switching from waterbath stunning to controlled atmospheric stunning (CAS) would save almost 450 million litres of water in the US alone

Ethical sustainability

- Adoption of the Better Chicken Commitment, is estimated to prevent **at least** 33 (13 to 53) hours of disabling pain, 79 (-99 to 260) hours of hurtful pain and 25 (5 to 45) seconds of excruciating pain for every bird affected by this intervention*
- Animal welfare is important to the majority of consumers

*For pain definitions see https://welfarefootprint.org/broilers/

Introduction

The Better Chicken Commitment (BCC) is a set of scientifically backed criteria designed to reduce the most significant areas of suffering associated with the intensive factory farming of broilers. Different regions have their own versions of the BCC (EU, US, AU/NZ), however the welfare fundamentals remain the same. These requirements include; the use of slower growing breeds, lower stocking densities, environmental enrichment, and more humane slaughter methods (for details see betterchickencommitment.com).

Sustainability is often seen as a challenge to implementing the BCC, specifically through its requirement for slower growing breeds and lower stocking densities; this overly simplistic approach considers the BCC as simply more feed, more space, and fewer flock cycles. But what do we mean by sustainability?

Over time, sustainability has changed from a simple resource based concept (for example, a resource becoming so depleted it is no longer available), to something incorporating broader impacts and ethical considerations (Broom et al., 2013). There is no one agreed definition of sustainability, however, there are a number of helpful definitions and constructs on which we can make informed assessments of sustainability.

Here, we will consider sustainability in terms of: animal health, human health, environmental health and ethical (or social) sustainability, leaning on the definition provided by Drury et al (2023), which states: ***we should minimise our immediate and future negative impact on humans, other animals, and the planet, while simultaneously maximising our positive impacts on these domains.*** The framework aligns to other related sustainability objectives such as the UN's three pillared One Health approach of healthy animals, humans and ecosystems.

With significant welfare problems in standard poultry production (CIWF, 2019, Dixon, 2020, Rayner et al, 2020, Schuck-Paim and Alonso, 2022), expected growth in global poultry production (Poultry World, 2022) and increasing public and political concern (EFSA, 2023) for animal welfare and environmental protection, there is a need to ensure that - in accordance with Drury's definition - we minimise our negative impacts and wherever possible, maximise the positive outcomes in each domain. Environmental concerns, for example, cannot be an excuse for poor animal welfare standards.

Maximising Animal Health

Reducing Mortality

Unnaturally fast growth rate is considered one of the biggest factors contributing to mortality due to the excessive stress it has on the birds' bodies, influencing multiple conditions such as sudden death syndrome and ascites. However, the high rate of mortality in standard intensive production is often overlooked in relation to sustainability. When producing birds in the millions, mortalities are to be expected, however, the high mortality rates associated with conventional broiler production means that this death toll is unnecessarily high. Not only do millions of birds never even make it to the supermarket shelves they were intended for, farms are overstocked with birds to account for these accepted losses. Open Cages (2022) estimated that **approximately 64 million birds died before slaughter on UK farms in 2021**. **In the US this figure is over 487 million**[A1] (National Chicken Council data, 2022). Meaning that **in the US and UK alone, *over half a billion birds* were reared without ever entering the food supply chain**. Half a billion birds still requiring food, water and space, contributing to the overall environmental footprint, and suffering needlessly. This is approximately 1 in every 20 birds reared. This is clearly unsustainable.

Faster growing breeds used in standard commercial production have significantly higher mortality than slower growing BCC compliant breeds (Baxter et al, 2021; Dixon, 2020; Rayner et al, 2020). At stocking densities of 34 kg/m2, (higher than the BCC but lower than conventional production) Rayner et al (2020) found the total mortality of faster growing breeds was 6.23 compared with 2.58 percent in the slower growing breeds. With these mortality rates, for every million birds that are required, an additional 36.5 thousand faster growing birds would need to be placed. That is thirty-six thousand birds' worth of extra feed, water and space, and 36.5 thousand more birds suffering for every million required (See Table 1).

1 Million Birds Required	
Slower Growing	Faster Growing
2.58% Mortality	6.23% Mortality
1,025,800 Birds Placed	1,062,300 Birds Placed
+ 36,500 Faster Growing Birds Required	

Table 1 *- The number of birds placed to produce 1 million birds depending on breed, according to the results of Rayner et al (2020). Birds still requiring food, water, and space.*

Even at low stocking densities **the average mortality of the three most commonly used conventional faster growing breeds - Ross 308, Cobb 500, and Hubbard Flex - was almost twice as high as the slower growing breed (JA757)** (Dixon, 2020). The findings were similar when comparing the Redbro - a slower growing breed - and the Ross 308 (Baxter et al, 2021). These research findings are borne out in commercial production: RSPCA Assured farms (BCC compliant) had mortality rates 65 percent lower than standard UK production (RSPCA, n.d.), whilst Norsk Kylling, a Norwegian BCC producer, has an average daily mortality rate 40 percent lower than their national average (Norsk Kylling, n.d.).

Furthermore, slower growing breeds appear to adapt better to transport conditions. **RSPCA Assured reared birds were 70 percent less likely to be dead on arrival (DOA) at the slaughterhouse than conventional breeds, whilst Norsk Kylling reduced their DOAs by 75 percent following implementation of the BCC.**

Reducing Disease Incidence

The increase in on-farm mortality and DOAs seen in commercial conditions is due to the poorer health and welfare of the birds. The presence of an enlarged right ventricle (one of the heart chambers) was significantly higher in DOA birds: 34.4 percent compared to only 4.1 percent in birds that were slaughtered (Nijdam et al., 2006). An enlarged ventricle is commonly found in birds with the condition ascites. **Norsk Kylling found that ascites was down 80 percent when they switched to the slower growing breed** (See Table 2).

Ascites, also known as water-belly, causes extreme suffering, with estimates of up to 40 minutes of excruciating pain in the fatal stages (Schuck-Paim and Alonso, 2022) . Mortality can range from 0 percent to as high as 30 percent; it is estimated that **8 percent of US broiler mortality each year is caused by ascites, costing the industry over $100 million annually** (Pavlidis et al, 2007). **One of the biggest contributors to the development of ascites is the growth rate of the birds** as the cardiovascular system cannot meet the demands of the rapidly growing muscles (Balog, 2003). Broilers with a slower growth rate and higher feed conversion ratio have a significantly lower incidence of ascites than faster growing birds with a lower feed conversion ratio (Buys et al, 1999., Balog 2003., Baghbanzadeh and Decuypere, 2008). Ascites is a common reason for rejections with incidence approximately twice as high in the faster growing breed (Baxter et al, 2021).

	Norsk Kylling	Rayner et al (2020)[A2]	Baxter et al (2021)[A3]	RSPCA (n.d.)[A4]
Average Daily Mortality	39% Lower	-	-	-
Average Dead on Arrival (DOA)	75% Lower	50% Lower	10% Lower	70.6% Lower
Ascites	80% Lower	-	-	-
Rejections / Downgrades	-	55.2% Lower	29.5% Lower	15.8% Lower
Total Mortality	13% Lower	58.6% Lower	42.1% Lower	64.7% Lower

Table 2 - showing the reduction of mortalities and morbidities of slower growing breeds compared to faster growing breeds. Norsk Kylling supply when switching from fast growth Ross 308 to the slower growing JA757 (Source: CIWF), Rayner et al (2020), Baxter et al (2021), RSPCA, all of which compared faster and slower growing breeds.

Sudden death syndrome, sometimes referred to as 'flip-over' disease, is a condition that causes the birds to flip over and die suddenly; its occurrence can range from 0.5 to 6 percent ***even in an apparently healthy faster growing flock*** (MSD Manual, 2022, Olkowski et al, 2008, Siddiqui et al, 2009, Awachat and Majumdar, 2014) and generally accounts for approximately ⅓ of all on farm mortalities (Sosnówka-Czajka and Skomorucha, 2022). **With some mega farms in both the UK and the US holding over 1 million birds, this is a death toll of up to 40,000 birds on these farms, per cycle, just to this one condition alone.** The MSD veterinary manual (2022) states - "The incidence of sudden death syndrome can be minimised by slowing the growth rate of broilers, particularly during the first 3 weeks of life." - one of the criteria of the BCC.

During the UK heatwave of summer 2022 millions of broilers died from heat stress (The Independent, 2022), as did thousands back in 2019 (Insider, 2019). With the ongoing rise in temperatures it can be expected that this will continue to impact bird mortality if not appropriately addressed, as well as being an already continuous challenge for broiler production in hotter climates. For example, Brazilian farms already operate at lower stocking densities (27.55 kg/m2) and use open sided housing to help address this (Tuyttens et al, 2015). While ventilation systems play a huge role in heat management, there are two important welfare factors that could significantly reduce heat stress related mortality: breed and stocking density. The BCC addresses both of these issues and would have a significant positive impact, improving welfare and financial losses through heat stress related mortality (See Box 2) .

The mortality and morbidity rates associated with current faster growing birds and intensive production systems means that millions are born with either the expectation of dying before ever reaching the processing plant, or being rejected once they get there. Data from the National Chicken Council (2022) on US broiler performance shows that in 2021 broilers were the heaviest they have ever been at 6.46 pounds (2.93 kg). In the same year the average mortality rate was at its highest since 1965 at 5.3 percent. We cannot eliminate mortality and disease completely, but we can significantly reduce it, as clearly demonstrated in commercial and trial conditions (Table 2). Switching to a slower growing healthier breed would not only significantly improve the welfare of the birds but mean that fewer birds would be needed at placement to meet demand; this has implications for ethical, environmental and economic sustainability and is a perfect example of welfare and sustainability working in harmony.

Box 2. The Impact of Heat Stress:

The circulatory system in faster growing broilers is under significant stress due to the growth rate of the birds. Not only does this faster growth rate increase body heat production (Lin et al, 2006), but heat stress also increases heart rate and blood flow (Ahmad and Sarwar, 2006) and pulmonary hypertension (Deeb, 2002), putting their already strained hearts under even more stress. When we consider stocking density, the less space between birds means the less air that is able to circulate and higher litter temperature. Aside from the temperature itself, one of the biggest problems comes from the relative humidity which increases significantly above 30 kg/m2 (Jones et al, 2005). The reason humidity is a problem is because chickens have no sweat glands and therefore pant to help reduce body temperature (Yousaf et al, 2019), which works by moisture evaporating from their respiratory tract. When temperature and humidity are high this mechanism becomes ineffective causing the birds to keep increasing their respiration rate to the point of hyperventilation. This increase can then induce respiratory alkalosis through a rise in blood plasma pH, from an excessive loss of CO_2 (Teeter et al, 1984). Lu et al (2007) also demonstrates that heat stress is breed dependent. Even breeding companies recommend reduced stocking densities during high temperatures. Hubbard (2006) recommends 24.2 - 28.6 kg/m2 in hotter climates, and Aviagen (2016) 20 - 25 kg/m2. It is clear that both breed and stocking density have an impact on broiler mortality during hot climates, and the adoption of the BCC would address both of these and help to reduce future heat related mortality. As previously stated, birds that don't make it to slaughter are still taking extra space, consuming feed, and are therefore negatively affecting sustainability.

Reducing Myopathies

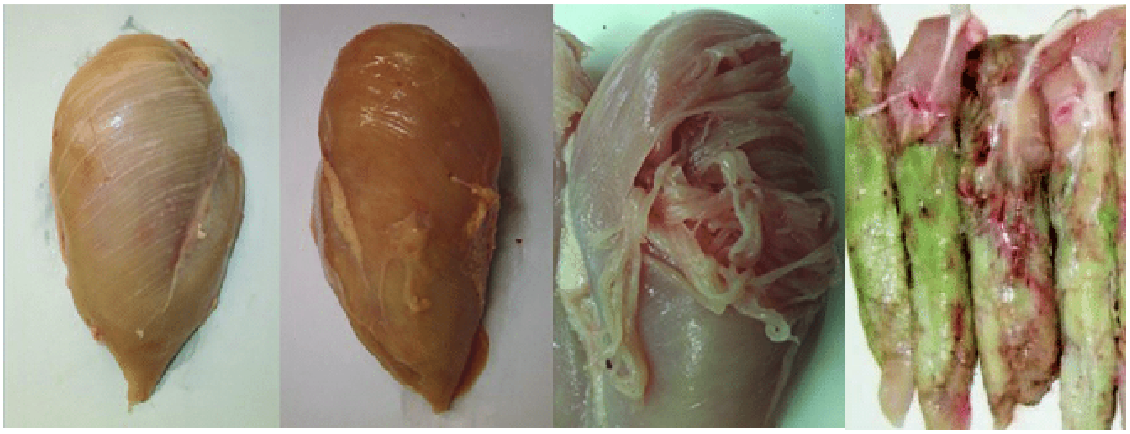


Figure 1 - (Left to Right) White Striping, Wooden Breast, Spaghetti Breast, Deep Pectoral Myopathy

Sources: Characterising the Influence of Genetics on Breast Muscle Myopathies in Broiler Chickens - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Breast-fillets-showing-the-novel-myopathies-white-striping-WS-left-wooden-breast_fig1_343750481 [accessed 11 Apr, 2023], Occurrence and characteristics of chicken breast muscles with DPM symptoms - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Symptoms-of-DPM-in-broiler-chicken-stage-III_fig3_257431186 [accessed 11 Apr, 2023]

Fast growing strains used in standard production have a significantly higher incidence of muscular myopathies - abnormalities in the muscle cell structure (Dixon, 2020). These myopathies can be painful (Sihvo, 2019) and affect meat quality considerably (Malila et al, 2018). While most affected meat is still perfectly safe to eat, it is nutritionally different (Kuttappan et al, 2012a) and less appealing to the consumer (Kuttappan et al, 2012b), meaning that during the processing stage, meat with visible myopathic conditions are often downgraded due to not meeting quality specifications (See Figure 2). A significant amount of downgraded meat means that either more birds have to be reared in order to produce enough 'quality' meat, or lower quality meat is reaching the consumers. The main muscular myopathies affecting chicken are white striping (WS) and wooden breast (WB), deep pectoral myopathy, also known as green muscle disease, and stringy spongy, also known as spaghetti breast. WS and WB are the two most common myopathies.

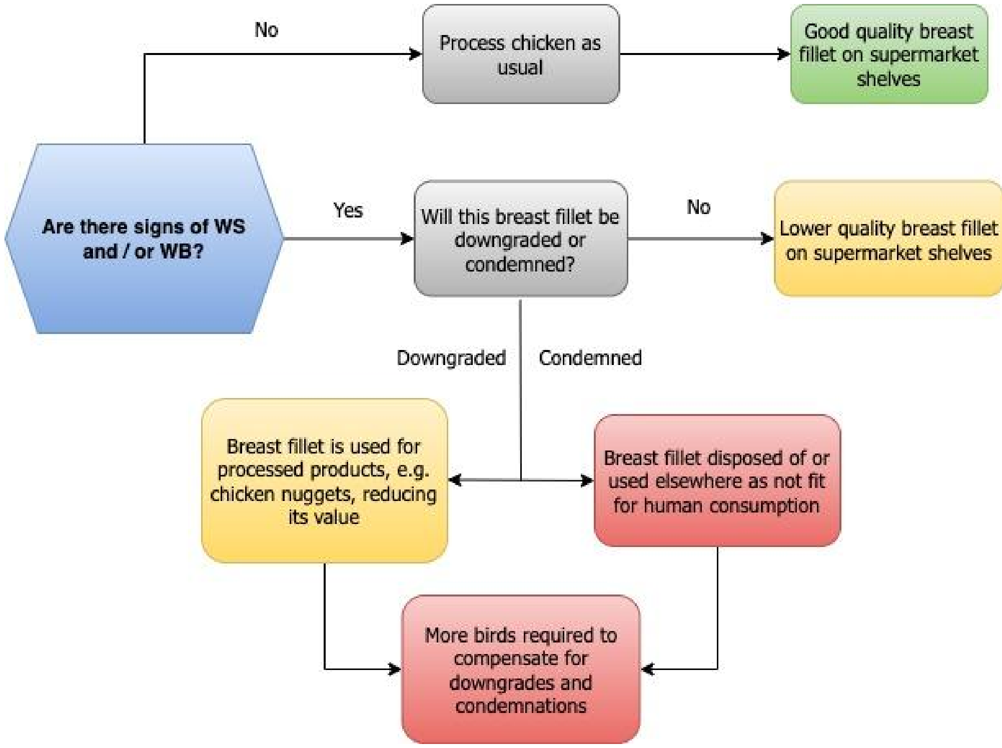


Figure 2 - A flow chart demonstrating the process of chicken with myopathies during processing.

While the exact mechanisms resulting in breast myopathies are not yet completely understood, they are understood to be associated with the increased growth rate of birds (Kuttappan et al, 2016). This is likely due to the circulatory system being unable to keep up with the oxygen and nutrient demands of the enlarged breast muscles, leading to damage and / or death of the muscle tissue. A study comparing 12 different breeds demonstrated that the conventional faster growing breed had greater incidence and severity of WS and WB than the slower growing breeds (Santos et al, 2021). Dixon (2020) found that the incidence of moderate WS in the conventional breeds was 57.1 - 63.9 percent, and 6.3 - 14.8 percent with severe WS. Conversely, the slower growing breed only had a 8.7 percent incidence of moderate WS, with 90.4 percent showing no signs at all. The same conventional breeds had a WB incidence of 3.7 - 23.4 percent, while the slower growing breed had less than 1 percent.

These results are reflected in real world poultry production. **Studies in the UK, Poland, Canada and SE Asia show 85-99 percent incidence of WS** (The Humane League UK, Anima International, Malila et al 2018,Che et al, 2022) and 6.6 - 82.4 percent WB (Malila et al 2018,Che et al, 2022), highlighting the 'severe impact' of these diseases on producers, meat processors and retailers (Malila et al, 2018). Figures such as these can be found in various different regions, demonstrating that this is a global issue.

While there is little to no available public data available, Baxter et al (2021) found that **downgrades and rejections due to muscle myopathies were 29.5 percent[A3] lower in a slower growing breed**, compared to a conventional faster growing breed. The available science clearly demonstrates that higher welfare slower growing breeds would reduce the incidence of these conditions. The BCC would help address this issue through a reduction in these likely painful conditions (Papah et al, 2017), therefore improving quality, and improving sustainability through a reduction in suffering and the reduction of birds needing to be reared.

Protecting Human Health

Sustainable Antibiotic Usage

Antibiotics are widely used in poultry production, to treat and prevent illness and, in some parts of the world, to promote growth. Globally it is estimated that farmed animals are responsible for 66 percent of all antibiotic usage (Tiseo et al, 2020), with chicken making up approximately 40 percent[(A5)] of this (Van Boeckel et al, 2015). **Overuse of antibiotics in poultry production is cited as the leading cause of resistance development in bacteria** (Kousar et al., 2021). There is substantial evidence linking antibiotic usage in broilers to antimicrobial resistance (AMR) for a variety of pathogens, including *Campylobacter* and *E. coli,* major causes of foodborne infections in humans. The Food Standards Agency UK (2021) found that 60.6 percent of *Campylobacter jejuni* taken from retail chickens were resistant to tetracycline, an antibiotic widely used in human medicine. Similarly, ***E. coli* isolated from chickens in the US, Brazil, China, Poland, United Kingdom, Germany, France, and Spain were found to contain resistance to a number of antibiotics, including penicillins and tetracyclines** (Roth et al., 2019); see Info Box 3: *AMR and Foodborne Illness* for more information. As well as the direct risk to human health and medicine, antibiotic usage in poultry production poses a serious environmental risk to surrounding lands and waters (Gržinić et al, 2023). **Antibiotic resistant genes were found in rivers downstream from intensive broiler farms** (World Animal Protection, 2022).

A commercially viable solution is to raise healthier animals requiring fewer antibiotics; the use of slower growing breeds, as required by the BCC, is part of this solution. It has been demonstrated that **faster growing breeds require 3 to 5 times more antibiotics than slower growing breeds** (CIWF, 2020, Alliance to Save Our Antibiotics, 2016, Speksnijder et al, 2015). The use of fluoroquinolones, antibiotics considered "critically important in human medicine" whose "use in animals should be restricted to mitigate the risk to public health" (Fitt, 2020), was almost 6.7 times lower in slower growing breeds in 2021 (Royal GD, 2022). Fluoroquinolones are also strongly linked with antibiotic resistance in campylobacter isolated from both humans and broilers (PHE as cited in Alliance to Save Our Antibiotics, 2016, Jorgensen et al, 2019) further signifying the importance of a global shift to antibiotic reduction through slower growing broilers.

The Netherlands has begun to implement a large-scale transition to slower growing breeds with the majority of the market no longer using conventional breeds. This in turn has had a huge impact on the overall antibiotic usage across the whole Dutch industry (SDa, 2022). **In 2021 over two thirds (69%) of farms with alternative breeds did not use any antibiotics at all, versus just 26% of farms with conventional breeds**. This includes no usage of critically important antibiotics on alternative breed farms, whereas 9 of the farms with conventional breeds (2.5%) used fluoroquinolones and 3 (0.8%) used colistin.

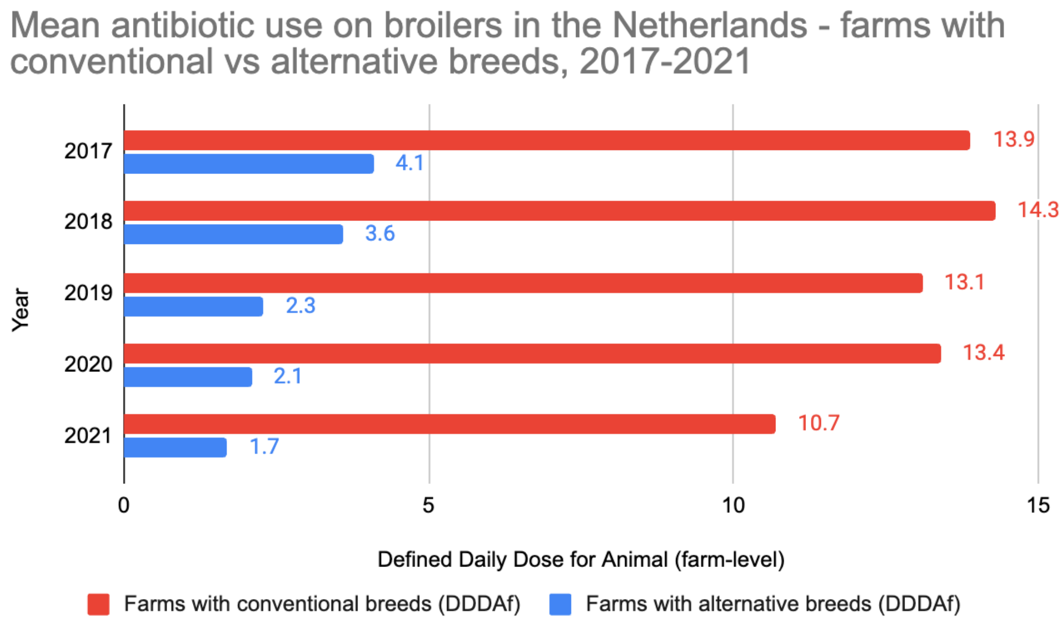


Figure 3 - *The mean antibiotic usage on broilers in the Netherlands between 2017 - 2021 - Demonstrating the difference between conventional and alternative (slower growing) breeds.*

This widespread adoption of alternative breeds in the Netherlands has allowed the overall industry antibiotic usage to drop by a third between 2017 and 2021 (SDa, 2022). Alternatively, in the UK where this wide scale adoption of slower growing breeds has stalled, antibiotic usage actually increased by a third across the same period (UK-VARSS, 2022).

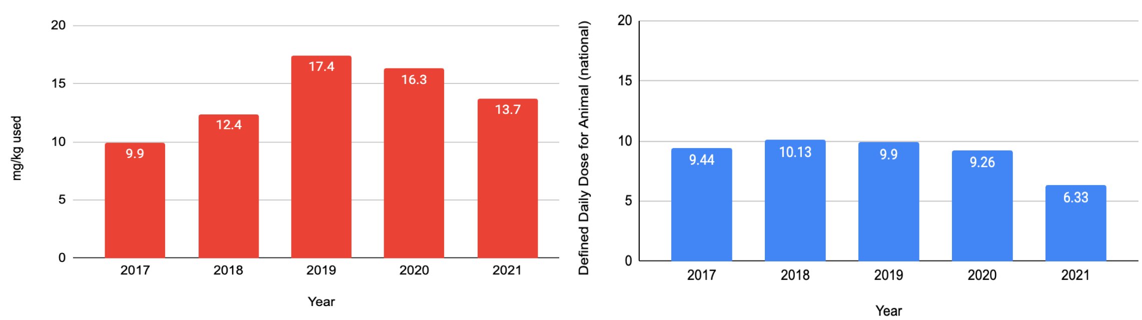


Figure 4 - *The mean antibiotic usage between 2017 - 2021 in the UK and Netherlands, respectively.*

Reducing meat consumption is another way to help reduce antibiotic usage. It is estimated that if global meat consumption was reduced to 40 g/day per person, this could reduce the global consumption of antimicrobials in food by 66 percent by 2030 (Van Boeckel et al, 2017). In 2016, while China introduced national guidelines recommending consuming only 40 - 75 g/day of meat and poultry (Wang et al, 2016. As cited in Van Boeckel et al, 2017), the average US meat consumption was 260 g/day (OECD, 2015. As cited in Van Boeckel et al, 2017), meaning that reducing meat consumption to this level on a global scale is unlikely at this time. However, a more modest global reduction to 165 g/day may still result in a 22 per cent reduction in consumption of antimicrobials in food by 2030 (Van Boeckel et al, 2017). These reductions are based on current standards of production in the most intensive systems; **switching to BCC standards *together* with reduced levels of chicken production and consumption would further improve these sustainability measures through reduced antibiotic usage.** A reduction in meat consumption would additionally have a positive impact on the overall environmental footprint (United Nations, 2022) and human health parameters.

Strict regulation and monitoring can reduce antimicrobial use in chicken production; a global cap of 50 mg/PCU, for example, could reduce total consumption of antimicrobials in food animals by 64 percent (Van Boeckel et al, 2017). However, 2018 antibiotic sales in Europe alone range from 2.9 to 466.3 mg/PCU, in Norway and Cyprus respectively (ESVAC, 2020); the challenges faced by each country may not be universal and require different interventions. There are also risks to this strategy: countries meeting the threshold are unlikely to make any effort to reduce consumption further, and those countries significantly under this threshold may see it as an opportunity to increase their current consumption. Lower income countries may not have the funds or facilities to successfully manage a regulatory / monitoring program.

Whilst antibiotic reduction targets and reduced meat consumption can help towards sustainability, the adoption of slower growing breeds is the only solution to addressing all three tenets of the One Health approach, improving animal, human, and environmental health. It is also the only solution to address societal concerns regarding animal welfare. If there is opportunity to reduce antibiotic usage further then there is a responsibility to do so. Sick animals should always have access to antibiotics as their health and welfare takes priority, but never to mask poor production standards or genetics. There is no reason we cannot lower usage and improve welfare at the same time. The BCC is a clear opportunity to both reduce antibiotic usage and improve animal welfare. For a sustainable future we must protect our antibiotics and the One Health approach provides a moral imperative to do so.

Box 3: AMR and Foodborne Illness

Antimicrobial resistance (AMR) was associated with 4.95 million human deaths in 2019, globally, with the economic impact in the US alone costing the US health system 20 billion USD annually. It is estimated that global deaths will rise to 10 million per year, with an accumulative cost of 100 trillion USD, by 2050, if AMR is not addressed now (O'Neil et al, 2016). AMR is caused by the use of antimicrobials, leading to the emergence of antibiotic resistance in bacteria, with resistance genes able to pass between bacterial species (OECD, n.d.). Globally it is estimated that farmed animals are responsible for 66 percent of all antibiotic usage (Tiseo et al, 2020), meaning that if we want to address the ongoing antibiotic crisis then we must address factory farming.

There is substantial evidence linking antibiotic usage in broilers to AMR for a variety of pathogens. Campylobacter is the leading bacterial cause of diarrhoeal disease in the US (CDC, 2019), and the most common cause of food poisoning in the UK (NHS, 2021), with 70 percent of these infections coming from chicken (FSA, 2021). The Food UK Standards Agency (2021) found that 60.6 percent of *Campylobacter jejuni* taken from retail chickens contained tetracycline resistance. Currently in the UK the two most common classes of antibiotics used in poultry production are tetracyclines and penicillins (UK-VARRS, 2020), which are both widely used in human medicine, meaning consumers are at direct risk. This means that this resistance is likely to get worse if antibiotic usage is not further reduced, further increasing the direct risk to human medicine. These are not the only antibiotics used that are currently at risk through poultry production. A multinational study by Roth et al (2019) took place to identify antibiotic resistance within E. coli isolated from broilers in the following countries; US, Brazil, China, Poland, United Kingdom, Germany, France, and Spain. Aminoglycosides, sulfonamides, penicillins and tetracyclines are all classes of antibiotics permitted for use in poultry production within these countries. The rate of resistance was above 40 percent for antibiotics in all of those classes in every country, other than ampicillin resistance in the US. While further quantitative data is needed to confirm the cause / effect relationship, it is clear that AMR and poultry production is a global problem.

Contributing to Environmental Sustainability

Feed Emissions and Land Use Change

The biggest contributors to greenhouse gas emissions (GHGs) in poultry production are: 1) emissions from land use change (LUC) for feed production (i.e. deforestation & soil degradation) and 2) emissions from food production (Mostert et al, 2022). Production of soya is, in turn, one of the biggest contributors to feed emissions (Poultry News, 2023) and, as no commercially viable alternative yet exists, soya is likely to still be required in production for the coming years. However, the nutritional needs of fast and slower growing broilers are different and must be factored into any sustainability analysis of higher welfare and standard broiler production.

Slower growing strains can thrive with a lower amount of soybean products in their diet and this has been shown to result in lower emissions from LUC per kg feed produced in some higher welfare production systems (Mostert et al, 2022; see Figure 5 and Box 4 for more detailed analysis). Removing or reducing LUC emissions - by sourcing only sustainable soya, not reliant on deforestation - can result in further and more significant reductions in emissions, helping companies to meet their environmental sustainability targets.

Figure 5 shows the emissions between production systems with and without LUC emissions. The gains are slightly greater in conventional systems, but the significant welfare concerns remain. Taking the step to only source sustainable soya, *together* with higher welfare production, helps to satisfy the environmental, animal and human health aspects of sustainability as well as the ethical dimension..

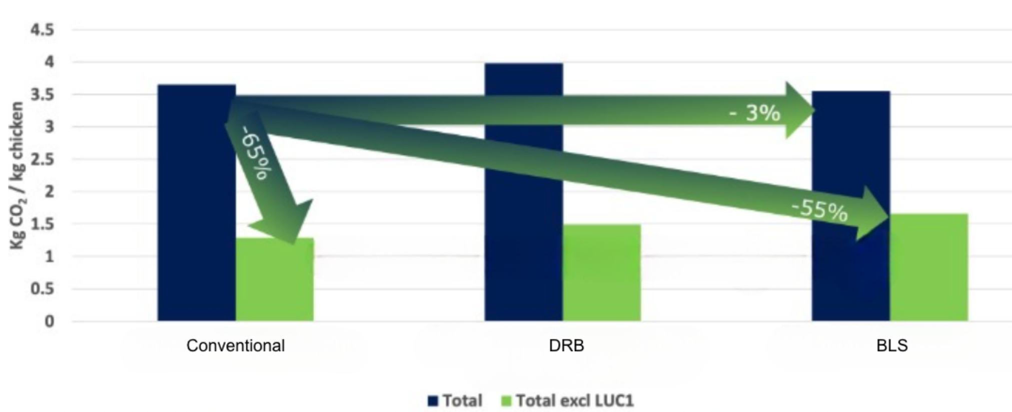


Figure 5 - *Life cycle analysis of greenhouse gas emissions per kg of live weight at the broiler farm (Mostert et al, 2022). This graph demonstrates the differences in emissions within each production system with and without LUC emissions. DRB = Dutch Retail Broiler; BLS = Beter Leven One Star (aligned to the BCC).*

Box 4: *Mostert et al (2022) Analysis*

At the broiler stage, the highest difference in GHG emissions was between the starter diets of the conventional and the BLS systems with the conventional system being + 40 g CO2 - eq / Kg feed. For LUC emissions the highest difference was between the finisher diets of the same two groups (+ 720 g CO2-eq/kg feed). The higher LUC emissions are due to the higher soya content in the feed of conventional birds. At the same stage the conventional birds had a lower feed intake and energy use per Kg of live weight produced, however, only when LUC emissions were not included. When LUC emissions were included the most efficient system was the BLS. Even during the parent stock rearing and laying periods, where welfare standards are likely similar between all groups due to no specific requirements, the BLS and DRB broilers still had lower GHG emissions compared to the conventional birds as feed intake, mortality and selection was lower per hen, making them around 10 percent more efficient per egg delivered to the hatchery. During the layer period the BLS system had the lowest feed intake per delivered egg, however, the GHG emissions from LUC were higher, meaning ingredient, layer performance, and soya country of origin is important to help mitigate this.

		Conventional	Dutch Retail Broiler (DRB)	Better Life One Star (BLS)
Per Hen	Rearing Period	9.59	8.31	**8.01**
	Laying Period	0.40	**0.34**	0.35
	Hatchery	0.51	**0.45**	0.46
Per Kg Live Weight	Broiler Farm	3.65	3.98	**3.55**

Greenhouse gas emissions (kg CO2-eq)

'The impact of changing toward higher welfare broiler production systems on greenhouse gas emissions: a Dutch case study using life cycle assessment', Mostert et al, 2022.

Overall, total emissions were lower for the BLS system due to overall lower amounts of soybean products being nutritionally required for their diets, and can be further reduced by sourcing soybean products from a country with low LUC emissions. Similar to this study, comparing emissions from different production systems, Boggia et al (2010) found that even with a higher feed intake, organic production had overall lower GHG emissions than conventional systems due to the different feed composition of their diets.

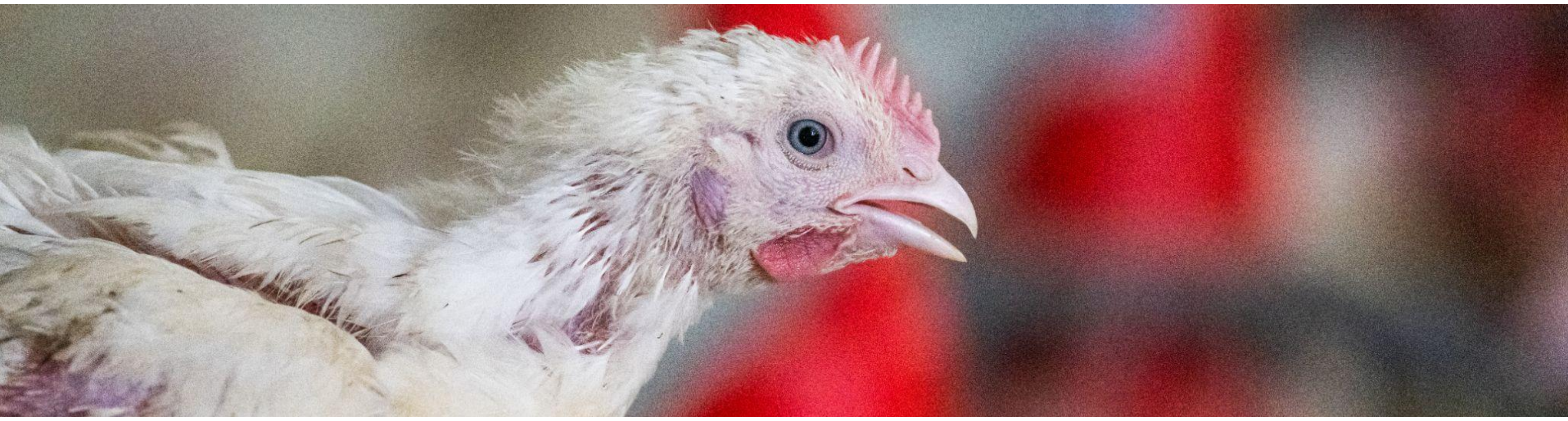
Water Usage

Sustainable water usage is not only vital for socio-economic development, water is also the critical link between the climate system, the environment, and human society, and is only renewable if responsibly managed (UNDESA, 2015). Water usage in agricultural systems plays a role in this. Water is used throughout the whole production cycle for broilers, from drinking water through to cleaning water. This great use of water means it is essential to try and reduce it in any areas it is safely possible to do so. There are changes that can be made now, as well as promising developments for future technologies.

One of the criteria of the BCC is to move away from electric waterbath stunning and to adopt Controlled Atmospheric Stunning (CAS) systems. CAS systems not only deliver significant welfare benefits (https://welfarefootprint.org/research-projects/poultry-slaughter/), they also use considerably less water than conventional electrical methods.

As well as improving broiler welfare, there are also sustainability benefits of switching systems, specifically around water usage. The European Commission Directorate General for Health and Consumers (2012) calculates that **electric waterbath systems use almost three times as much water per day compared with CAS systems**. Calculated for a slaughterhouse with the capacity of 12,000 birds per hour, they calculate that an electric waterbath system uses 9.0m^3 of water per day, compared to only 3.5m^3 for a CAS system. As some processing plants run all year round, minus 10 days for various holidays, a CAS system would save almost 2 million litres* of water annually. **In 2019 only 5.5 percent of the 254 federally inspected chicken slaughter facilities in the US were using CAS systems** (Vieira and Peacock, 2021); **if the remaining 94.5 percent switched to CAS, this would save almost 450 million litres** of water annually**.[A6] On a global scale this would be a considerable reduction in water usage. Despite higher installation cost of CAS, the reduced labour, reduced water usage, and improved animal welfare outweigh this, even with slower line speeds. Renewable energy sources can easily compensate for the electricity usage, making a CAS system even more sustainable.

The example of water usage in different slaughter systems perfectly illustrates how welfare and water usage can work together. With CAS systems being a requirement of the BCC, this would mean an automatic instant saving in water by making the switch.



Animal Welfare

According to our definition of sustainability (see Introduction, P5) there is an ethical imperative to ensure we minimise harms and - wherever possible - optimise benefits to animal health and welfare. If practices result in unnecessary suffering, they cannot be considered sustainable. The conditions described so far - mortality rates, myopathies, and slaughter methods - all have a significant impact on suffering and *can* be avoided or minimised through adoption of the BCC, as demonstrated through scientific studies and commercial practice.

Schuck-Paim and Alonso (2022) measured the impact of different production methods on the time spent in pain for the average animal within that system. They calculated that the adoption of the BCC resulted in a significant reduction in the amount of pain each animal endured, when compared to conventional production (see Table 3).

	Pain Reduction With the BCC	
	Before Slaughter	**During Slaughter**
Hurtful *Disrupts the ability of individuals to function optimally*	24%	-
Disabling *Pain that takes priority over most behaviours and prevents all forms of enjoyment or positive welfare*	66%	87 - 90%
Excruciating *Extreme levels of pain that are not normally tolerated even if only for a few seconds*	78%	99 - 100%

Table 3 - The reduction in pain when switching from conventional production to the BCC (Schuck-Paim and Alonso, 2022)

These reductions in levels of pain come from the overall positive welfare impact of the BCC. This includes the reduction in mortality and associated conditions; ascites, lameness, and more humane slaughter.

It is also important to consider customer perception when addressing ethical and social sustainability. Not only is there a growing perception among consumers that animal welfare should be protected and improved, many consumers consider higher welfare products to be healthier, tastier, and more environmentally friendly (Alonso et al, 2020). Across 7 European countries (Netherlands, UK, France, Hungary, Sweden, Norway, Italy), 69 to 87 percent of consumers, respectively, state that animal welfare is important to them (Welfare Quality, 2007). It is clear that switching to the BCC not only improves sustainability in the areas discussed previously, but improves ethical sustainability by default. However, it is paramount that these benefits are communicated effectively to consumers.

Economical Sustainability

The BCC alone provides a significant positive impact to sustainability. When we consider economic sustainability, there are other factors to take into account to help increase this impact further. These include; better carcass utilisation, reduced food wastage, and the use of renewable energy.

Carcass utilisation is using as much of each bird as possible, be this through recipe innovations or simply 'sharing' birds with other companies also signed up to the BCC. Pieminister, a pie manufacturer who uses 100 percent slower growing, BCC compliant breeds, has changed its recipes to include thigh meat as well as breast, and do not use imports or exports. The change has meant they now only require **almost half the number of birds to produce the same amount of meat** they were using previously (Pieminister, 2023). As well as the clear reduction in overall birds, effective carcass utilisation could potentially reduce reliance on imports and exports, reducing emissions through less meat needing to be transported.

Food Wastage: In the US in 2016, only 81 percent of fresh chicken produced was consumed, the rest became a mixture of household and store waste (Statista, 2023). That is a 19 percent of their total produced chickens that will have suffered considerably through their short lives, simply to become waste. This is almost 1 in 5 birds unnecessarily using feed and space, contributing to the overall environmental footprint. Similar wastage figures can also be found elsewhere. For example , in 2018 approximately 143 kilograms per person of food waste was produced in the UK, totaling around 9.5 million tonnes. 70 percent of this is produced from household food waste alone (GOV.UK, 2023). Household food waste that could have been eaten costs the average family with children around £60 per month (WRAP, 2020). Not only is wastage impacting the planet, it is impacting our pockets.

Renewable Energy: There are many sources of renewable energy that can be utilised to compliment the sustainability improvements of the BCC. For example, by installing 460 solar panels on an acre of land an Arkansas farmer is predicted to save $25,000 per year on electricity bills, over 90 percent of the farm's annual electricity cost. It is calculated that with the 25 year warranty, the farm will earn at least 20 years of free electricity (Arkansas Agricultural Experiment Station, 2021). Other examples include the management of chicken waste. It is estimated that 2.73 Mt of the 4.55 Mt of poultry litter currently produced in the UK annually can be used for energy recovery. Using the "gasification process", this could supply 0.6 percent of the country's electricity and heat demand, saving 1.7 Mt of GHG emissions - or 0.4 percent of the country's total emissions - annually Jeswani et al (2019)

Conclusion

Sustainability incorporates a number of areas in which we should aim to minimise our negative impacts, whilst optimising the benefits wherever possible. These include animal, human and health parameters as well as ethical considerations. Initiatives such as the UN's One Health programme recognise the interconnectedness of these domains and the need to protect each; environmental sustainability, for example, cannot be used as an excuse to continue with practices that systematically lead to poor animal health. This report clearly demonstrates that adoption of the BCC contributes to minimising the negative impacts and improving the positive impacts across a number of sustainability criteria. **The instant benefits associated with adoption of the BCC include: lower mortality rates, significantly reducing the number of birds needing to be reared; and significant reductions in antibiotics usage, minimising long term effects on human health and the environment.** Implementation of the BCC would also reduce muscular myopathies, resulting in fewer downgrades and condemnations and helps to conserve water through the requirement for CAS slaughter. Other improvements include the biggest source of emissions: feed supply. As well as slower growing breeds requiring lower amounts of soya, responsible sourcing could completely eliminate LUC emissions. The sustainability credentials of the BCC can be further enhanced with existing strategies such as renewable energy sourcing and effective manure management. **Finally, the immediate and significant benefits to animal welfare should not - and must not - be ignored within the sustainability agenda; there is clear evidence that society does not wish to contribute to animal suffering in the food choices they make; the BCC provides companies with a ready-made set of criteria to align with these societal values.** It is worth noting, that whilst the UN's SDGs make no specific reference to animal welfare, a recent study found no conflict between achieving an SDG and improving animal welfare, rather creating the one actually helps achieving the other (Keeling et al., 2019). In other words, **animal welfare and sustainability objectives can go hand in hand.** Our Norsk Kylling case study (Appendix 1) provides clear evidence of the commercial viability of welfare and sustainability working together.

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Appendix 1

CASE STUDY: Improving Welfare & Sustainability in the Real World

So far this report has considered various factors that influence the sustainability of poultry production and how these can be further mitigated through the adoption of the BCC. This section will explore the real life application of the BCC and its effect on sustainability and the environment. Norsk Kylling, who have been mentioned previously, is a poultry supplier in Norway that holds approximately 27 percent of the country's market share. They manage their whole supply chain, from parent flocks through to, and including, the processing plant. They committed to the European Chicken Commitment (ECC) in 2020 and had fulfilled all of the requirements by spring 2022. During this time they have taken a number of steps towards creating a more sustainable, environmentally friendly future, whilst dramatically improving bird welfare. Norsk Kylling have set themselves some extremely ambitious targets (Norsk Kylling, 2021), aiming to become climate neutral by 2030, through a 51 percent total reduction in emissions, and to also use completely soya-free feed by 2030. The way in which they plan to achieve these goals is through **an holistic approach that puts animal welfare first**.

In assessing their carbon footprint they ensure they cover their whole supply chain by splitting it into three areas:

	Scope Description	2019 to 2021 Emissions
Scope 1	Emissions generated directly by operations (stationary combustion / transport / coolants)	**- 26%**
Scope 2	Indirect emissions from purchased energy (electricity / remote heating)	**- 53%**
Scope 3	Other indirect emissions, including customers and suppliers (downstream transport / waste / chicken feed / packaging etc)	**+ 3%**

Between 2019 and 2021 their scope 1 and 2 emissions were reduced by 26 and 53 percent, respectively. As this included the slower growing breed of chicken, their scope 3 emissions increased by 3 percent.

The National Farmers Union (2019), comparing the BCC to Red Tractor (RT), a conventional farming system, states "*It is estimated that greenhouse gas emissions per kg of live weight are 23% higher for BCC systems compared to RT systems. In addition, more land will be needed to grow the extra wheat and soya that will be consumed by BCC chickens. Based on typical crop yields, the increase in land area amounts to around 22%. Water consumption is also calculated to be around 22% higher per bird BCC.*"

Chicken feed makes up the vast majority of total emissions, so a 3 percent increase in scope 3 emissions (which includes chicken feed) has the potential to be substantial, making it one of the biggest sustainability concerns. However, previous estimates for the BCC have placed the emissions increase at a much higher percentage (~22 percent higher than Red Tractor, a conventional production label). Having only a 3 percent increase this close to the beginning of their sustainability journey, Norsk Kylling are already challenging industry preconceptions.

The data actually showed that due to altered feed composition and reduced mortality, amongst other things, that the overall carbon footprint of their newer slower growing breed is 1 percent lower than their previous faster growing breed. One reason is due to using a different feed supplier, and another likely reason is due to a **40 percent decrease in daily mortality, and a 67 percent decrease in transport mortality**. As previously mentioned, feed ingredient sourcing can have a huge impact on emissions, and also, slower growing breeds are less likely to suffer with the detrimental health conditions described earlier in this report, meaning fewer birds are needed. Another initiative includes growing the birds slightly larger, further reducing the number of birds needing to be reared. **Their overall combined effort at improving welfare and sustainability together means that Norsk Kylling now produces 3 million fewer birds each year, but still produces the same amount of meat.**

As well as the immediate improvements through the ECC, Norsk Kylling has also made use of some of the renewable energy technologies at both farm level and processing level. The installation of solar cells, wood chip heating, and heat recovery systems on their farms means that they have reduced their total carbon footprint for heating by 21 percent, saving 1400 tons of carbon dioxide annually, despite having increased their overall farmhouse area by 28 percent. Their current processing plant has cut its emissions by 100 percent compared to their previous plant by installing solar panels for energy, thermal energy storage solutions, and recovering waste energy from an adjacent industry. The plant also utilises nearby sea water which it uses for cooling. This system alone saves up to 20 percent more energy than the previous system. This means **their processing plant is already climate neutral compared to the previous one.** Alongside these changes, they also continue to run a project to identify even more renewable options

Some of their current projects and initiatives for increasing sustainability include:

- The planting of flower meadows to help preserve biodiversity, including 10 square kilometres around the processing plant and around 6 square kilometres around each farm.
- The use of more environmentally friendly transport, including biogas trucks. Since 2021 they have achieved an annual reduction of 630 tons of carbon dioxide.
- Processing their own chicken waste into biogas, and powering several light trucks with biogas produced from other by-products in their value chain.
- In 2021, recycled materials made up 35 percent of the plastic in their packaging, with the plan to be at 100 percent by 2030.
- Using 100 percent of each chicken by using surplus parts in pet food production and energy production.
- They use a shelf life indicator on their packaging, rather than a date, to reduce food wastage.

It is not one big change, but many little ones that together create a huge impact. One of the main challenges to the BCC, that could fall under the umbrella of sustainability, is the perceived financial cost increase, predominantly due to the increased lifespan and increased feed. Being completely BCC compliant, the direct benefits that come with this, such as reduced mortality and fewer rejects, combined with increased slaughter weight and yield, means that Norsk Kylling have completely mitigated these increased costs (CIWF, 2020). Not only have they developed a more sustainable future, they have mitigated the biggest perceived problem associated with the BCC, the increased cost of production. Norsk Kylling expertly demonstrates that sustainability is more than just extra feed and space and does not have to compromise animal welfare. They have done this through better bird health (lower mortality), better feed sourcing, various renewable energy sources, and the commitment to ongoing projects that will further reduce their environmental footprint. Norsk Kylling has successfully achieved the synergy between welfare and sustainability and will continue to improve as time goes on.

Appendix 2

Calculations

A1 - 487 million birds

2022 - 9.2 billion birds produced

https://www.nationalchickencouncil.org/statistic/broiler-industry-key-facts/

2022 - Mortality 5.3%

https://www.nationalchickencouncil.org/about-the-industry/statistics/u-s-broiler-performance/

Total = 487m broilers

A2 - Rayner et al (2020) - Group 3 (slower growing breed) and Group 4 (conventional breed) at 34 kg/m2

Total Mortality (%)*				
Leg Culls	0.49 ± 0.12	0.78 ± 0.21	0.62 ± 0.17	2.09 ± 0.39
Other Culls	0.41 ± 0.04	0.71 ± 0.18	0.60 ± 0.19	1.03 ± 0.03
Dead	1.21 ± 0.14	1.71 ± 0.23	1.37 ± 0.21	3.11 ± 0.49
Total	2.10 ± 0.30	3.20 ± 0.54	2.58 ± 0.56	6.23 ± 0.62
Processing welfare outcomes (%)				
Catching and transport time (hr:min)	3:26 ± 0:19	4:09 ± 0:13	3:35 ± 0:20	3:36 ± 0:17
Dead on Arrival	0.02 ± 0.01	0.03 ± 0.03	0.02 ± 0.01	0.04 ± 0.02
Pre-processing Culls	0.02 ± 0.01	0.02 ± 0.01	0.02 ± 0.01	0.14 ± 0.06
Total Post-mortem Inspection Rejections	0.14 ± 0.03	0.45 ± 0.15	0.60 ± 0.15	1.34 ± 0.37

Rejections
(0.6/1.34)100 = 44.8% = 55.2% reduction
DOA
(0.02/0.04)100 = 50% = 50% reduction
Total Mortality
(2.58/6.23)100 = 41.4% = 58.6% reduction

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A3 - Baxter et al (2021) - Redbro and Ross 308, respectively

Downgrades (%)	0.67 ± 0.31	0.95 ± 0.58
Dead on arrival (%)	0.09 ± 0.03	0.10 ± 0.03
Total Mortality (mort + culls; %)	2.18 ± 0.60	3.76 ± 1.45

Downgrades
(0.67/0.95)100 = 70.5 % = 29.5% reduction
DOA
(0.09/0.1)100 = 90 % = 10% reduction
Total Mortality
(2.18/3.76)100 = 57.9 % = 42.1% reduction

A4 - RSPCA - Everyone's a Winner - Freedom Food (now RSPCA Assured) and ACP (Red Tractor)

Standards	Average level of slaughterhouse rejects (%)
RSPCA (labelled Freedom Food)	1.6
ACP (labelled Red Tractor)	1.9

Standards	Average level of birds dead on arrival at slaughterhouse (%)
RSPCA (labelled Freedom Food)	0.05
ACP (labelled Red Tractor)	0.17

Standards	Average level of mortality (%)
RSPCA (labelled Freedom Food)	1.8
ACP (labelled Red Tractor)	5.1

Rejects
(1.6 / 1.9) = 84.2% = 15.8% reduction

DOA
(0.05 / 0.17) = 29.4% = 70.6% reduction

Mortality
(1.8 / 5.1) = 35.3% = 64.7% reduction

A5 - 40%

Van Boeckel et al (2015) -
"We estimate that the global average annual consumption of antimicrobials per kilogram of animal produced was 45 mg·kg−1,148 mg·kg−1, and 172 mg·kg−1 for cattle, chicken, and pigs, respectively."

Total = 365 mg·kg−1 Chicken = 148 mg·kg−1 (148/365)100 = 40.55 %

A6

**** (9.0 x 355 days = 3195) - (3.5 x 355 days = 1242.5) = 1952.5m3 (1m3 = 1000 litres) 1952.5 x 1000 = 1,952,500 litres***

9.0m3 daily (water bath) for 355 days - 3.5m3 daily (CAS) for 355 days

***** (254 - 14 CAS users = 230) x 1952.5 = 449,075m3 (1m3 = 1000 litres) 449,075 x 1000 = 449,075,000 litres***

230 US slaughterhouses not yet using CAS, each one could save 1952.5m3 by switching