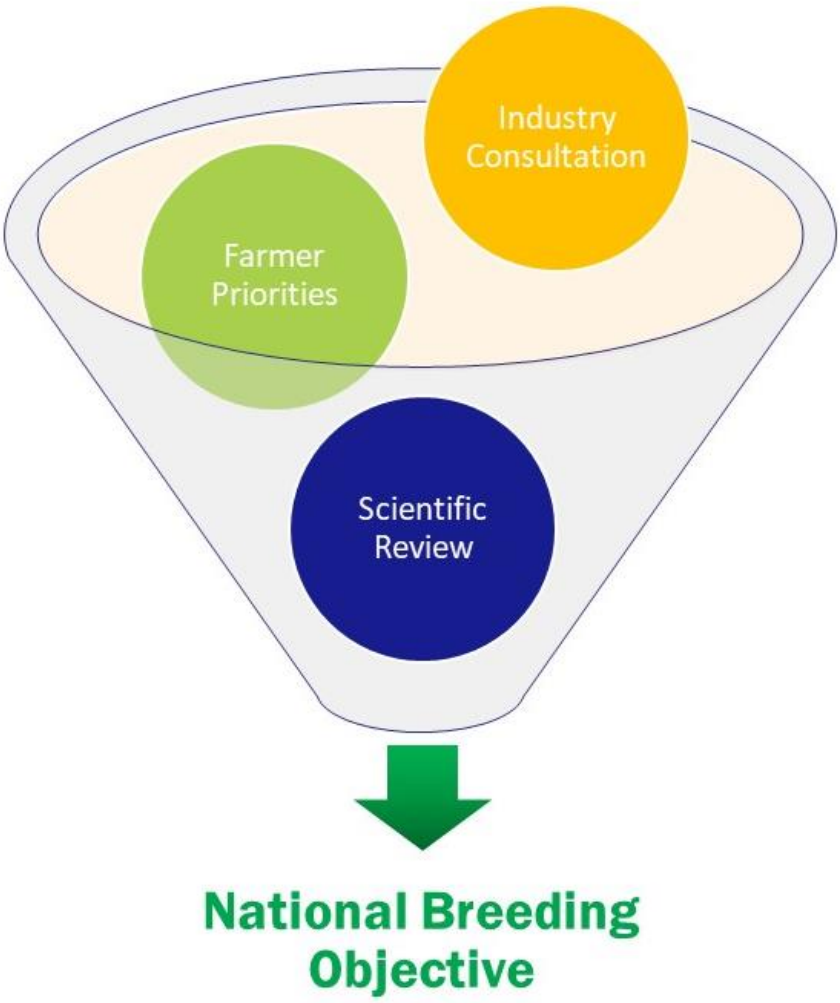
NBO 2025 Discussion Paper

Your herd. Your asset. Your future.



Contents

DataGene Solutions for Herd Development

1 What is a National Breeding Objective?

The National Breeding Objective (NBO) describes the collective breeding priorities for Australian dairy herds. Its purpose is to enable farmers to breed herds that meet the future needs of the Australian dairy industry.

While Australian Breeding Values (ABVs) express a bull or cow's genetic potential for a single trait such as fertility or protein kilograms most farmers want to improve more than one trait in their herd.

The NBO supports genetic selection pressure for an agreed group of desirable traits, providing direction for both bull and cow breeding across the country.

1.1 Australia's three indices

The current National Breeding Objective for the Australian dairy industry is aimed at increasing net farm profit and improved sustainability. It is expressed through the three breeding indices: Balanced Performance Index (BPI), Health Weighted Index (HWI) and Sustainability Index – see box.

Australia's three breeding indices

Australia's three breeding indices (BPI, HWI, SI) are used to rank bulls, cows and herds so that superior genetics can be identified and used in breeding programs.

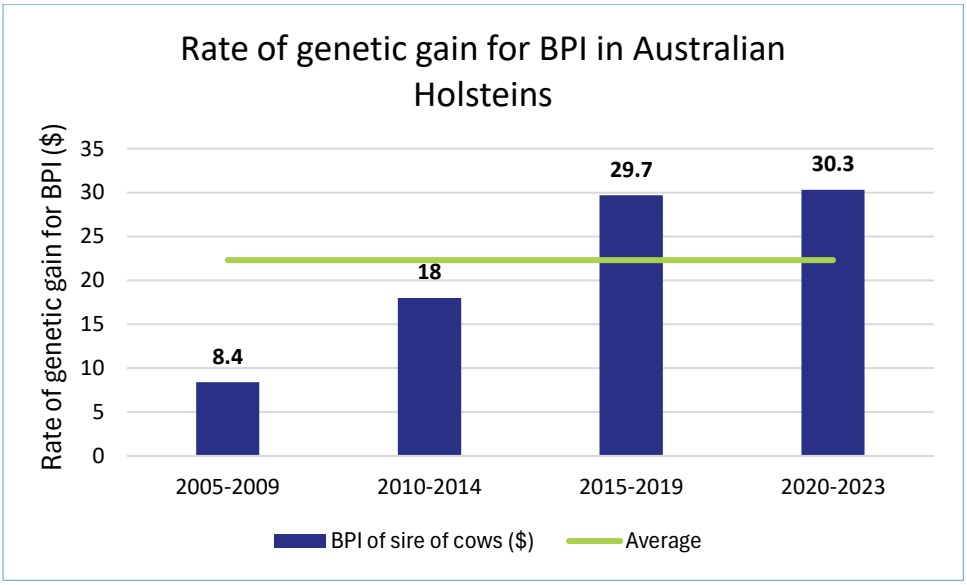
These indices combine the traits that drive on-farm profit, with different weightings to reflect different farmer breeding preferences.

The BPI is an economic index that reflects most farmer preferences. It drives net profit through a balance of functionality, type and yield. The Health Weighted Index puts extra emphasis on traits like fertility and cell count. The Sustainability Index fast track the reduction in greenhouse gas emission intensity.

1.2 Genetic trends

Genetic trends give an indication of progress made towards achieving the National Breeding Objective. Since the introduction of the BPI, there has been a positive and sustained increase in the use of Australian indices. The past 15 years has seen more than tripling of the rate of genetic gain in the sires used to produce Australian cows, as shown in the graph below. This has been due to the combination of the use of genomics to

select young bulls and heifers to breed replacements, based on BPI; an increased awareness of BPI; and implementation of the Good Bulls Extension strategy.



1.3 Reviewing the NBO

The National Breeding Objective must evolve over time in response to the changing needs of dairy businesses, new knowledge and breeding technologies. As the NBO evolves, so do the indices. DataGene has a policy to review the NBO and the index formulated to meet this objective every five years.

The review undertaken in 2014 resulted in the introduction of three indices (BPI, HWI, TWI) in 2015. Another review in 2020 changed the trait weightings for BPI and HWI and removed TWI. In August 2022, DataGene released the Sustainability Index for fast tracking the reduction in greenhouse gas emission intensity. In December 2022, the weight on milk volume in the indices was updated to better reflect the current Australian milk pricing. As a result, the volume penalty was removed from the indices but they retained the feed cost to produce a kilogram of fat, a kilogram of protein and a litre of milk.

2 2024/25 NBO review

The purpose of the 2024/2025 NBO review:

- To check that the National Breeding Objective as expressed through the BPI reflects farmer needs for breeding sustainable and profitable herds over the next 10 years.
- To develop indices based on strong scientific principles which are in line with farmer preferences and meet the agreed NBO.
- To inform the future direction of DairyBio research priorities.

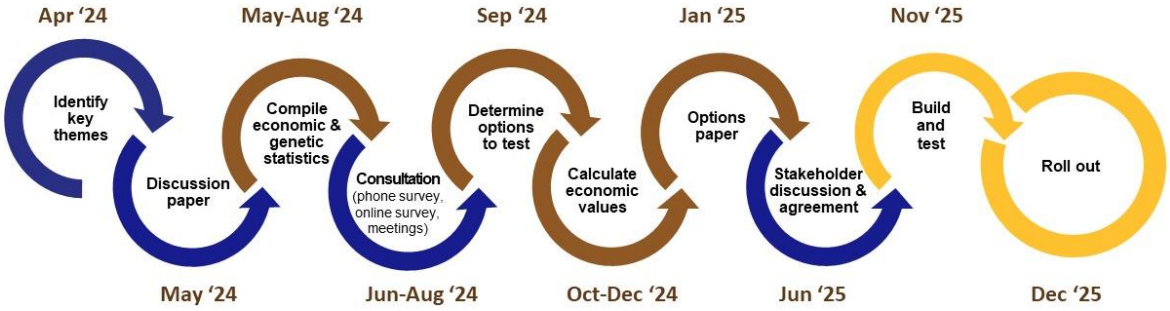
3 Process

Australian indices influence the next generations of Australian dairy herds. DataGene leads the review process under the guidance of the Genetic Evaluation Standing Committee which includes representatives of the herd improvement industry as nominated by Australian Dairy Farmers, National Herd Improvement Association, Dairy Australia or the DataGene Board.

The process for the 2025 NBO review involves three main stages:

1. Consultation – identify industry needs and discussing proposed options (May – July 24)
2. Analysis and development of options (May – Jan 25)
3. Implementation (build and test) – changes to the genetic evaluation system (July – Dec 25) for rollout with the December ABV release.

The detailed activities and timelines for the National Breeding Objective Review are outlined in the graphic below (blue: consultation; brown: analysis; yellow implementation). It is expected that the review will be complete by Autumn 2025 with an implementation date of December 2025. The timing of the implementation is planned around the main breeding seasons with a December release the most practical option for farmers and commercial organisations.



Different stakeholder groups are involved in different stages of the process, as outlined in the table below.

Activity	Stakeholders involved
Identify key themes	Genetic Evaluation Standing Committee (February - April 2024)
Discussion Paper	Genetic Evaluation Standing Committee (June 2024)
Compile economic and genetic statistics	Agriculture Victoria Dairy Australia Trade & Strategy Group and Farm Team Independent analysts DataGene staff
Consultation process	Farmers, breed associations, bull companies, herd improvement service providers, DA Regional Programs,
Options paper and discussion	Genetic Evaluation Standing Committee Bull companies Breed organisations Dairy Australia Farm team
Stakeholder agreement	Genetic Evaluation Standing Committee
Development and testing of models; updating genetic evaluation system (build and test)	DataGene ABV Team and external testers

4 Consultation approach

A multi-pronged consultation approach is being used to better understand the industry's evolving needs from its national breeding objective. It involves:

- Identification of key themes through the industry's Genetic Evaluation Standing Committee resulting in this "Discussion Paper".
- Online survey for anyone in the industry (voluntary).
- In-depth telephone interviews with dairy farmers.
- Stakeholder meetings (for in-depth, technical discussions).

The findings from these consultation sessions will inform the development of a list of options for testing and analysis. After the analysis, a short list of options (including recommendations) will be developed for stakeholder discussion and agreement.

5 Key themes in this review

The key themes to be investigated in the 2024/25 review are:

1. Use of current indices
2. Future needs
3. Breeding for sustainable and profitable cows
4. Heat tolerance
5. Indices for specific production systems
6. Jersey-specific indices
7. Updating the average (base)
8. Inbreeding

6 Discussion

6.1 Use of current indices

Australia's three breeding indices (BPI, HWI, SI) are used to rank bulls, cows and herds so that superior genetics can be identified and used in breeding programs.

These indices combine the traits that drive on-farm profit and emissions intensity, with different weightings to reflect different farmer breeding preferences.

The BPI is an economic index that reflects most farmer preferences. It drives net profit through a balance of functionality, type and production. The Health Weighted Index puts extra emphasis on traits like fertility and cell count. The Sustainability Index fast tracks the reduction in greenhouse gas emission intensity.

Do BPI, HWI and SI still reflect future breeding needs?
Are BPI/HWI/SI missing any particular traits that are important in the future?
Do you think overseas indices are more relevant for some Australian herds?

6.2 Future needs

DataGene currently publishes 47 breeding values and three indices. These are tools to enable farmers to improve the important traits in their herds. Since the ABVs were first published over 40 years ago, new traits have been added as farmer needs have changed and technology and data improved. This review seeks to identify emerging needs and their importance to farmers. This understanding will inform animal research direction for the next 5+ years.

When thinking about your farm (or your client's farm), what are the key animal-related issues that face your farm over the next 10-20 years?

6.3 Breeding for sustainable and profitable cows

The same traits are included in the BPI and Sustainability Index. However, the relative emphasis (weighting) on each trait is different. The BPI is an *economic* index. Traits are weighted according to their economic value and reflect the contribution of that trait to dairy business profitability. The Sustainability Index is an *efficiency* index. Traits are weighted to reflect the animal's ability to emit less greenhouse gas per unit of milk produced. This is done by emphasising production, survival and feed saved to dilute the greenhouse gas emissions.

This NBO review seeks to gain industry insight into two traits that are particularly important for breeding sustainable and profitable cows: Feed Saved and Survival.

Feed Saved in the BPI

The Feed Saved ABV was introduced in 2015 to quantify genetic differences in feed efficiency between animals. The Feed Saved ABV allows farmers to breed cows with reduced feed requirements for the same amount of milk produced. The Feed Saved ABV is reflected in the BPI at 50% of its true economic value in all breeds except for Jerseys where it is not included at all. The cost of feed is based on the historical marginal cost of feed over the past four years with a 1-year forecast. It is appropriate to review both the feed costs as well as the 50% discount that is applied to this trait. This issue was included in the 2019/20 NBO review and while the feed costs were updated, the feedback was uncomfortable with including feed efficiency at 100% at that time.

Feed Saved is one key driver of methane emissions intensity. Less feed for the same milk means less methane for the same milk. It is also a key driver of profitability. Less feed for the same milk means less cost for the same milk.

Should feed saved be included at its full weight in the BPI?

Survival in the indices

The two most important determinants of a dairy bull's genetic merit for profitability are milk yield and survival. Survival – also known as longevity or productive herd life – refers to a bull's ability to produce daughters that last in the herd for many lactations.

Survival is a significant contributor to reducing methane gas emissions on dairy farms. The longer a cow lasts in the milking herd, the longer she has to offset the methane she emitted during her rearing period. Survival also contributes directly to overall profitability on dairy farms in Australia because:

- Fewer replacements are needed, which means lower heifer rearing costs (or greater income as surplus heifers are sold).
- The herd is more mature – more mature cows have greater milk yields than younger cows.
- A greater proportion of the culling decisions can be based on yield, resulting in an increase in the average yield of the herd.

The traits that influence survival of a cow in the herd, include yield, fertility, cell count, milking speed, likeability and type.

The Survival ABV includes: actual survival of cows, likeability and type. The Survival ABV is included in the indices as it is such an important driver of profitability.

A revised Survival ABV is under development by DairyBio. It will be based on separate analyses for survival in the first lactation and later lactations, which will be combined with likeability and type into a revised Survival ABV. This is due to be implemented by DataGene in the December 2024 public run.

This NBO review aims to determine the industry's preference for how indices account for survival. There are several options when accounting for survival in indices:

1. Applying some of the economic value of survival to the Survival ABV and the rest to its contributing traits. This results in some double counting that could over-emphasise traits linked to survival. This is the current option being used in the BPI.
2. Applying all of the economic value of survival to the Survival ABV. This would reduce the weightings on fertility, cell count, type and other traits. And there may be very little, if any, economic weight on type traits.
3. Applying all the economic value of survival to its contributing traits. This means there would be far less weighting on the Survival ABV itself.

Is it important that survival has its own place in an index, rather than indirect emphasis through other traits?

6.4 Heat tolerance

Released in 2017, the Heat Tolerance ABV identifies animals with a greater ability to tolerate hot, humid conditions with less impact on milk yield. The economic value of Heat Tolerance varies according to the location of the farm; having a greater economic value in locations where there are more hot and humid days and nights. Farmers who want to apply more pressure are supported through tools like the Good Bulls App where filters can be applied to screen out animals with a Heat Tolerance ABV below a nominated threshold.

Recent work by DairyBio has included much more recent data and improved reliability. This is scheduled to be implemented by DataGene in mid-2024.

Is there support for generating a different index for hotter and more humid regions that would have an economic value placed on Heat Tolerance?

6.5 Indices for specific production systems

In the past, Australia's dairy industry was underpinned by a pasture-based production system, which was typically supplemented with 1.5 to 2.0 tonne of grain per cow and conserved fodder (usually home grown). While this continues to be the dominant system in Gippsland, Western Victoria, Northeast Victoria and coastal NSW, other dairying regions have a greater focus on pasture or Total Mixed Rations (TMR). Tasmania has a predominately seasonal calving and grazing system with some grain supplementation but usually not at the same levels as the mainland due to availability and the cost of transport. In Northern Victoria, inland NSW and SE Queensland there is a trend towards intensive, housed systems with large free stall or compost barns and TMR feeding and year-round calving. TMR feeding is a result of growing higher dry matter yielding crops such as maize to better utilise the irrigation water resource. There is evidence indicating a trend to more intensive systems in SA and WA, although there will likely still be a mix of intensive and "conventional" systems in these areas.

Countries such as Ireland and New Zealand have a single focused index, but also have reasonably homogenous production systems. The UK has introduced two new indices to stand alongside the PLI (Profitable Lifetime Index). They are the SCI – Spring Calving Index (focus on solids and grazing) and ACI – Autumn Calving Index (focus on higher milk flow via supplementation). The introduction of these indexes is in recognition of farmer needs for different trait weightings in these different production systems.

This review aims to:

1. Determine if industry thinks the breeding needs of farmers across all production systems are met by the current three indices.
2. If not, determine what alternative indices for different production systems would include.

Does the industry think the current indices reflect the breeding needs across all production systems?
Do we need different indices for these different systems? What are the differences needed?

6.6 Jersey-specific indices

The Jersey breed is the second largest breed in the country. There is a feeling amongst some Jersey breeders that a breed-specific index could be useful given the breed's unique characteristics, such as smaller stature, higher components and heat tolerance.

Do dairy farmers with Jersey and Jersey cross animals want a Jersey specific index?
Would dairy farmers select Jersey bulls using a Jersey specific index rather than the BPI or an index from another country?
What are the key differences in any requested separate Jersey index?

6.7 Updating the average (known as the base)

ABVs are relative measures that are compared to an average (known as the base). The base is defined as the purebred cows of the same breed that were born in a specific timeframe. This timeframe can be periodically adjusted. Globally, there are different approaches to the timing of base changes. There isn't a right/wrong answer from a scientific point of view.

The last Australian base change occurred in 2014 following a period of annual base adjustments. Keeping a constant base from year to year allows the industry to see progress through higher numbers. However, over time the base can lose some relevance as the animals are no longer in current Australian herds. The current base for production and conformation traits is cows born between 2009 and 2013. For all other traits, the base is bulls born between 2002 and 2006.

Between 2008 and 2015, the policy was that the base was updated in April of each year. However, during the 2014 NBO Review, the industry made clear a preference for less frequent base updates. The current policy links base reviews with the five yearly NBO review. This issue was included in the 2019/20 review and feedback was to continue with the existing base until the 2024/25 NBO review.

The base influences the marketability of animals and support for ABVs because of the positive optics of higher numbers. For example, bulls are very difficult to market if they fall below a threshold such as 100 for Type (domestic semen market) or 0 for Milk (export semen market). An older base has the benefits of showing the new animals to be quite a lot better on some traits.

Maintaining a relatively young group of cows in the base means that the ABVs are more reflective of the current national herd but the ABVs are not as high.

Should the base be adjusted to a more modern base, even though it will mean ABVs drop for most traits?

6.8 Inbreeding

Since the inception of genomics, we have seen a rise in the levels of inbreeding in purebred populations. This leads to an increase in inbreeding depression; a reduction in economically important traits such as production, survival, and fertility. Some countries factor inbreeding into their breeding values by imposing small penalties that are commensurate with the bull's level of relatedness with the general population and reflects the level of expected inbreeding depression on economically important traits such as production and fertility.

Are you concerned about inbreeding in your herd?
Should the indices include a penalty relating to a bull's general level of relatedness to the national herd?

7 Have your voice heard

The NBO Review influences the characteristics of future generations of Australian dairy cows. Farmers and service providers are asked to carefully consider the questions in this discussion paper and contribute your perspectives. Opportunities to do this include:

Online surveys: Farmers and herd improvement industry members will have the opportunity to complete an online survey during June – July 2024. This will be promoted through industry media and stakeholders can follow the link from www.datagene.com.au.

Farmer in-depth interviews: Farmers who are interested in having a more in-depth discussion about the issues can nominate in their online survey to be contacted for a follow up phone interview. These are scheduled for July 2024.

Stakeholder meetings: Stakeholder meetings for more technical discussions are scheduled for August 2024.