



Is the EBI breeding for more environmentally responsible cows?

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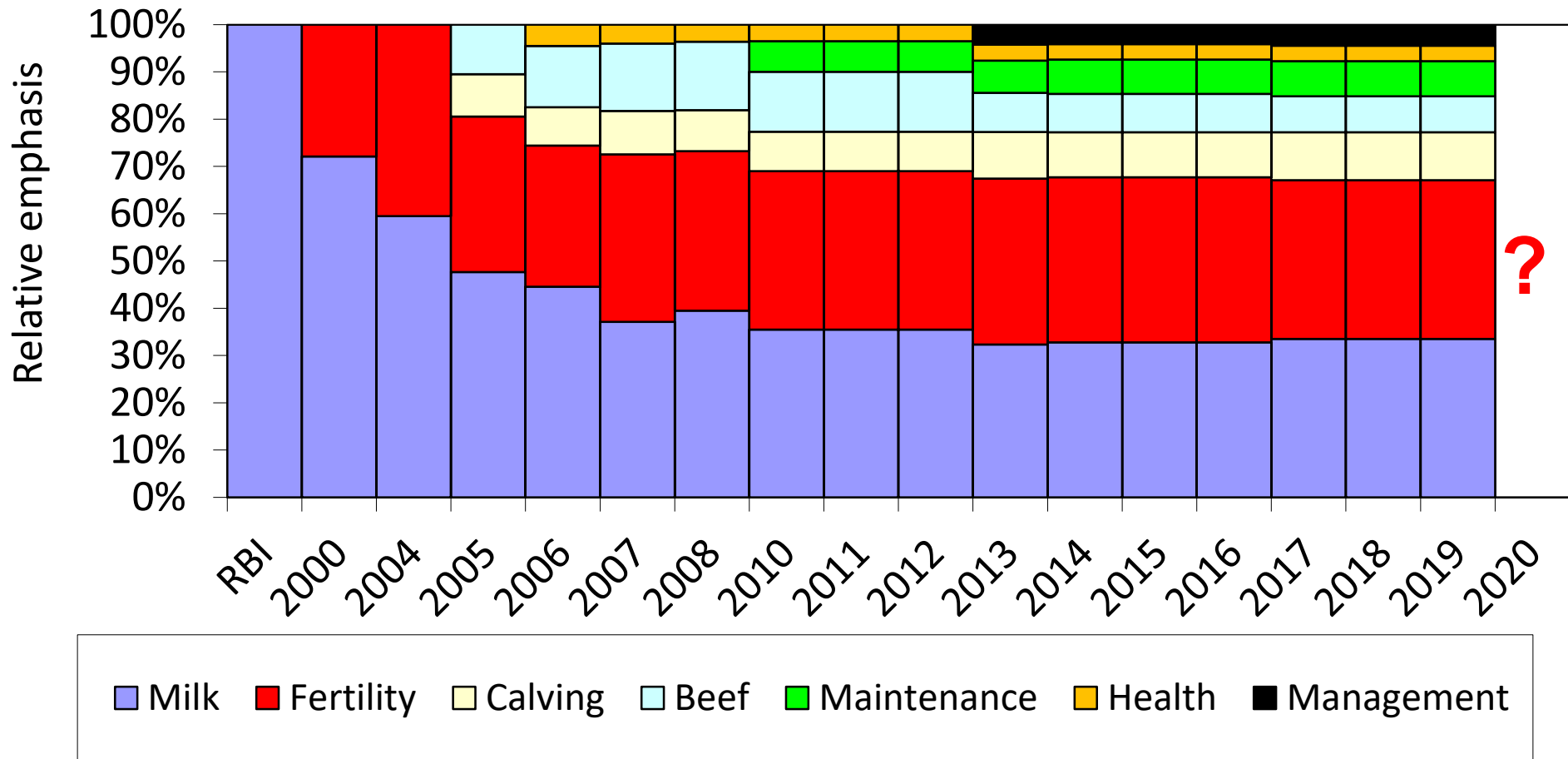
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Irish Grasslands Association, Jan 2020

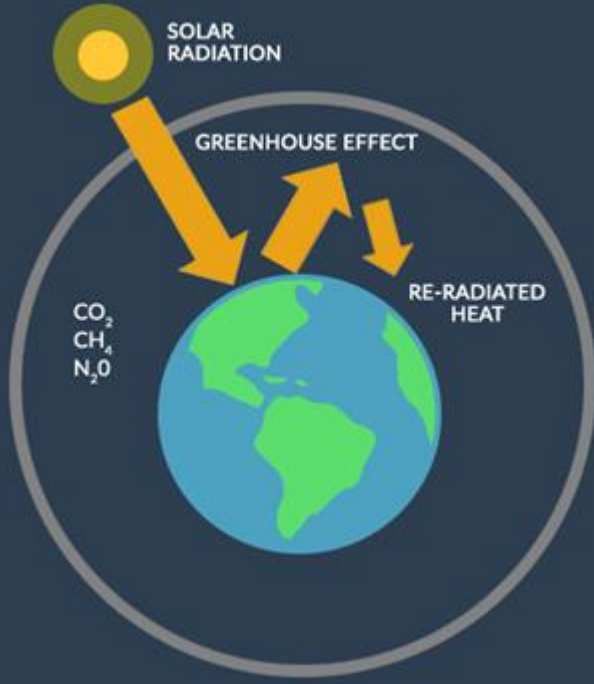
The EBI – where to next?



The EBI – what's missing??

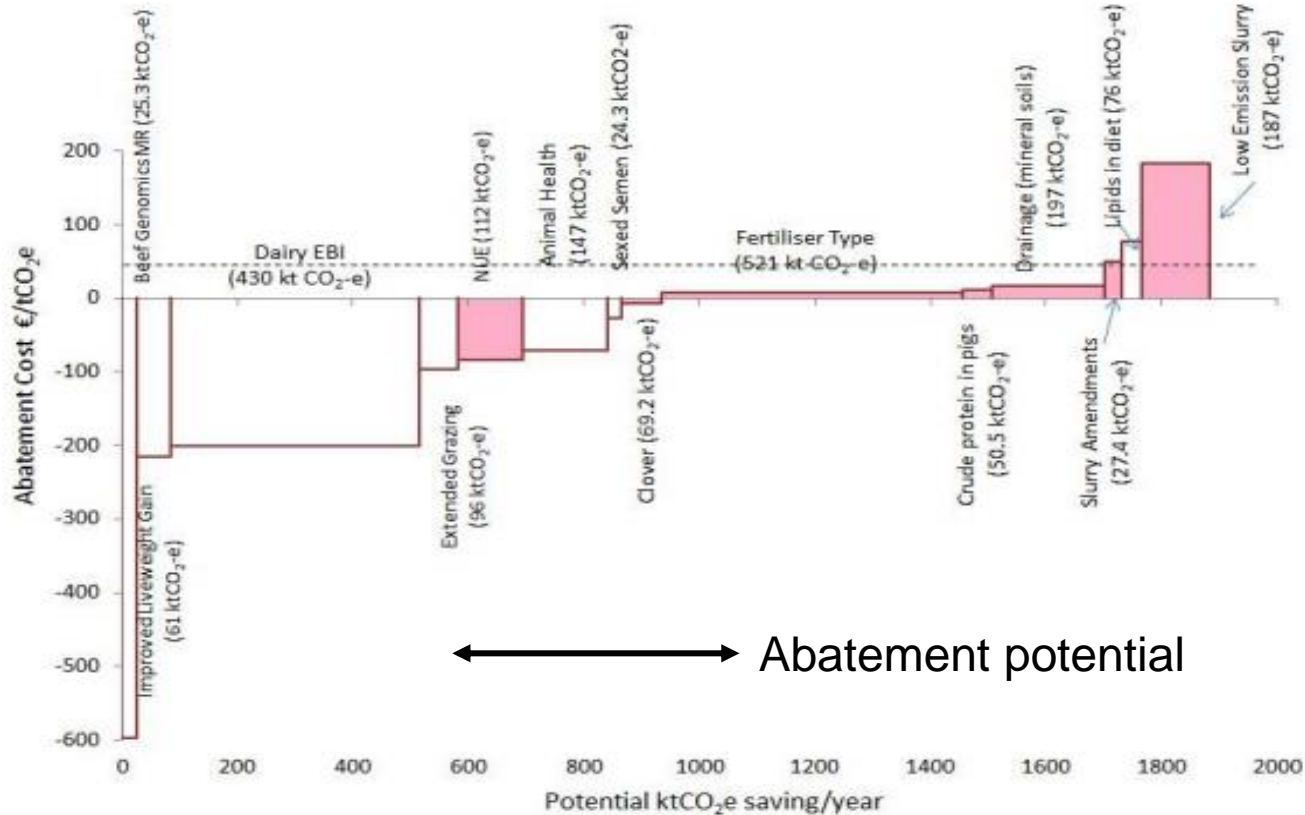
1. Product quality (milk and meat)
 2. Feed intake and efficiency
 3. Animal health and well-being
 4. Environmental hoofprint
 5. ??????
- Other traits we can do better

What is a greenhouse gas



Gas	Lifetime	Global Warming Potential (GWP)	
		20 years	100 years
Methane	12.4	84-86	28-34
Hydrofluorocarbon	13.4	3710-3790	1300-1550
Chlorofluorocarbon	45	6900-7020	4660-5350
Nitrous oxide	121	264-268	265-298
Carbon tetrafluoride	50000	4880-4950	6630-7350

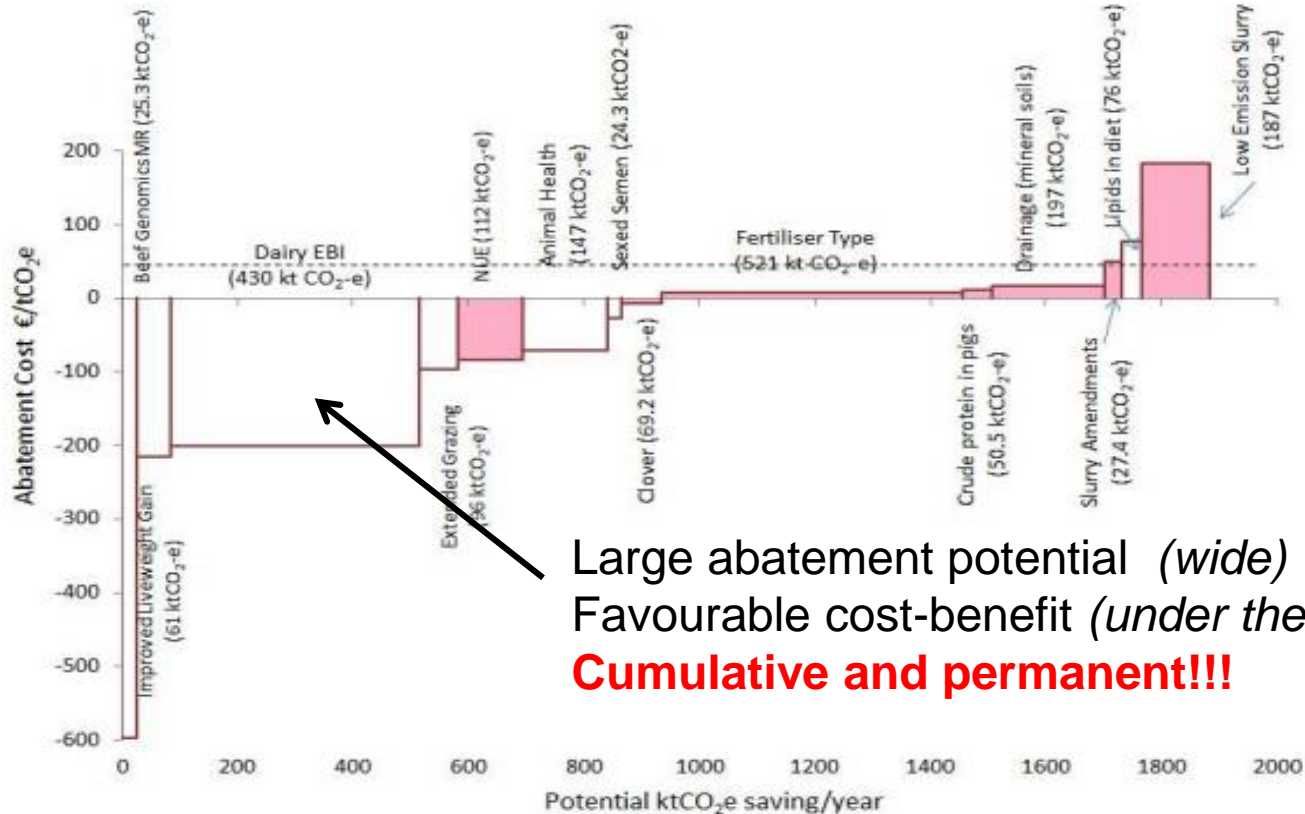
Marginal Abatement Cost curve (MACC)



Cost - benefit

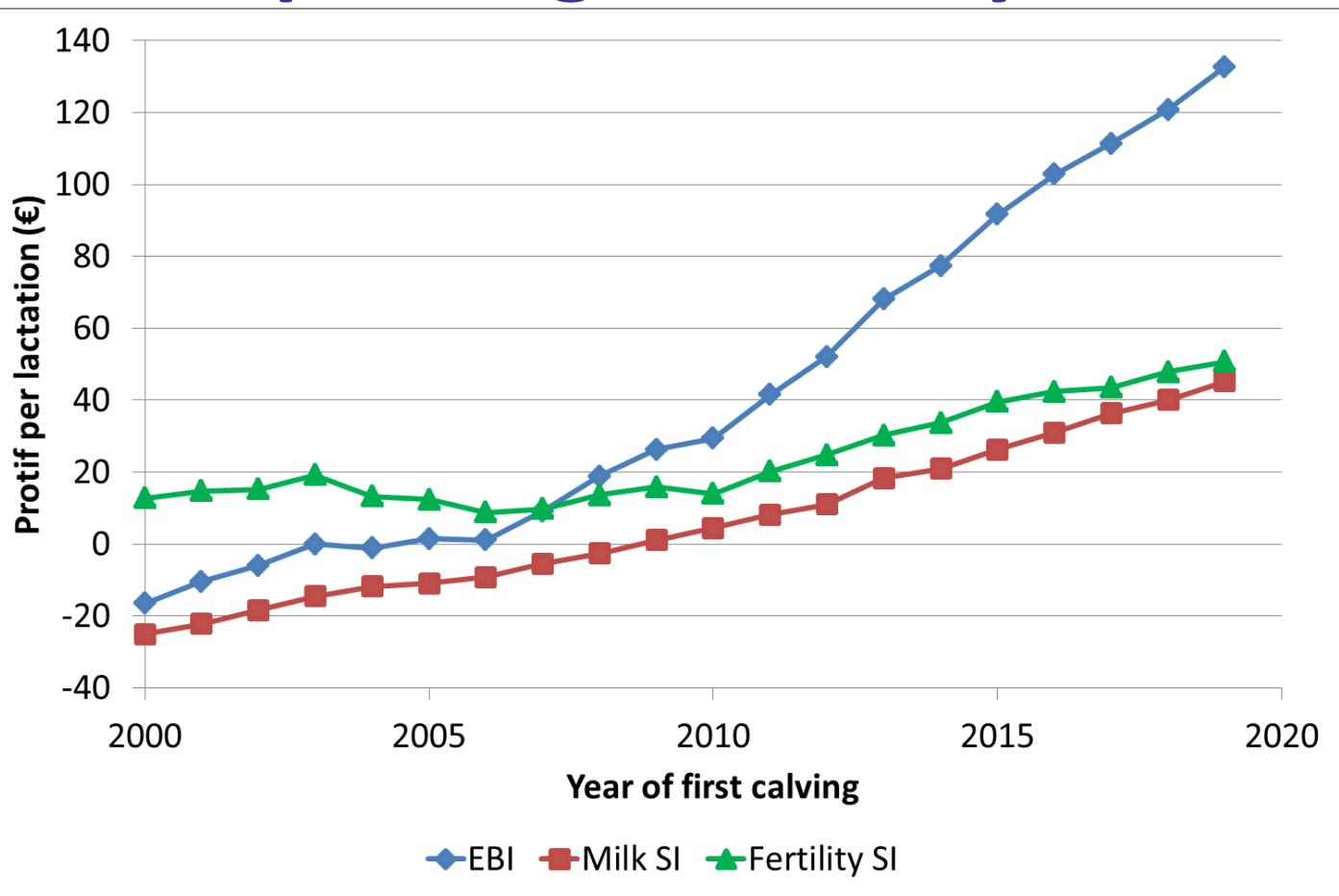
Abatement potential

Marginal Abatement Cost curve (MACC)



Large abatement potential (*wide*)
Favourable cost-benefit (*under the line*)
Cumulative and permanent!!!

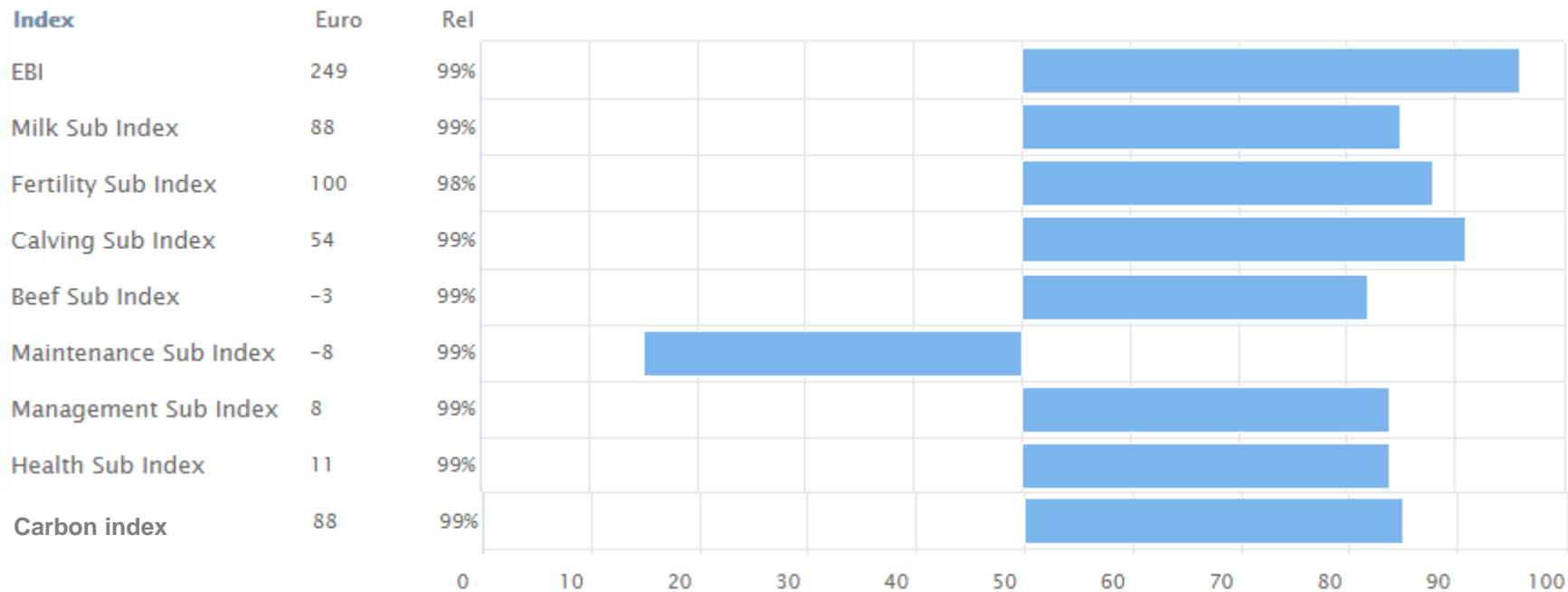
Improving efficiency the easy way!



Can we go faster??

14% improvement in carbon footprint per kg fat+protein corrected yield

Another subindex?



Carbon breeding index

$$\begin{aligned} \text{EBI} = & \text{Economic_value}_{\text{Milk}} * \text{PTA}_{\text{Milk}} \\ & + \text{Economic_value}_{\text{Protein}} * \text{PTA}_{\text{Protein}} \\ & + \text{Economic_value}_{\text{Fat}} * \text{PTA}_{\text{Fat}} \\ & + \text{Economic_value}_{\text{Calv_int}} * \text{PTA}_{\text{Calv_int}} \\ & + \text{Economic_value}_{\text{Survival}} * \text{PTA}_{\text{Survival}} \\ & + \text{Economic_value}_{\text{LiveWt}} * \text{PTA}_{\text{LiveWt}} \\ & + \dots \end{aligned}$$

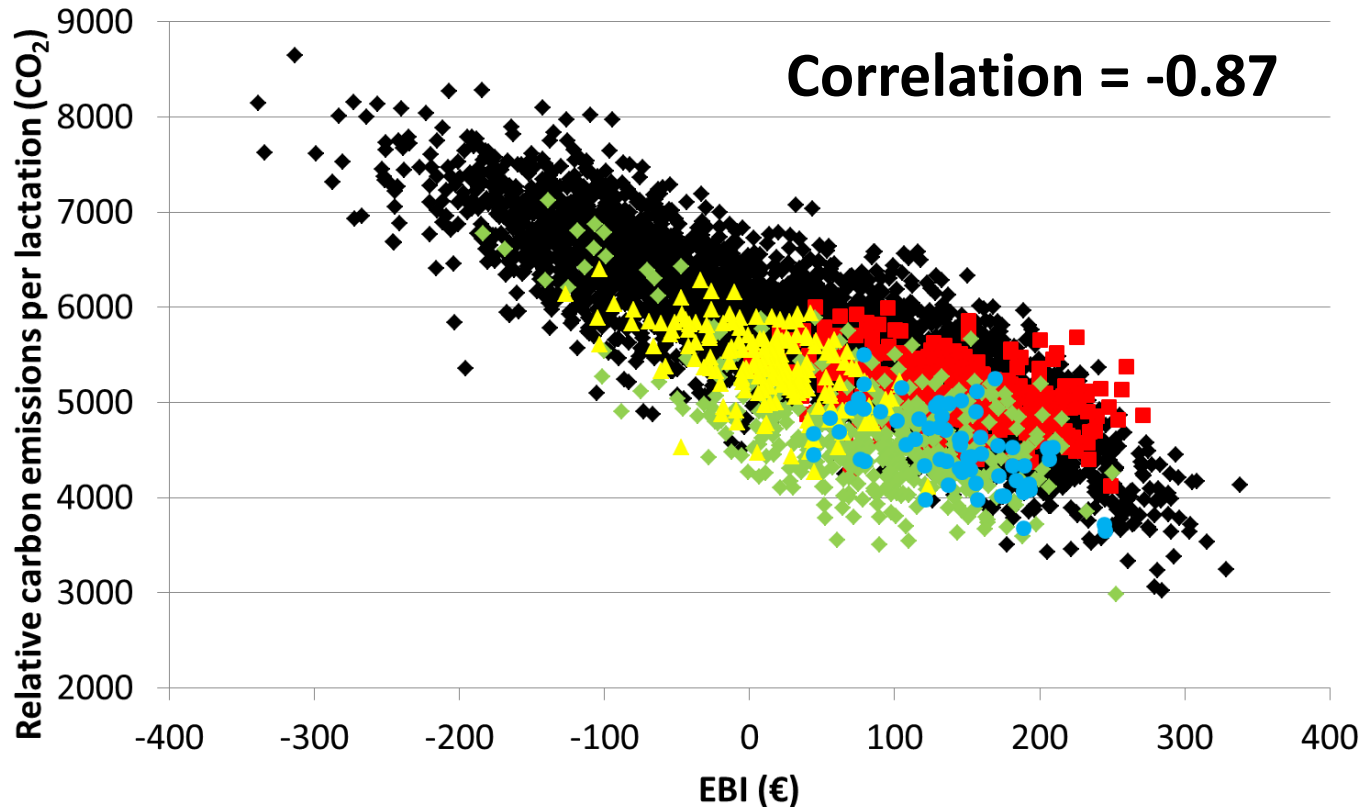
$$\begin{aligned} \text{CBI} = & \text{Carbon_value}_{\text{Milk}} * \text{€} * \text{PTA}_{\text{Milk}} \\ & + \text{Carbon_value}_{\text{Protein}} * \text{€} * \text{PTA}_{\text{Protein}} \\ & + \text{Carbon_value}_{\text{Fat}} * \text{€} * \text{PTA}_{\text{Fat}} \\ & + \text{Carbon_value}_{\text{Calv_int}} * \text{€} * \text{PTA}_{\text{Calv_int}} \\ & + \text{Carbon_value}_{\text{Survival}} * \text{€} * \text{PTA}_{\text{Survival}} \\ & + \text{Carbon_value}_{\text{LiveWt}} * \text{€} * \text{PTA}_{\text{LiveWt}} \\ & + \dots \end{aligned}$$

Carbon breeding index

$$\begin{aligned} \text{EBI} = & -0.09 * \text{PTA}_{\text{Milk}} \\ & + 5.88 * \text{PTA}_{\text{Protein}} \\ & + 2.08 * \text{PTA}_{\text{Fat}} \\ & -12.59 * \text{PTA}_{\text{Calv_int}} \\ & + 12.43 * \text{PTA}_{\text{Survival}} \\ & + -1.65 * \text{PTA}_{\text{LiveWt}} \\ & + \dots \end{aligned}$$

$$\begin{aligned} \text{CBI} = & 0.22 * \text{€} * \text{PTA}_{\text{Milk}} \\ & +5.654 * \text{€} * \text{PTA}_{\text{Protein}} \\ & + 5.408 * \text{€} * \text{PTA}_{\text{Fat}} \\ & + 179.41 * \text{€} * \text{PTA}_{\text{Calv_int}} \\ & - 34.39 * \text{€} * \text{PTA}_{\text{Survival}} \\ & + 2.05 * \text{€} * \text{PTA}_{\text{LiveWt}} \\ & + \dots \end{aligned}$$

CBI v EBI



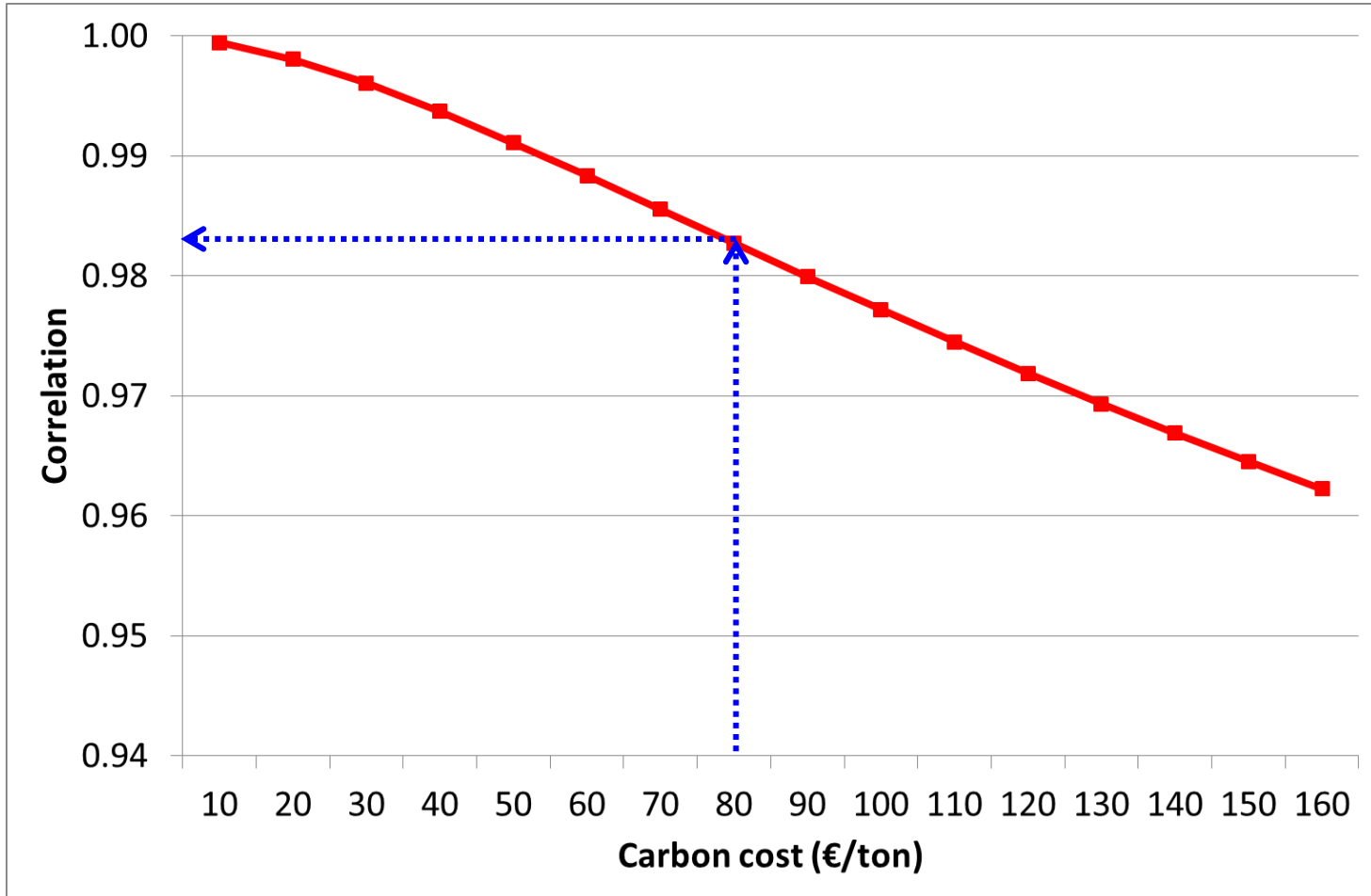
◆ Holstein ■ Jersey ◆ Friesian ▲ Montebeliarde ● Norwegian Red

Each €10 increase
in EBI



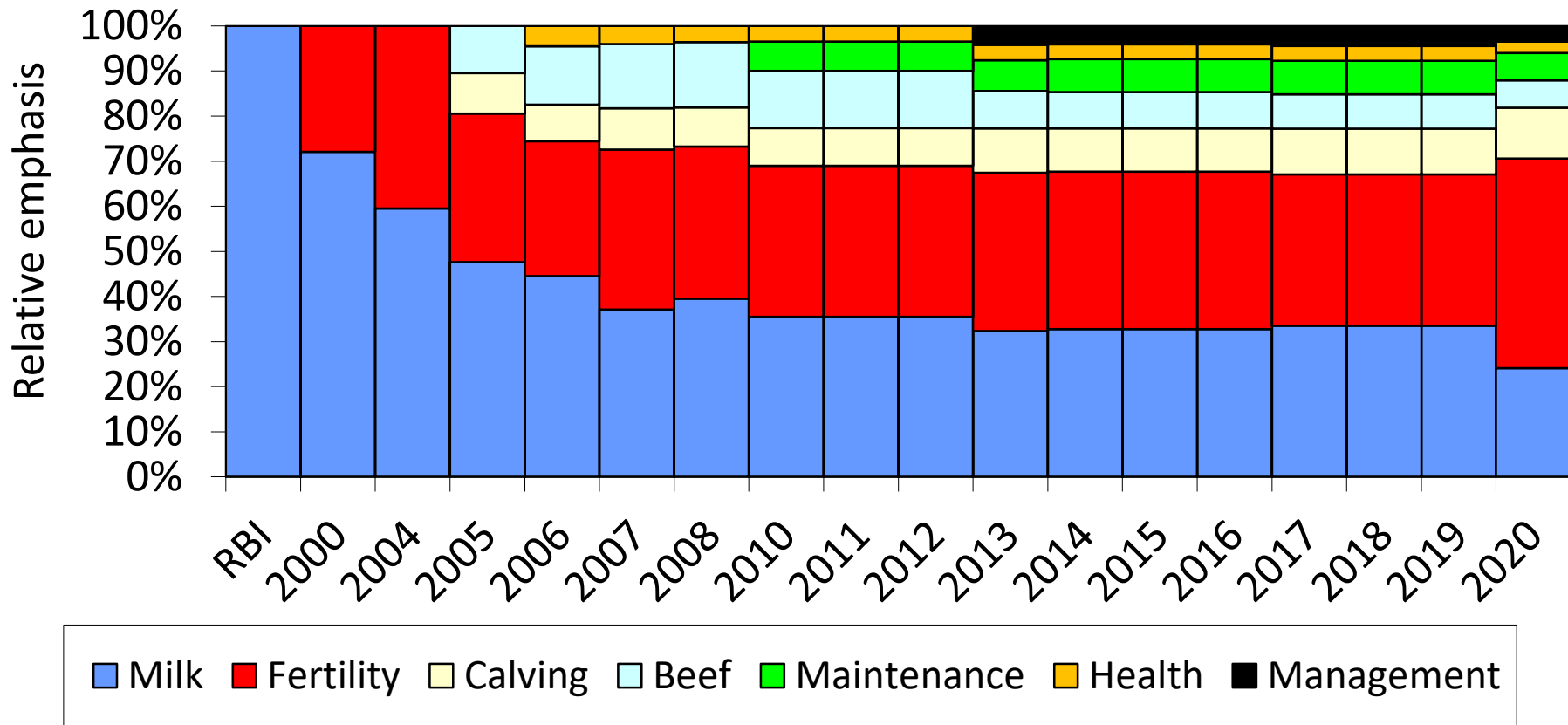
61.7 kg CO₂
equivalents less
per lactation

Correlation with EBI by carbon price

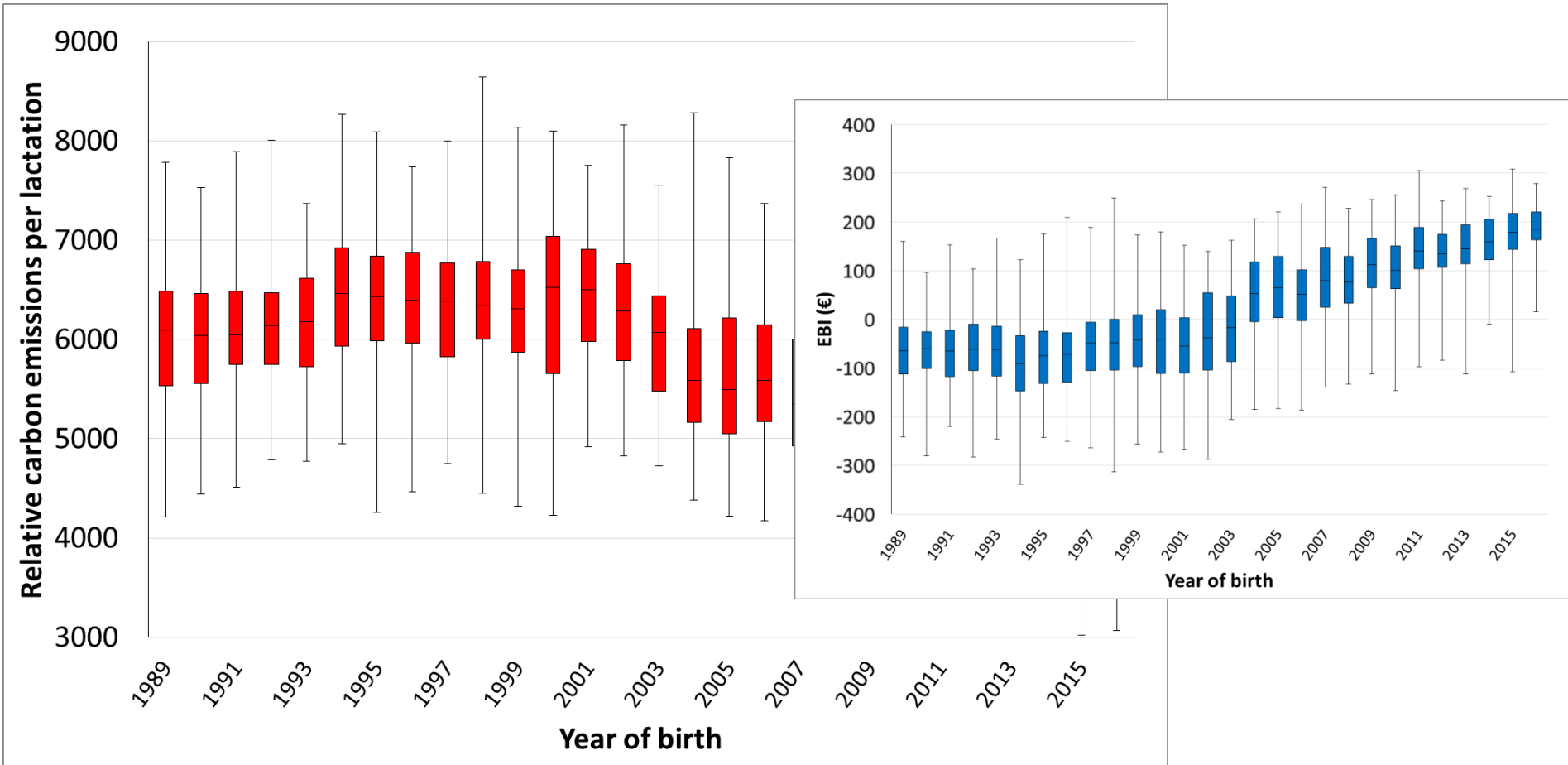


The new EBI?

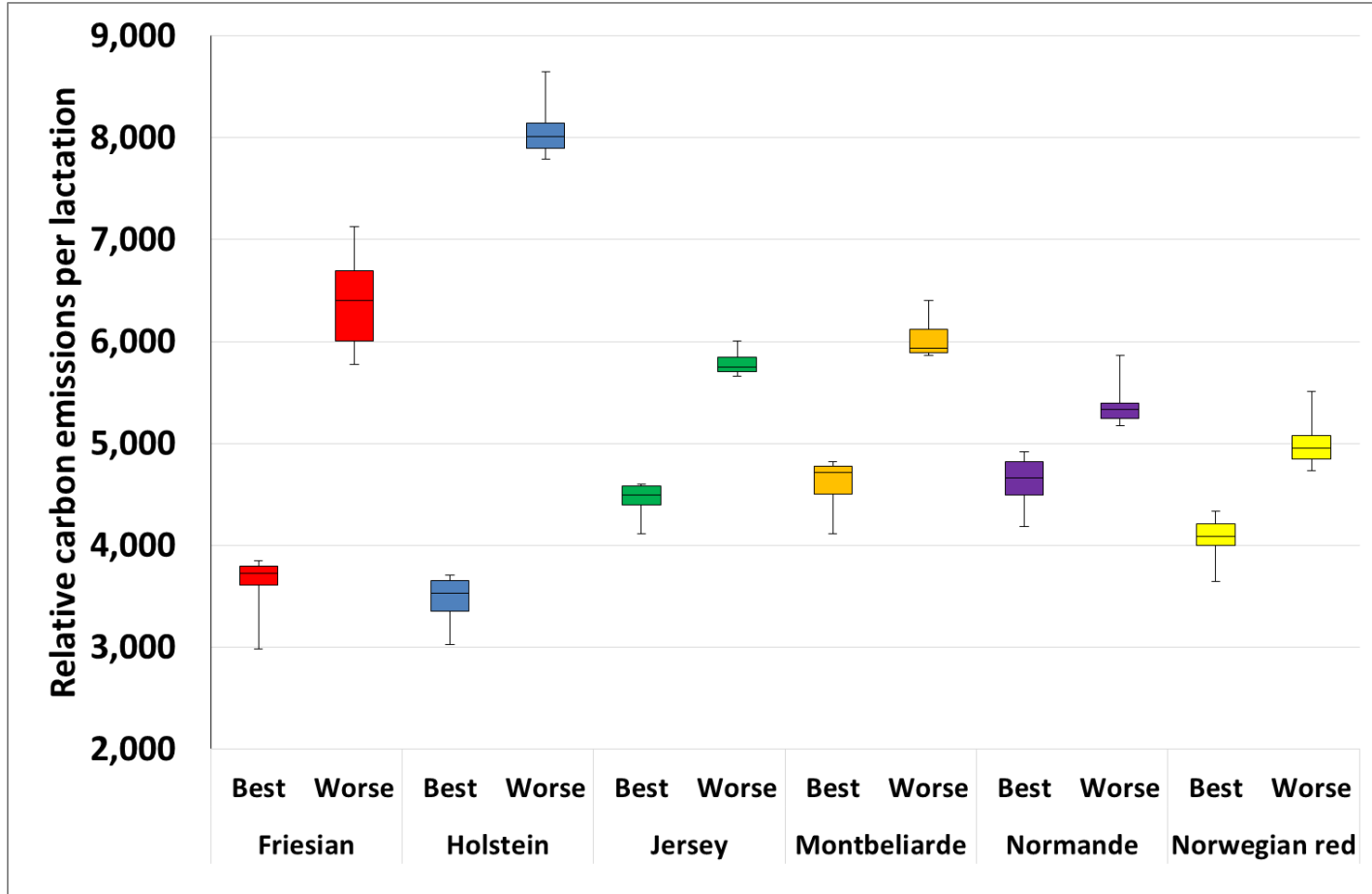
“E” = economic + environment



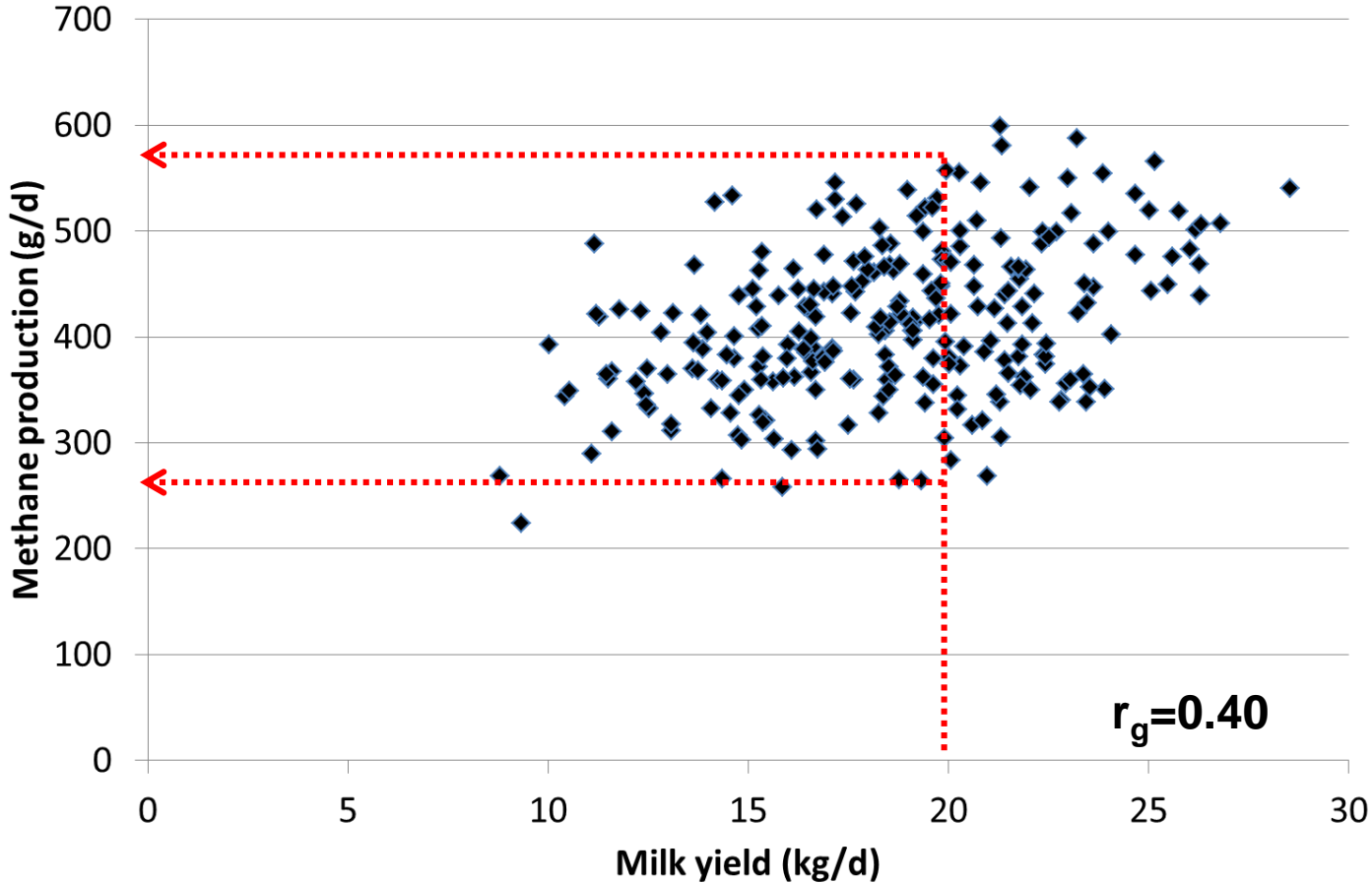
CBI by year of birth (HF bulls)



Good, bad and ugly



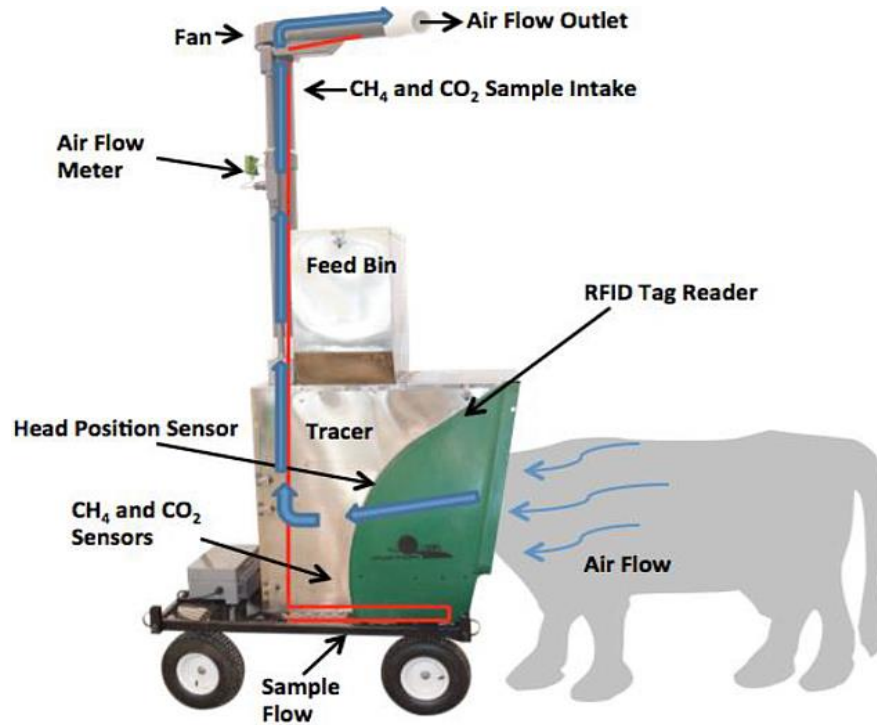
“Residual” variability



What is the variability?

Is it worth chasing?

GreenFeed systems



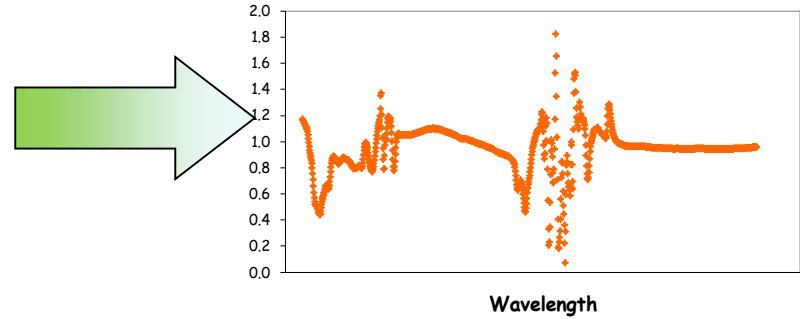
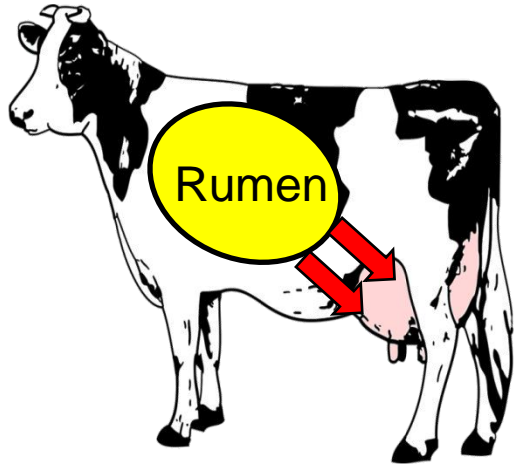
GreenFeed systems



Prerequisites for breeding

1. Important
2. Exhibit genetic variability
3. **Data availability**

Infra-red spectroscopy



Take home message

- **Environment is here to stay!**
- **Unbelievable opportunity to improve the environmental footprint of dairying**
- **Breeding is cumulative and permanent**
 - **And it is not slow!!!!**
 - **CBI is work in progress!**
 - **20% faster reduction in carbon footprint**
- **Dearth of data/information on methane production in Irish dairy cows**

Acknowledgments

- **Research Stimulus Fund GREENBREED**