



# Is the EBI breeding for more environmentally responsible cows?

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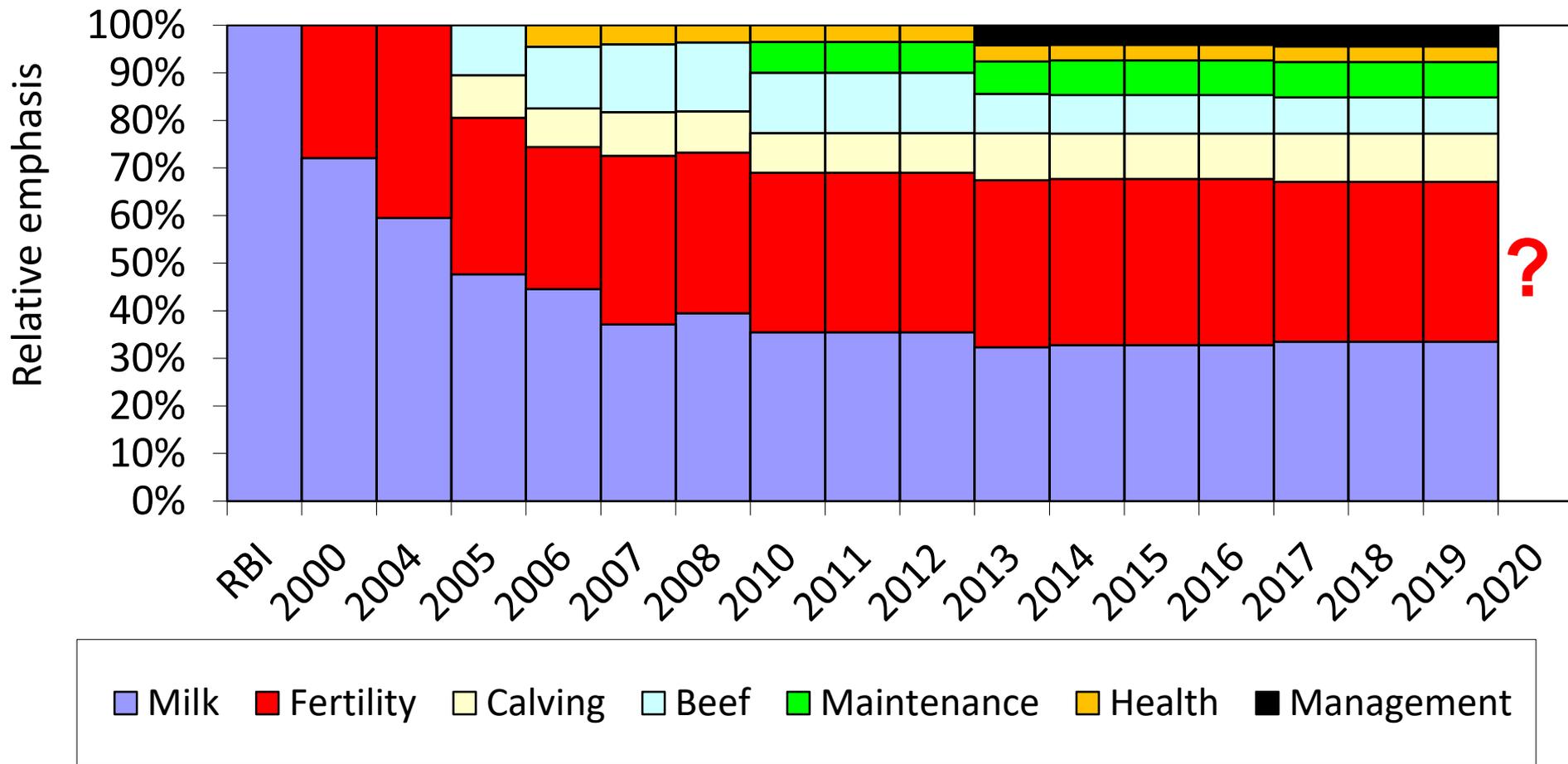
*January 2020*

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*Irish Grasslands Association, Jan 2020*

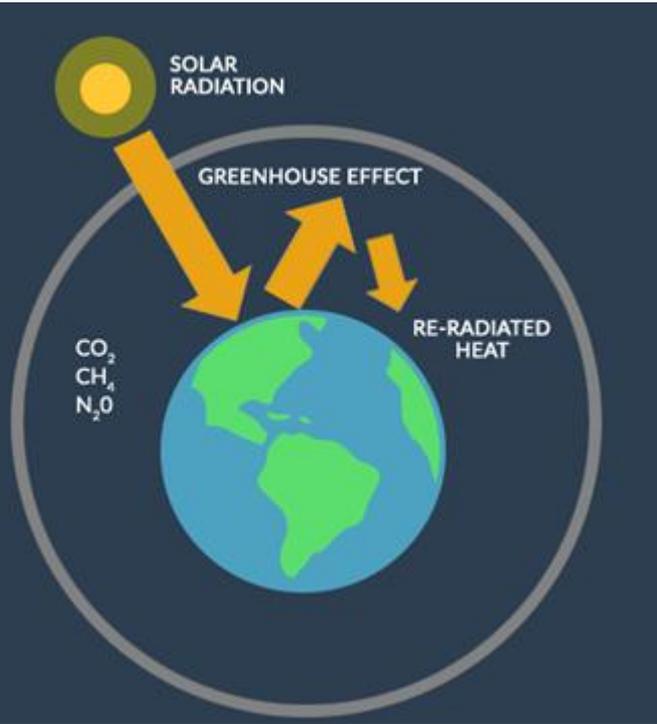
# The EBI – where to next?



# The EBI – what's missing??

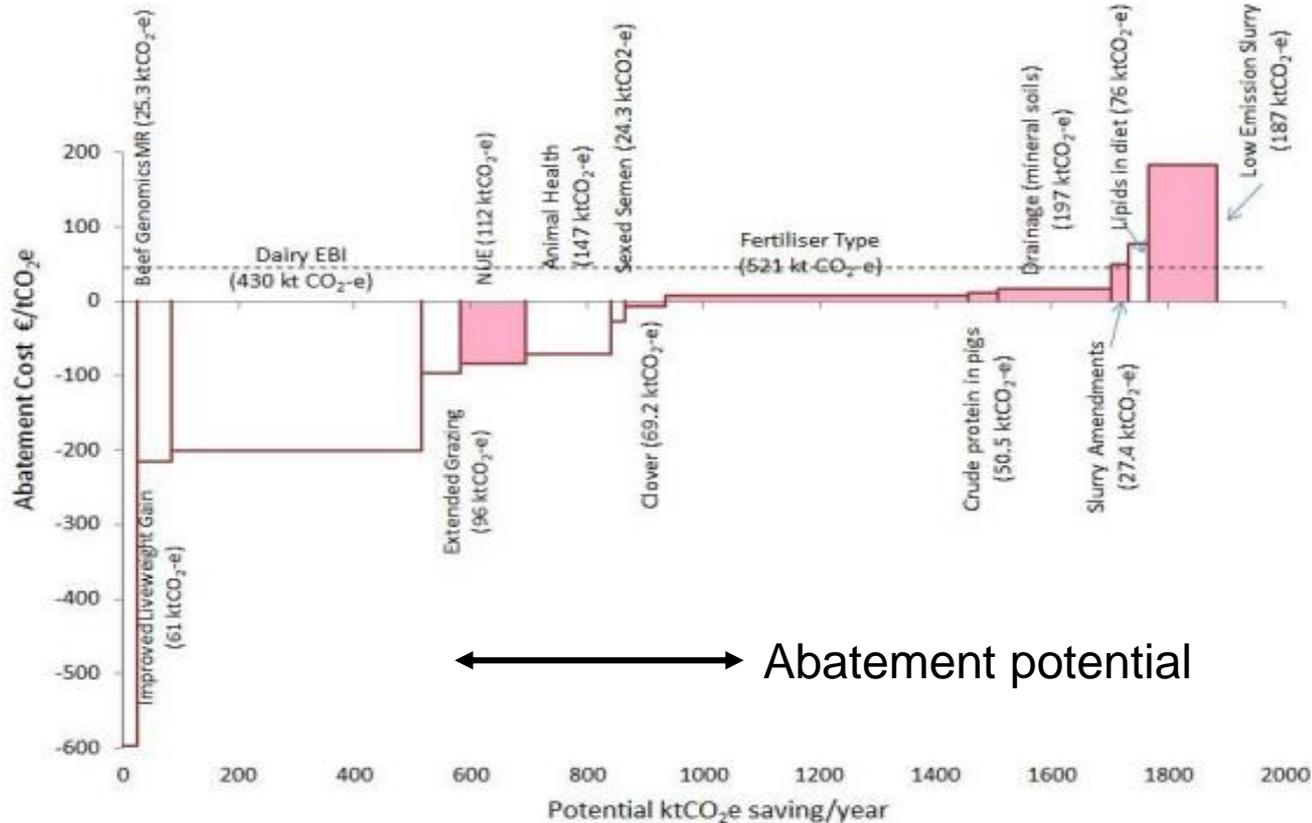
1. Product quality (milk and meat)
  2. Feed intake and efficiency
  3. Animal health and well-being
  4. Environmental hoofprint
  5. ??????
- Other traits we can do better

# 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

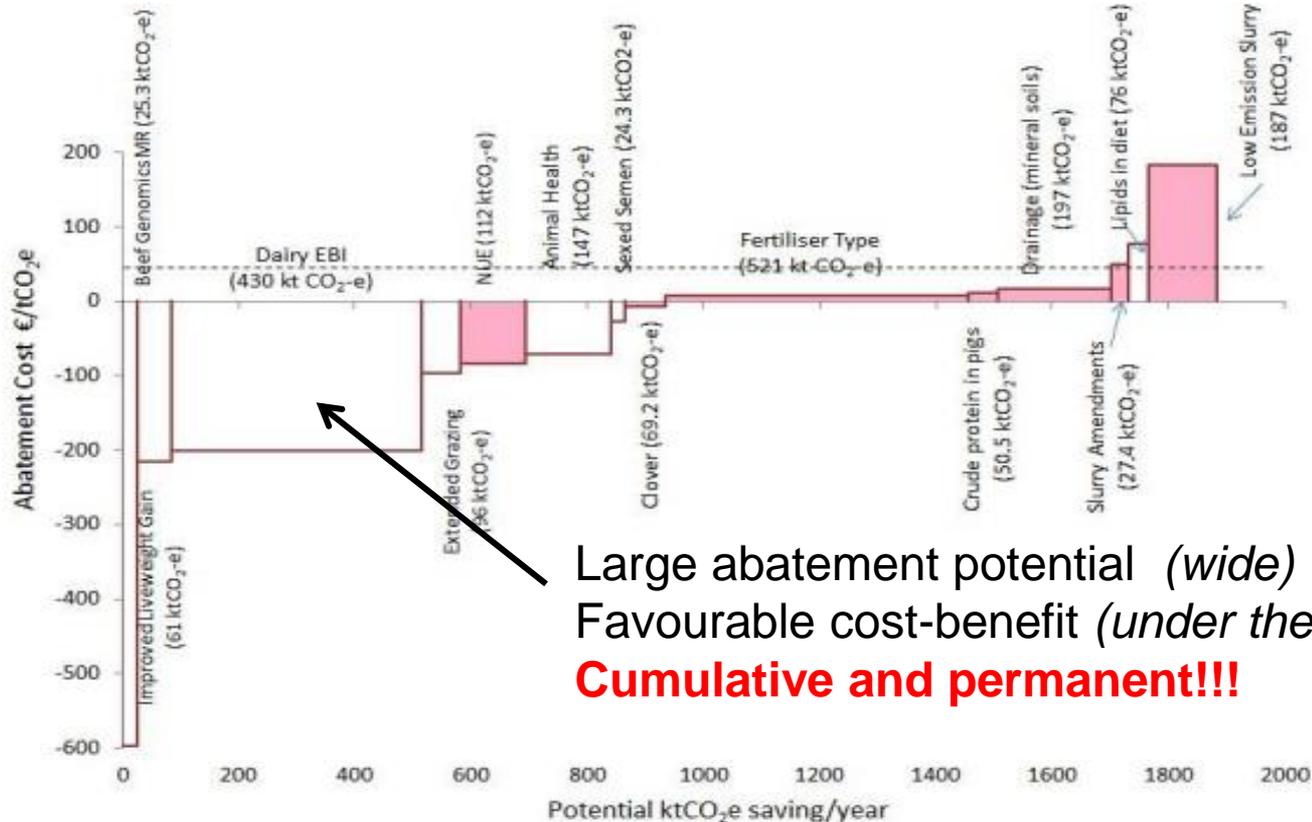
# Marginal Abatement Cost curve (MACC)



Cost - benefit

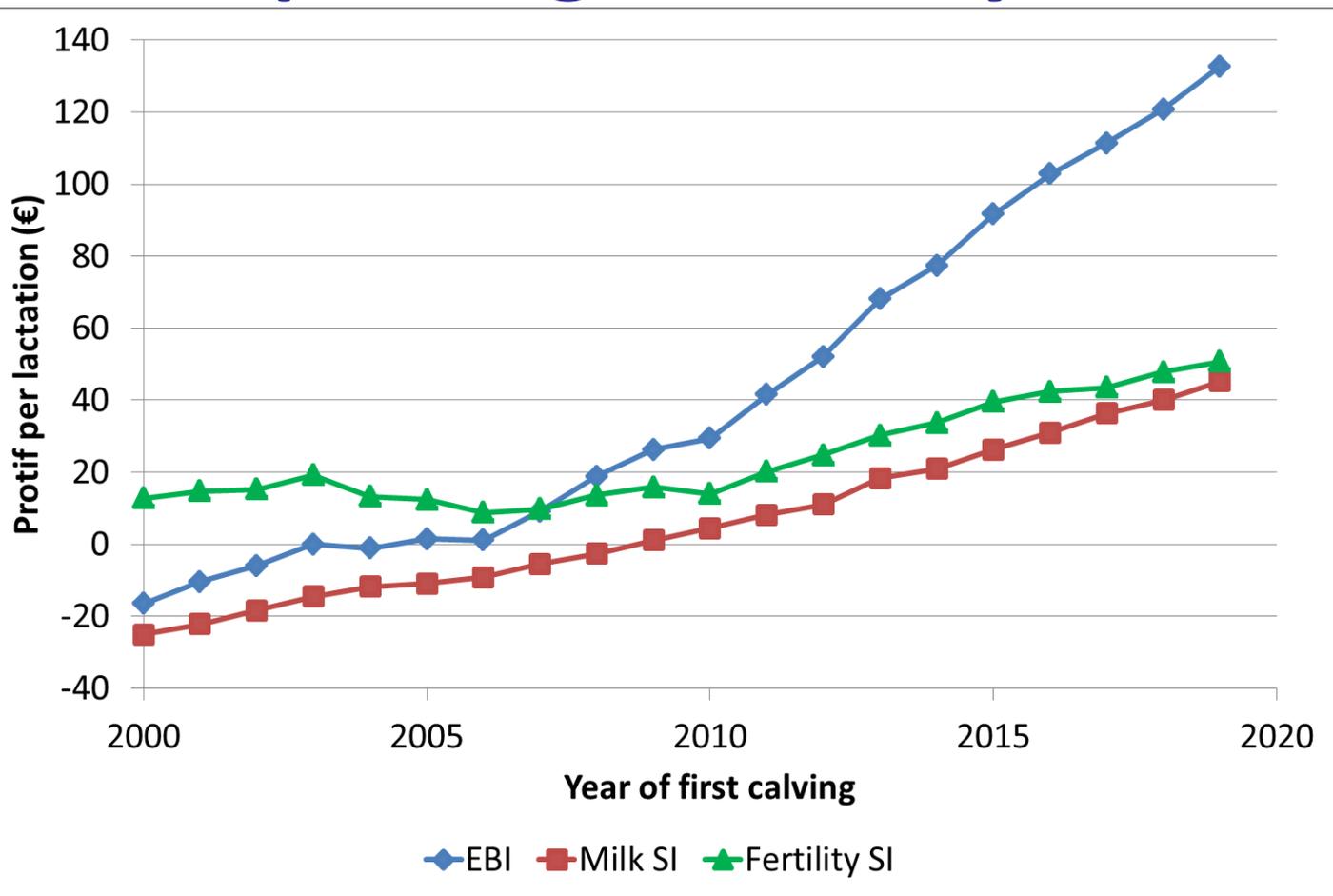
Abatement potential

# Marginal Abatement Cost curve (MACC)



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

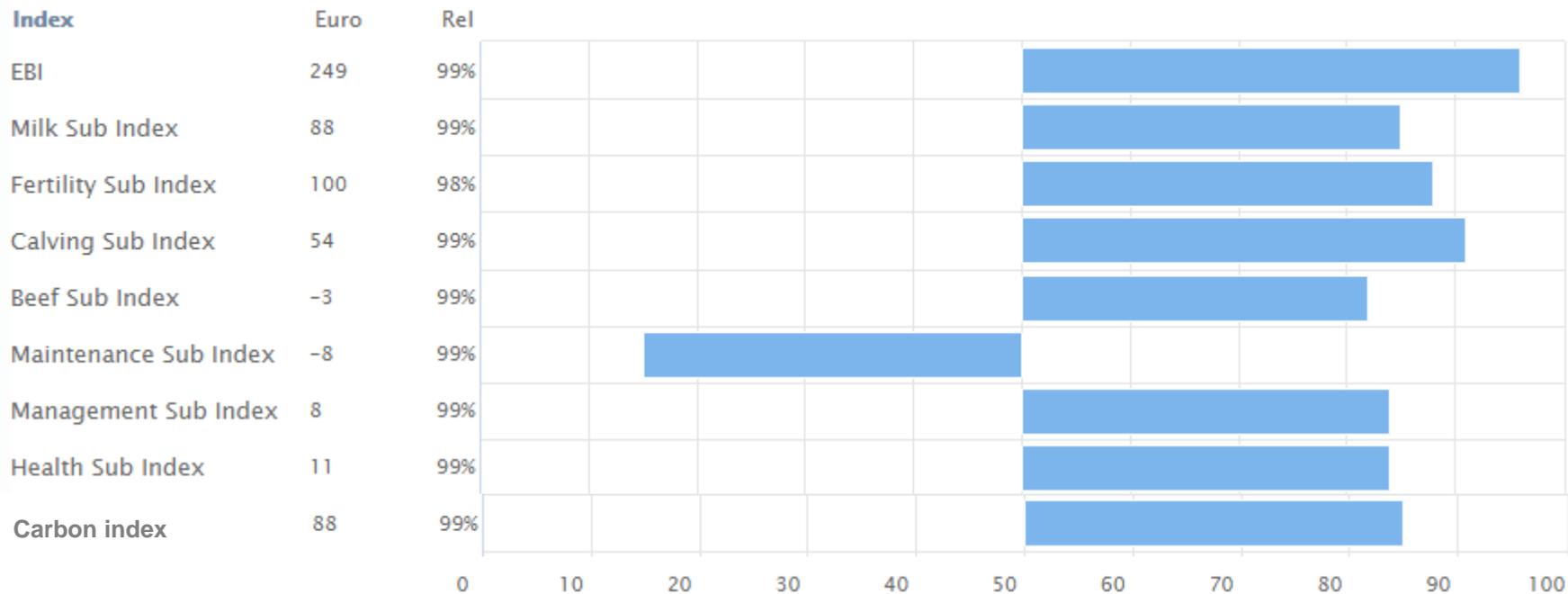
# Improving efficiency the easy way!



Can we go faster??

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

# Another subindex?



# Carbon breeding index

$$\begin{aligned} \text{EBI} &= \text{Economic\_value}_{\text{Milk}} * \text{PTA}_{\text{Milk}} \\ &+ \text{Economic\_value}_{\text{Protein}} * \text{PTA}_{\text{Protein}} \\ &+ \text{Economic\_value}_{\text{Fat}} * \text{PTA}_{\text{Fat}} \\ &+ \text{Economic\_value}_{\text{Calv\_int}} * \text{PTA}_{\text{Calv\_int}} \\ &+ \text{Economic\_value}_{\text{Survival}} * \text{PTA}_{\text{Survival}} \\ &+ \text{Economic\_value}_{\text{LiveWt}} * \text{PTA}_{\text{LiveWt}} \\ &+ \dots \end{aligned}$$

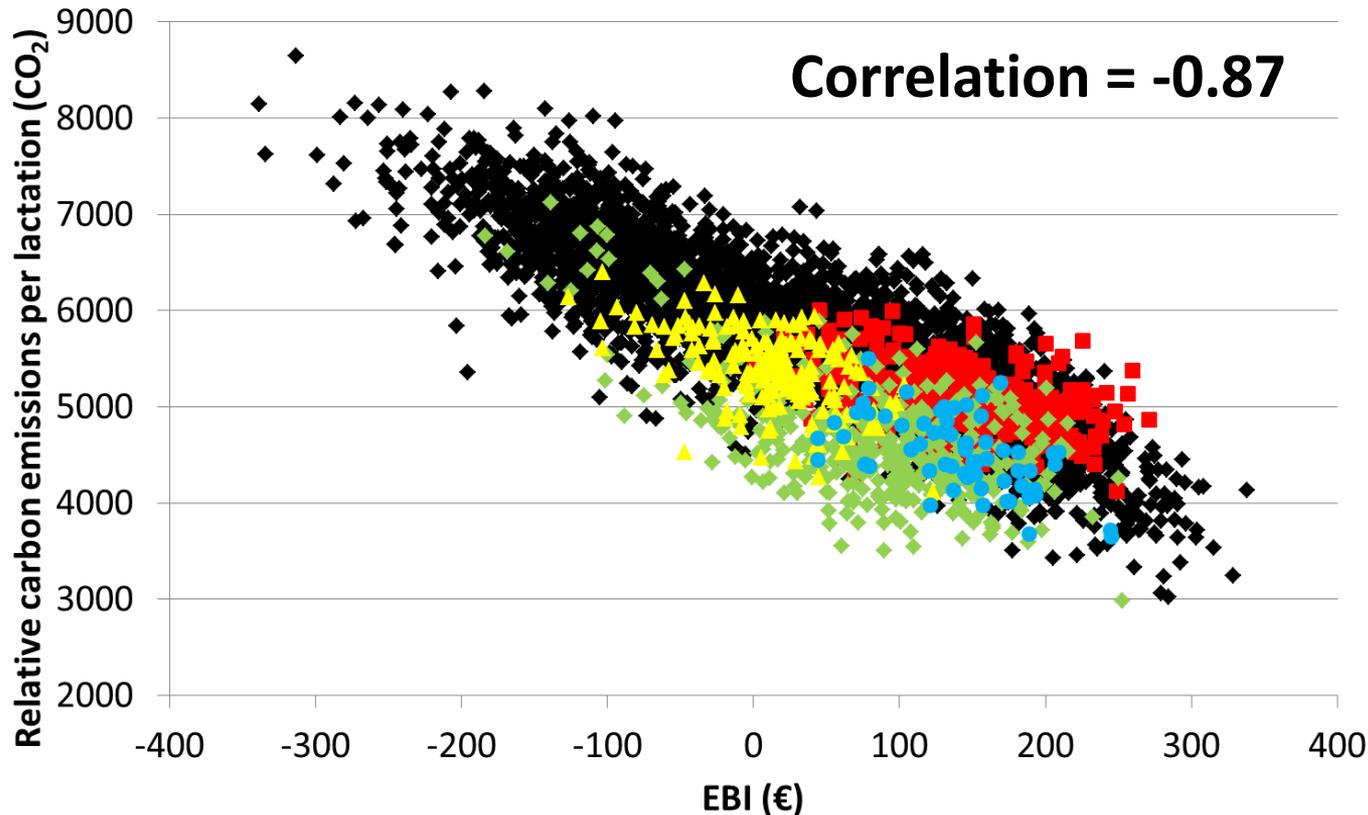
$$\begin{aligned} \text{CBI} &= \text{Carbon\_value}_{\text{Milk}} * \text{€} * \text{PTA}_{\text{Milk}} \\ &+ \text{Carbon\_value}_{\text{Protein}} * \text{€} * \text{PTA}_{\text{Protein}} \\ &+ \text{Carbon\_value}_{\text{Fat}} * \text{€} * \text{PTA}_{\text{Fat}} \\ &+ \text{Carbon\_value}_{\text{Calv\_int}} * \text{€} * \text{PTA}_{\text{Calv\_int}} \\ &+ \text{Carbon\_value}_{\text{Survival}} * \text{€} * \text{PTA}_{\text{Survival}} \\ &+ \text{Carbon\_value}_{\text{LiveWt}} * \text{€} * \text{PTA}_{\text{LiveWt}} \\ &+ \dots \end{aligned}$$

# 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



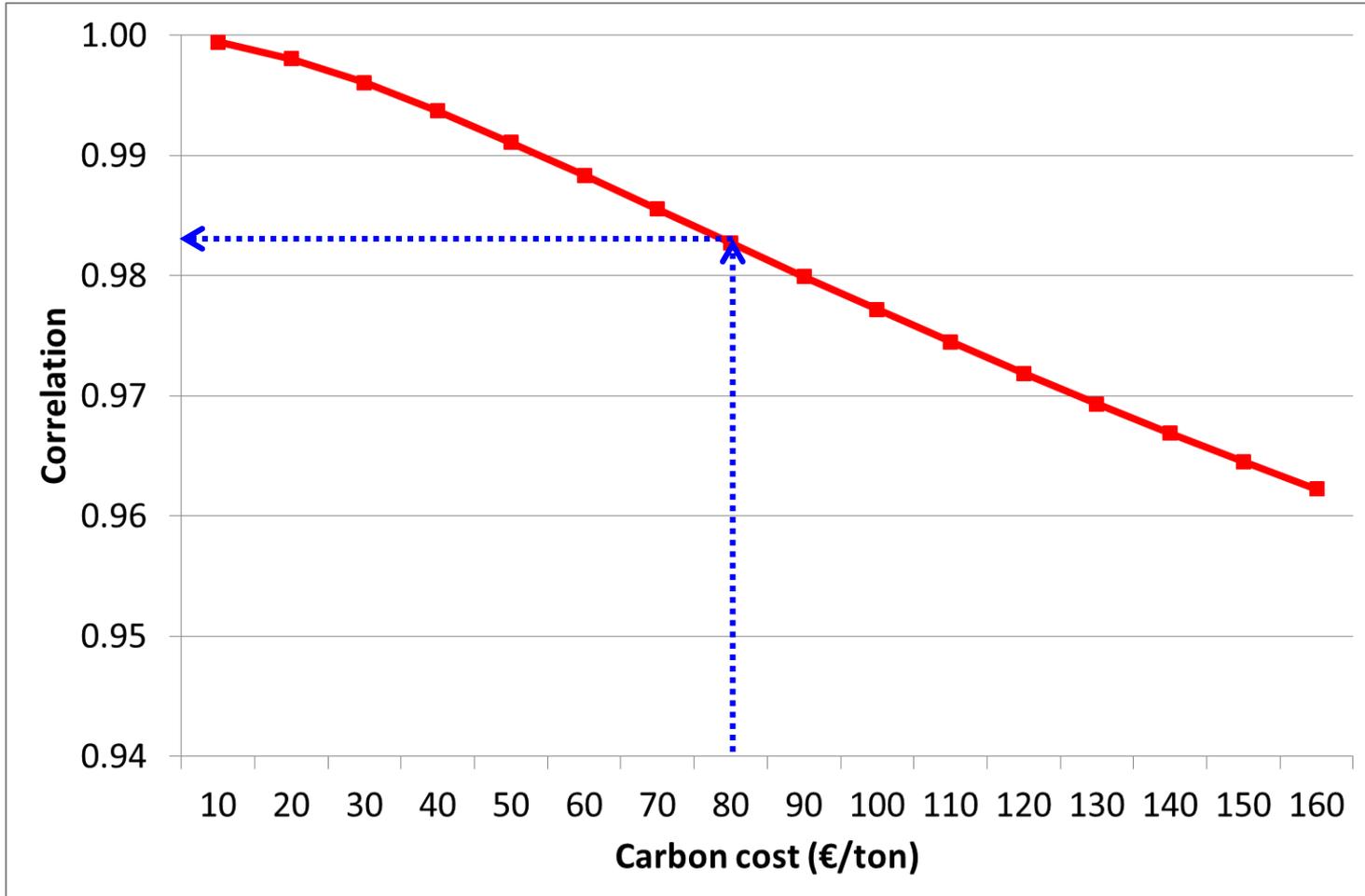
◆ Holstein    ■ Jersey    ◆ Friesian    ▲ Montebeliarde    ● Norwegian Red

**Each €10 increase  
in EBI**



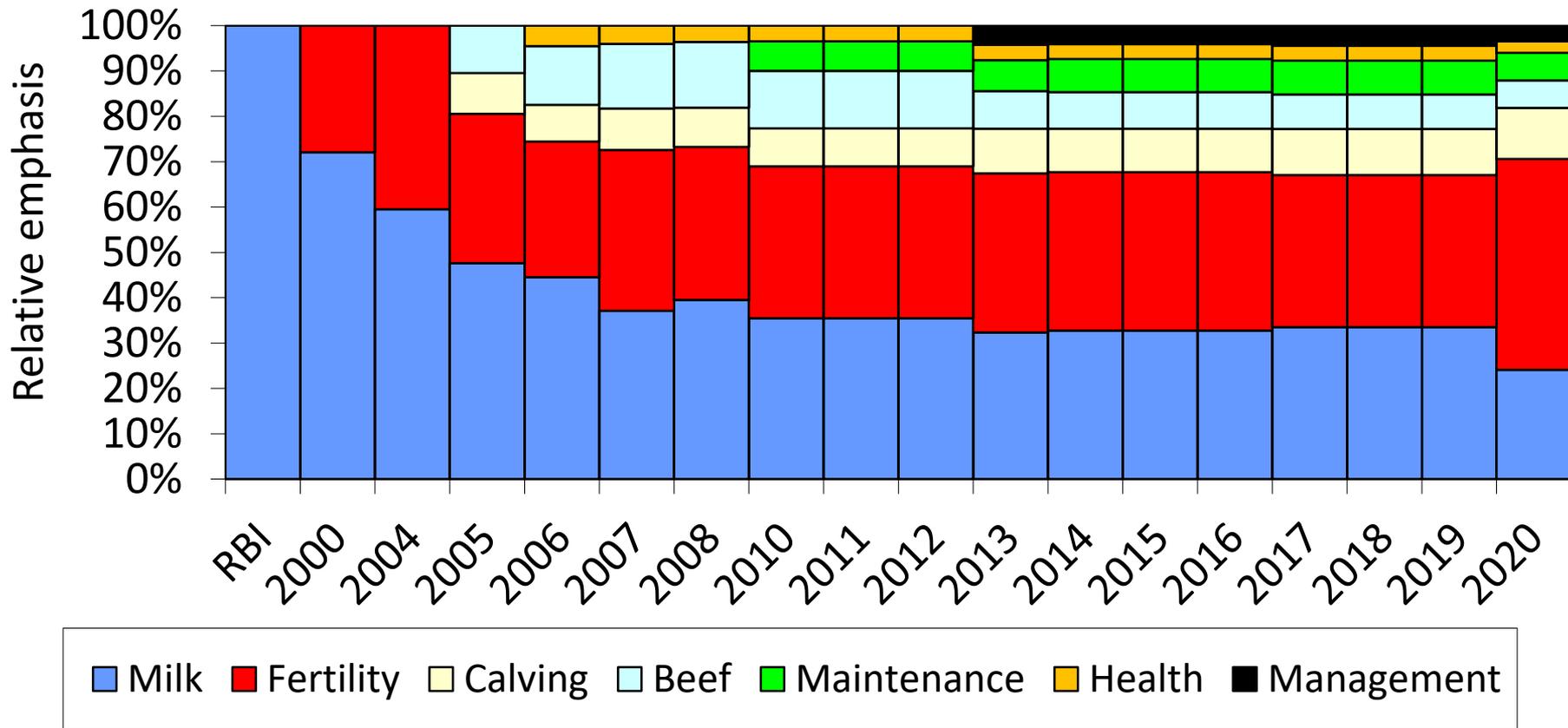
**61.7 kg CO<sub>2</sub>  
equivalents less  
per lactation**

# Correlation with EBI by carbon price

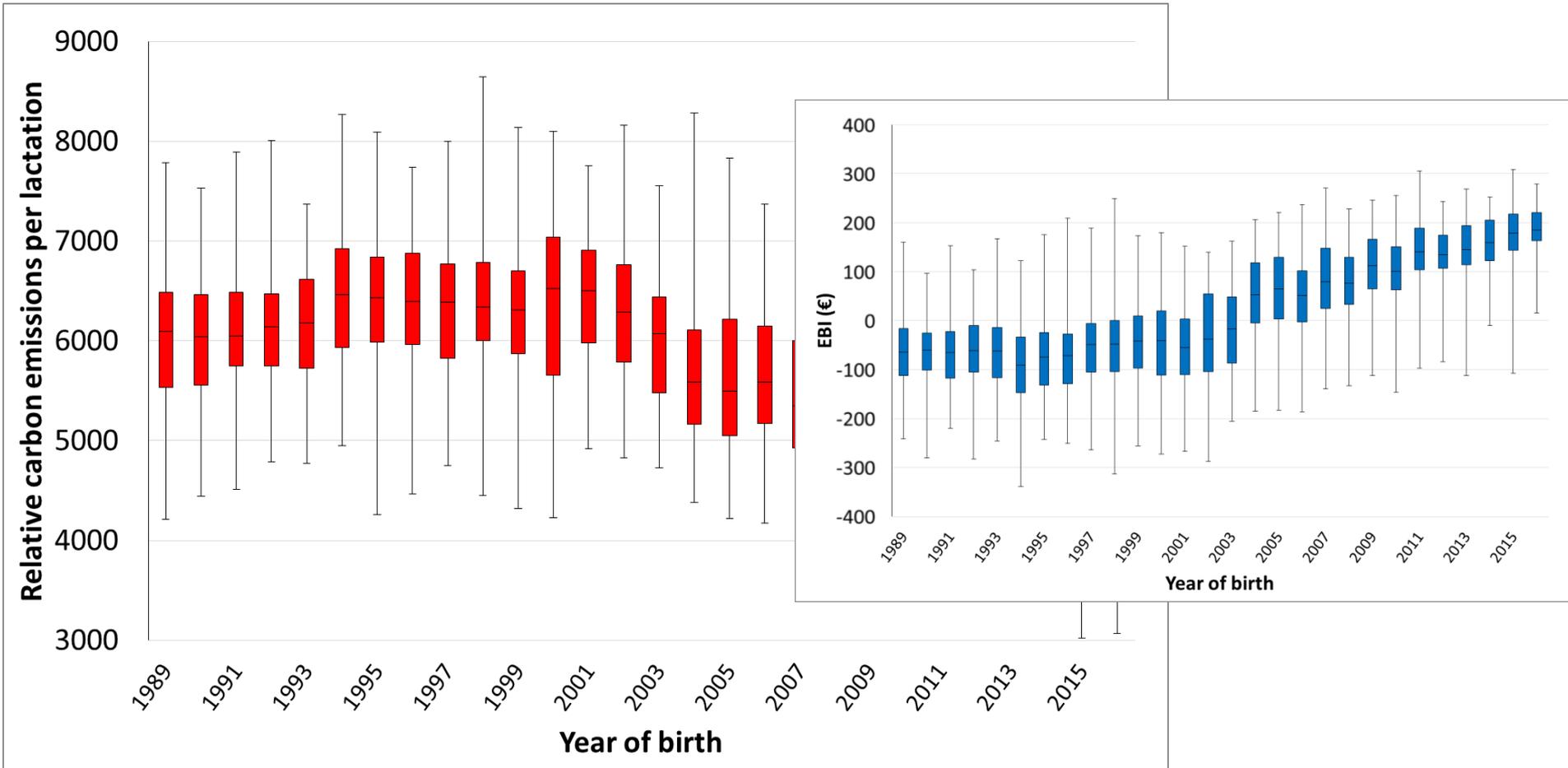


# The new EBI?

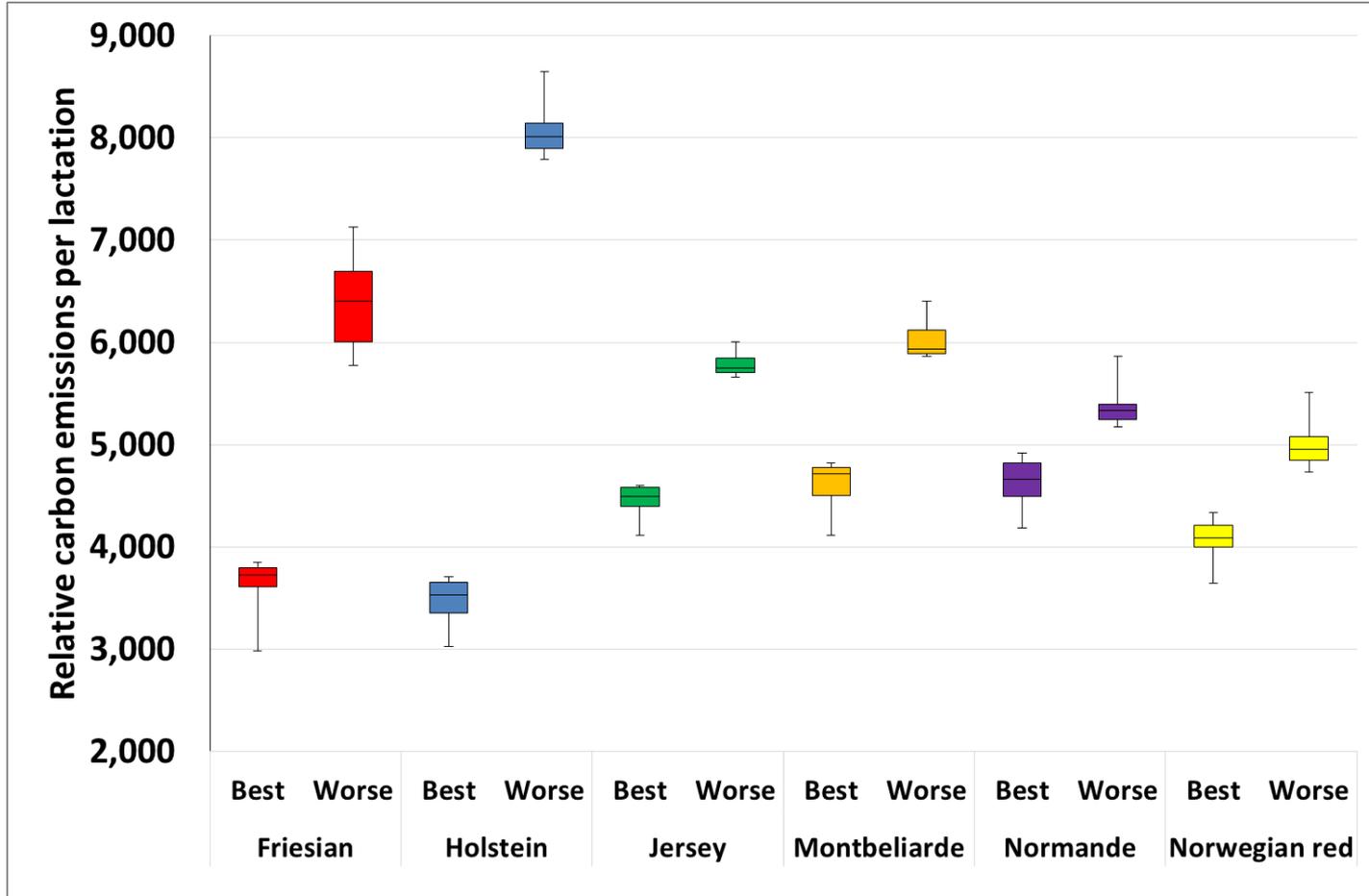
“E” = economic + environment



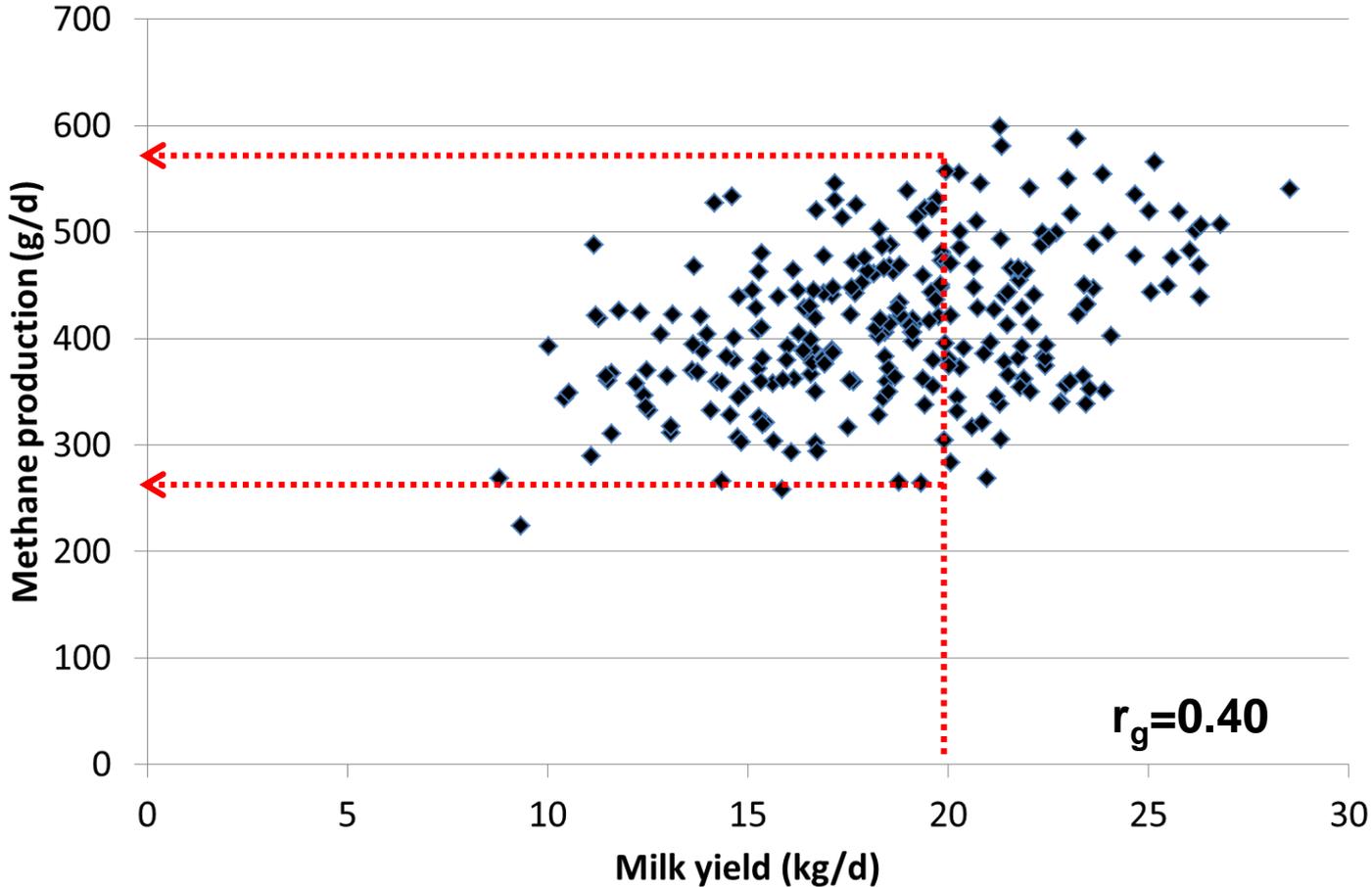
# CBI by year of birth (HF bulls)



# Good, bad and ugly



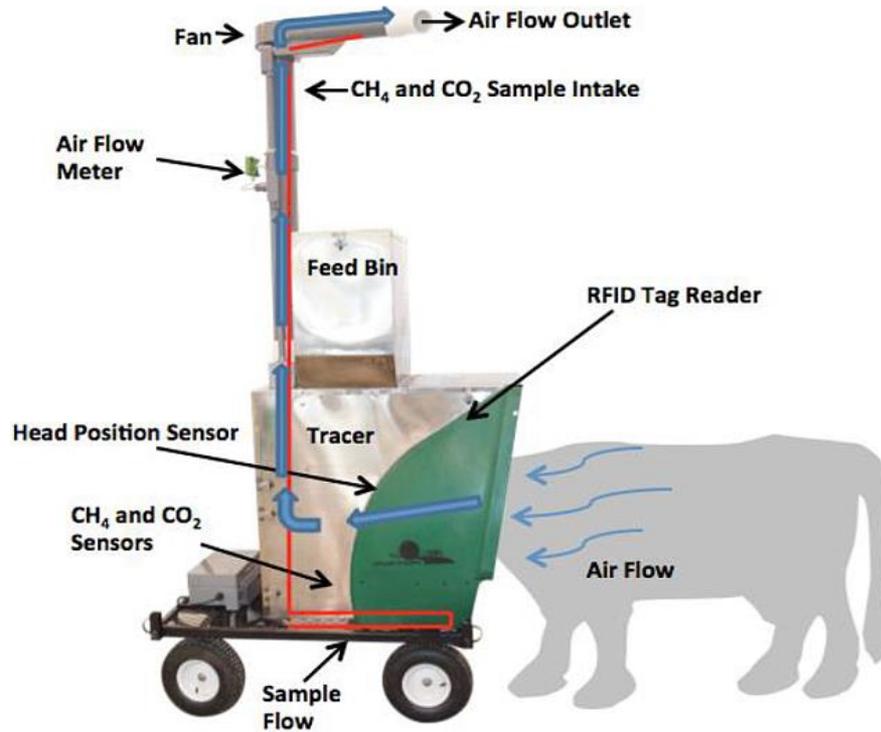
# “Residual” variability



**What is the variability?**

**Is it worth chasing?**

# GreenFeed systems



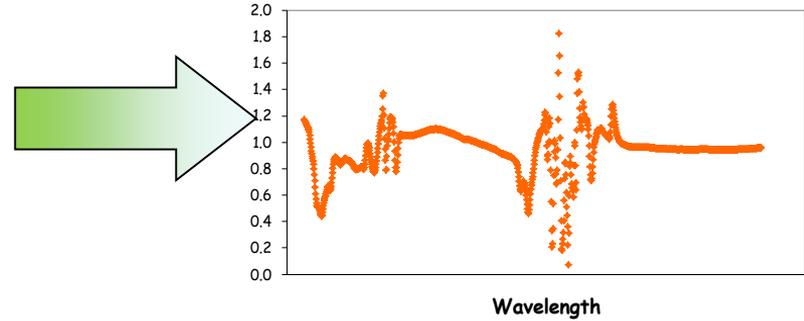
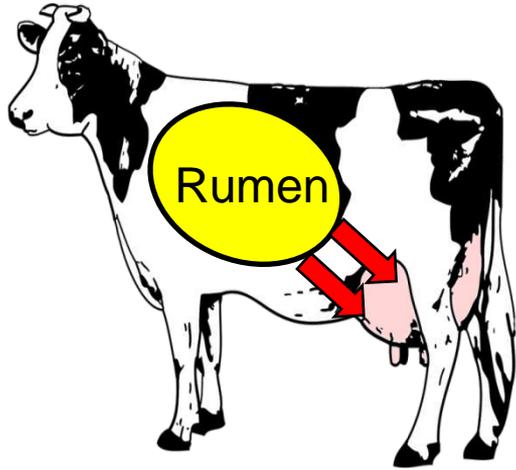
# GreenFeed systems



## 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**