

Long-term assessment of greenhouse gas emissions in Austria

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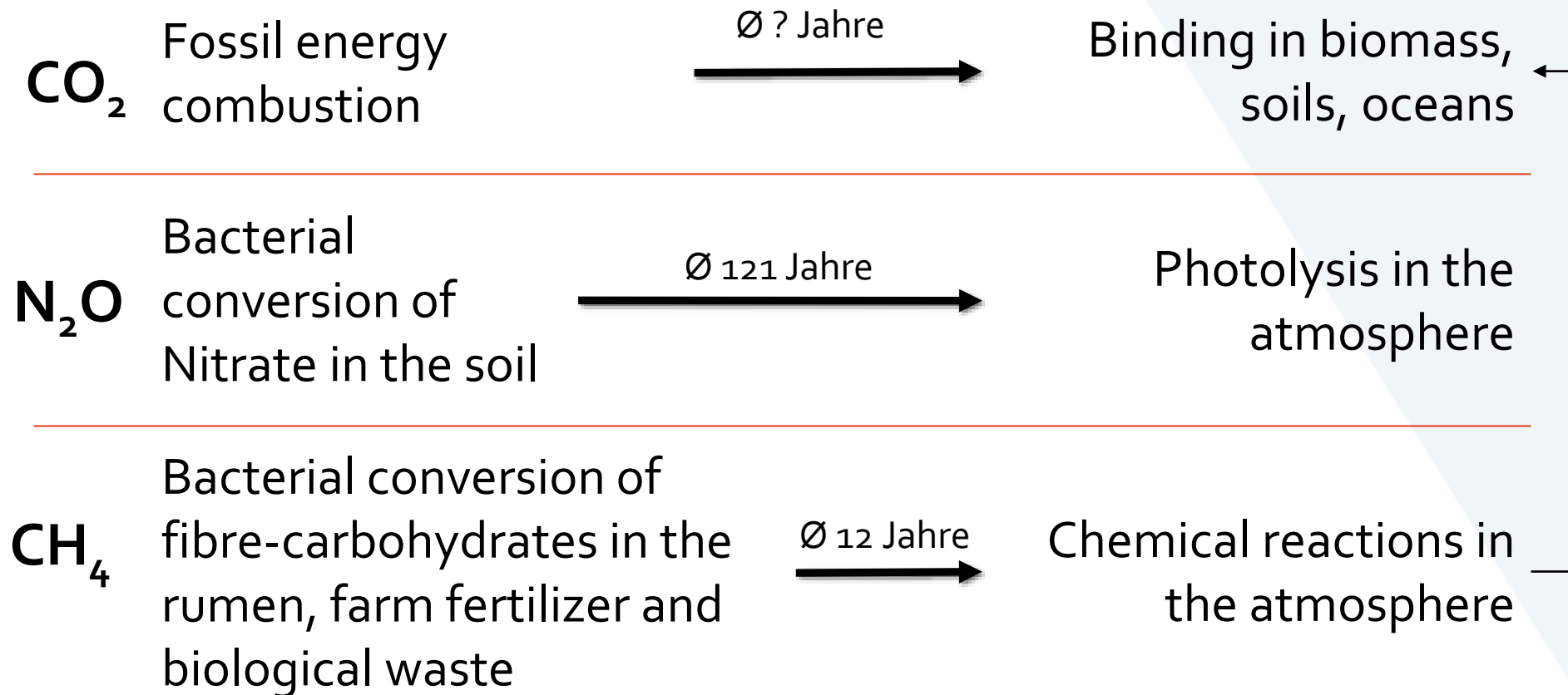
**Actually, everything
should be clear,
but it isn't. It's a scrum
of the guilty.**



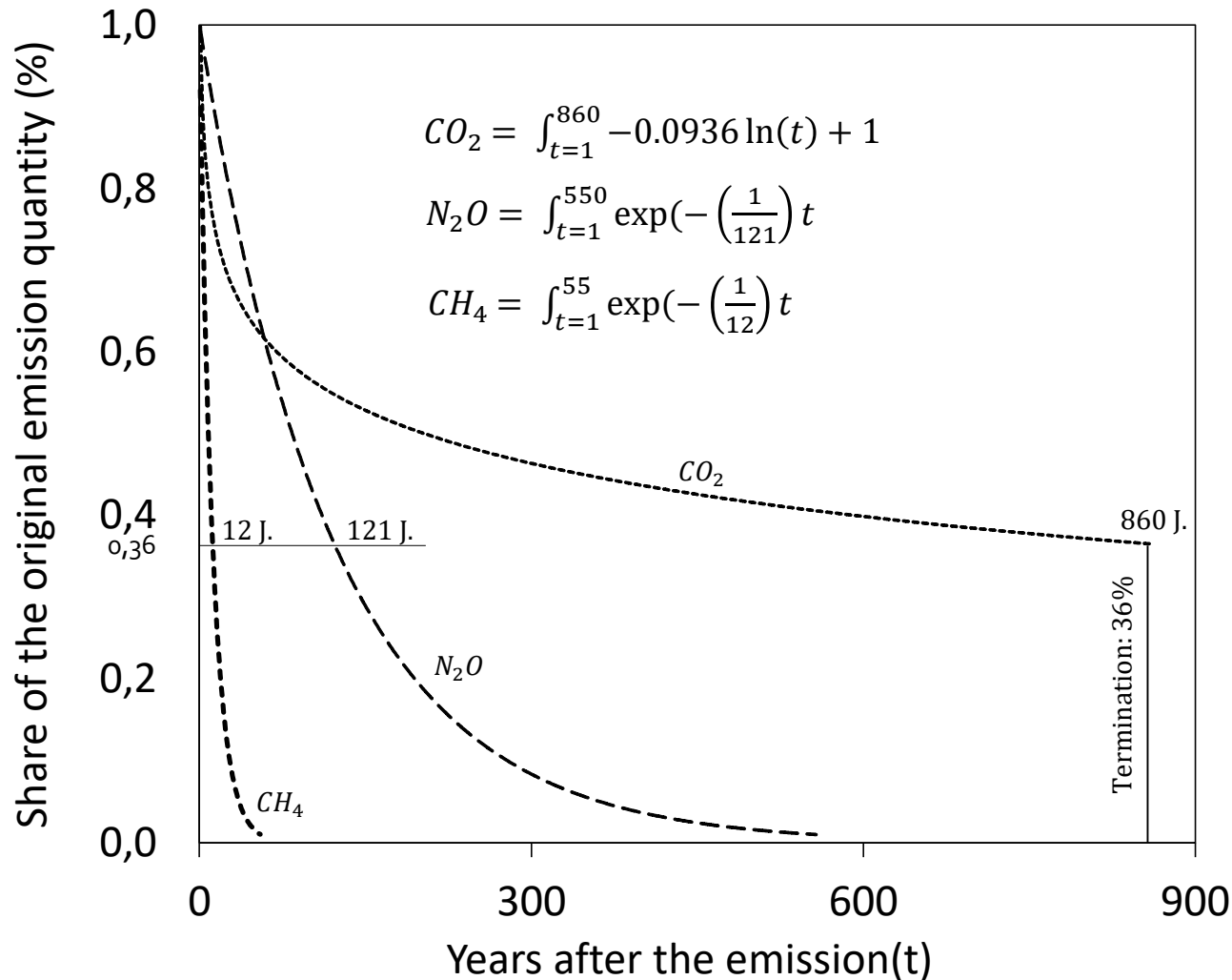
The enlightenment in 5 acts

- The chemical and physical basis
- The emissions pathways in Austria
- The impact wave and its interpretation
- What we can assume for the future
- The decision tree

The chemical and physical basis: The (most important) Green-House-Gases (GHG)

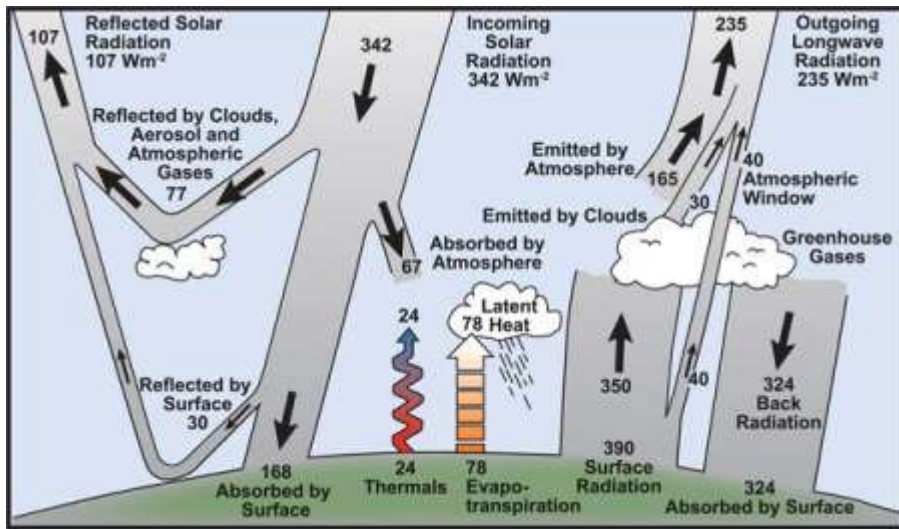


The chemical and physical basis: The degradation



For the mathematicians
among you: "The difference in
the basic functions says it all!"

The chemical and physical basis: The radiative forcing (RF)



Outgoing
Radiation/Reflection



originally balanced



Incoming
Radiation

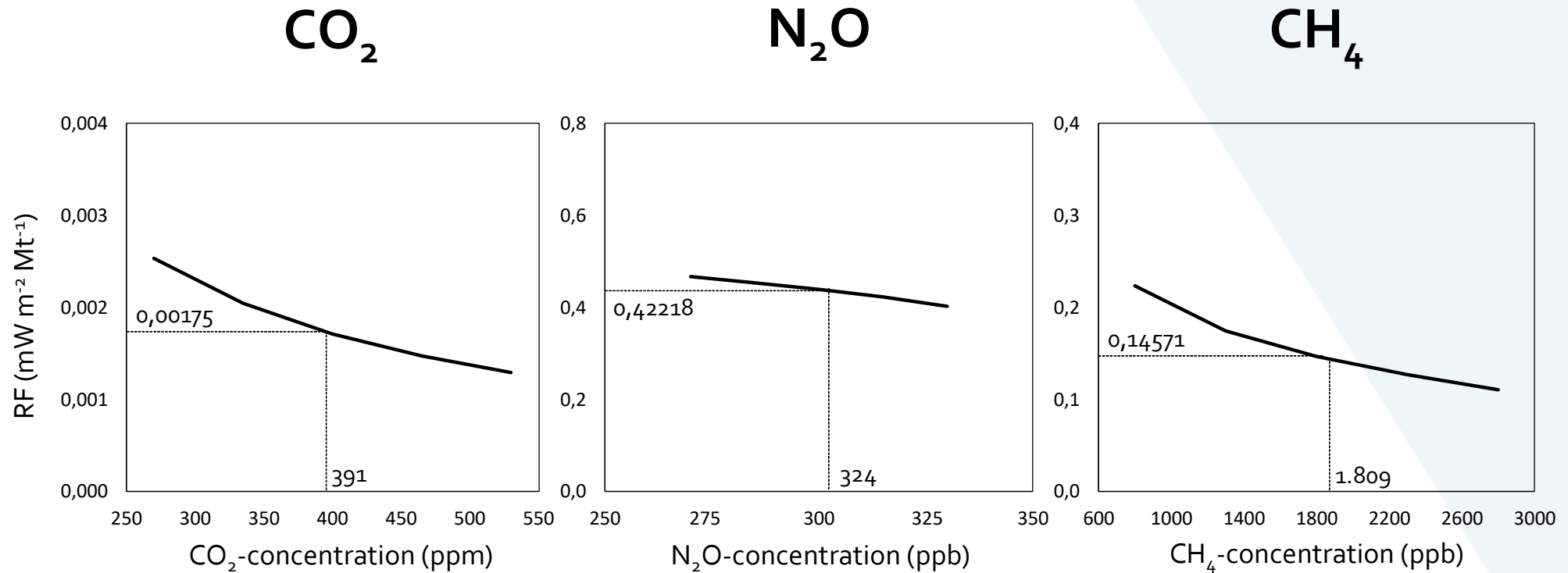
global + $2,72 \text{ W/m}^2$ ₁₇₅₀₋₂₀₁₉

**Radiative forcing =
The only one value.**

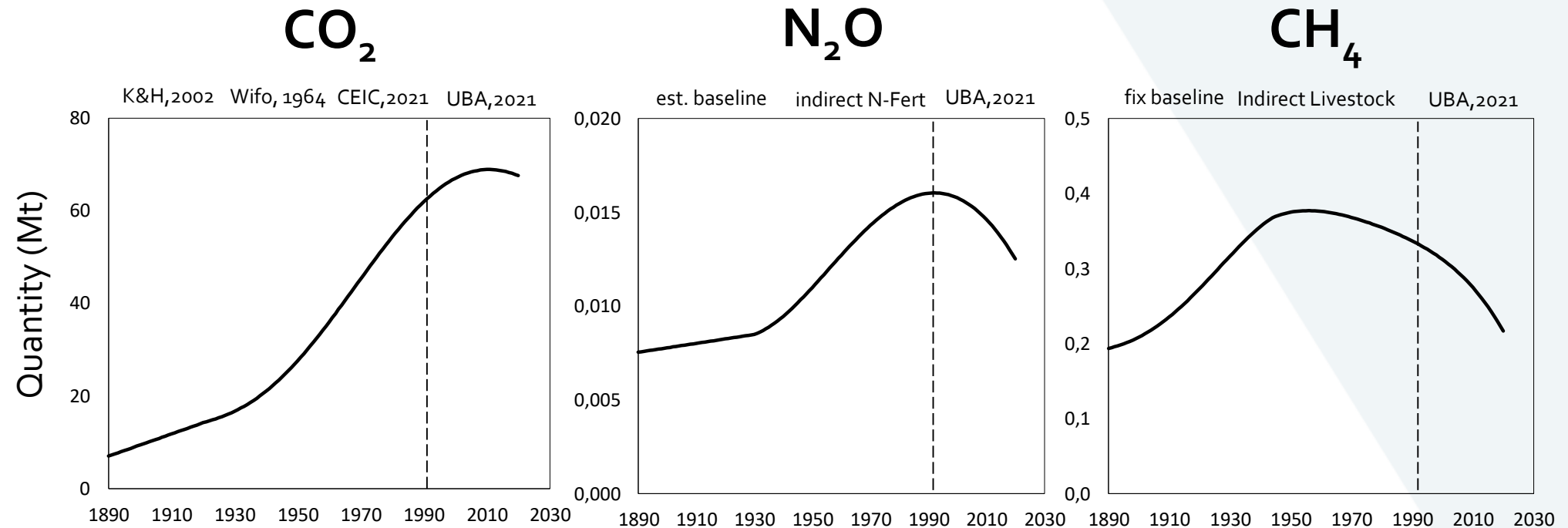
Forster et al 2007

Forster, P., et al. 2007. Changes in atmospheric constituents and in radiative forcing. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

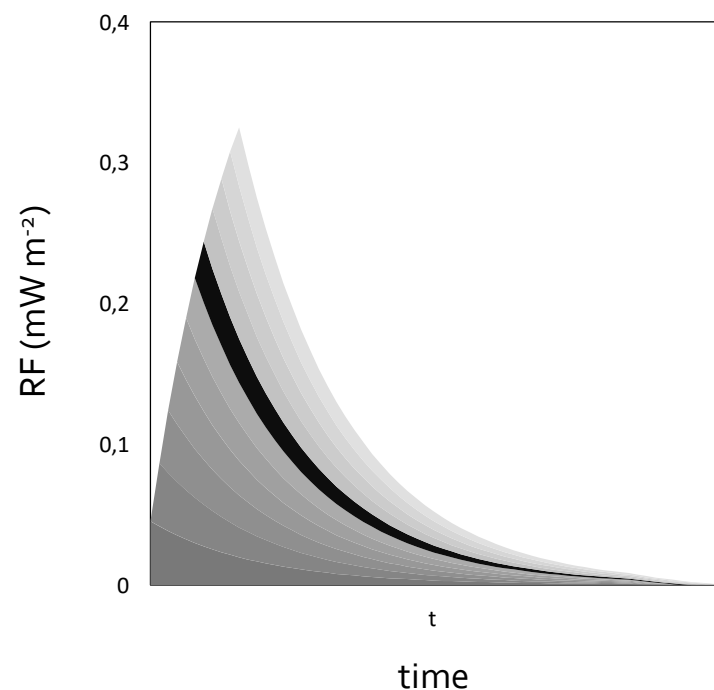
The chemical and physical basis: The radiative forcing (RF)/Emission



The historical emissions pathways in Austria



The impact wave and its interpretation

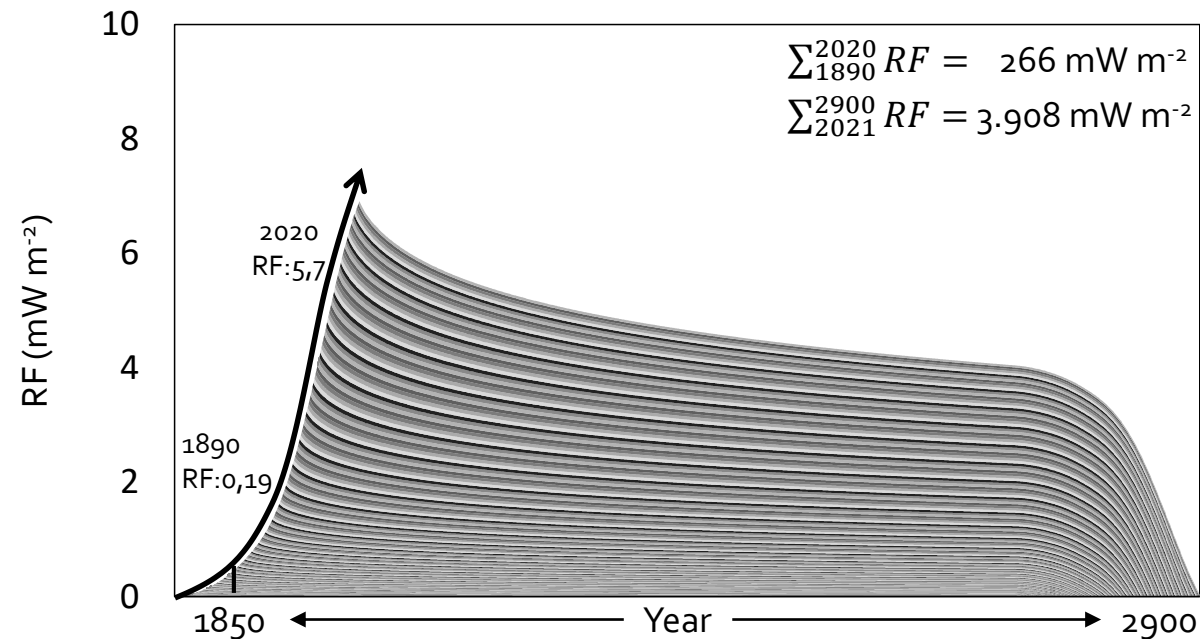


The overall effect of GHG-Emission depends on

- the amount of emissions over time
- the individual degradation path of GHG's
- the radiative forcing of GHG's

We will call it "Impact wave"

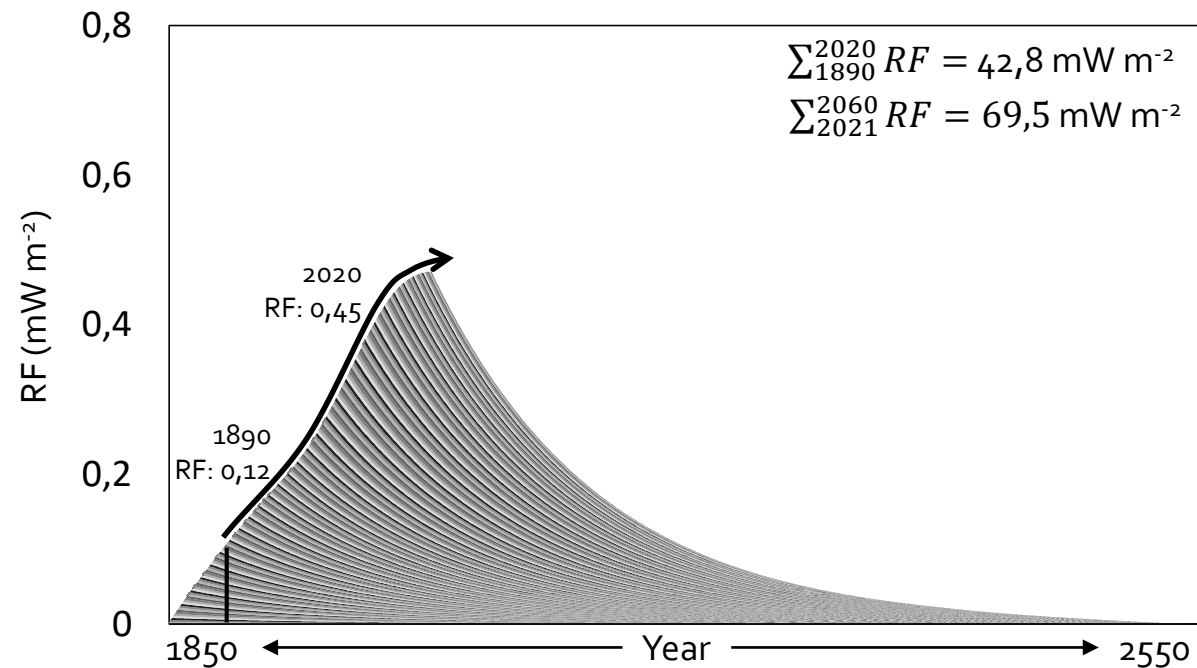
The impact wave and its interpretation: CO₂



Impact wave CO₂

- strong in aggregation
- long effective duration
- dramatic RF (quantity driven)
- punishment forever

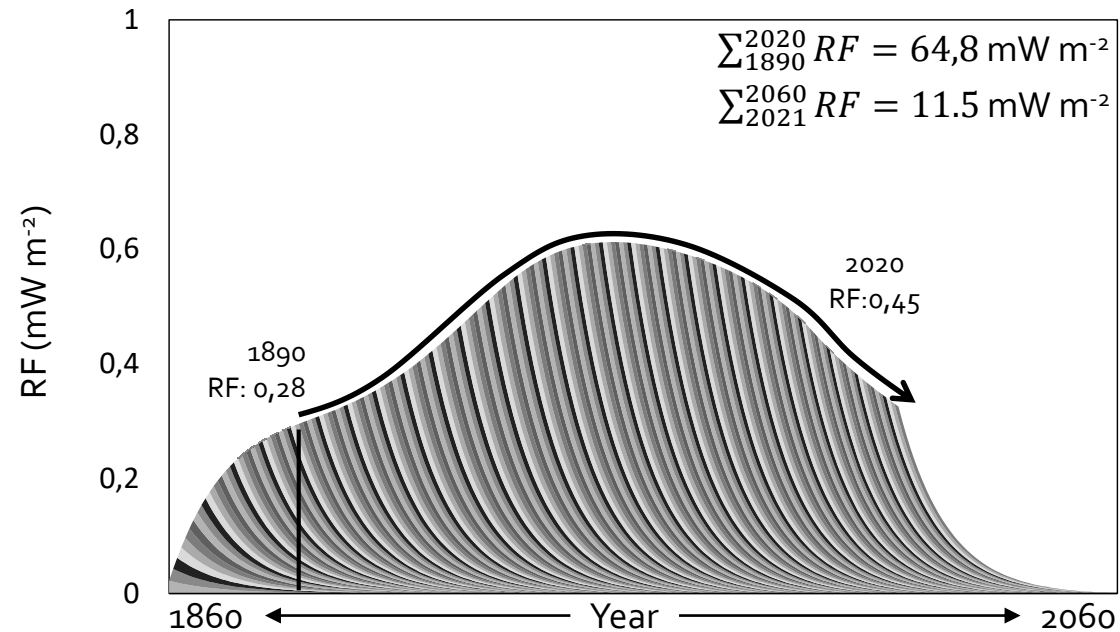
The impact wave and its interpretation: N₂O



Impact wave N₂O

- remarkable in aggregation
- media effective duration
- recognisable RF (quantity/quality)
- punishment for generations

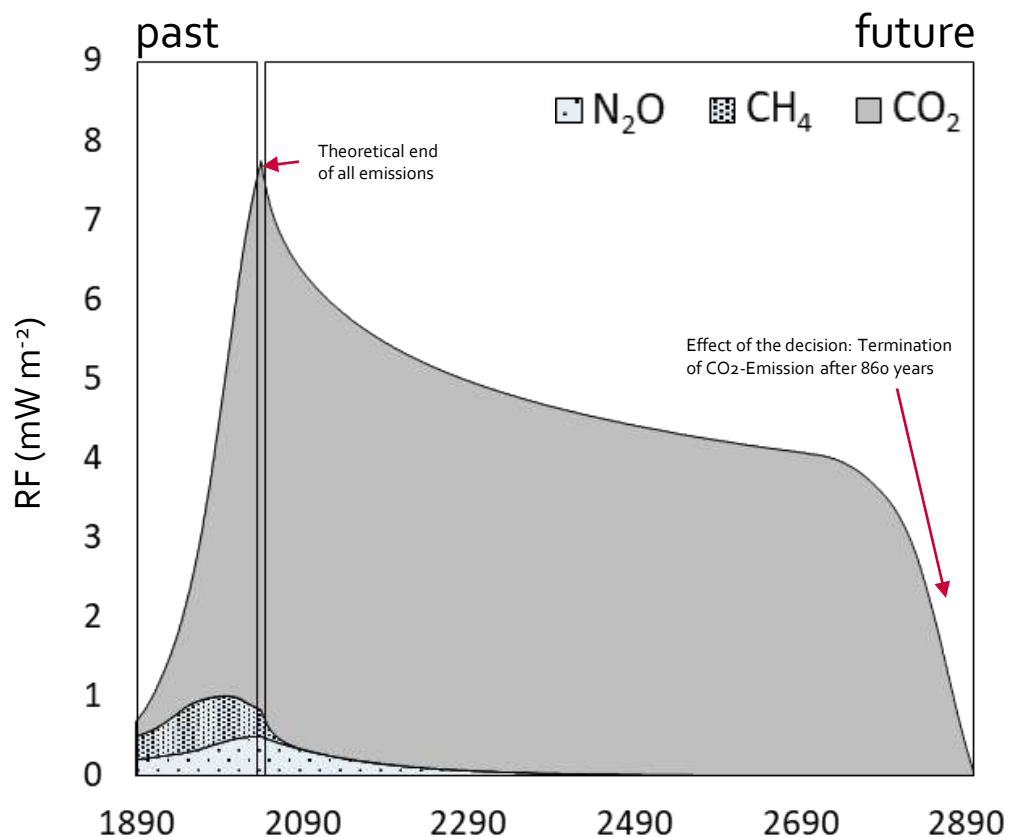
The impact wave and its interpretation: CH₄



Impact wave CH₄

- low aggregation
- low effective duration
- recognisable RF (quantity/quality)
- Net-Zero-Situation

The total impact wave...



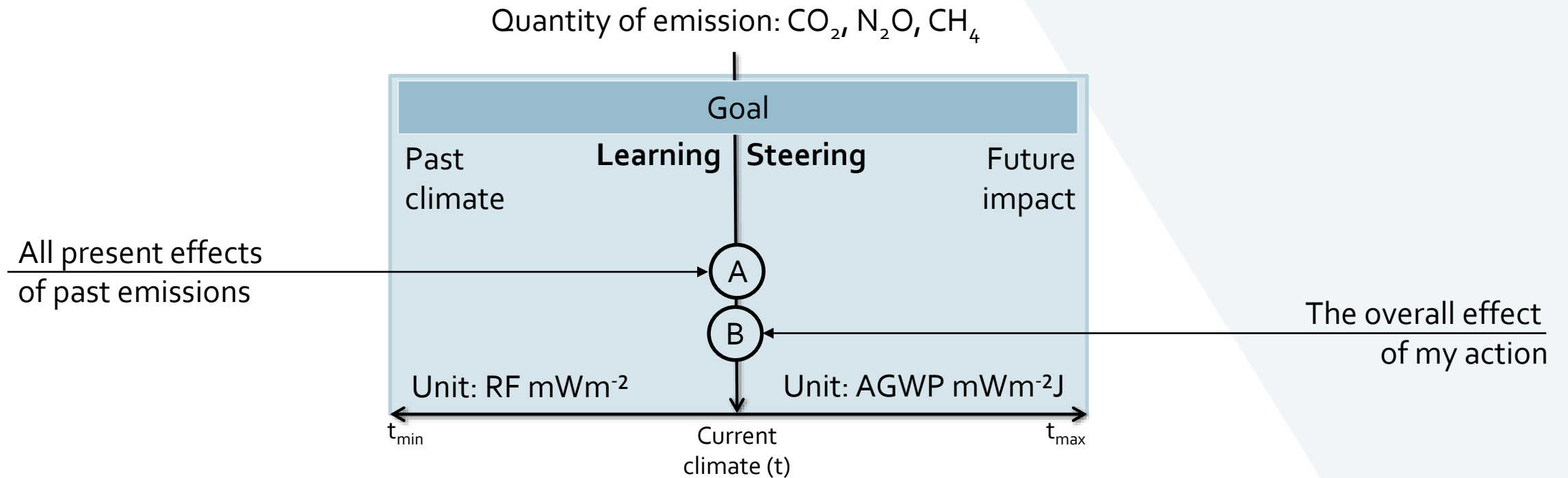
... from past to present.

- 8,6% of total effect.
- largely stable or declining development of short-lived GHGs, climate warming is driven by CO_2 emissions.

... from present to future.

- 91,4% of total effect.
- low effect of N_2O and dominant effect of CO_2

The method of interpretation of the wave determines (like always) the point of view

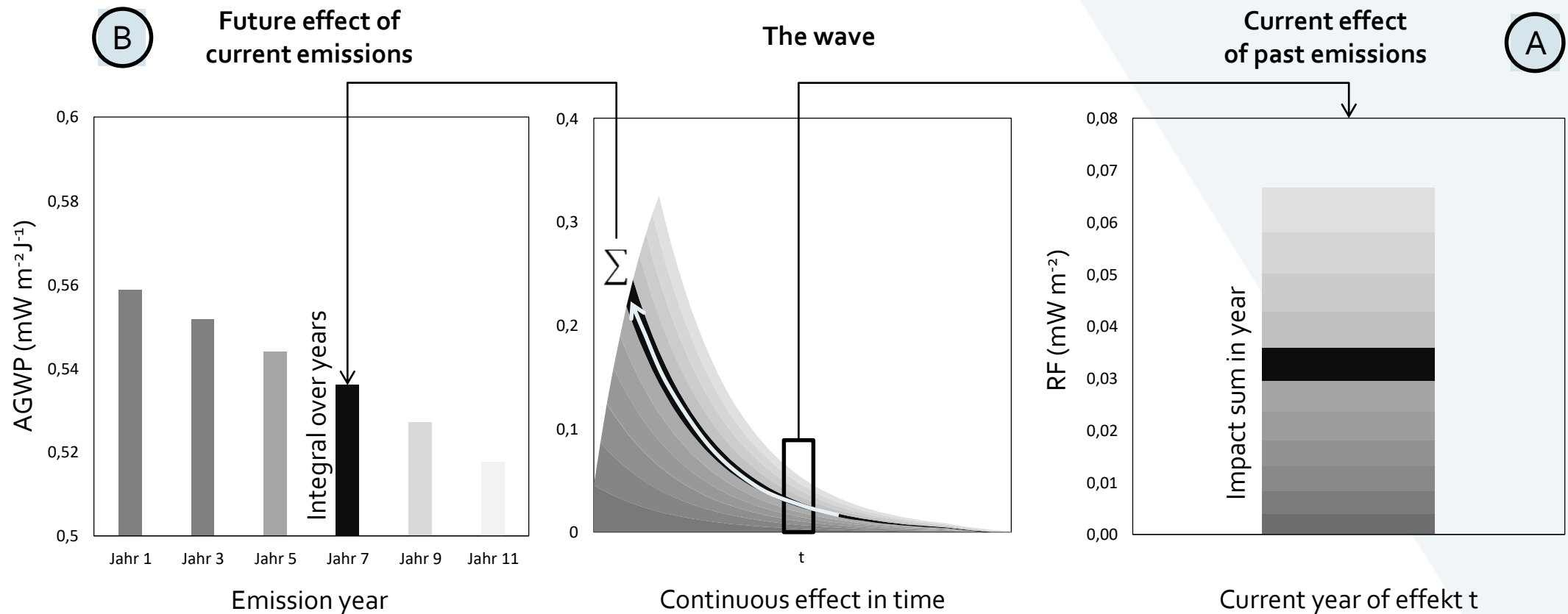


Learning curve

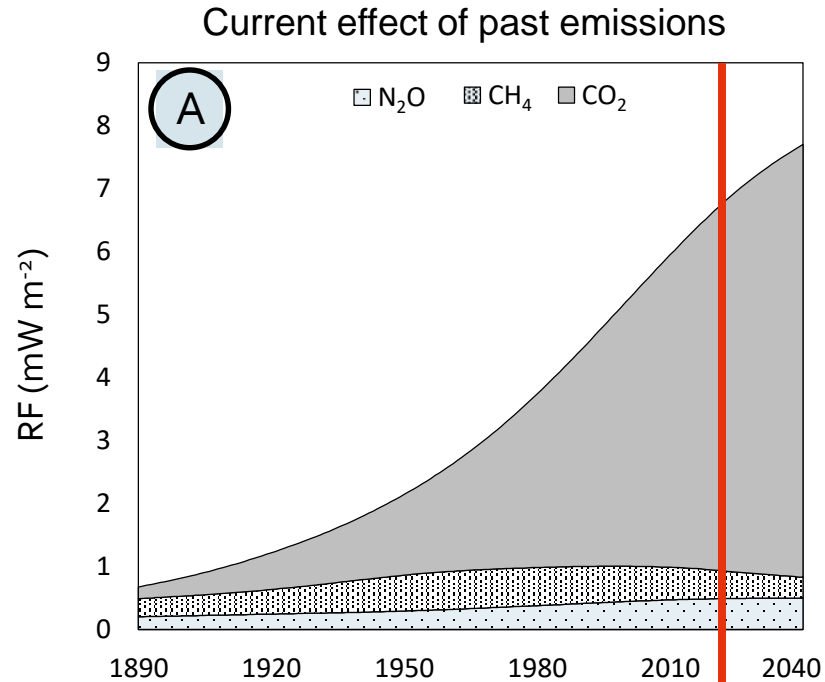
Public pressure to quick solutions

Responsibility of acting

The method of interpretation of the wave determines (like always) the point of view

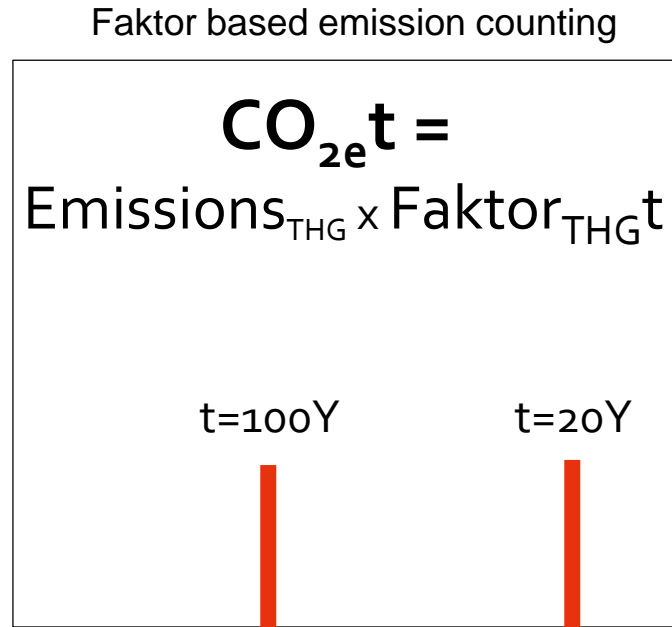


To learn



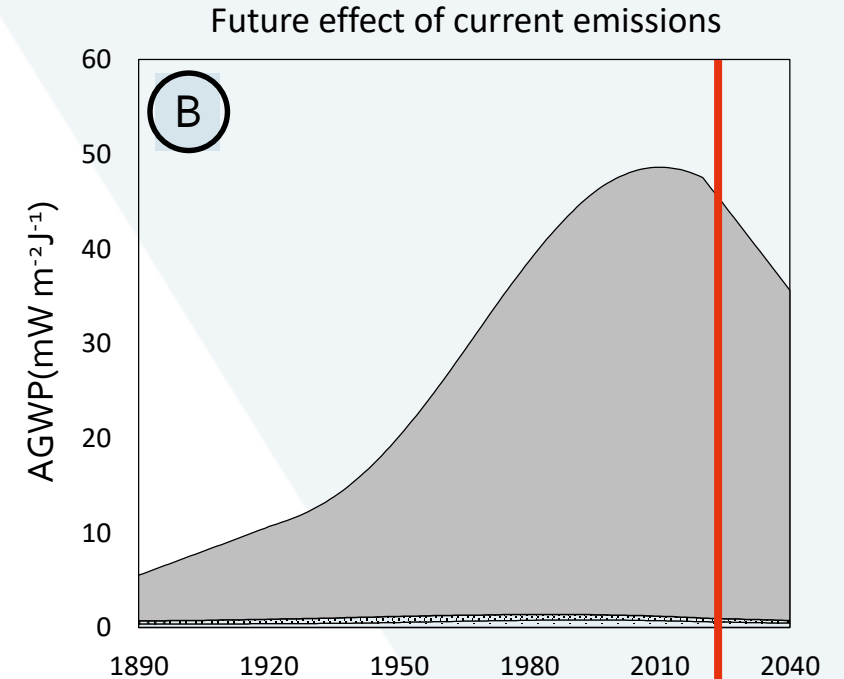
CO₂: 85,3%
N₂O: 7,5%
CH₄: 7,2%

Quick solution



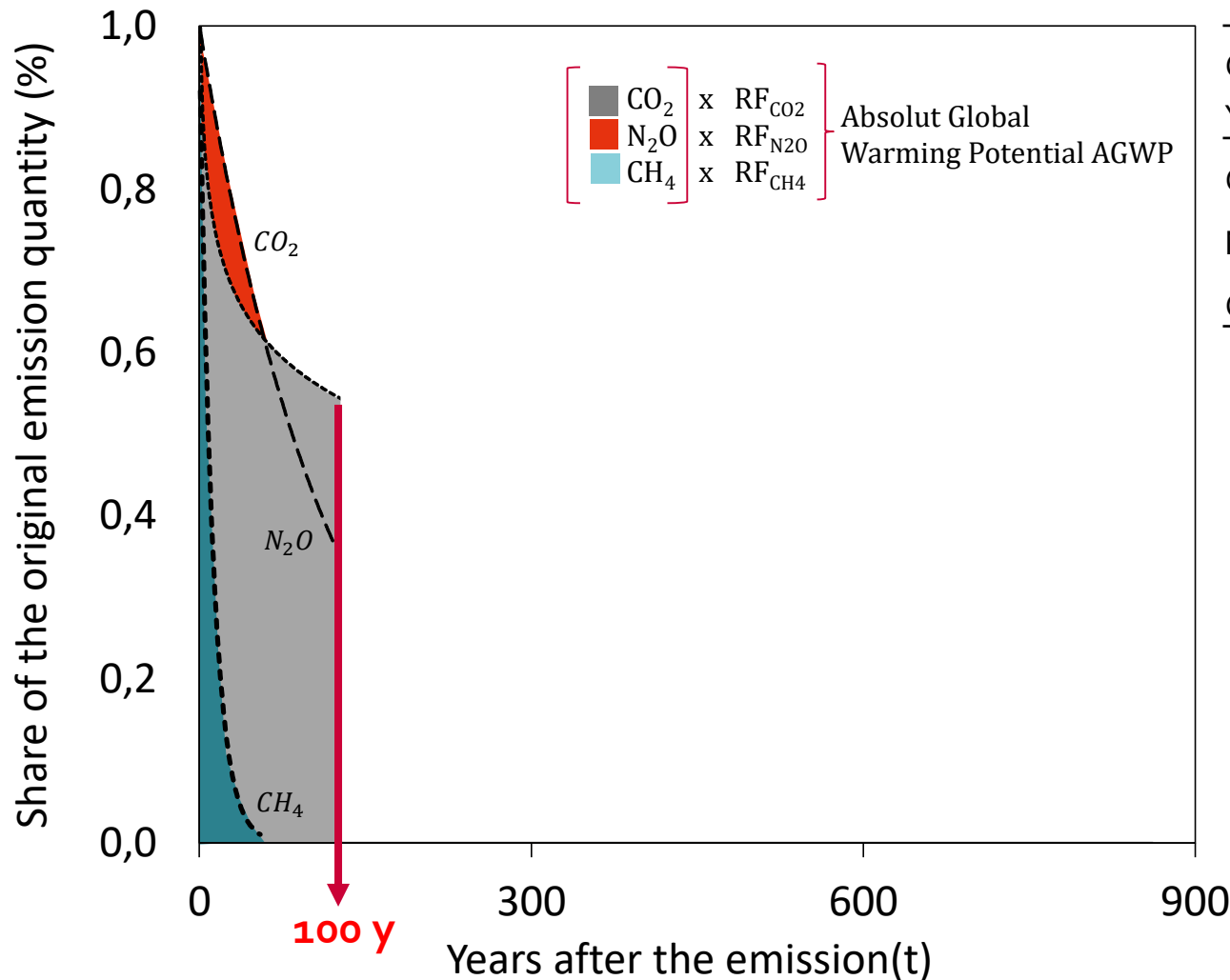
CO₂: 87,1% 75,3%
N₂O: 4,5% 3,8%
CH₄: 8,4% 20,9%

To be responsible



CO₂: 97,8%
N₂O: 1,4%
CH₄: 0,8%

Fitting the GWP-Factor = Cheating our grandchildren



Compared to short-lived greenhouse gases, the GWP₁₀₀ method reduces the pressure on CO₂ by a factor of 3-5.

GHG	1 Mt of emission acts in f(t)			RF (mW m ⁻² Mt ⁻¹)
Years	[1,max]	[1,100]	[1,20]	
CO ₂	0,690	0,115	0,028	1,0000
N ₂ O	50,366	28,607	7,750	100,000
CH ₄	1,774	1,775	1,453	0,00025

GHG	AGWP (mW m ⁻² Mt ⁻¹)		
Years	[1,max]	[1,100]	[1,20]
CO ₂	0,690	0,115	0,028
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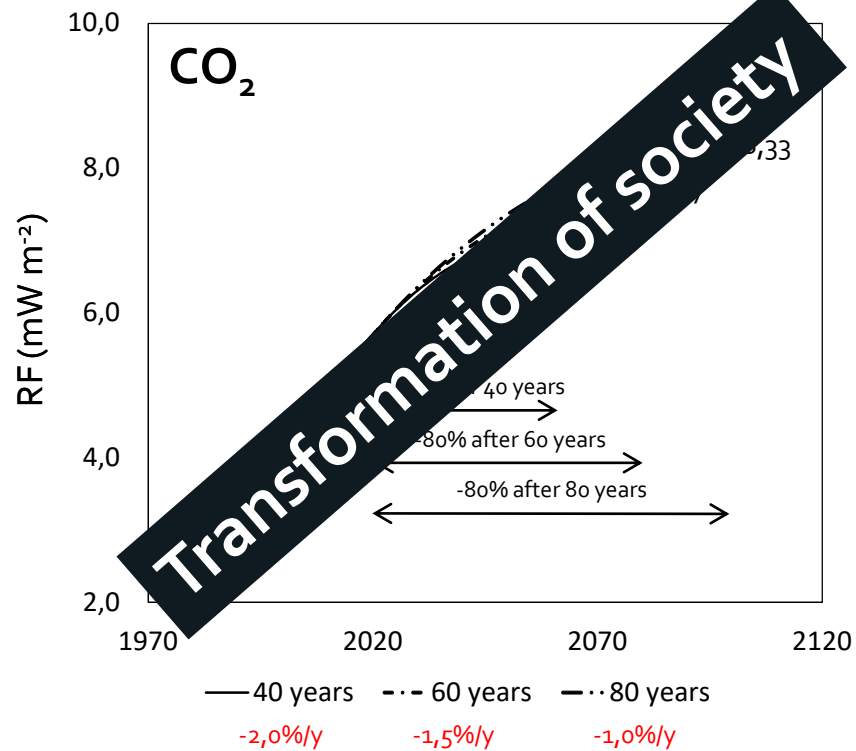
GHG	Faktor		
Years	GWP _[1,max]	GWP _[1,100]	GWP _[1,20]
CO ₂	1	1	1
N ₂ O	73,0	247,9	276,2
CH ₄	2,6	15,4	51,8

**Because any global international agreement is based on GWP,
we have to accept this serious shortcoming for now! 😞**

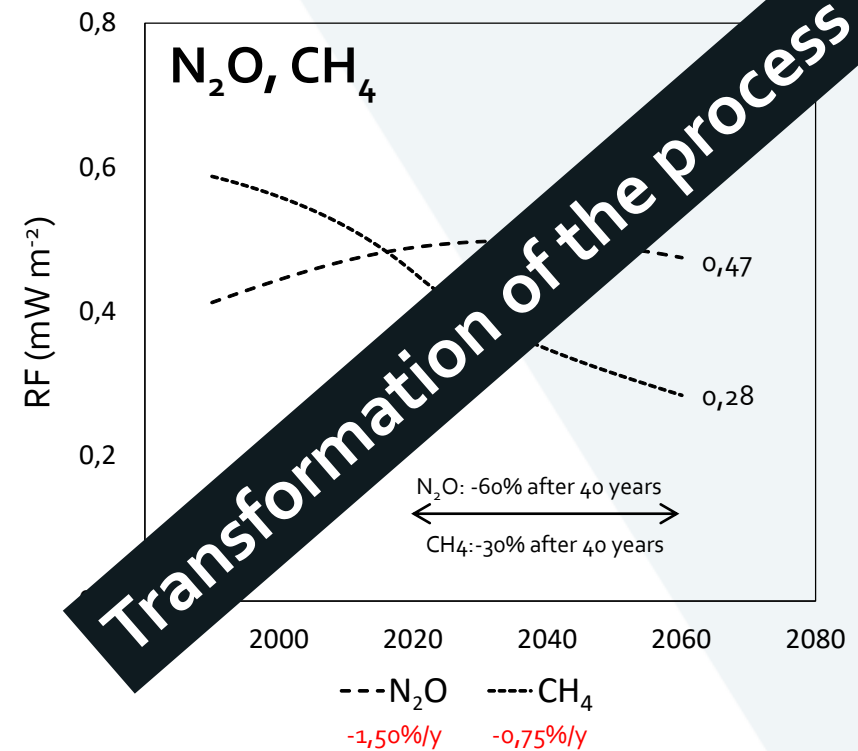
**However, we have to flatten the RF-curve as fast as possible.
How can we do this using method  ?**

What we can assume for the future - Method A

Pathways to stabilisation of radiative forcing in the year 2060

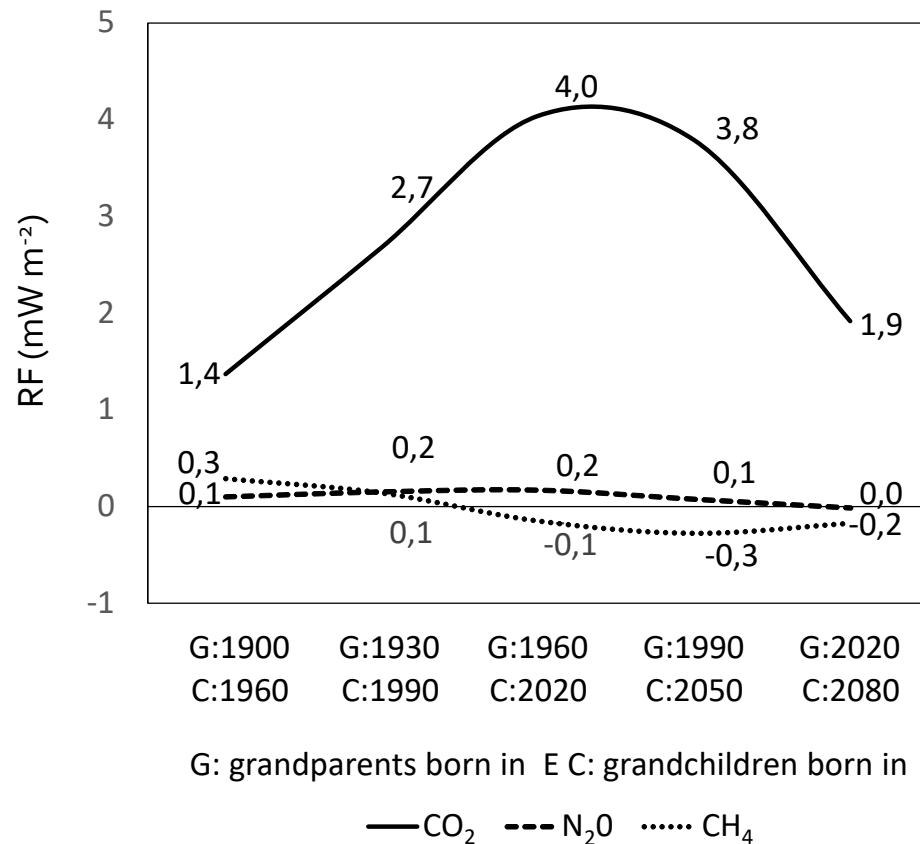


The success of an implementation path is not imaginable

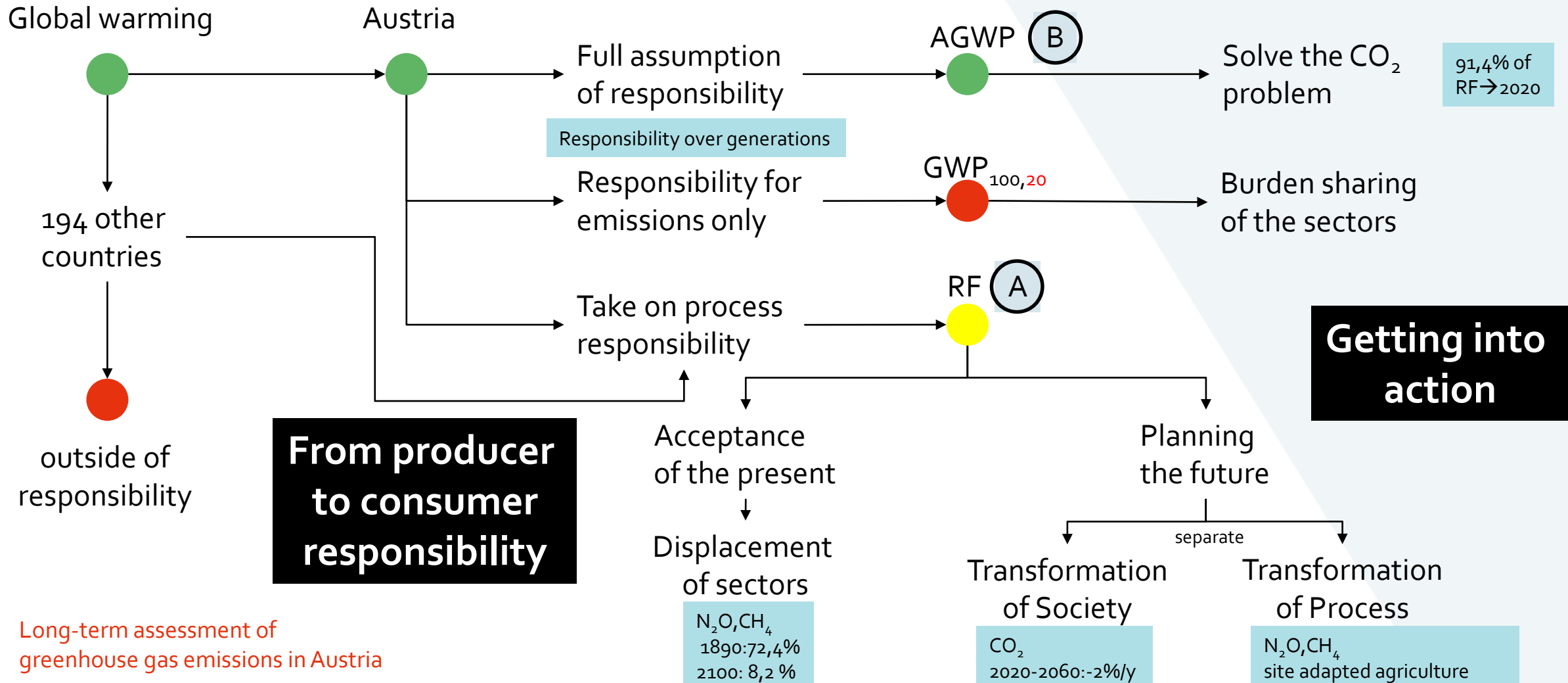


The path is defined and implementable!

GHG-Emissions → Responsibility over generations



The decision network



Summary

- Greenhouse gas emissions should not be described in terms of annual emission quantities but in terms of their additional contribution to the overall impact (RF).
- The degradation rate determines the aggregation force and this in turn determines the total damage for the future. The metric currently used (GWP) shortcuts the facts and distorts the assessment of greenhouse gases.
- From the perspective of long-term assessment, CO₂ and N₂O are currently building up their harmful effect more and more, while CH₄ is already reducing its effect.
- If every economic sector does not make a massive contribution to the reduction of greenhouse gases, every optimistic goal will be missed.
- Agriculture also has its contribution to make.



Thank you for your attention