

On the Timing of Greenhouse Gas Emissions

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a TRADITION of INNOVATION

Overview

- **Timing**
- **Stabilization targets**
- **Present value of GHG emissions**
- **An example**

Timing

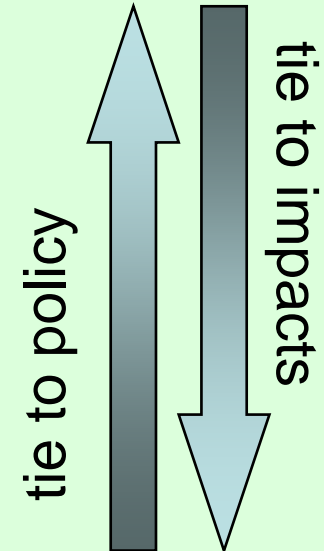
- **Land use change may cause large decreases in biomass (emission)**
 - at the start of the activity – deforestation for cropland
 - at the end of the activity – harvesting of forest
- **“Pay back” times may be long**
 - 10s of years
- **Do emissions and removals at different times have different value**

Stabilization Targets

- **Ultimate objective of the United Nations Framework Convention on Climate Change**
 - *Stabilization of greenhouse gas concentrations*
 - *To prevent dangerous anthropogenic interference with the climate system*
 - *Within a time frame sufficient to allow ecosystems to adapt naturally*

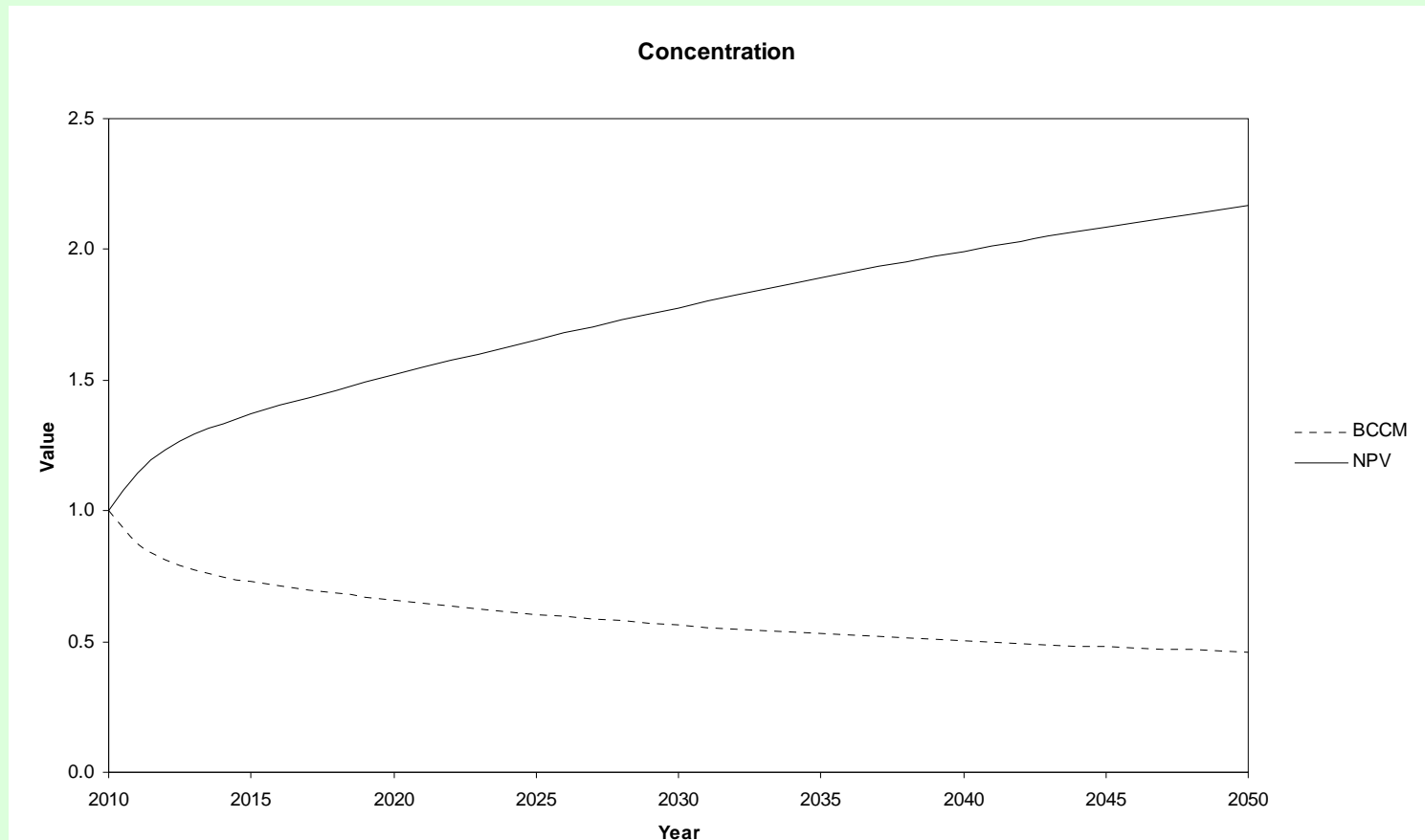
Stabilization Targets

- a. cumulative greenhouse gas emissions,**
- b. atmospheric greenhouse gas concentration,**
- c. radiative forcing, or**
- d. total change in temperature.**



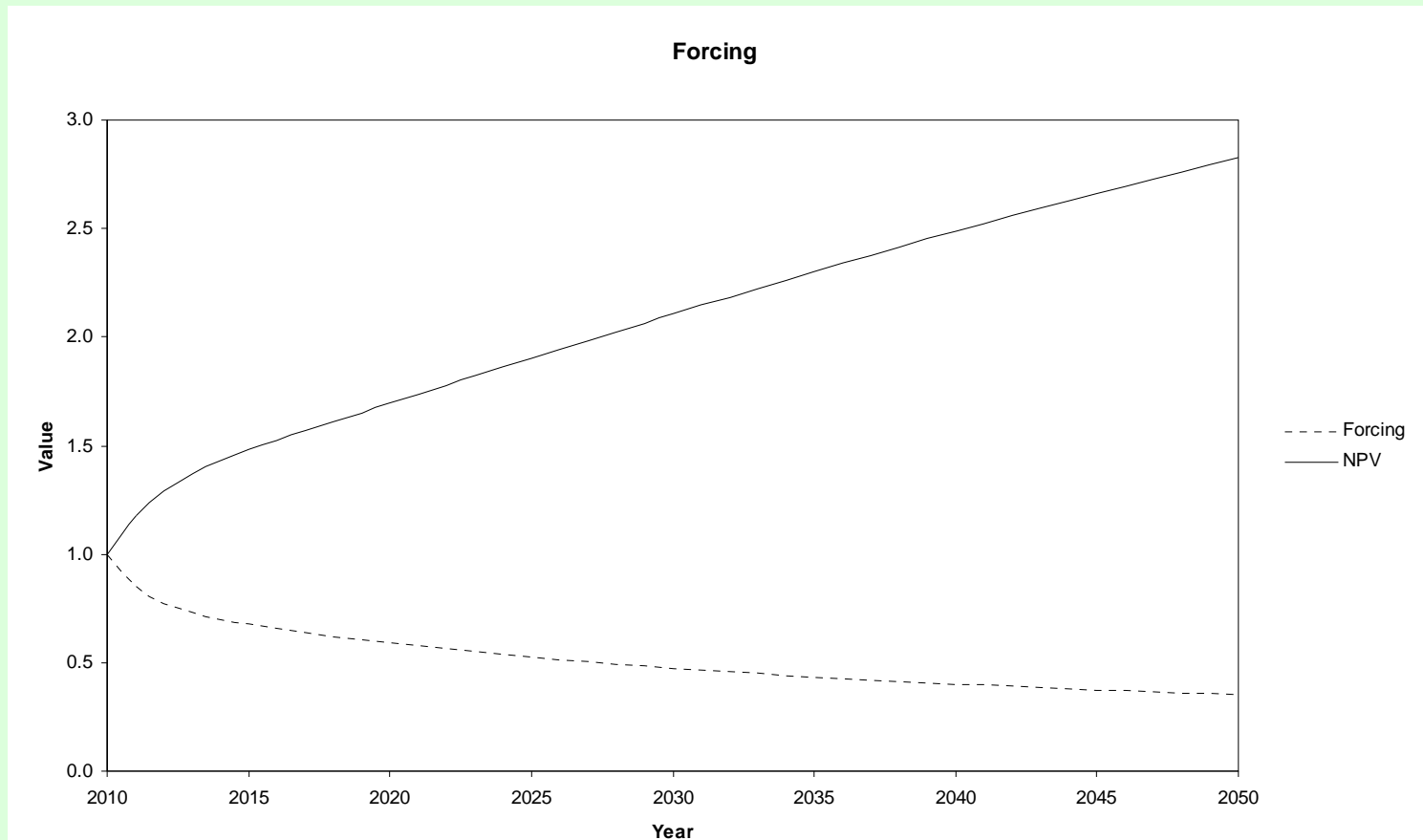
Greenhouse Gas Emission Concentration

- **Decreases with time due to natural factors**
 - Absorption by biosphere, oceans



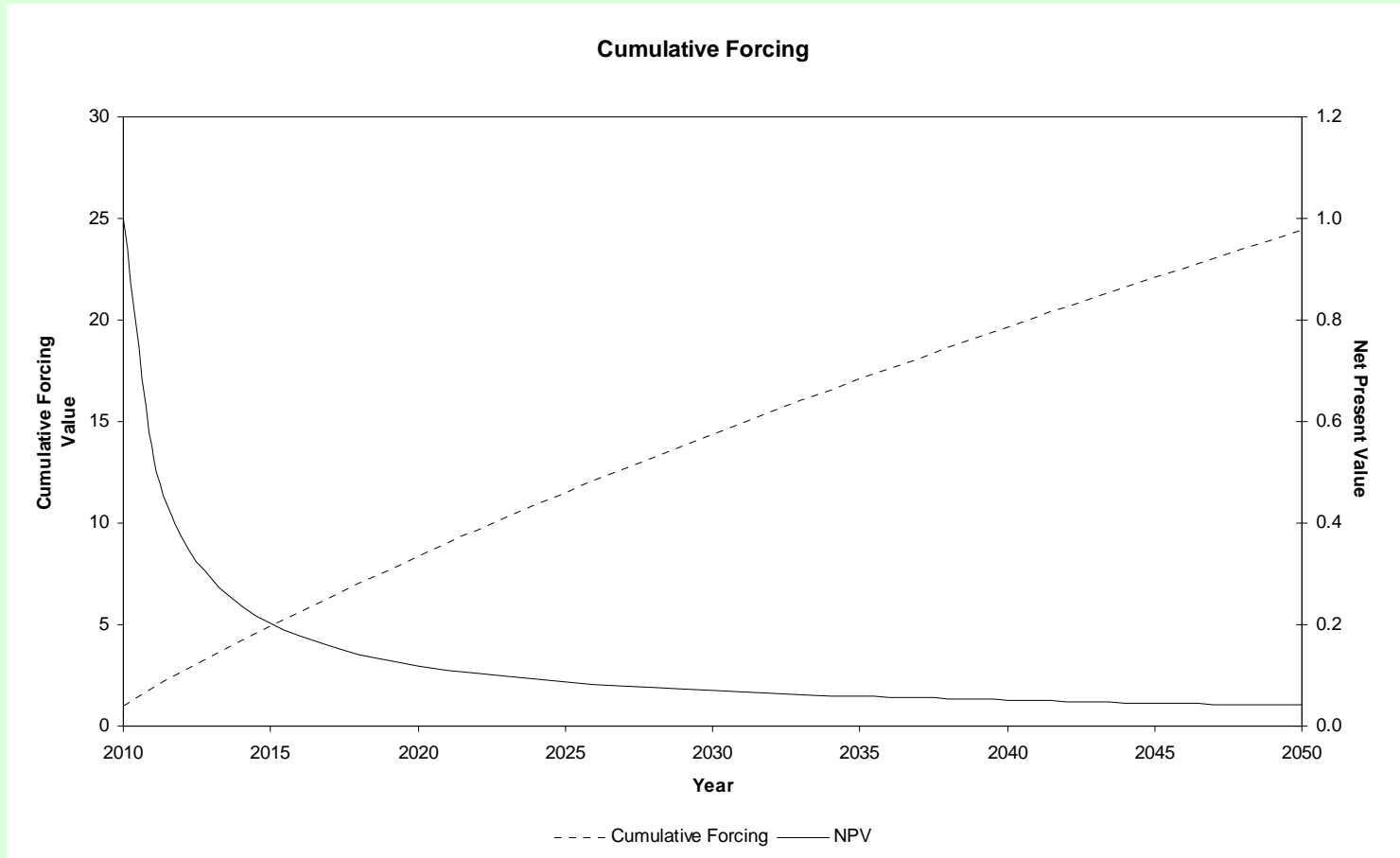
Radiative Forcing

- **Similar to GHG concentration but complicated by the change in surface energy absorption**



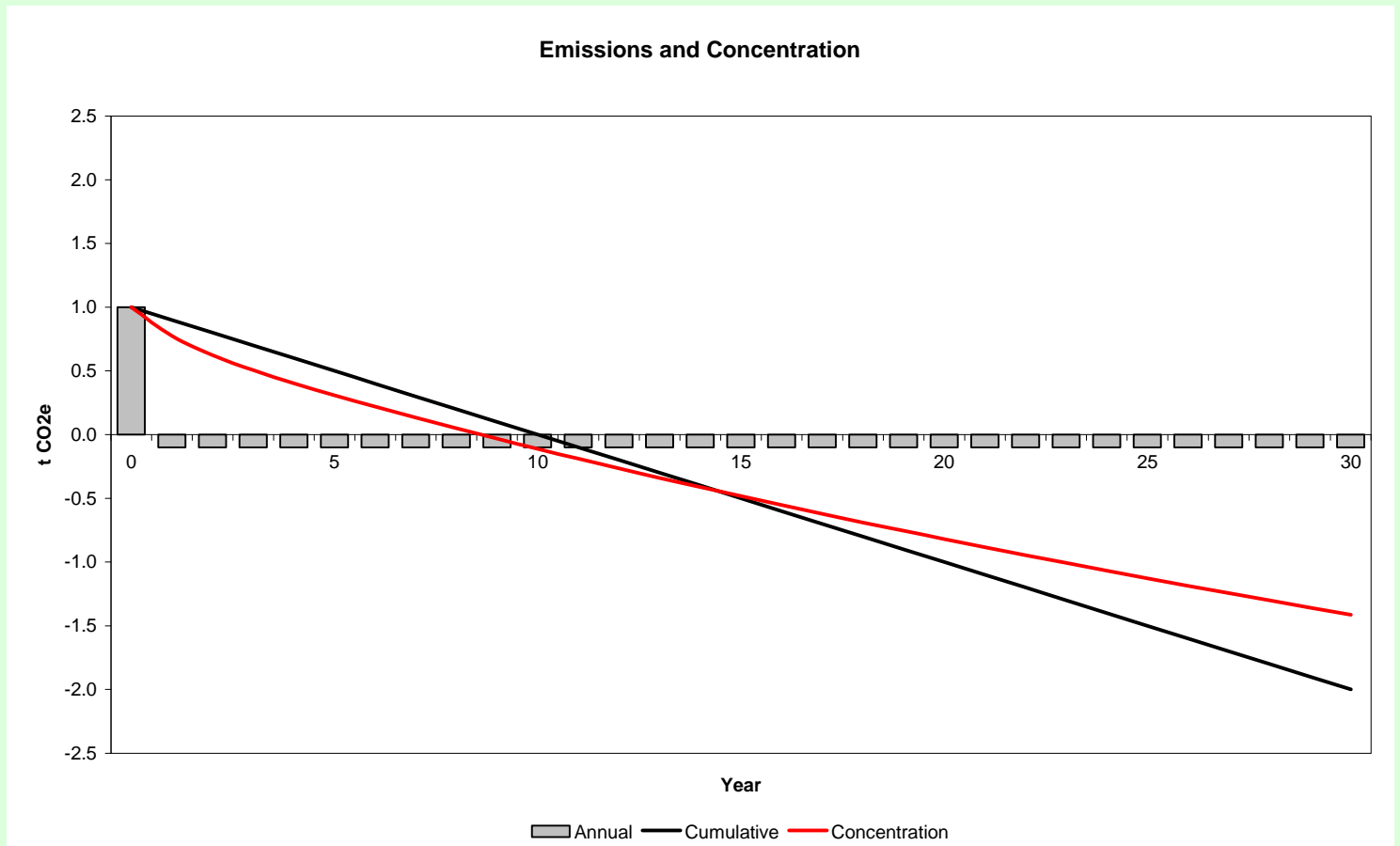
Cumulative Radiative Forcing

- **Most related to total temperature change**
 - Total energy pumped into the system



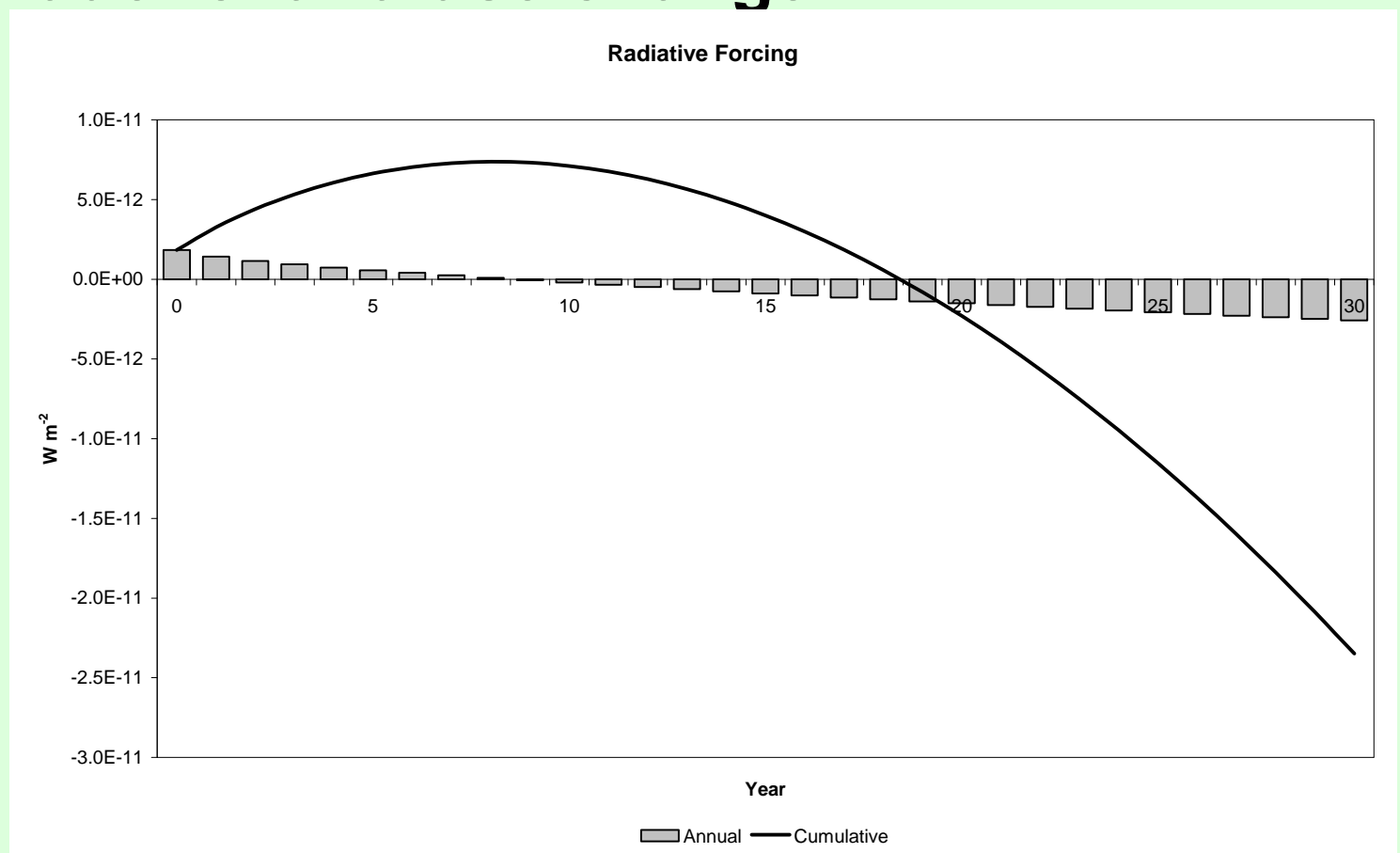
Example

- Emissions in first year saved by fossil fuel displacement over 10 years



Example

- **Small brightening (20%) of the surface due to land use change**



Conclusions

- **Timing does have a value depending on the target and the timeframe**
 - Cumulative GHGs – equal valued
 - GHG concentration – later emissions have more importance
 - Radiative forcing – similar to GHG concentration
 - Cumulative radiative forcing – early emissions have much more importance
- **Important for activities that cause large initials emissions that are recovered over longer times**