Metrics and stabilization of the climate – GCP, GTP and CETP

IAMC annual meeting, Utrecht, 2012-11-12

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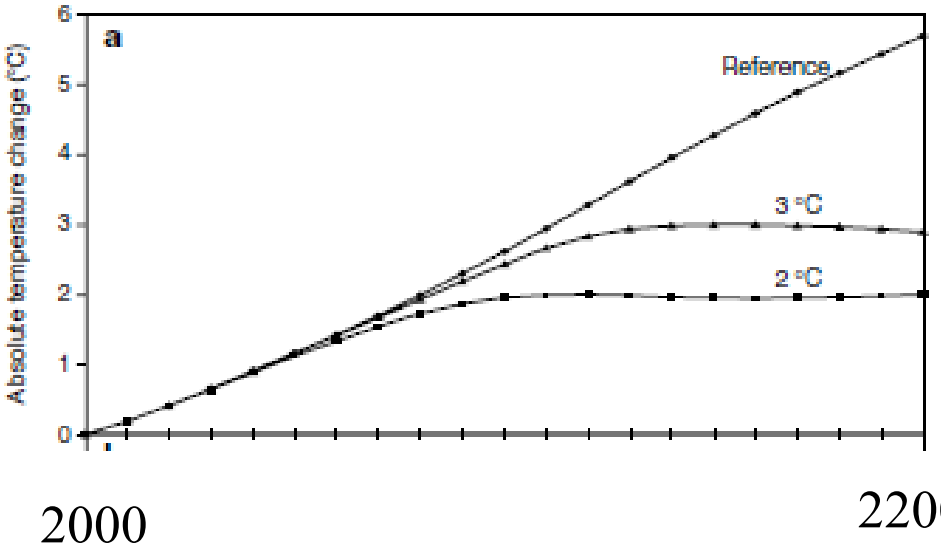
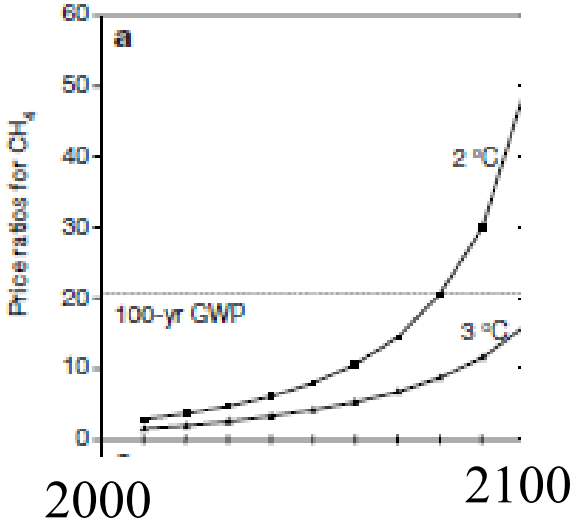
Stabilizing below 2ºC cost-effectively

GWP was not designed to facilitate the basket approach in a cost effective stabilization regime.

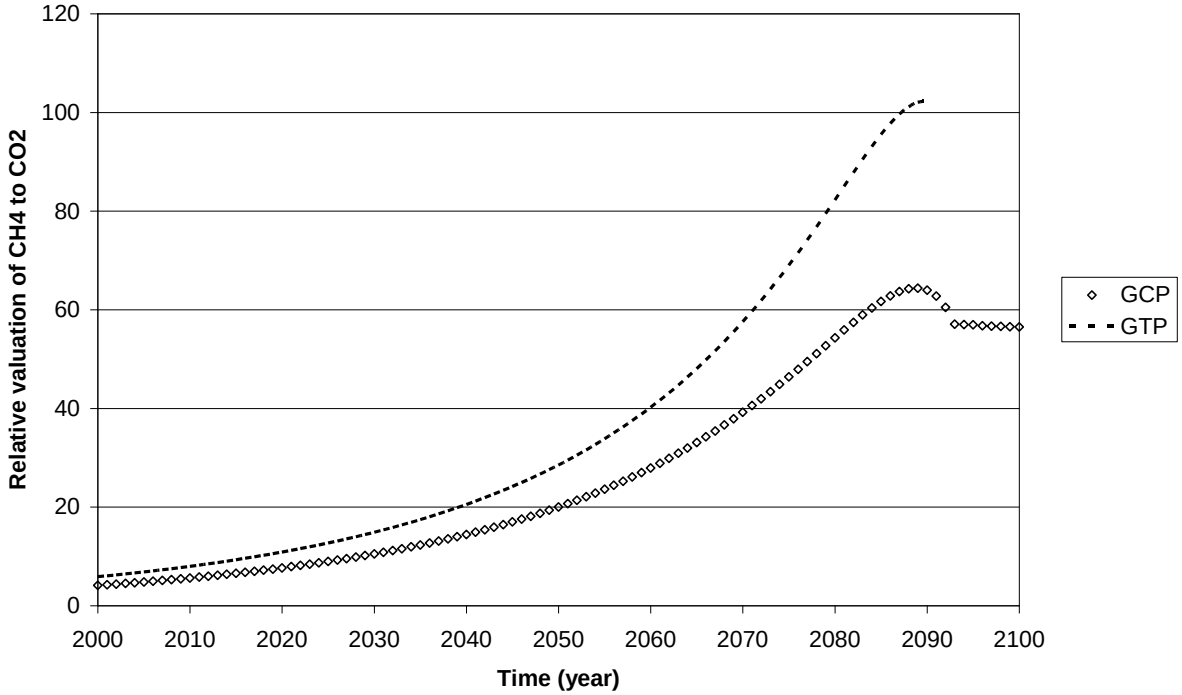
Global Cost Potential (GCP)





Manne & Richels, 2001, An alternative approach to establishing trade-offs among greenhouse gases, *Nature*

Comparison GCP and GTP for CH_4



$$GTP(t) = \frac{\Delta T_X(t)}{\Delta T_{CO_2}(t)}$$

Results from runs with the MiMiC model (Azar, Johansson & Persson)

Relationship between GTP and GCP originally formulated in : Shine K.P., Berntsen T.K., Fuglestvedt J.S., Bieltvedt Skeie R., Stuber N., 2007, Comparing the climate effect of emissions of short- and long-lived climate agents, *Philosophical Transactions of The Royal Society A*

Analytical relationship for GCP presented in Johansson D.JA. 2012, Economics- and Physical-Based Metrics for Relative Greenhouse Gas Valuations. *Climatic Change*. 110: 123-141.

Cost-Effective Temperature Potential (CETP)

An approximation of GCP.

Includes:

-physical information,

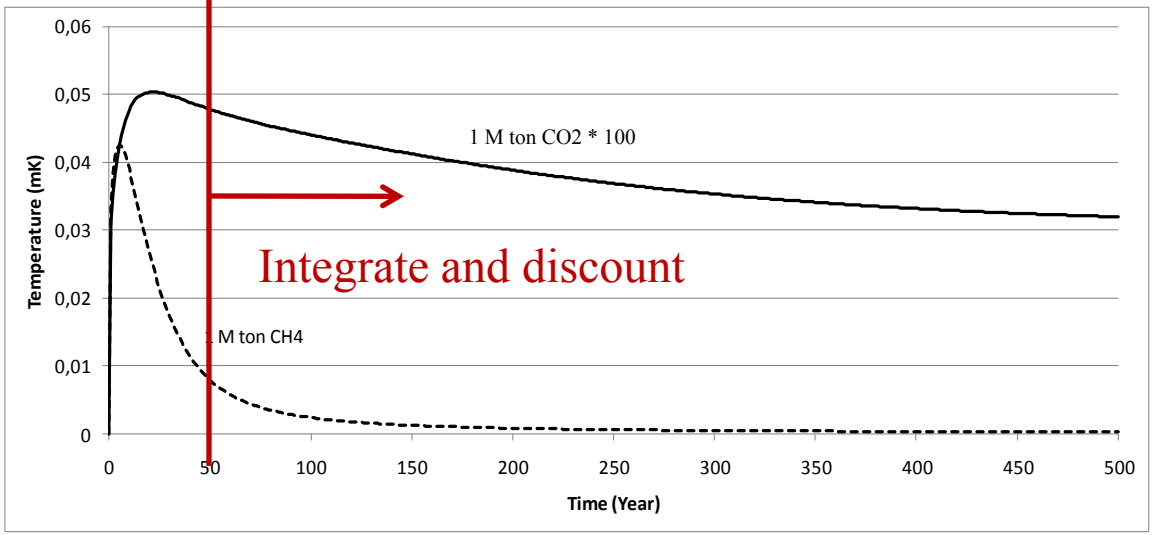
-an estimate of stabilisation year,

-discount rate.

Johansson, 2012, Economics- and physical-based metrics for comparing greenhouse gases, *Climatic Change*.

CETP

CETP for year *t*



The time integrated discounted temperature pulse beyond the year the stabilization target is met.

$$CETP(t) = \frac{\int_t^{\infty} \Delta T_X(\tau) e^{-r(\tau)} d\tau}{\int_t^{\infty} \Delta T_{CO_2}(\tau) e^{-r(\tau)} d\tau}$$

$e^{-r\tau}$=Discount factor

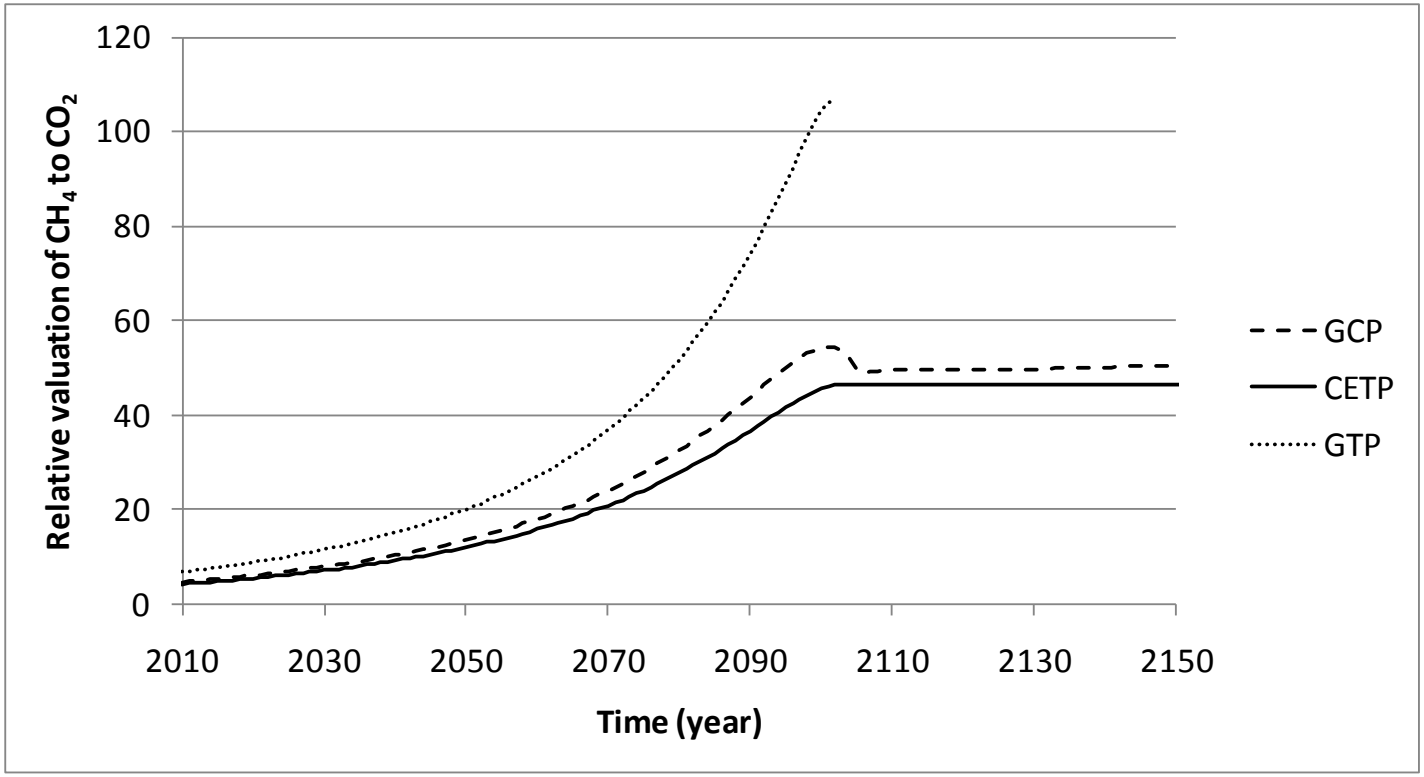
r-discount rate

τ -time

Johansson, 2012, Economics- and physical-based metrics for comparing greenhouse gases, *Climatic Change*.

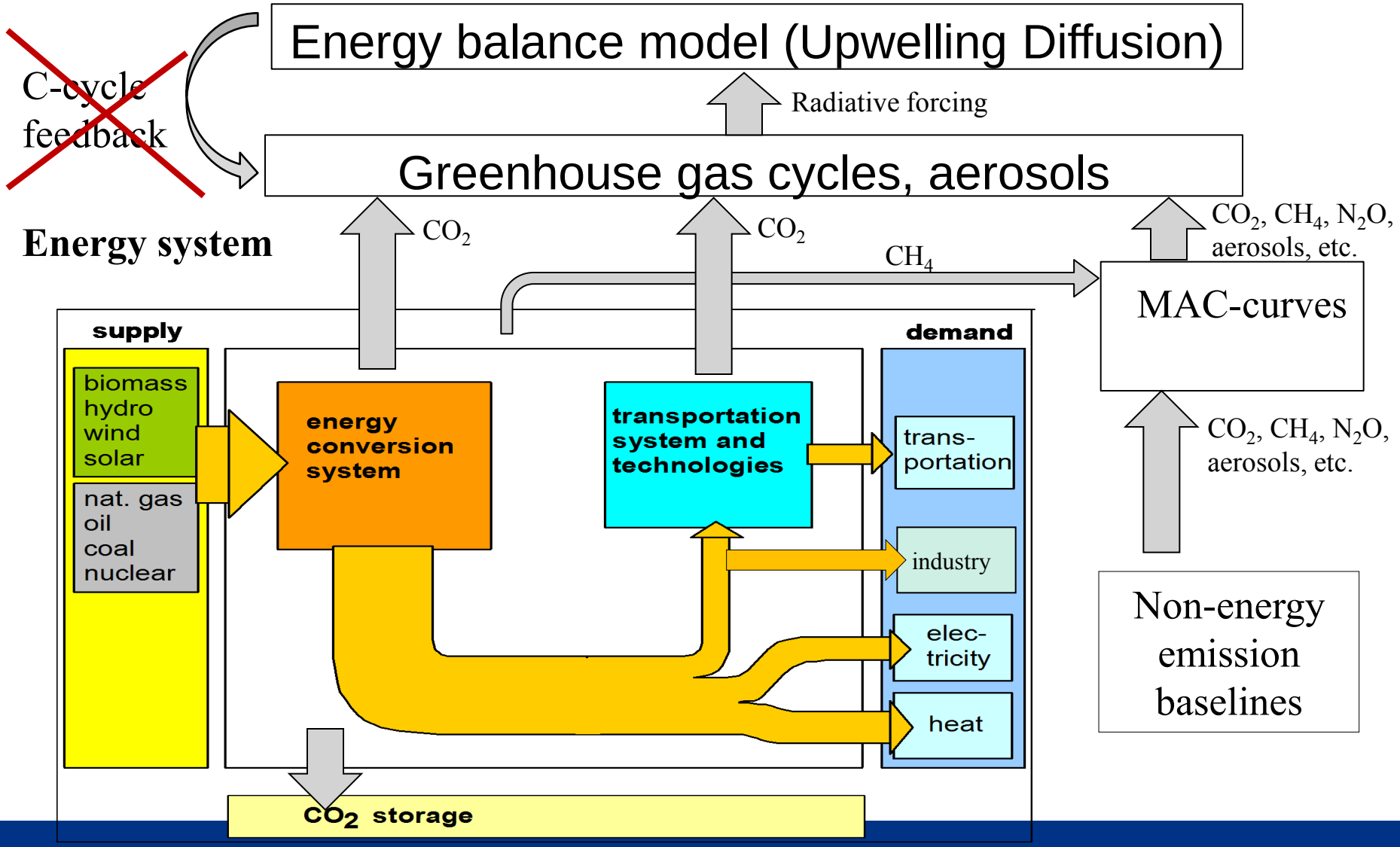
Comparison of CETP, GCP & GTP for CH_4

Discount rate 4 %, using a simple IAM



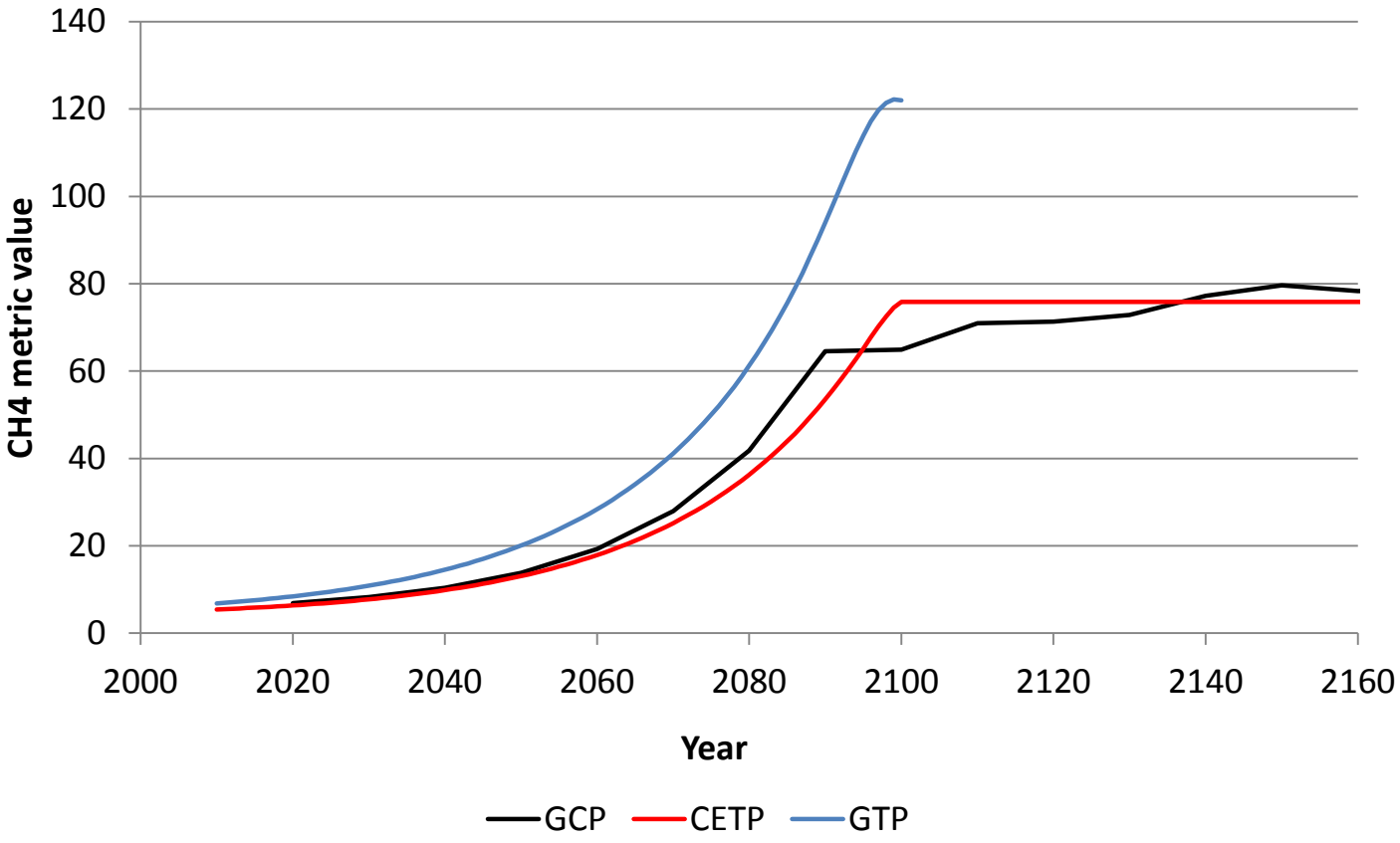
Johansson, 2012, Economics- and physical-based metrics for comparing greenhouse gases, *Climatic Change*.

Global Energy Transition (GET) model



Comparison of CETP, GCP & GTP for CH_4

Discount rate 5 %, using a complex IAM (GET) – preliminary results



Conclusion

- The GWP was not constructed to facilitate the implementation of cost-effective climate stabilization regime…
- … although it has enabled the implementation of the basket approach.
- Using cost effective trade-off ratios (Global Cost Potential - GCP) instead of the GWP could enhance the cost-effectiveness of a stabilization regime…
- … but one would then depend on complex optimizing IAMs.
- However, the CETP approximate the GCP well under a range of assumptions and models structures.

THANK YOU!

Questions, comments?