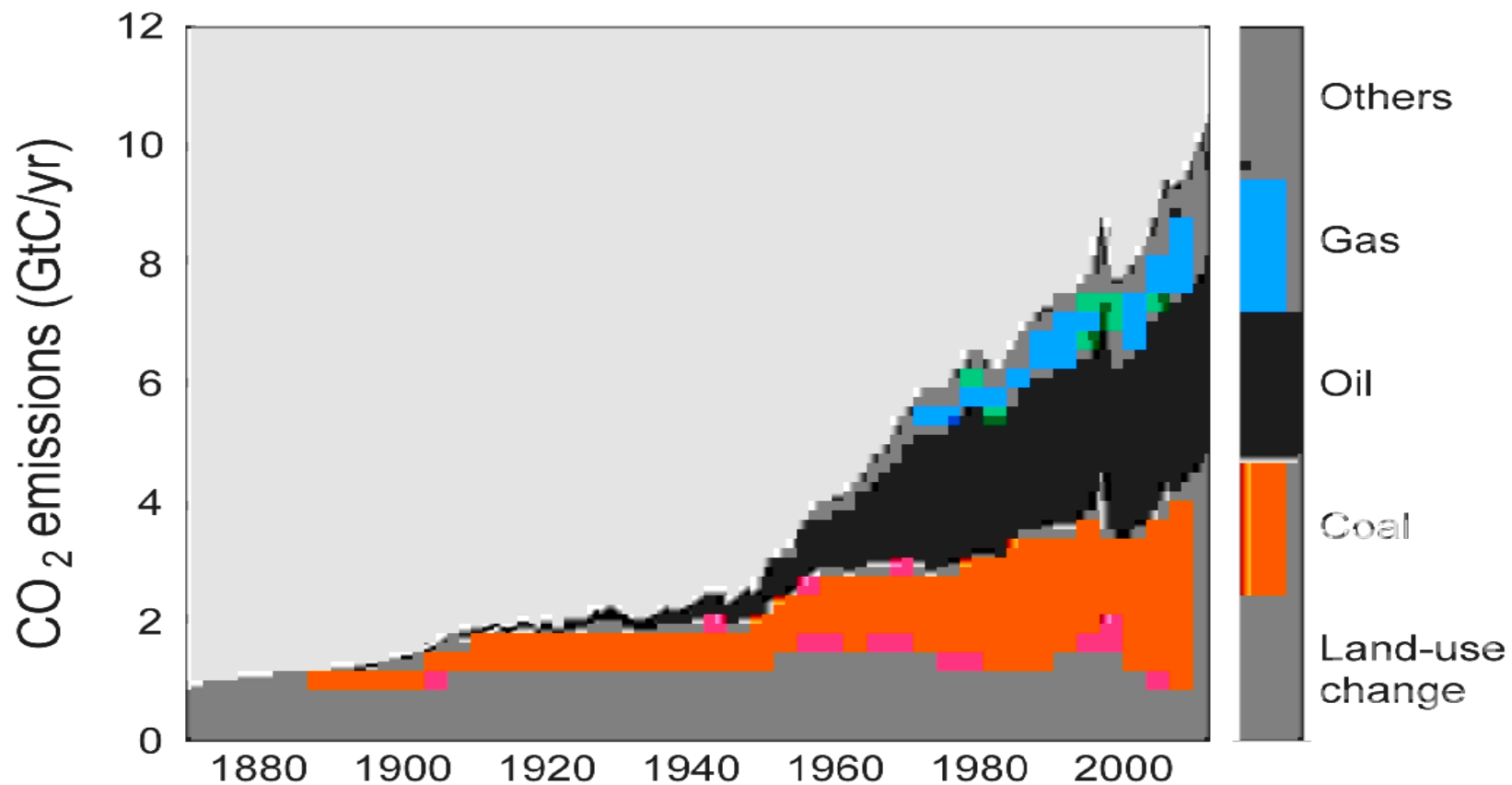


Figures de l'anhydride carbonique

Total Global Emissions of CO₂



Others: Emissions from cement production and gas flaring.

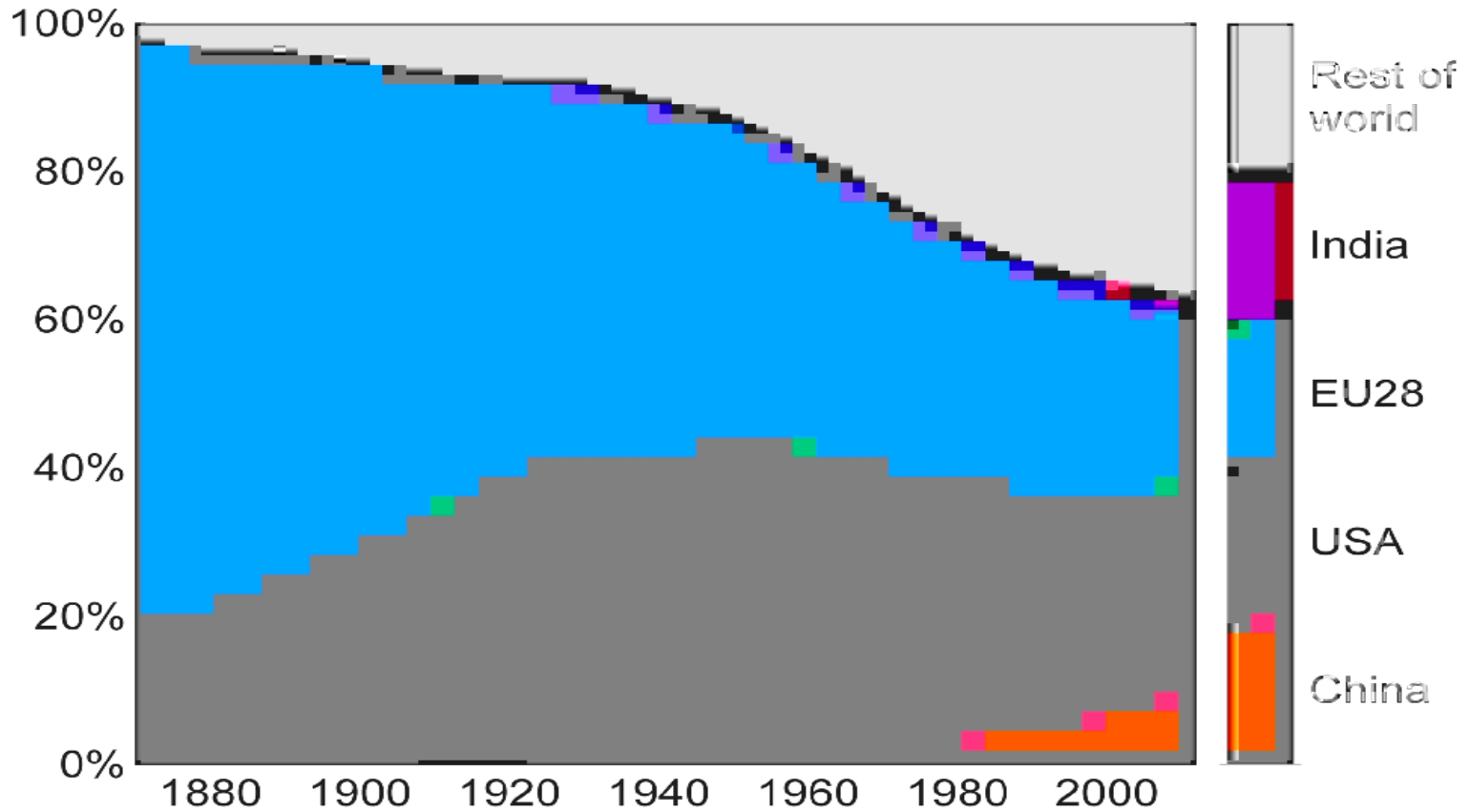
Source: [CDIAC Data](#); Houghton & Hackler (in review); [Global Carbon Project 2013](#)

Cumulative emissions from fossil-fuel and cement (1870–2012) :

USA (26%), EU28 (23%), China (11%), and India (4%) [64% of the total]

Cumulative emissions (1990–2012) :

USA (20%), EU28 (15%), China (18%), India (5%) [58% of the total]

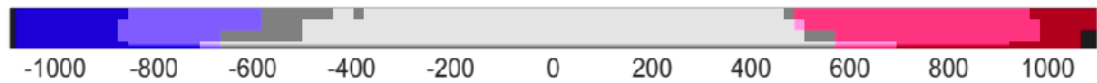
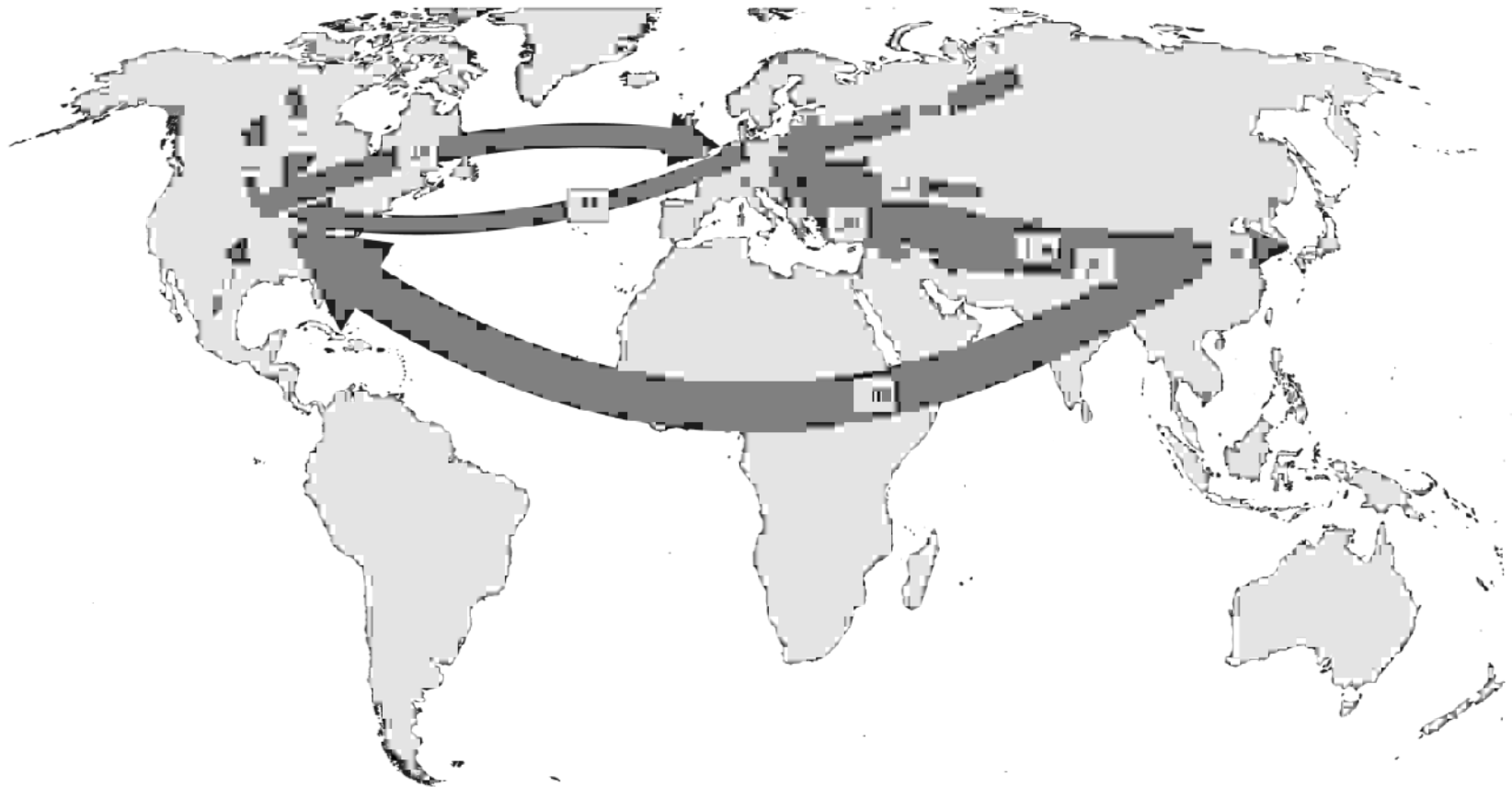


Source: [CDIAC Data](#); [Le Quéré et al 2013](#); [Global Carbon Project 2013](#)

Major Flows from Production to Consumption

Start of Arrow: fossil-fuel combustion

End of arrow: goods and services consumption



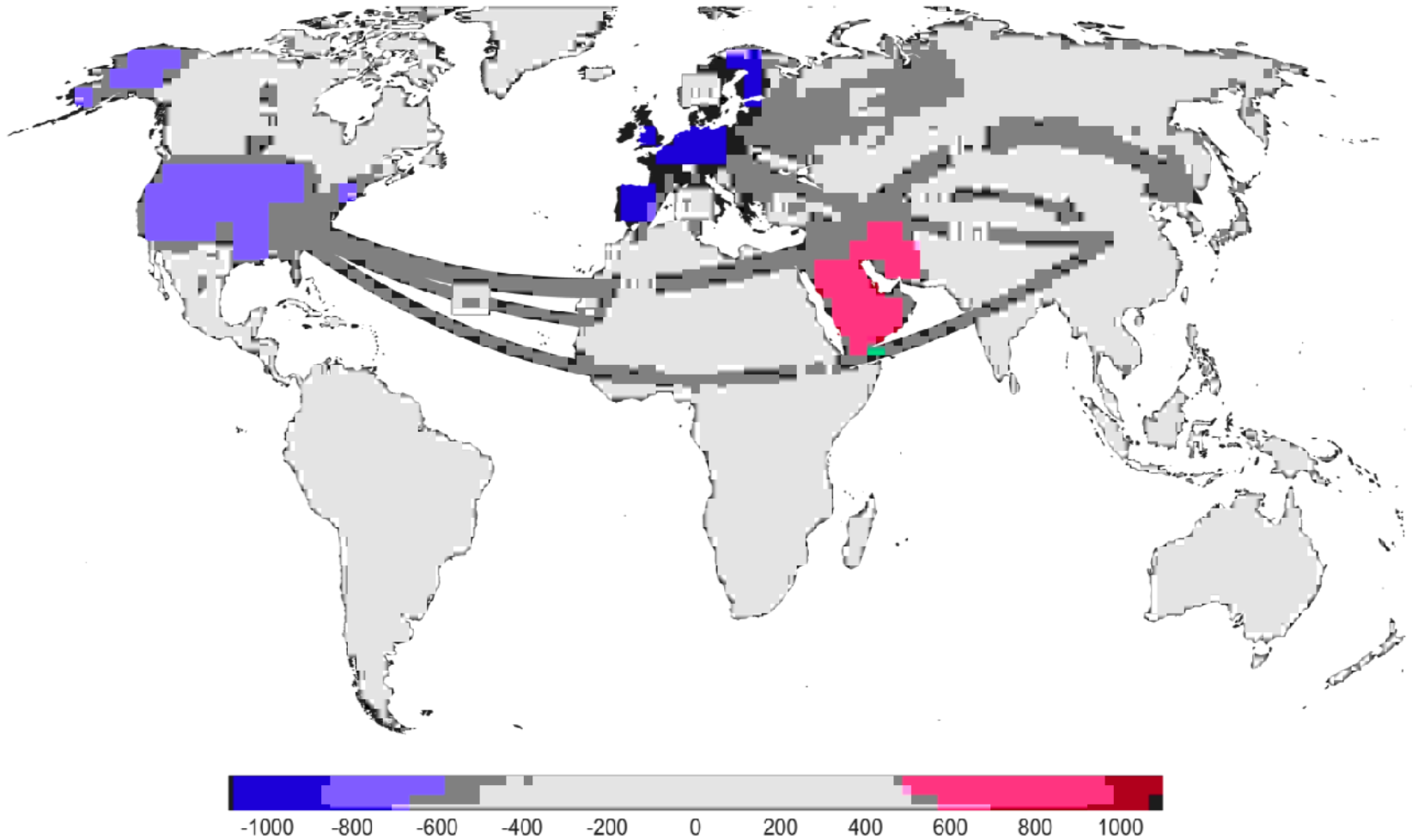
Values for 2007. EU27 is treated as one region. Units: TgC=GtC/1000

Source: [Peters et al 2012b](#)

Major Flows from Extraction to Consumption

Start of Arrow: fossil-fuel extraction

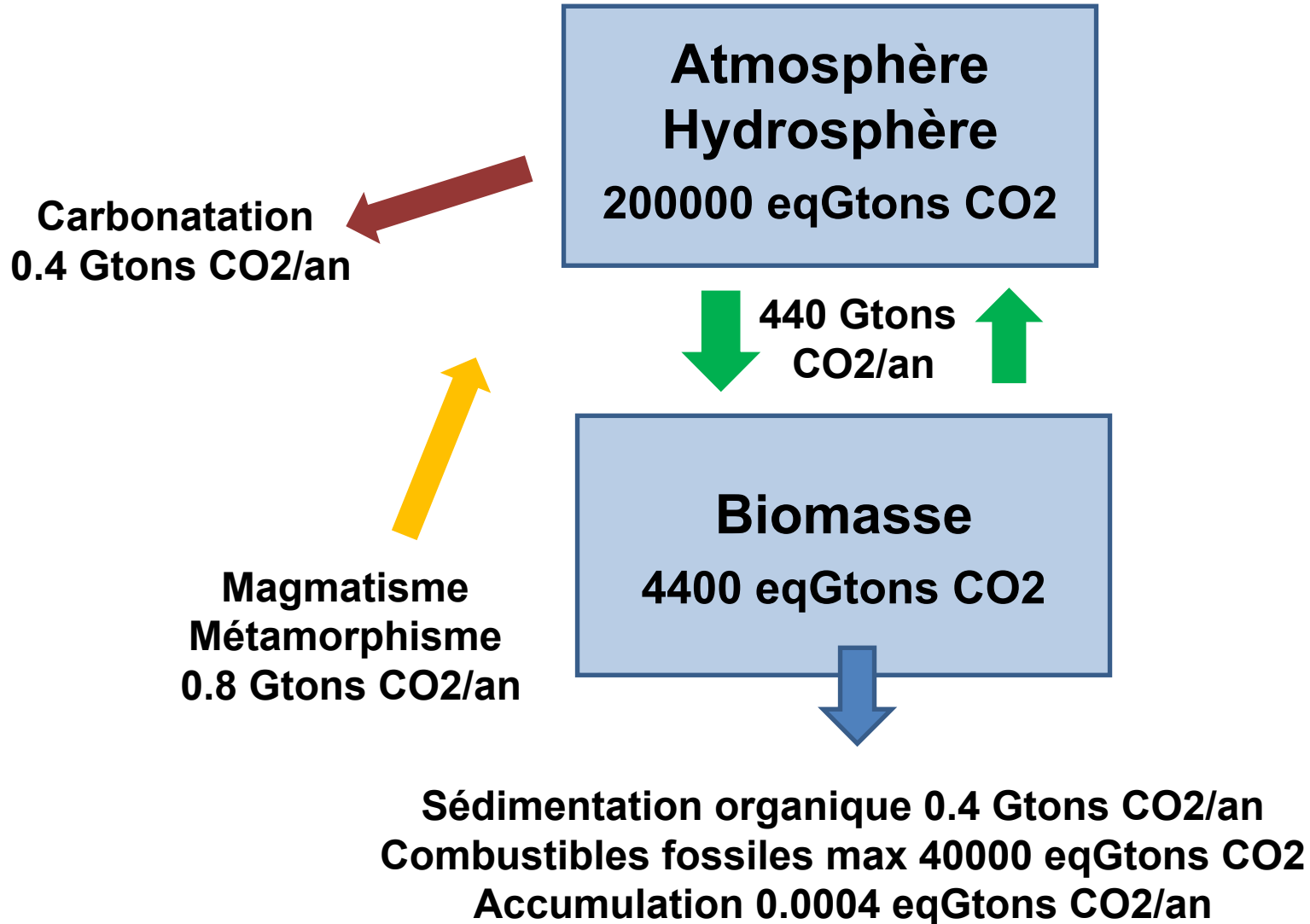
End of arrow: goods and services consumption



Values for 2007. EU27 is treated as one region. Units: TgC=GtC/1000

Source: [Peters et al 2012b](#)

Comment la nature régule-t-elle le CO₂ ?



Exemples de déstabilisations du cycle du carbone

Impacts astéroïdaux ou cométaires majeurs

Volcanisme massif

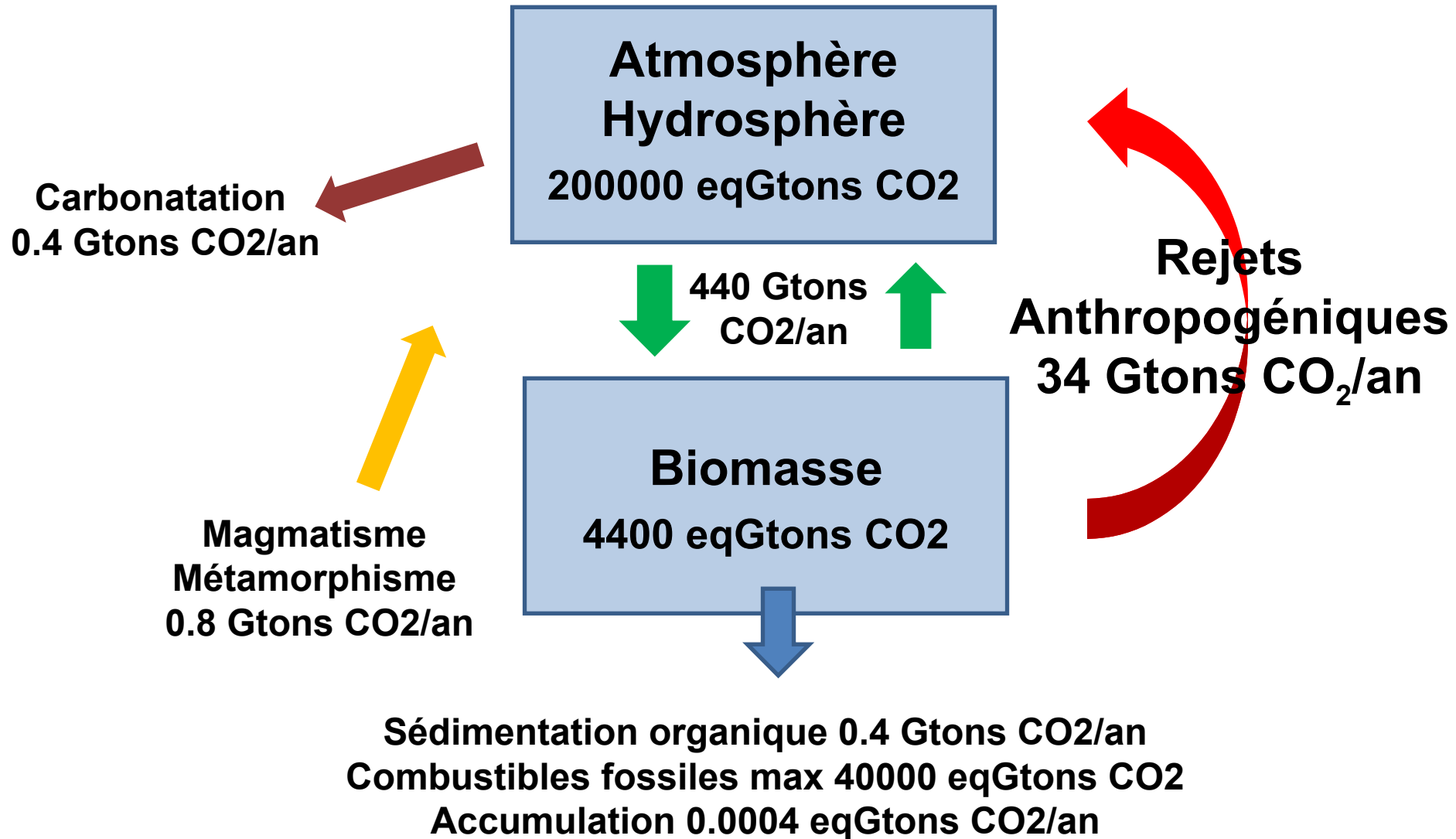
Incendies très importants de biomasse

Combustion des combustibles fossiles



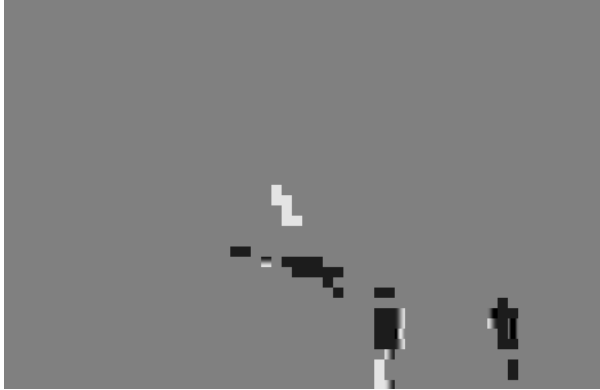
Figure 1. Comparison of mental test results between Canton and City-Country. The vertical axis represents the score on the mental test, and the horizontal axis represents the score on the mental test. The data points are connected by lines, and error bars are shown for each point. The graphs show a general upward trend in the data points.

La combustion des combustibles fossiles est une crise géologique majeure



Fate of Anthropogenic CO₂ Emissions (2003-2012 average)

8.6 ± 0.4 GtC/yr 92%



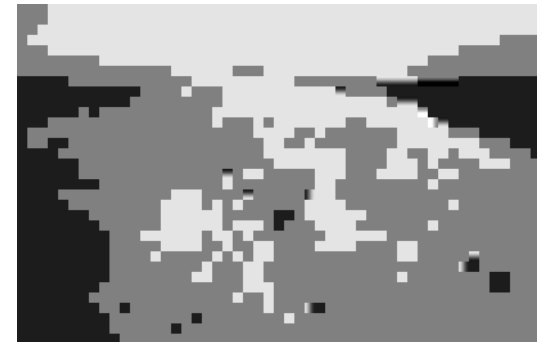
0.8 ± 0.5 GtC/yr 8%



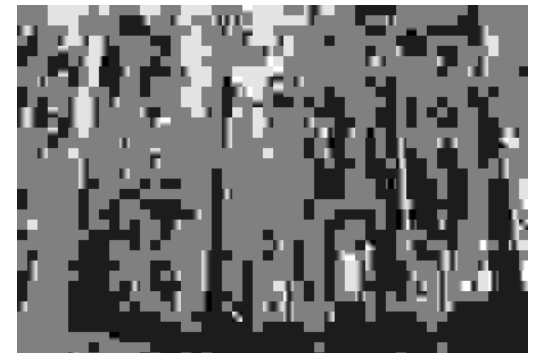
4.3 ± 0.1 GtC/yr
45%



2.6 ± 0.5 GtC/yr
27%



2.6 ± 0.8 GtC/yr
27%



Calculated as the residual
of all other flux components

Fate of Anthropogenic CO₂ Emissions (2003-2012 average)

8.6 ± 0.4 GtC/yr 92%



4.3 ± 0.1 GtC/yr
45%



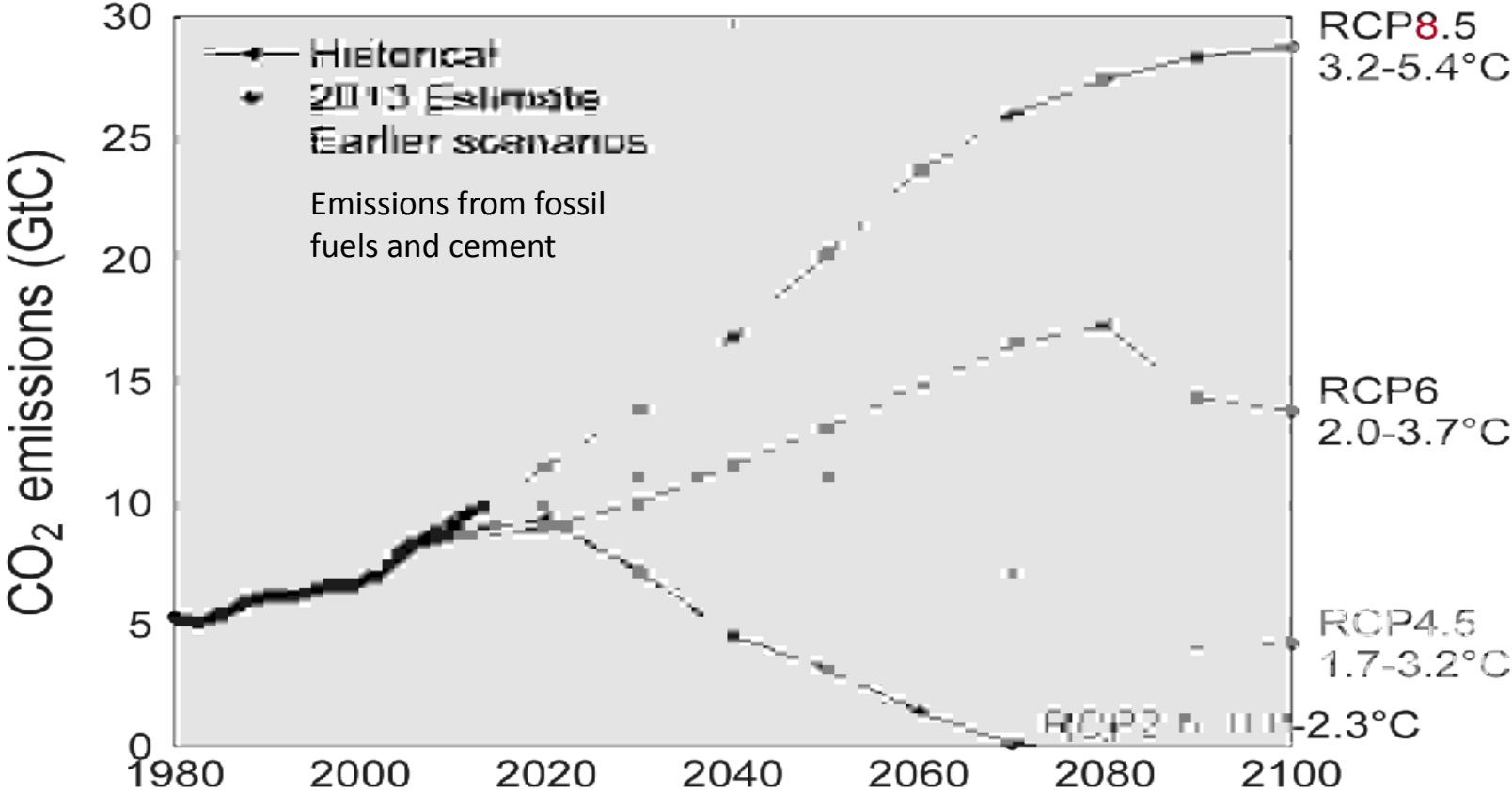
**Accumulation in the atmosphere
15 Gt CO₂/yr (eq. 4.3 Gt C/yr)**

0.8 ± 0.5 GtC/yr 8%



Observed Emissions and Emissions Scenarios

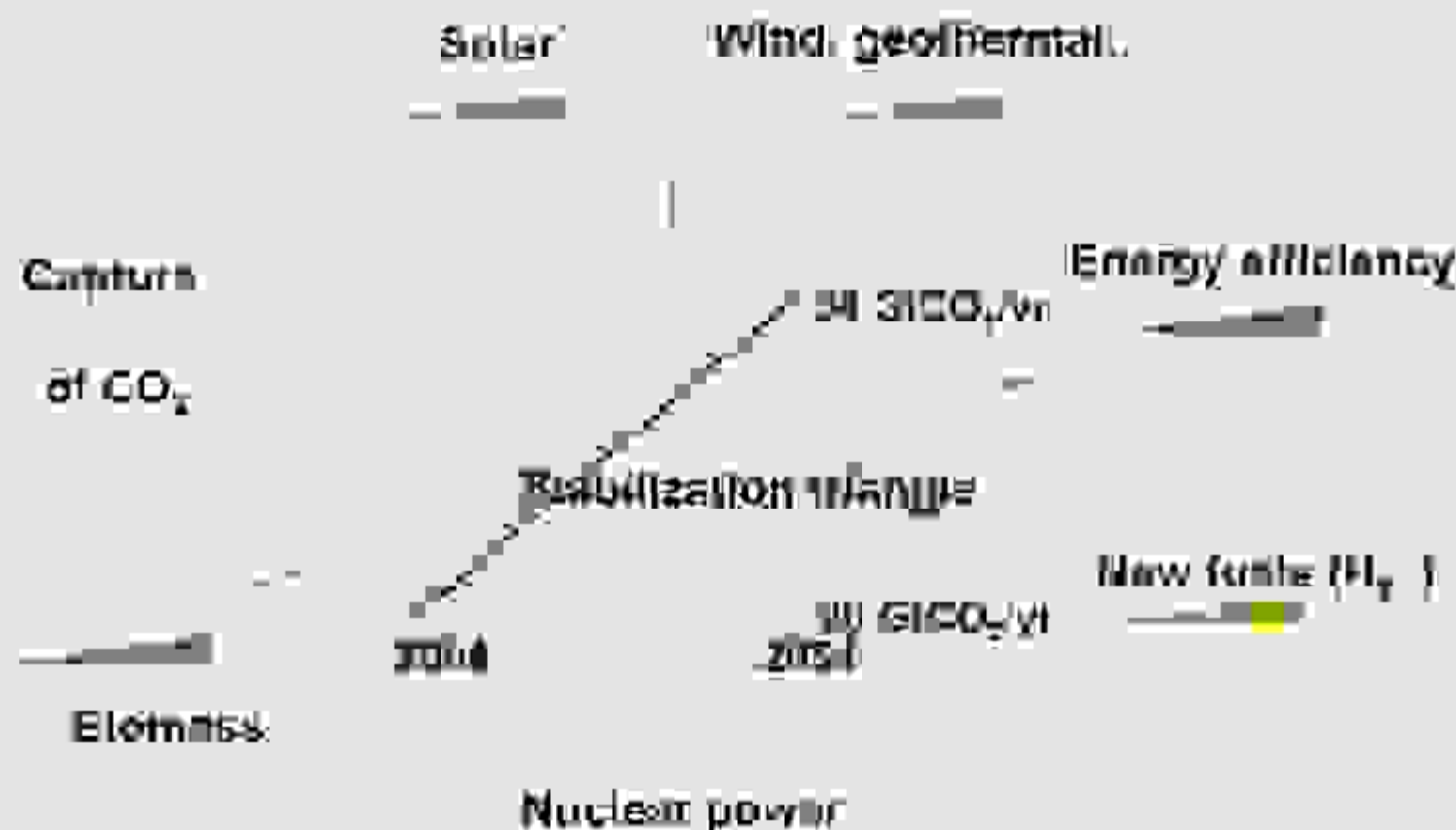
Emissions are on track for 3.2–5.4°C “likely” increase in temperature above pre-industrial
Large and sustained mitigation is required to keep below 2°C



Linear interpolation is used between individual data points

Source: [Peters et al. 2012a](#); [CDIAC Data](#); [Global Carbon Project 2013](#)

Stabilisation du CO₂ dans un monde en développement en attendant les renouvelables



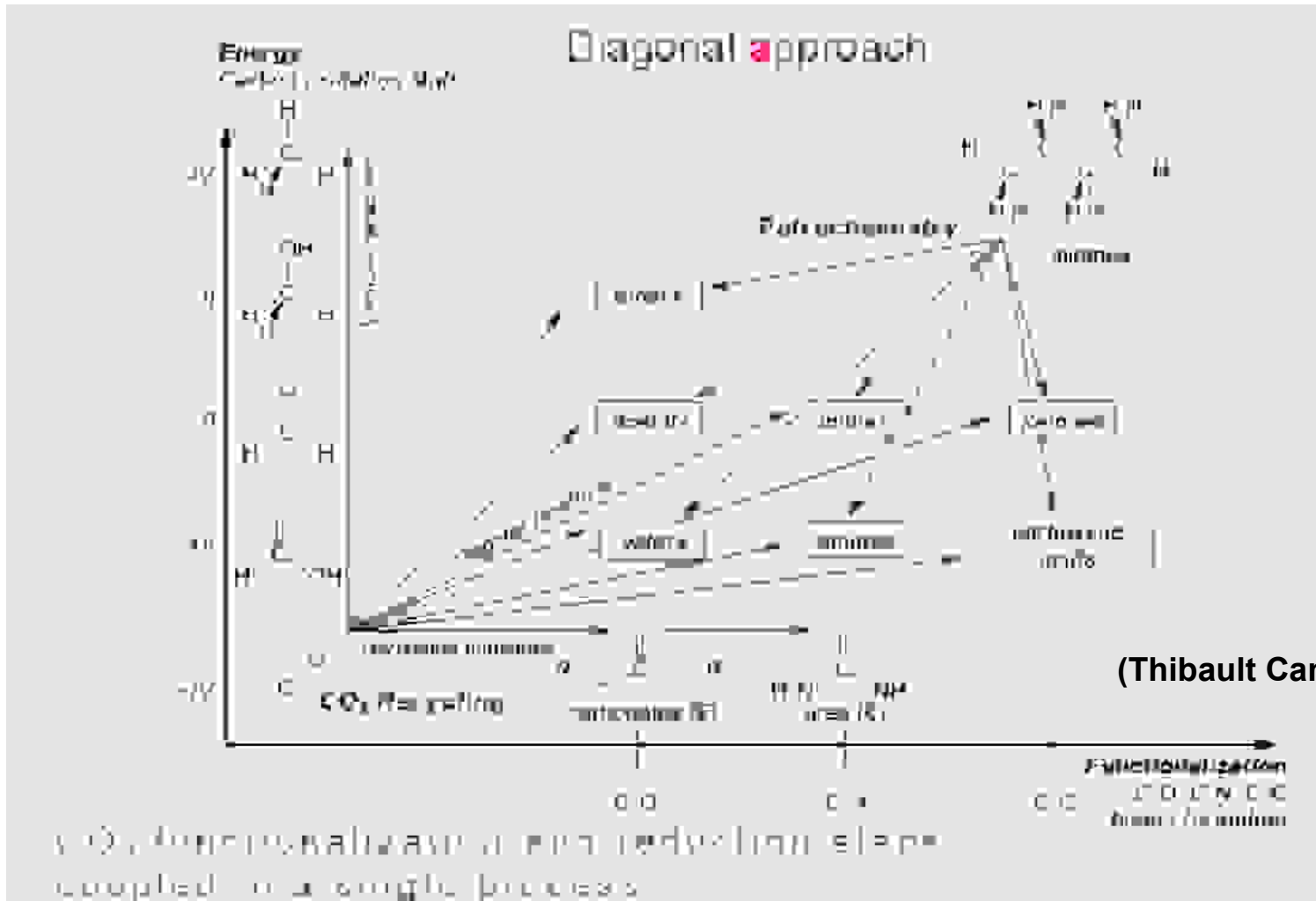
CO₂ capture and storage component costs
 1 tCO₂ emitted = 3.15 barrels of crude oil = 300 US\$

CCS component	Cost
Capture from a power plant	15 - 75 US\$/tCO ₂ net captured
Capture from gas processing or ammonia production	5 - 55 US\$/tCO ₂ net captured
Capture from other industrial sources	25 - 115 US\$/tCO ₂ net captured
Transportation	1 - 8 US\$/tCO ₂ transported per 200km
Geological storage	0.5 - 8 US\$/tCO ₂ injected
Ocean storage	5 - 10 US\$/tCO ₂ injected
Mineral carbonation	50 - 100 US\$/tCO ₂ not mineralized

Case	Case Description	Case Type	Case Status	Case Date	Case Time	Case Location
1	Case 1 Description	Case 1 Type	Case 1 Status	Case 1 Date	Case 1 Time	Case 1 Location
2	Case 2 Description	Case 2 Type	Case 2 Status	Case 2 Date	Case 2 Time	Case 2 Location
3	Case 3 Description	Case 3 Type	Case 3 Status	Case 3 Date	Case 3 Time	Case 3 Location
4	Case 4 Description	Case 4 Type	Case 4 Status	Case 4 Date	Case 4 Time	Case 4 Location
5	Case 5 Description	Case 5 Type	Case 5 Status	Case 5 Date	Case 5 Time	Case 5 Location
6	Case 6 Description	Case 6 Type	Case 6 Status	Case 6 Date	Case 6 Time	Case 6 Location
7	Case 7 Description	Case 7 Type	Case 7 Status	Case 7 Date	Case 7 Time	Case 7 Location
8	Case 8 Description	Case 8 Type	Case 8 Status	Case 8 Date	Case 8 Time	Case 8 Location
9	Case 9 Description	Case 9 Type	Case 9 Status	Case 9 Date	Case 9 Time	Case 9 Location
10	Case 10 Description	Case 10 Type	Case 10 Status	Case 10 Date	Case 10 Time	Case 10 Location
11	Case 11 Description	Case 11 Type	Case 11 Status	Case 11 Date	Case 11 Time	Case 11 Location
12	Case 12 Description	Case 12 Type	Case 12 Status	Case 12 Date	Case 12 Time	Case 12 Location
13	Case 13 Description	Case 13 Type	Case 13 Status	Case 13 Date	Case 13 Time	Case 13 Location
14	Case 14 Description	Case 14 Type	Case 14 Status	Case 14 Date	Case 14 Time	Case 14 Location
15	Case 15 Description	Case 15 Type	Case 15 Status	Case 15 Date	Case 15 Time	Case 15 Location
16	Case 16 Description	Case 16 Type	Case 16 Status	Case 16 Date	Case 16 Time	Case 16 Location
17	Case 17 Description	Case 17 Type	Case 17 Status	Case 17 Date	Case 17 Time	Case 17 Location
18	Case 18 Description	Case 18 Type	Case 18 Status	Case 18 Date	Case 18 Time	Case 18 Location
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20	Case 20 Description	Case 20 Type	Case 20 Status	Case 20 Date	Case 20 Time	Case 20 Location

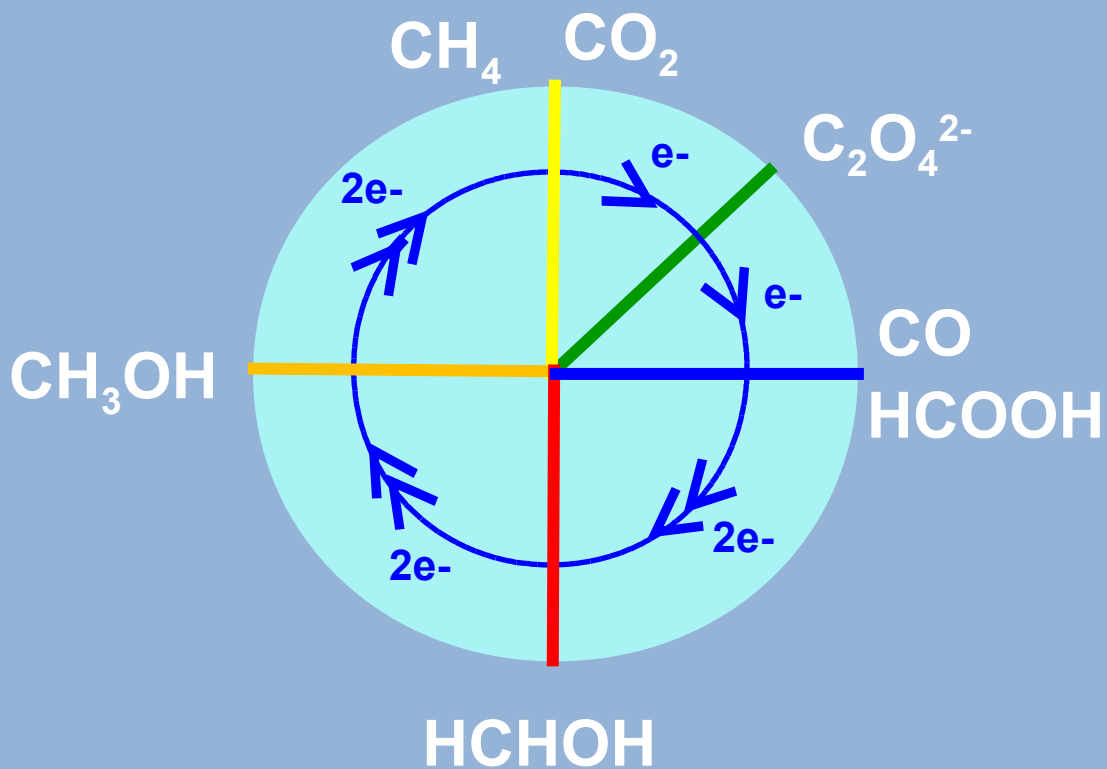
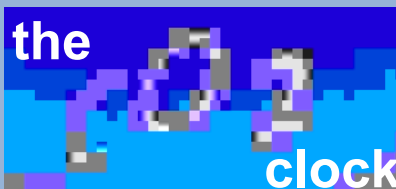
Case 1: Case 1 Description

EOR = Enhanced Oil Recovery = In-situ formation resistance hydrolysis



Le CO₂ comme matière première : 160 Mt/an aujourd'hui, 3Gt dans 40 ans ?

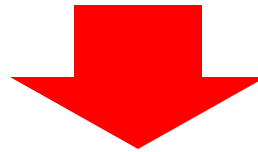
Making fuels and storing intermittent energy from CO₂



Et le ' CO_2 – made in – France' ?

2014 400 ppm CO_2 dans l'atmosphère

2050 500 ppm CO_2 dans l'atmosphère



**Arrêt complet des activités
économiques et humaines
sur le sol français**

499 ppm CO_2

All the data is shown in GtC

1 Gigatonne (Gt) = 1 billion tonnes = 1×10^{15} g = 1 Petagram (Pg)

1 kg carbon (C) = 3.664 kg carbon dioxide (CO₂)

1 GtC = 3.664 billion tonnes CO₂ = 3.664 GtCO₂

La MAC Curve de McKinsey comme exemple de représentation controversée des enjeux

