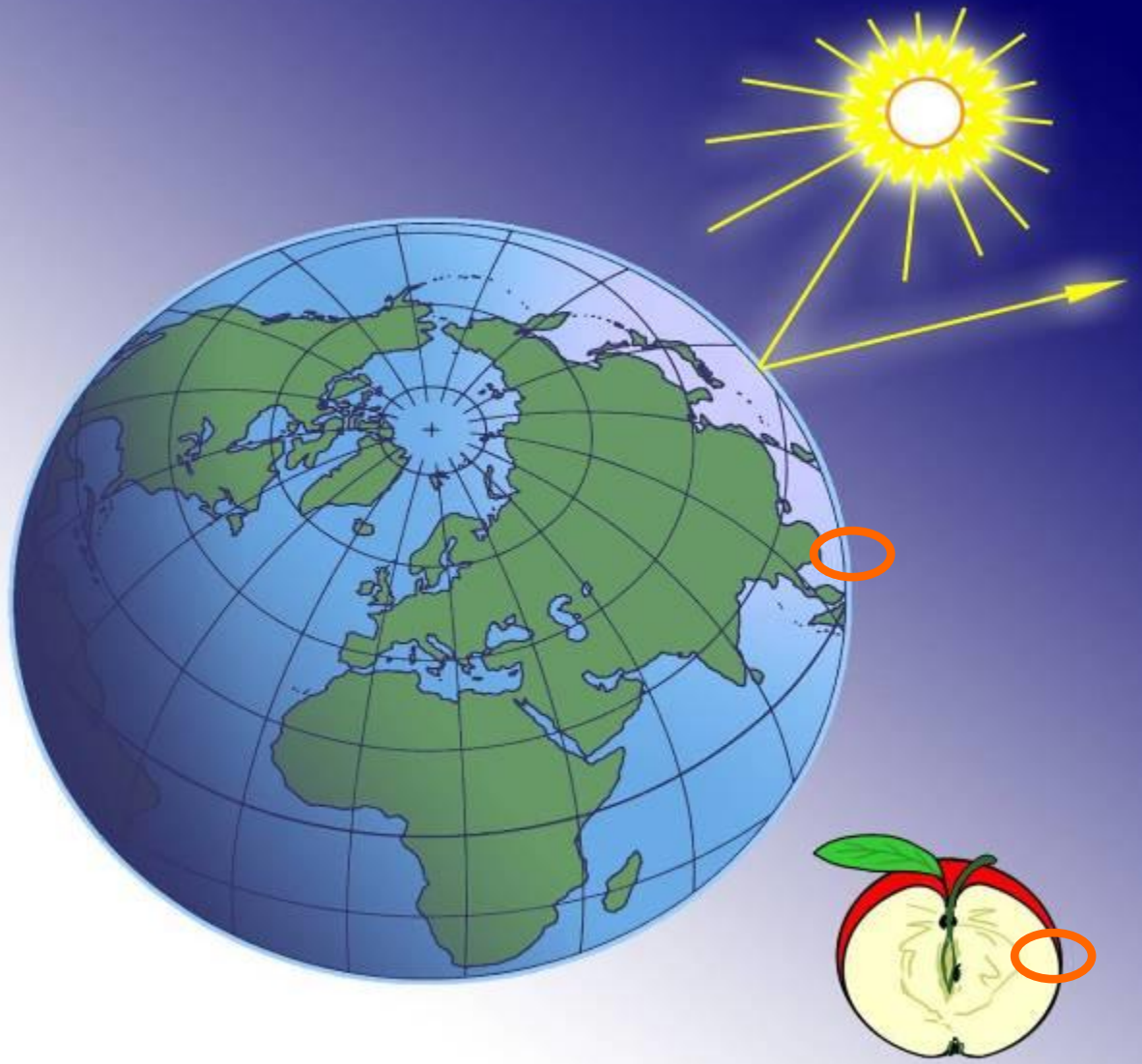
CLIMATE CHANGE IMPORTANCE OF PROCESSING CMM

BRIEF OVERVIEW OF:

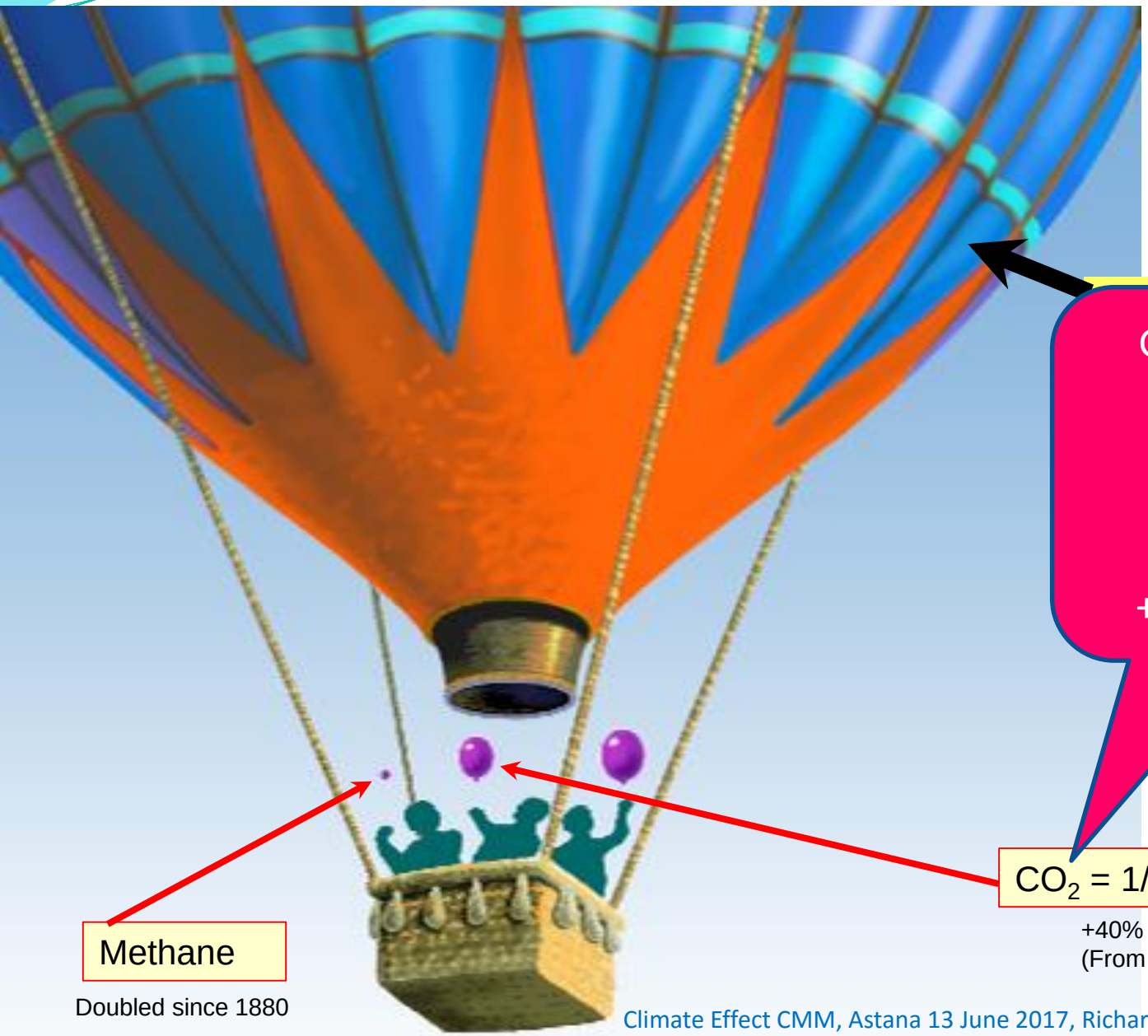
- Why is REDUCING METHANE emissions REALLY IMPORTANT?

- How can reducing CMM emissions be a “QUICK FIX” opportunity to help changing the trend of global warming?

One thin bubble of atmosphere



One thin bubble of atmosphere - composition



GreenHouseGas effect:

Average global temperature +15°C, not -15°C

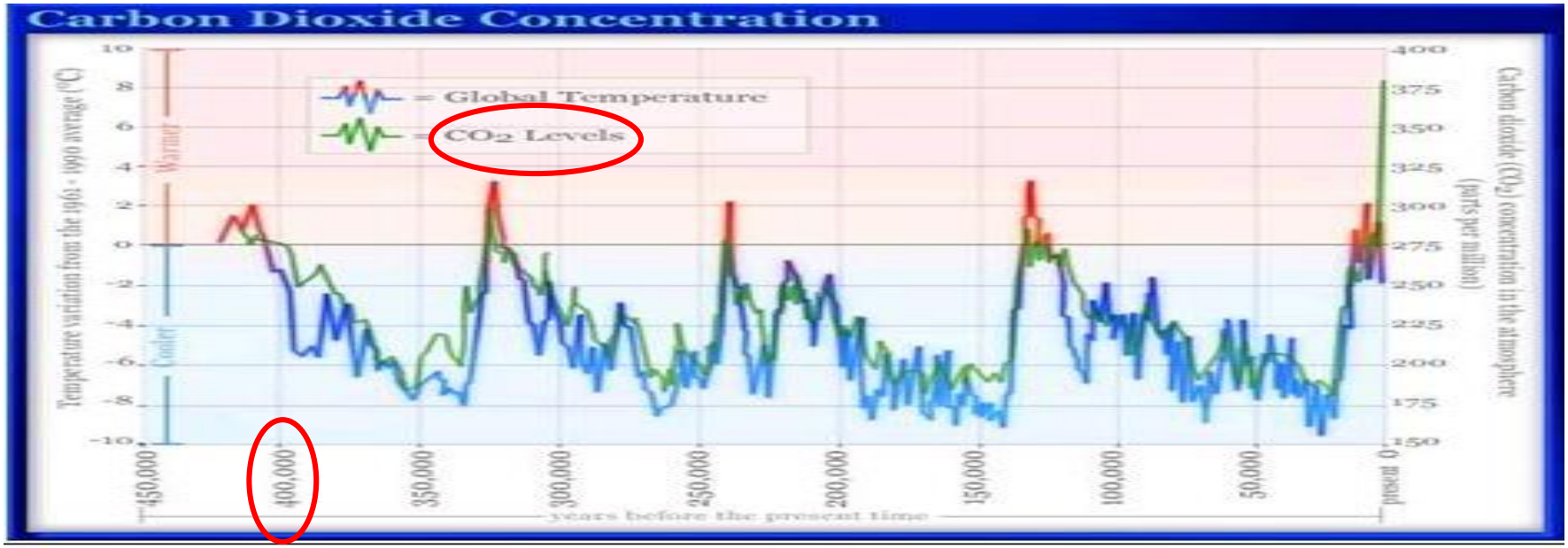
CO_2 = 1/3 of 0.1%

+40% since 1880
(From 280 to over 400 ppm)

Methane

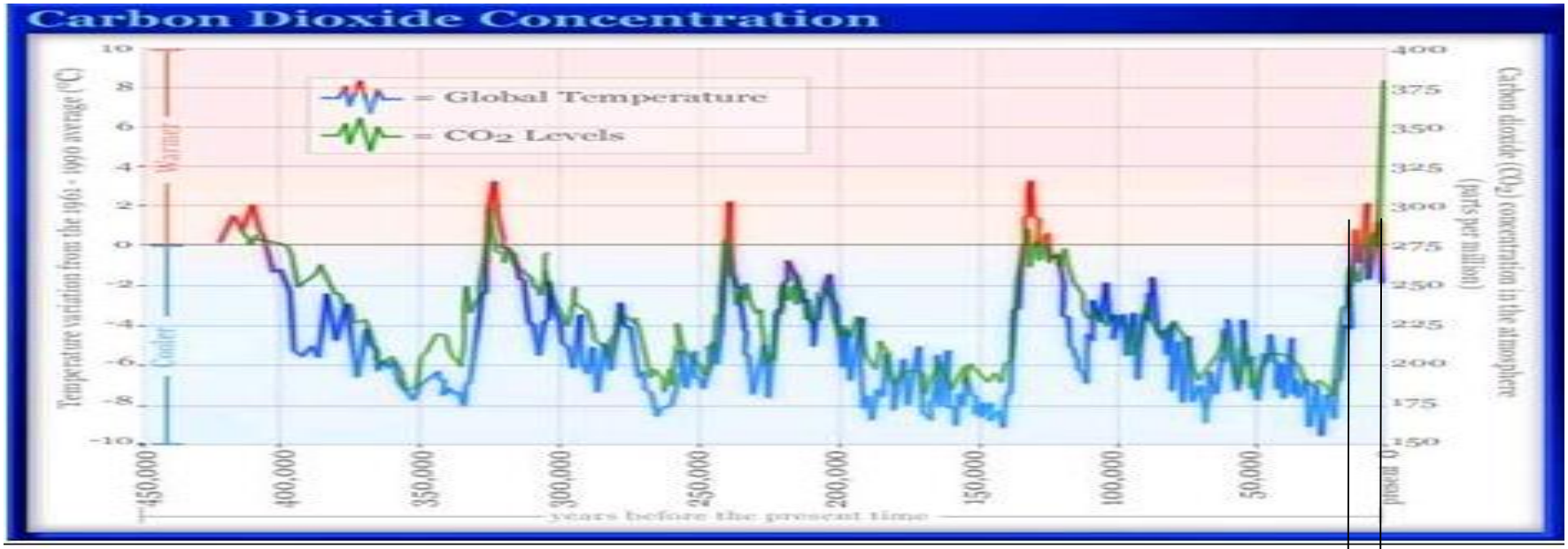
Doubled since 1880

CO_2 content in atmosphere



Source: Data adopted from National Oceanic & Atmospheric Administration <http://www.noaa.gov/> Accessed at: <http://www.seed.slb.com/en/scictr/watch/climate_change/causes_co2.htm>

CO_2 content in atmosphere



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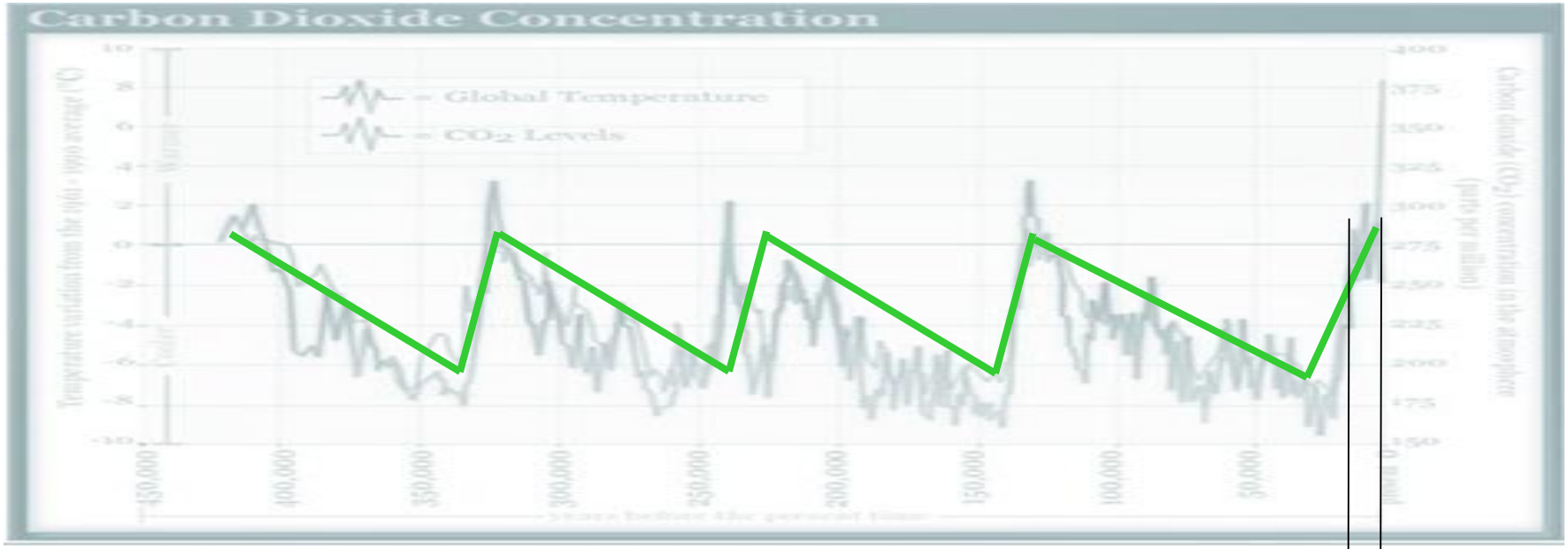
FOR REFERENCE:
History of mankind.
Start of agriculture
10,000 yrs ago

CO_2 content in atmosphere



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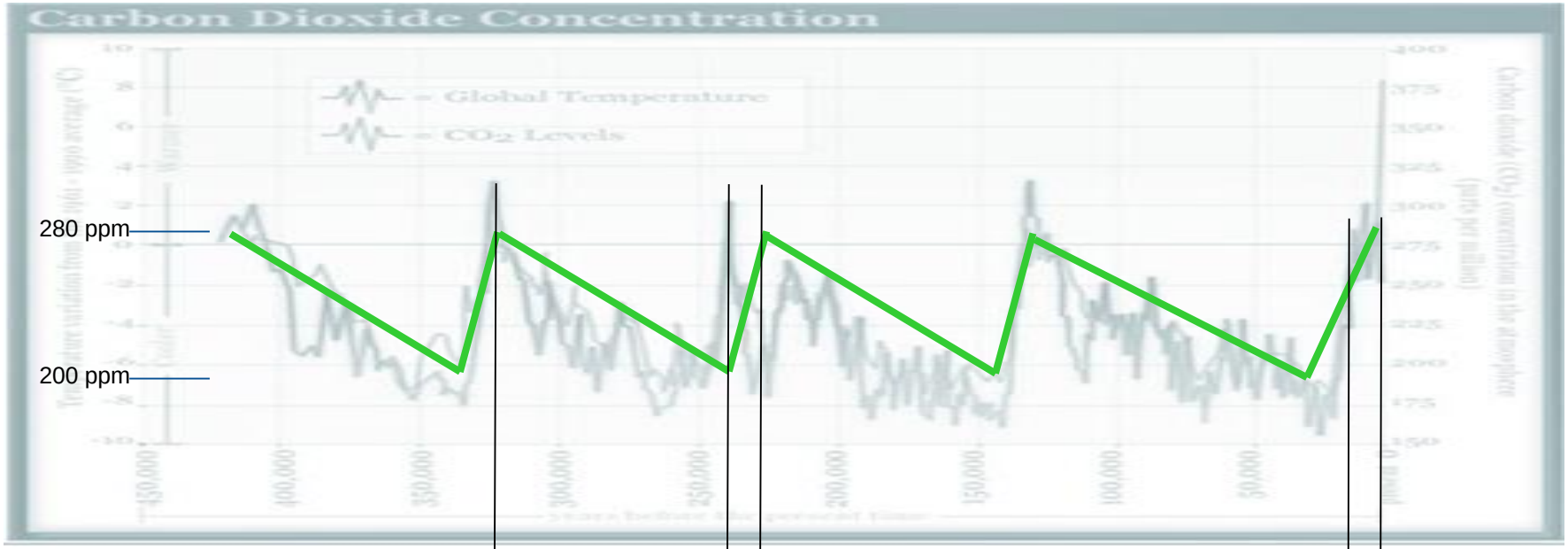

Source: Data adopted from National Oceanic & Atmospheric Administration <http://www.noaa.gov/> Accessed at: <http://www.seed.slb.com/en/scictr/watch/climate_change/causes_co2.htm>

90,000 yrs

10,000 yrs

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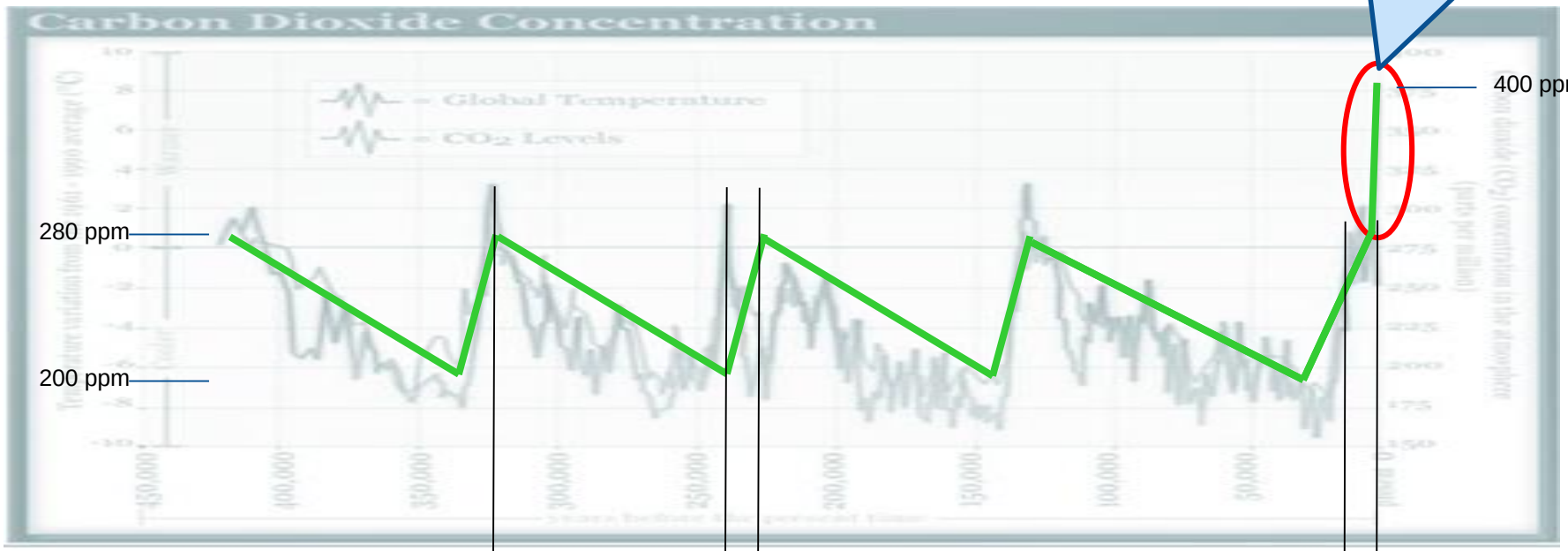
CO_2 content in atmosphere



Latest 150 yrs.
Clear link to industrialization.

Source: Data adopted from National Oceanic & Atmospheric Administration <http://www.noaa.gov/> Accessed at: <http://www.seed.slb.com/en/scictr/watch/climate_change/causes_co2.htm>

90,000 yrs

10,000 yrs

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10,000 yrs ago

CO_2 content in atmosphere

Expected next 50 yrs.

Source: Data adopted from National Oceanic & Atmospheric Administration <http://www.noaa.gov/> Accessed at: <http://www.seed.slb.com/en/scictr/watch/climate_change/causes_co2.htm>

90,000 yrs

10,000 yrs

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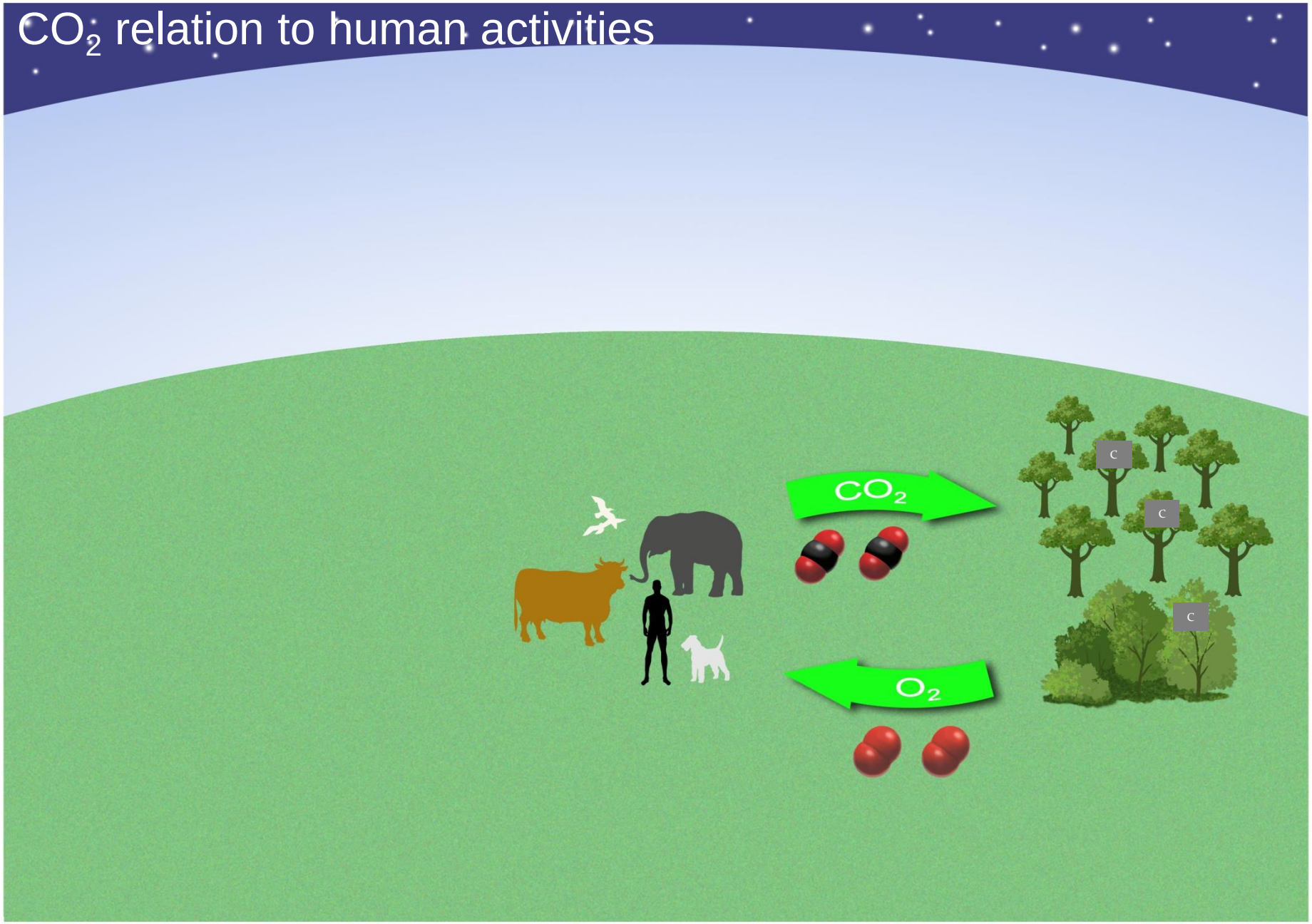
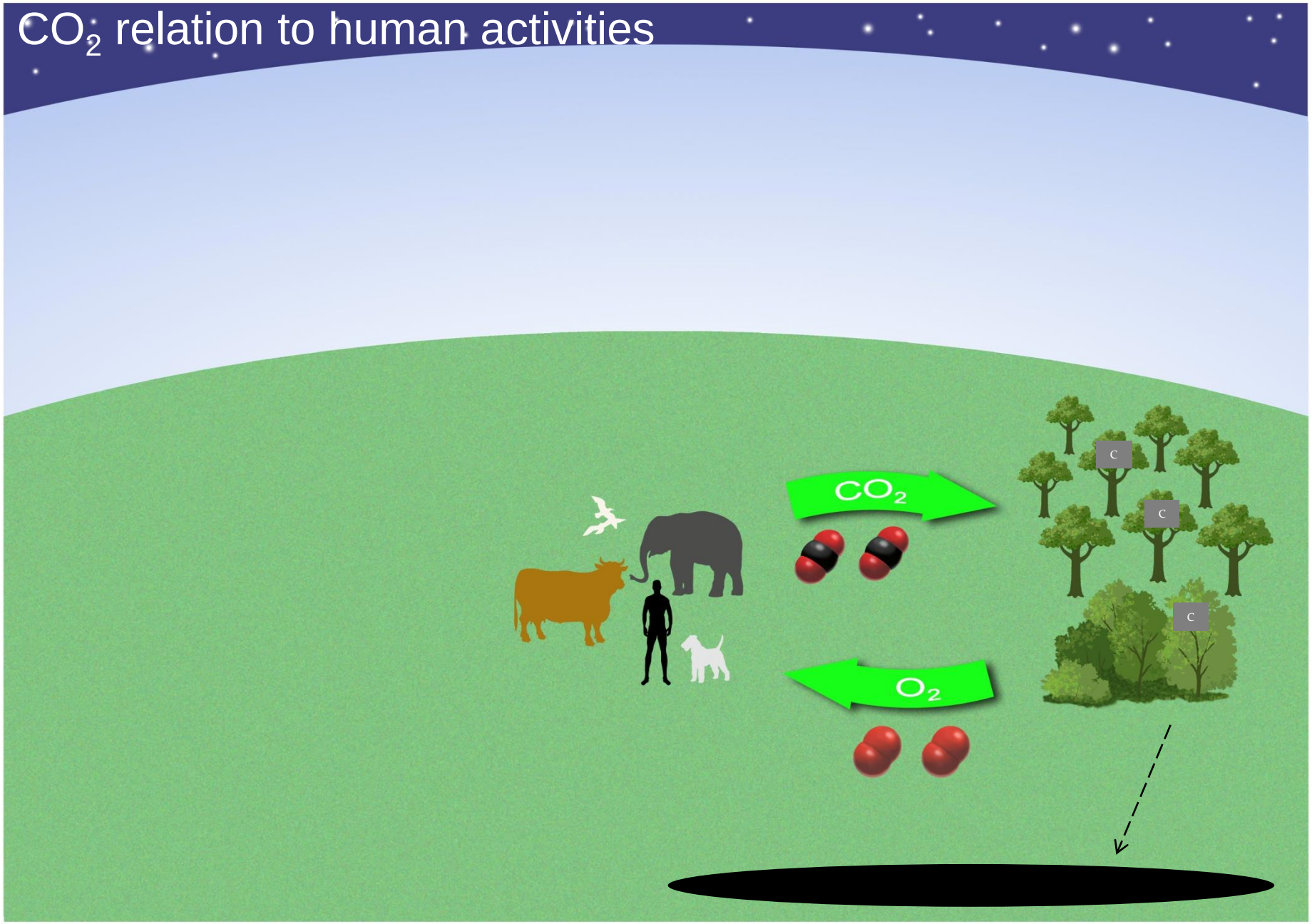
CO_2 relation to human activities



CO_2 relation to human activities



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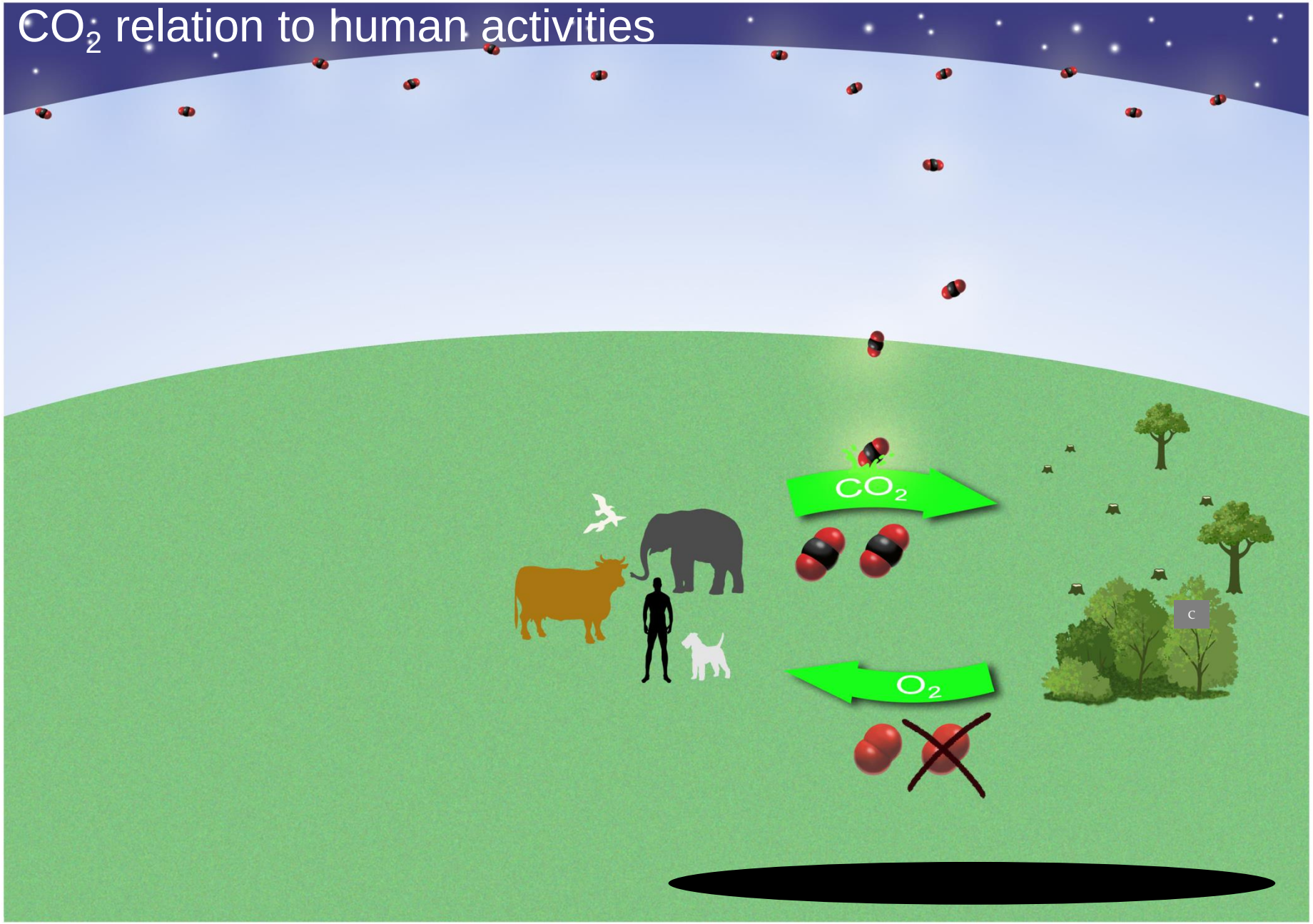

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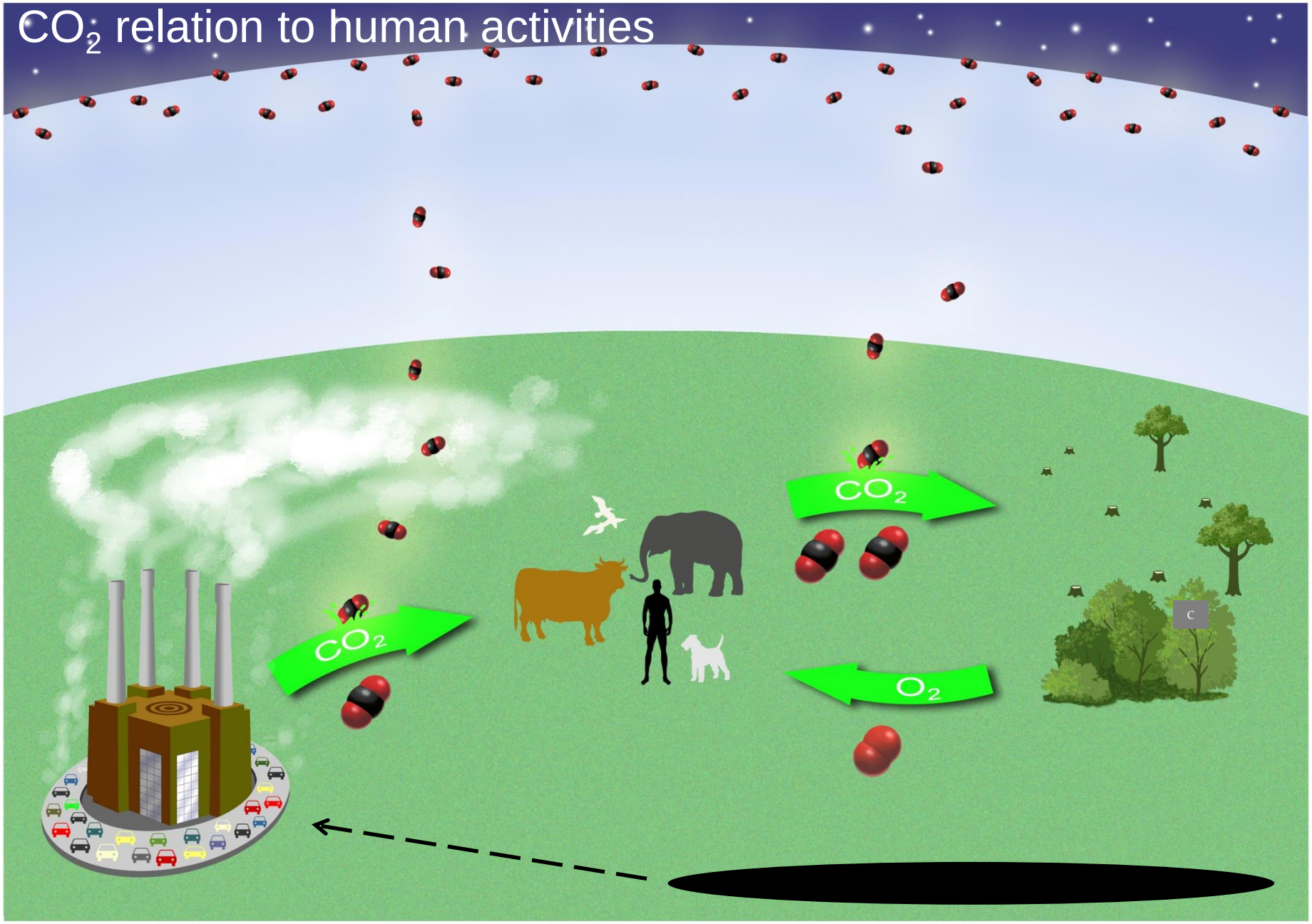
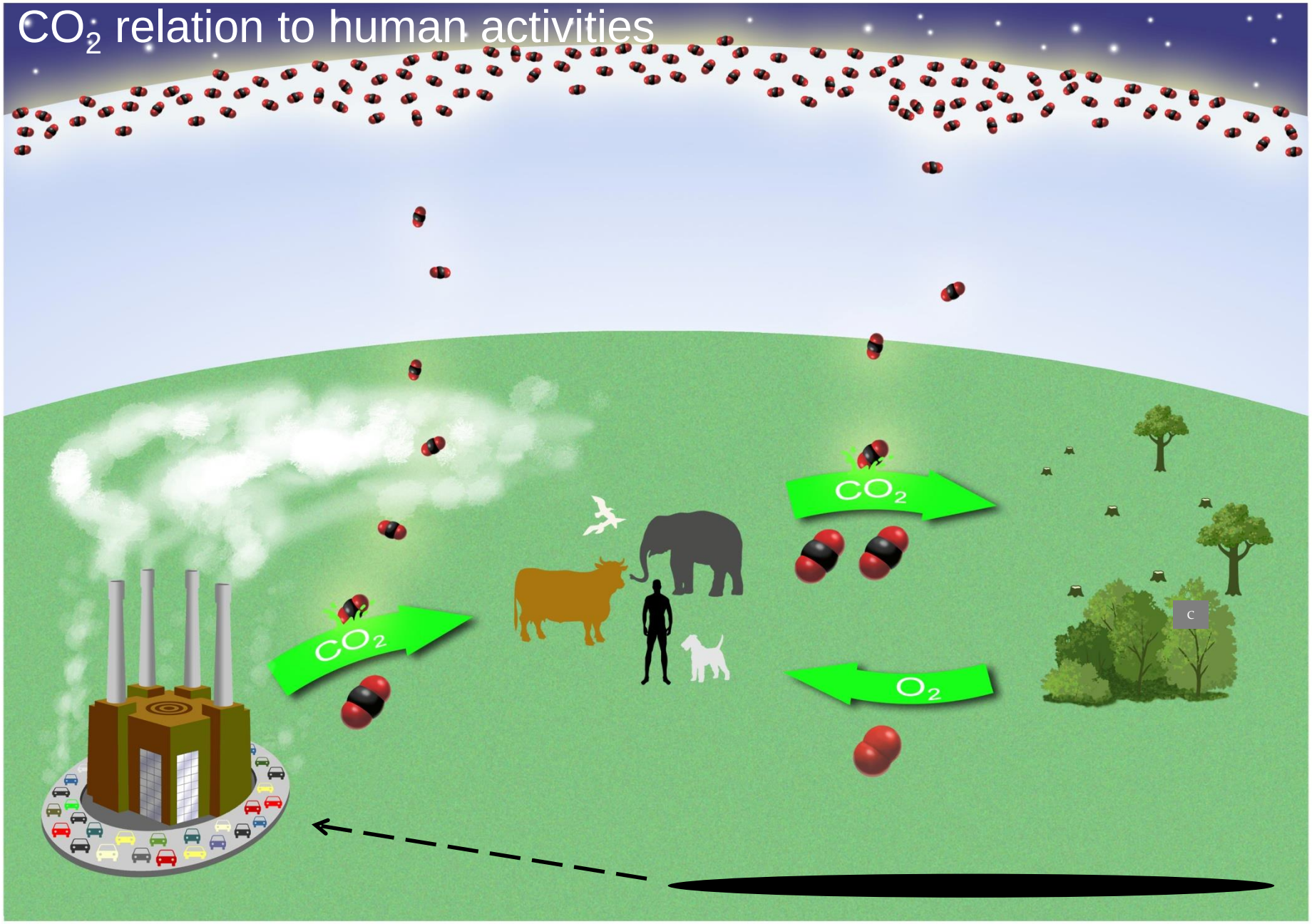
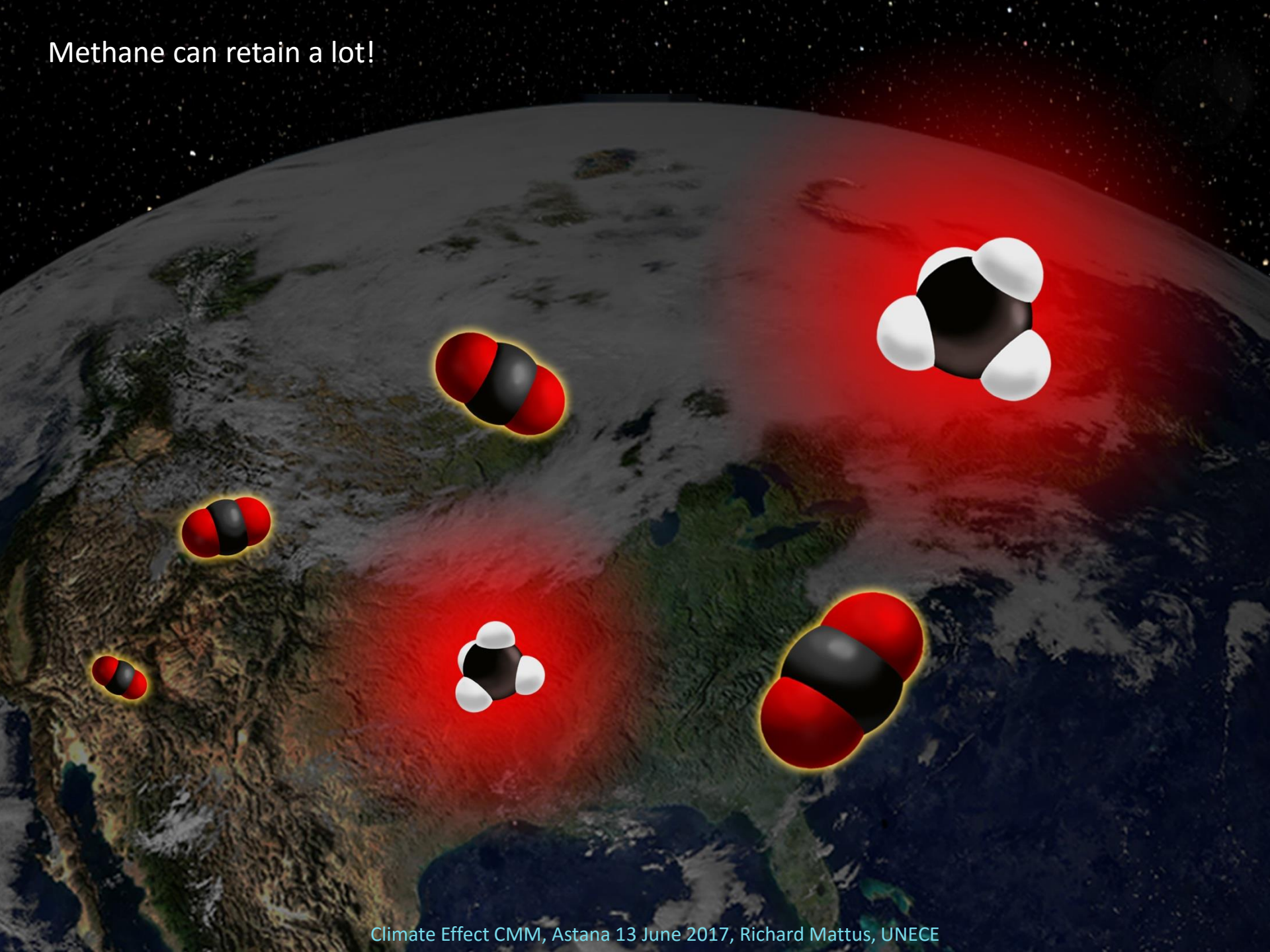


CO_2 relation to human activities

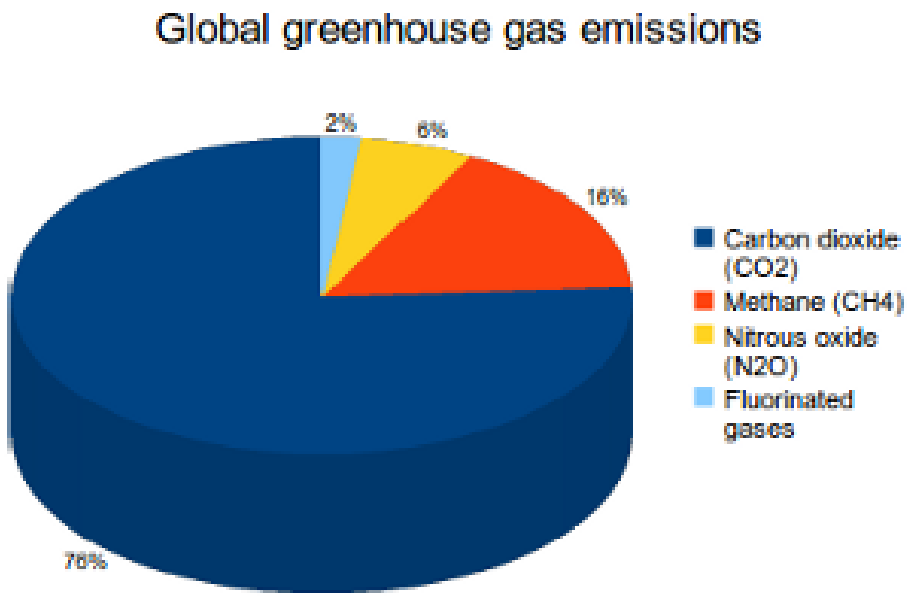


CO_2 in atmosphere can retain a bit of the sun's heat.

Methane can retain a lot!



Global Methane Emissions - by source (ANTHROPOGENIC)

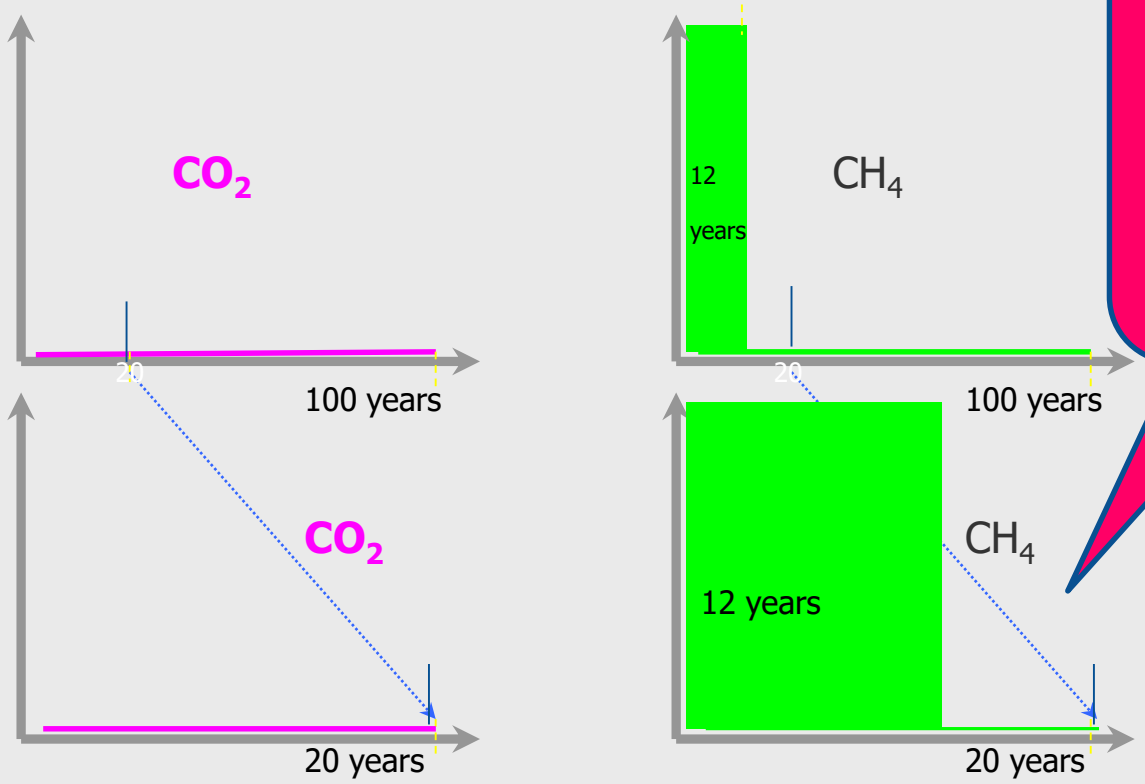


Source: GHG emissions 2012, IEA, International Energy Agency

	CO_2	CH_4
Global Warming Power	1	28*
Life time in atmosphere (years)	20 000 – 50 000	12

•Based on 100 yrs comparison acc to latest assessment by IPCC (2014).

Global Warming Potential – CH_4 vs CO_2

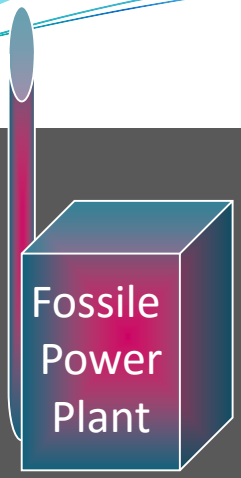


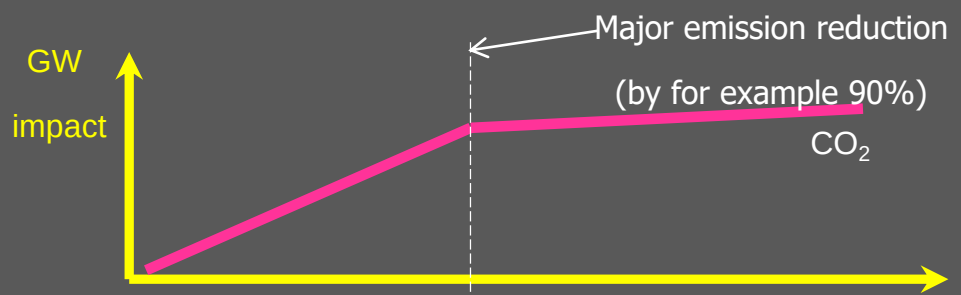
Methane is a very powerful GHG. Especially short term!

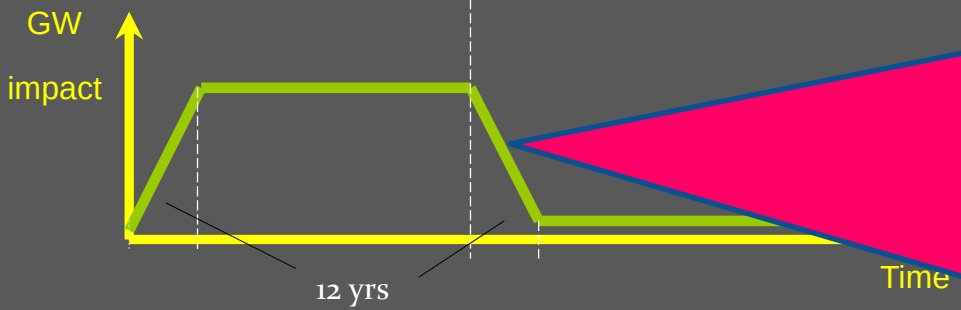
Acc to IPCC's 2014 AR5 (5th Assessment Report). (Acc to AR4 in 2007):

- Compared on 100 yr basis; Methane 28 times (25) more powerful
- Compared on 20 yr basis; Methane 84 times (72) more powerful

Impact of major emission reduction – CH_4 vs CO_2



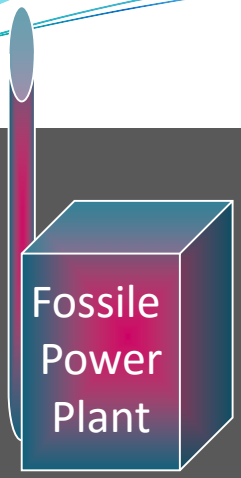


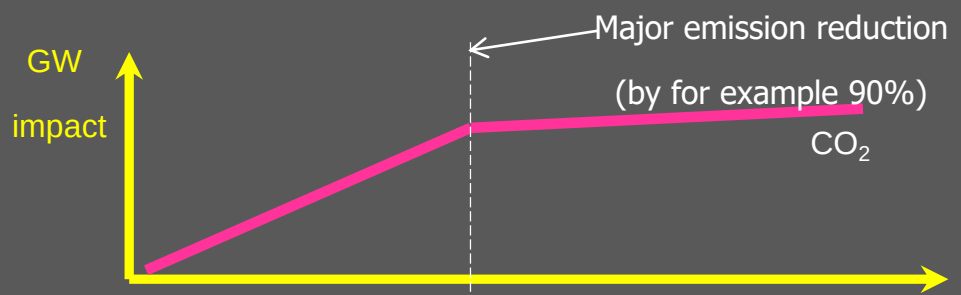


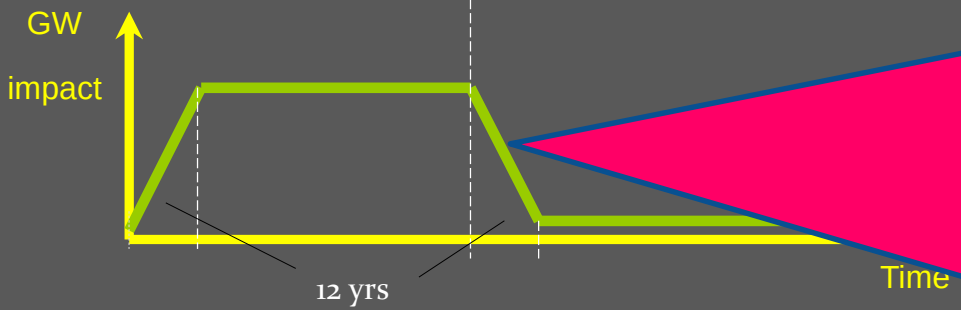
Reducing major sources of methane emissions:

QUICKLY has a POWERFUL positive impact.

Impact of major emission reduction – CH_4 vs CO_2







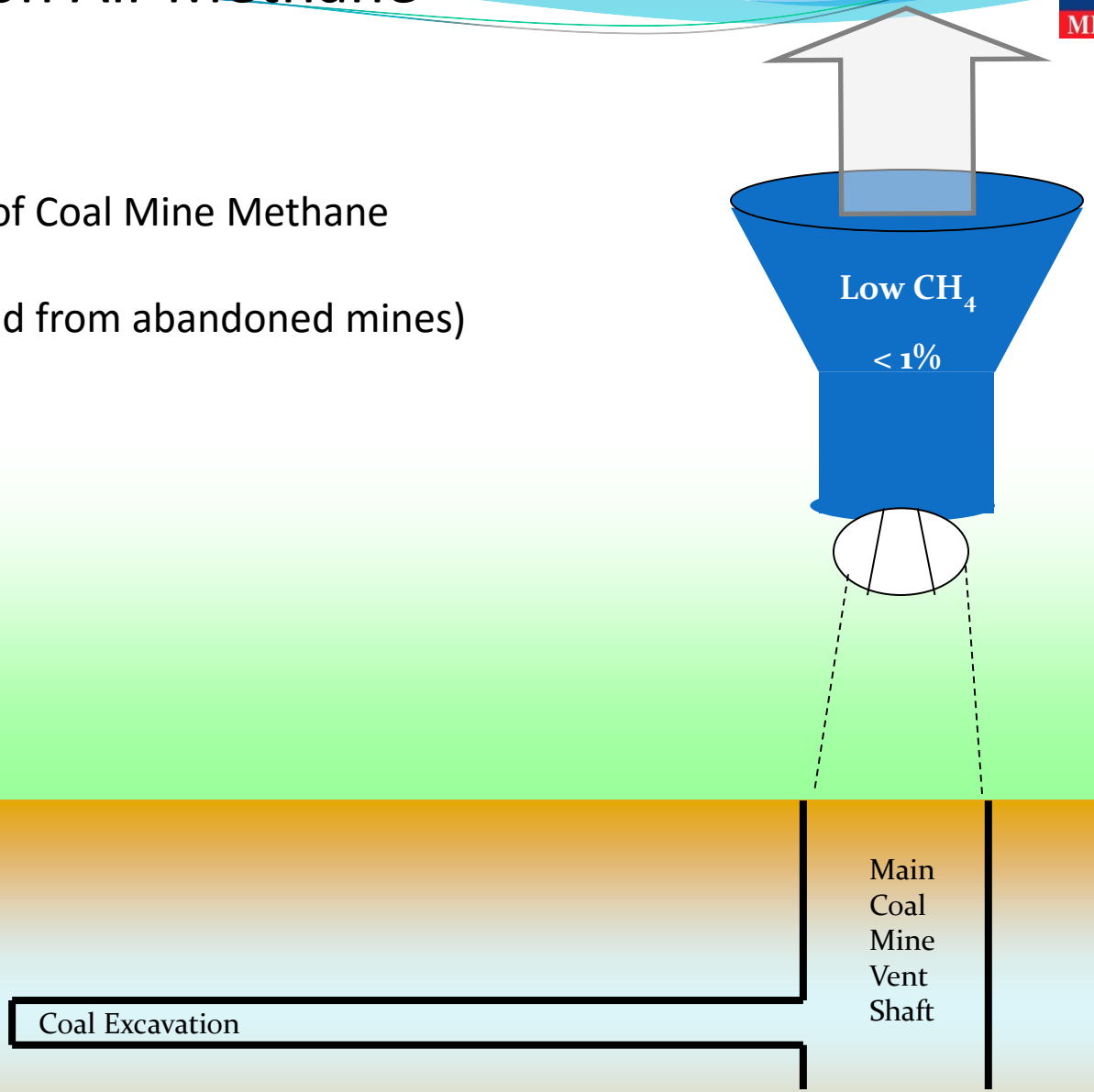
Reducing major sources of methane emissions:

QUICK FIX to change trend of Global Warming

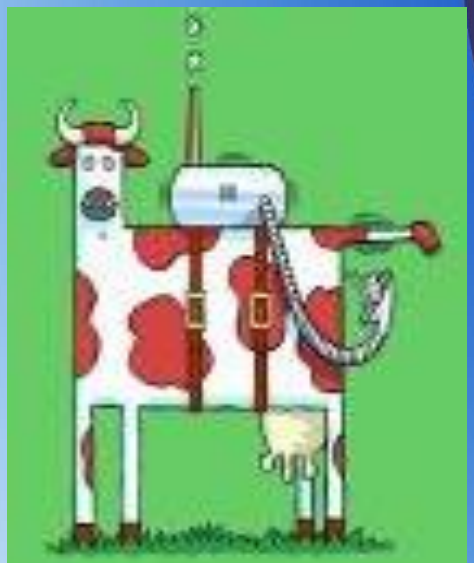
VAM, Ventilation Air Methane

~70 % of all emissions of Coal Mine Methane

(Rest is drainage gas and from abandoned mines)



VAM GreenHouse EFFECT on global warming



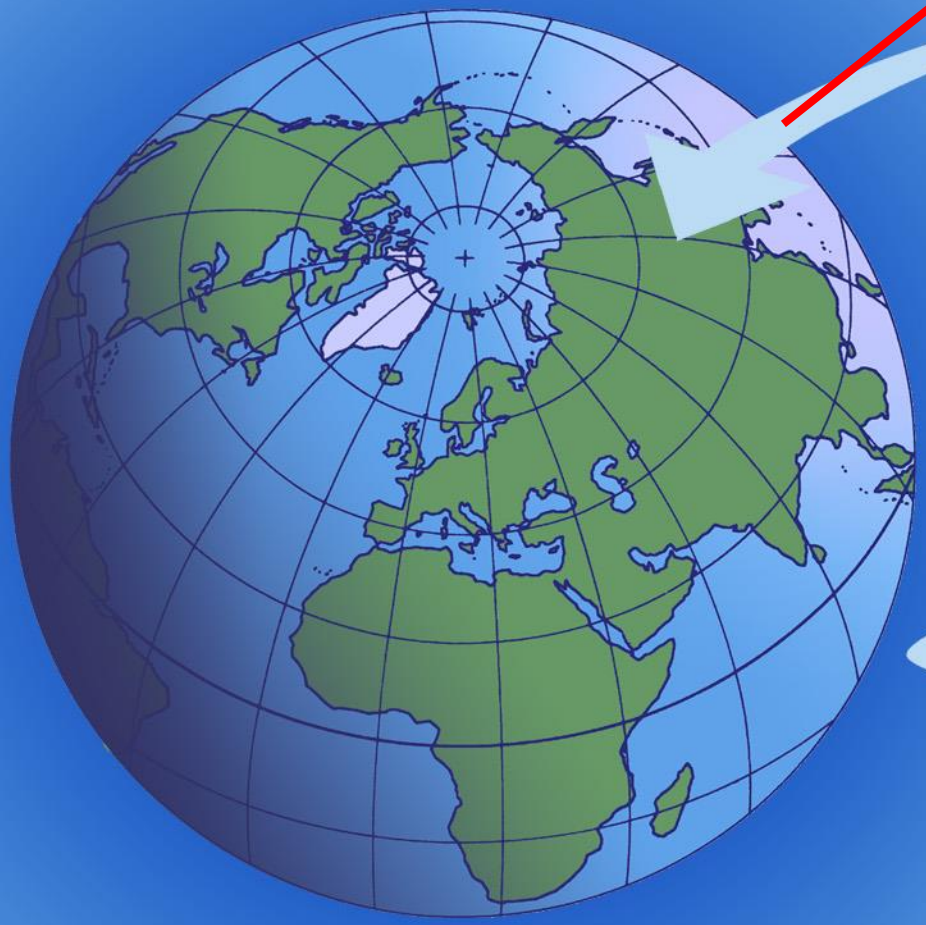
50 – 100 kgs/yr

Coal mine VAM

50 000 t CH_4/yr

(1 000 000 m3/h, 0.8%)

VAM GreenHouse EFFECT on global warming



1 million t CO_{2e}

Coal mine VAM

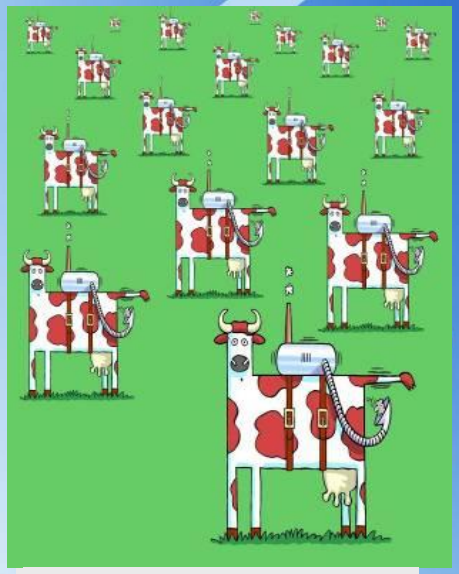
50 000 t CH_4/yr

(1 000 000 m3/h, 0.8%)

VAM GreenHouse EFFECT on global warming

1 million t CO_{2e}

VAM is a major single source of emissions.



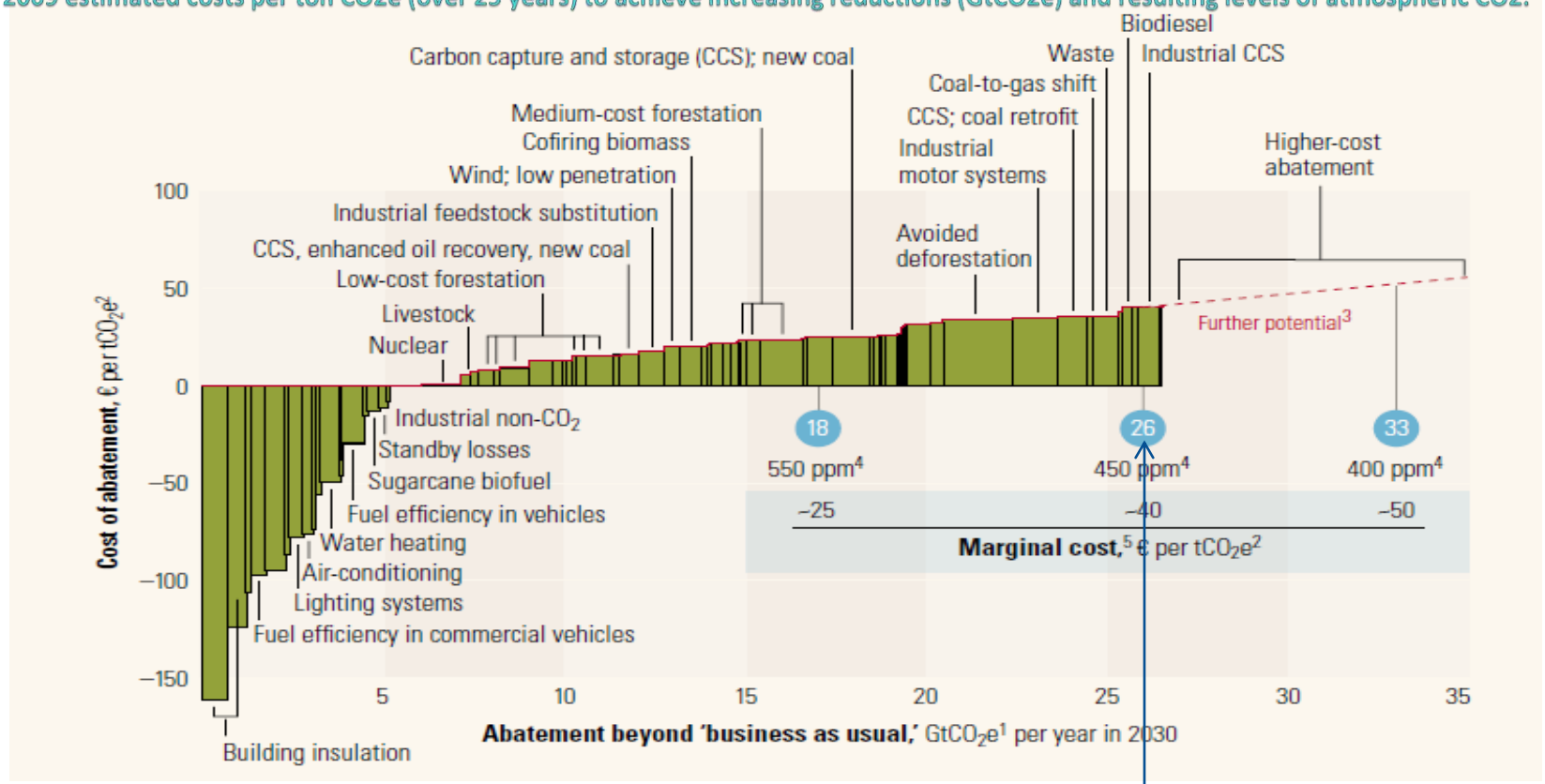
1 million cows =

½ million cars =

Coal mine VAM
50 000 t CH_4/yr
(1 000 000 m3/h, 0.8%)

McKinsey study of GHG abatement costs

2009 estimated costs per ton CO2e (over 25 years) to achieve increasing reductions (GtCO2e) and resulting levels of atmospheric CO2.



Example;

•To achieve atmospheric CO2 level of 450 ppm, a total of 26 GtCO2e needs to be abated, including all of the actions noted in the graph – i.e. up to and including Industrial CCS.

• The items with negative costs are profitable in their own merits (energy efficiency over 25 years).

McKinsey study of GHG abatement costs

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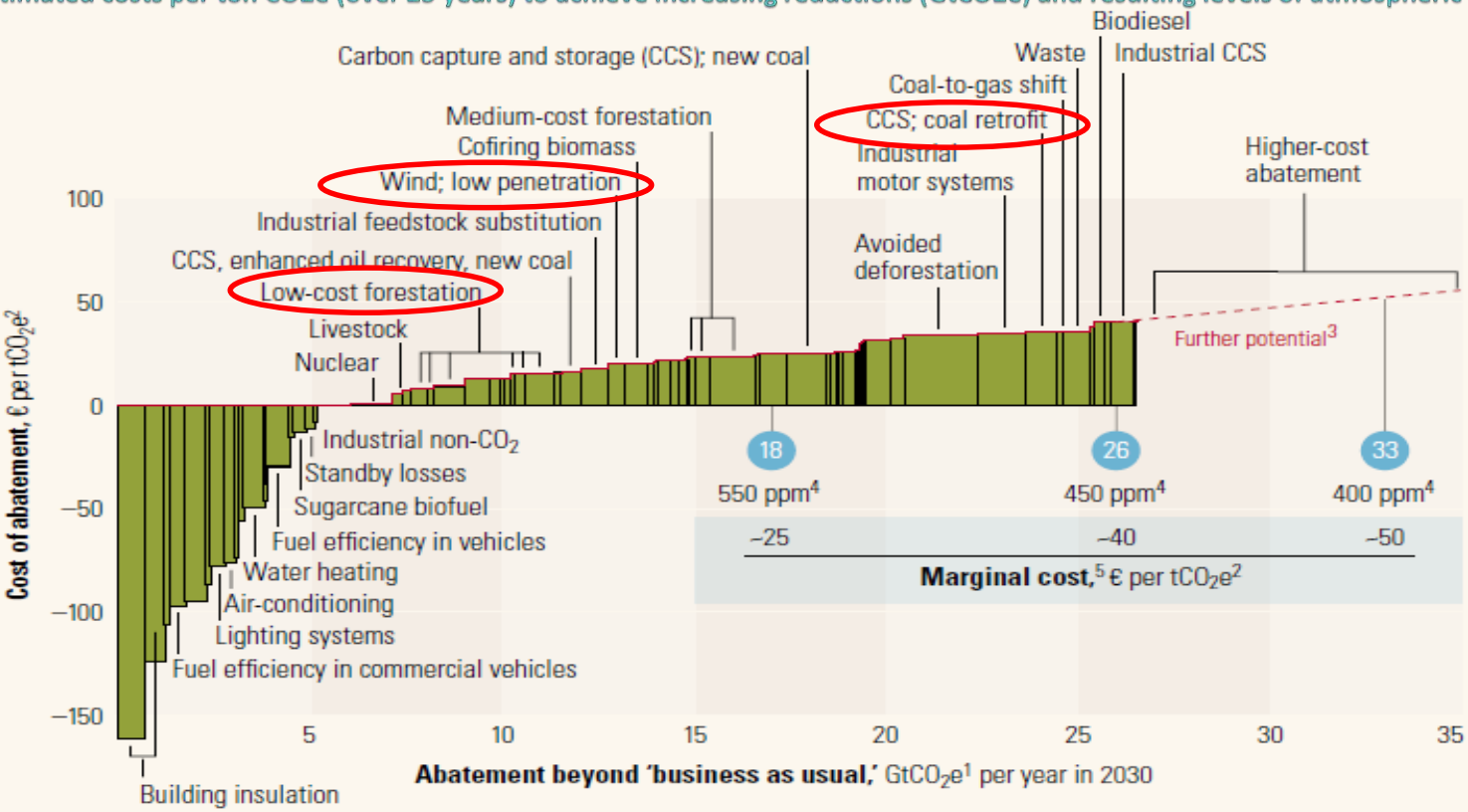

EXAMPLES

- Low cost forestation is EUR 10 – 15 /t CO2e
- Low penetration Wind Power is EUR ~20 /t CO2e
- CCS (Carbon Capture & Storage) applied as retrofit on existing coal fired power plants is EUR ~35 /t CO2e

McKinsey study of GHG abatement costs

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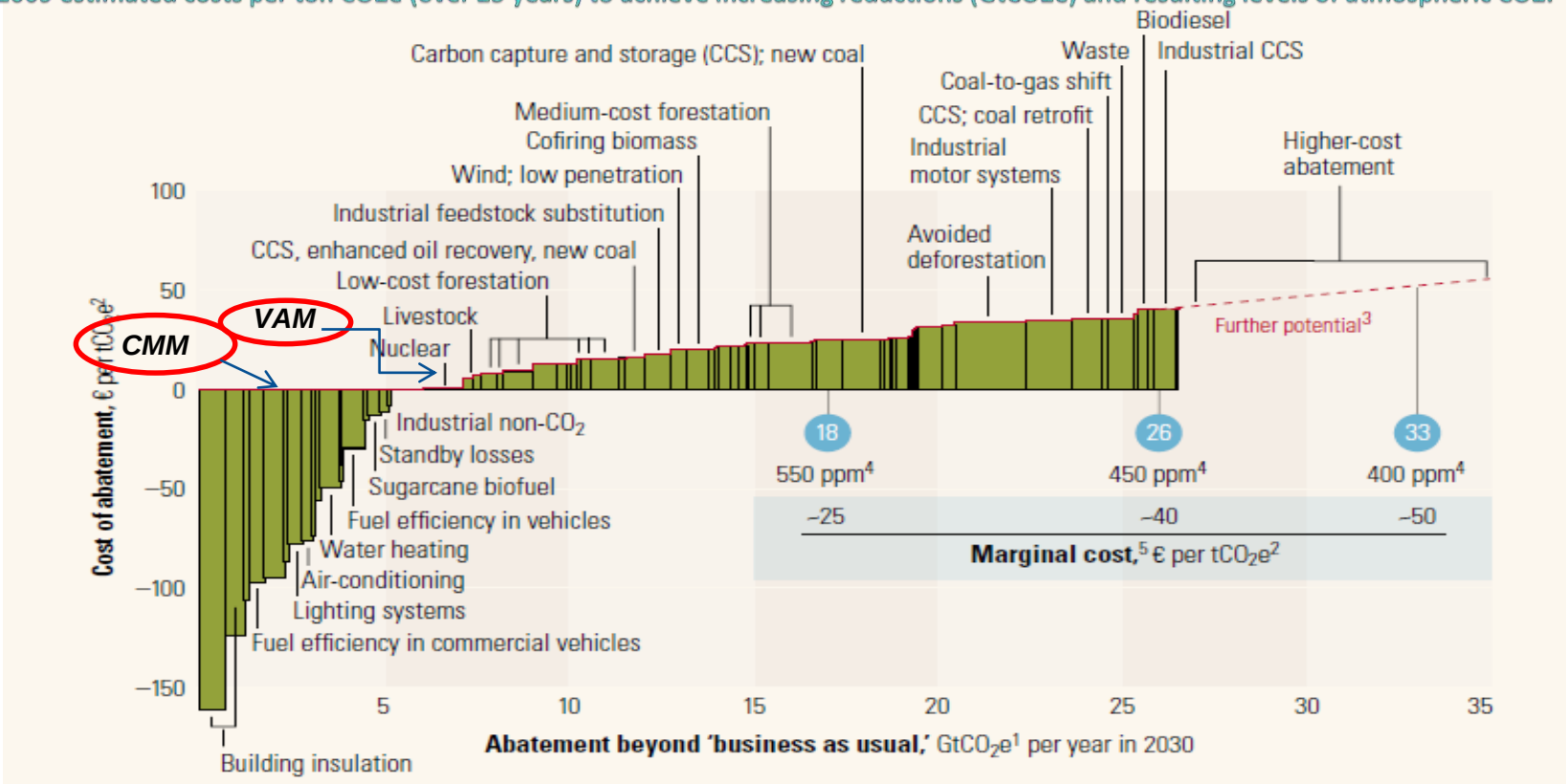


In this comparison, VAM processing would come out with an abatement cost around EUR 3-4 /t CO_{2e}.

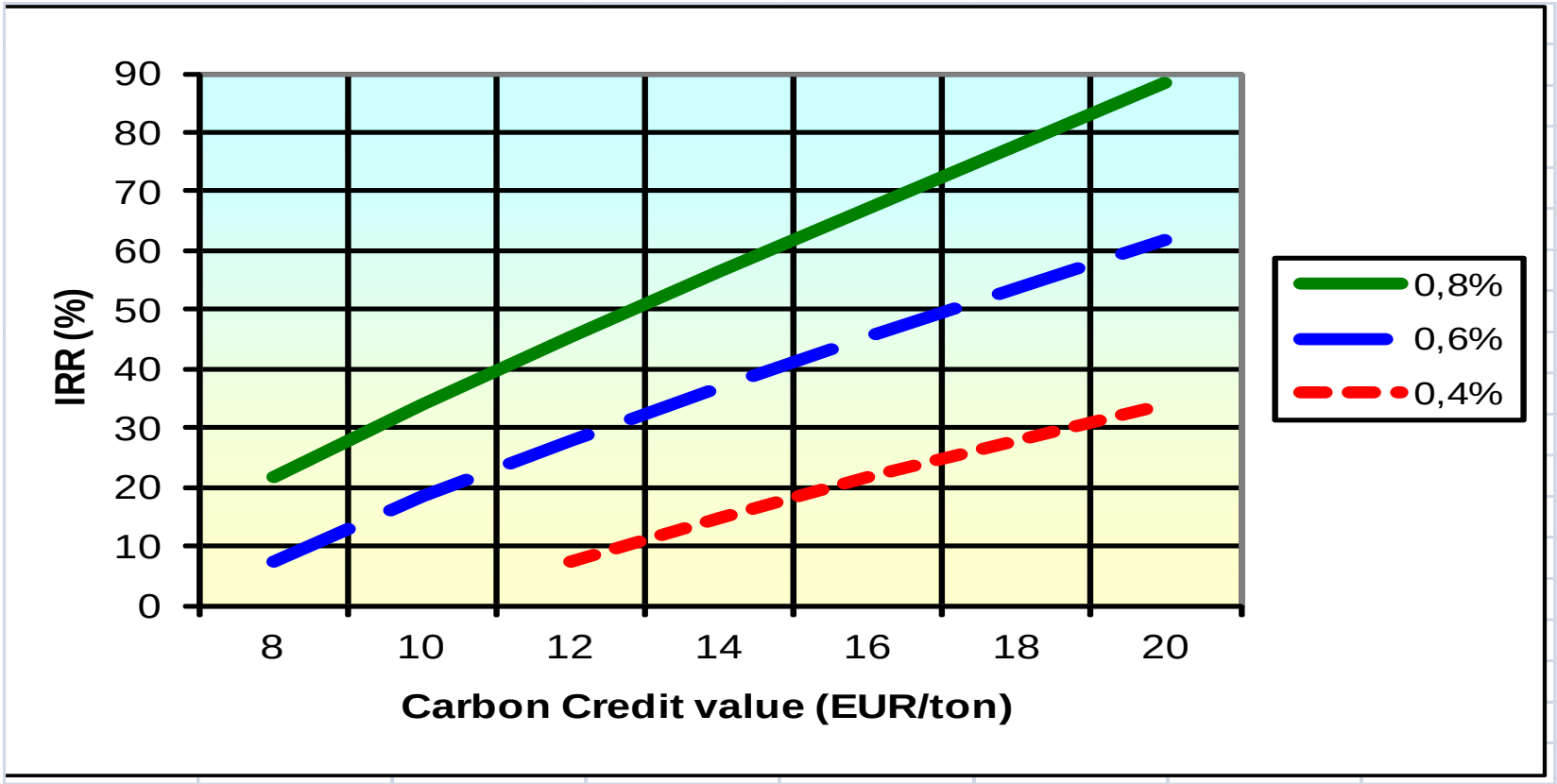
CONCLUSION:

- VAM processing highly cost efficient way to reduce large volumes of GHG emissions.
- CMM easier to utilize at value (electricity), therefore profitable.

GUIDE LINES

VALUE ON EMISSION REDUCTIONS

VAM project economics indications



CONCLUSIONS for reasonable/good pay back:

- VAM concentrations should be min ½ percent
- Carbon Credits (Carbon Tax..) should be minimum EUR 10/t CO_{2e}

CONCLUSIONS

Climate Aspects on CMM

- Methane is a very powerful GHG (GreenHouse Gas) - especially short term
- Short atmospheric life time means: Major of methane means that major emission reductions have a quick positive effect

- CMM, Coal Mine Methane, represents major single emission sources of GHG
- Climate opportunity: Quick fix to short term change trend of global warming!

Reducing emissions of mine gas CMM - a very cost efficient way to QUICKLY reduce climate impact!

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