Est-ce qu'on va capter le CO_2 un jour?

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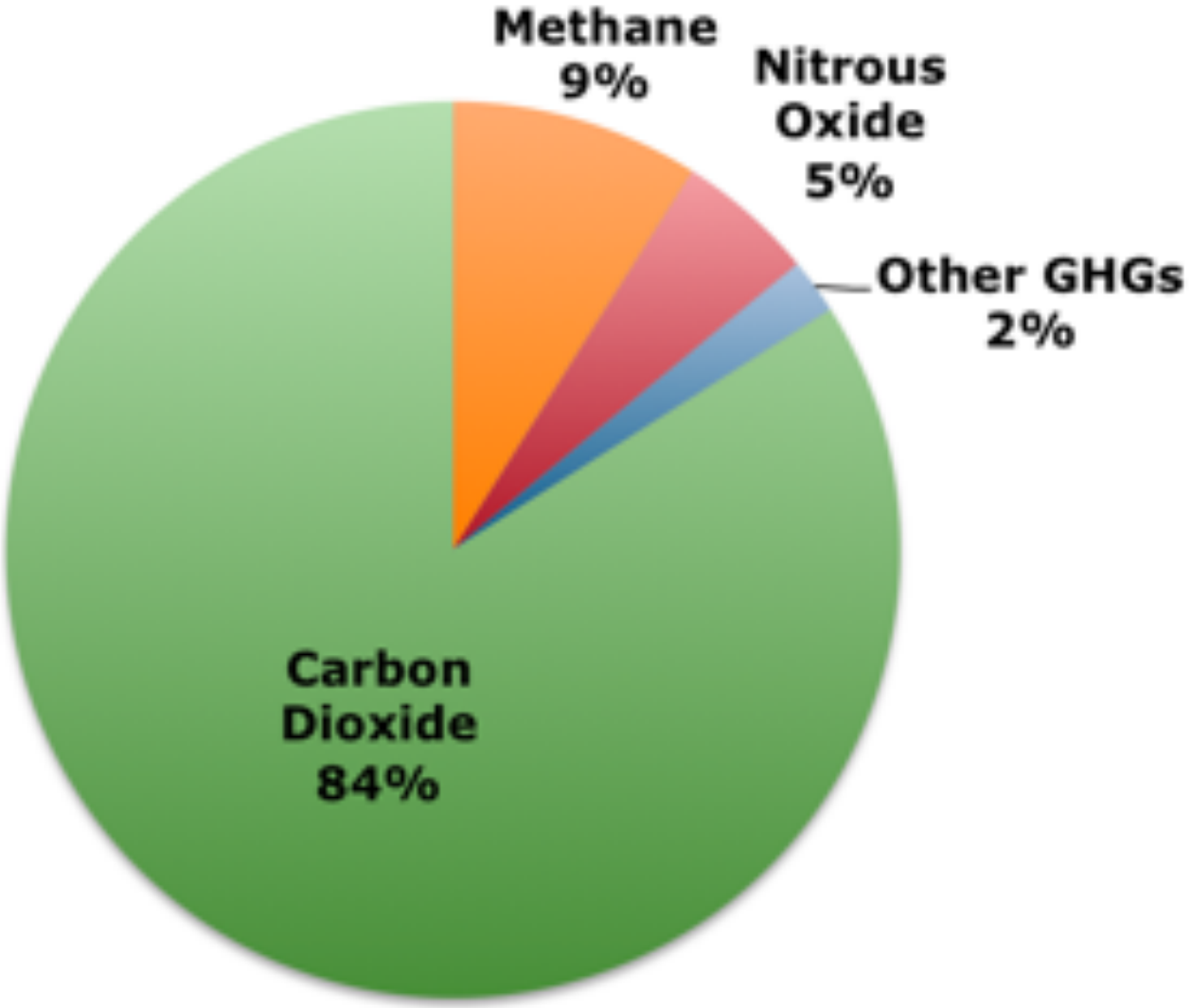
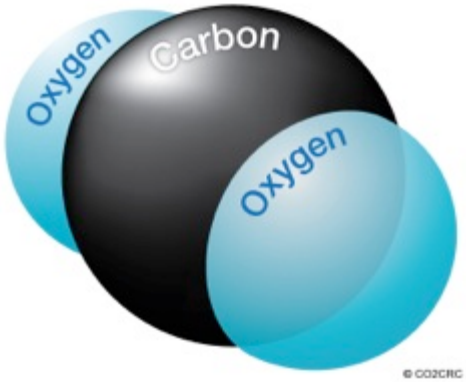
Why bug CO2 ?

U.S. Greenhouse Gas Emissions 2005

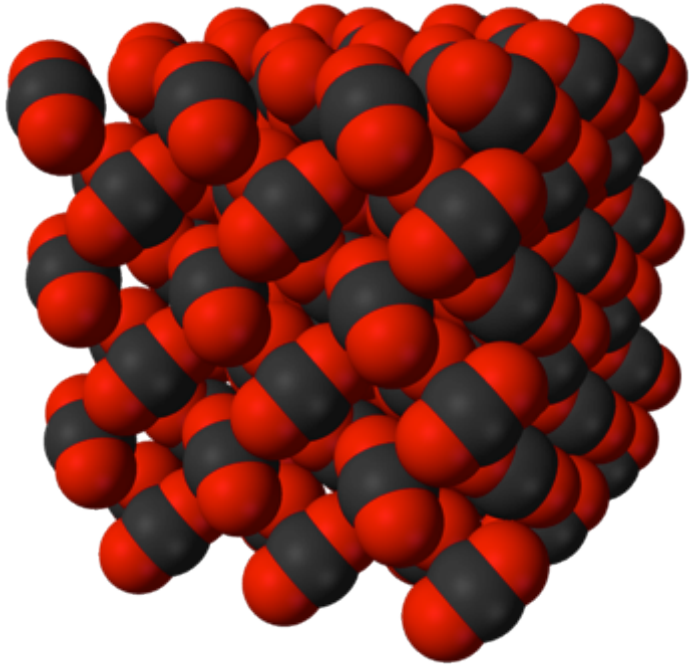


L'objet du délit : le CO_2

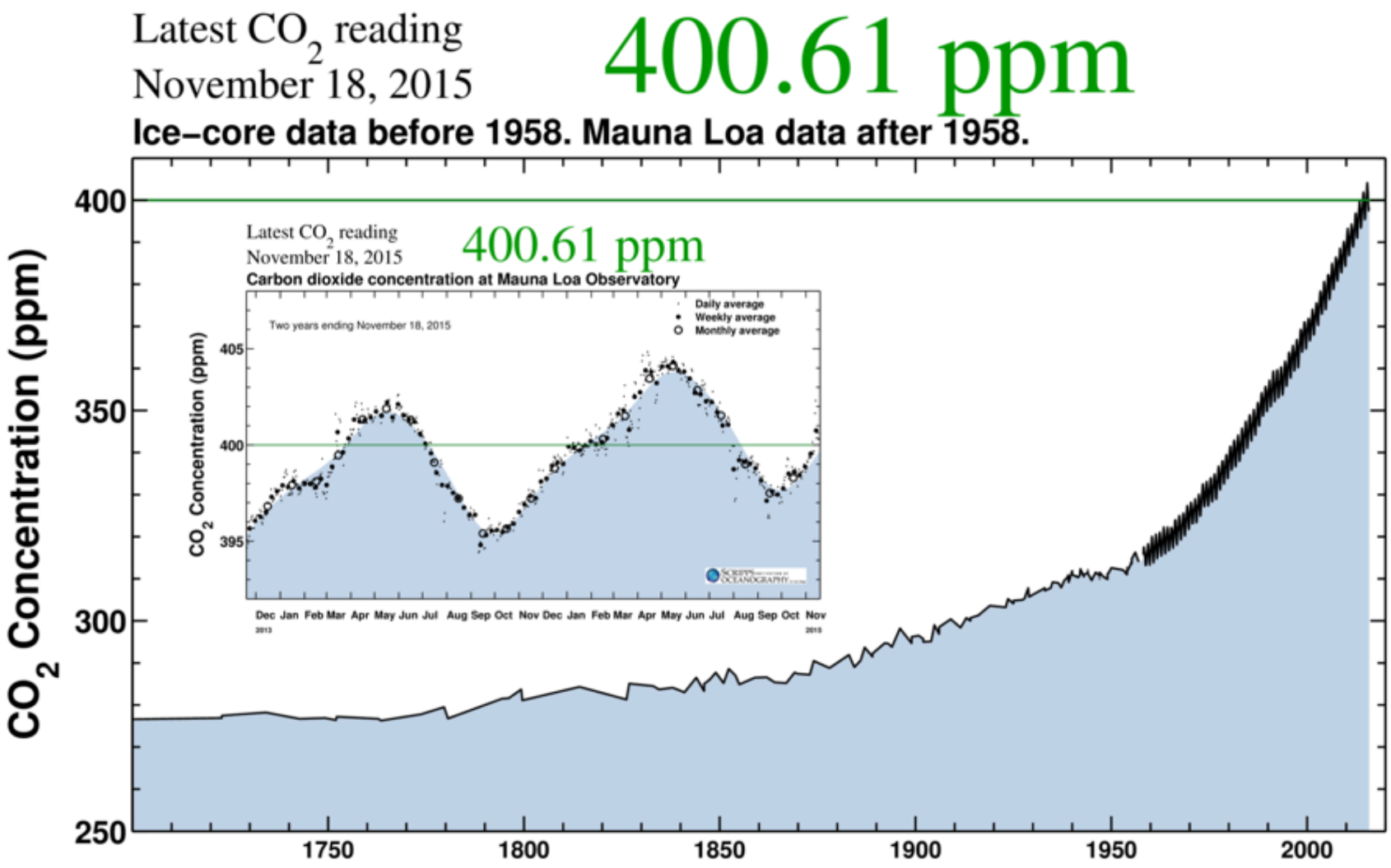
- ☑ Dioxyde de carbone
- ☑ Gaz carbonique
- ☑ CO_2



- ☑ Concentration : 0.04 % vol. / atm.
- ☑ M = 44 amu
- ☑ Taille (L-J) : ~0.3615 nm
- ☑ Temperature de sublimation = -78,5°C



CO_2 atmosphérique



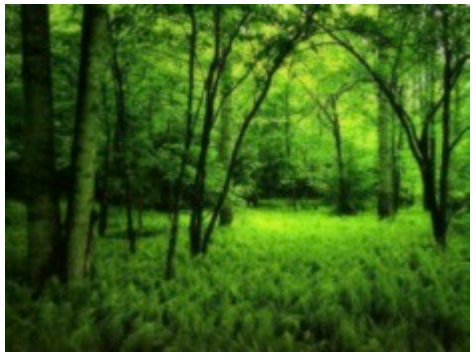
CO_2 numbers (2013)

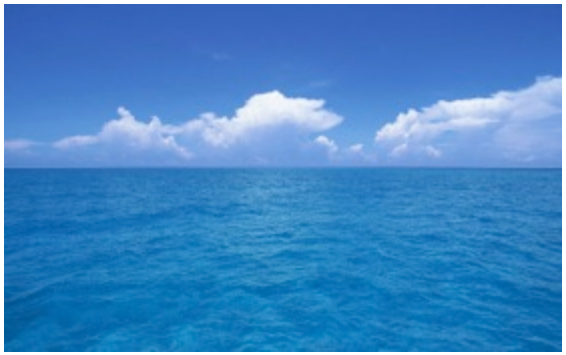
OUT

33,4 x10^9 metric tonnes / yr fossil fuels & cement

coal (43%), oil (33%), gas (18%),
cement (5.5%) & gas flaring (0.6%)

3,3 x10^9 metric tonnes / yr land use & change





IN

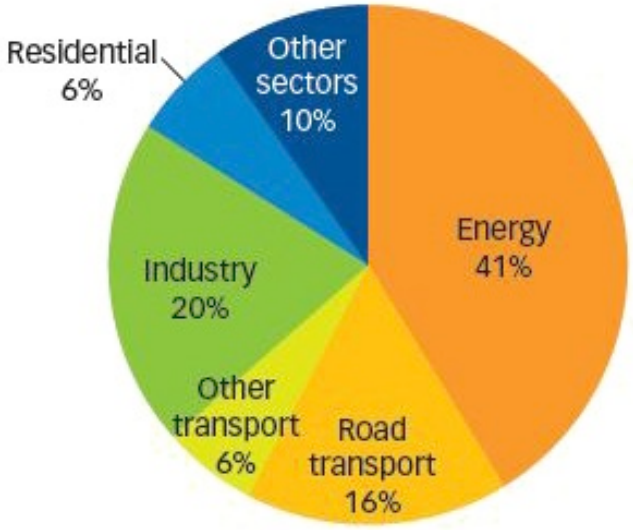
18,4 x10^9 metric tonnes / yr atmosphere

9.5 x10^9 metric tonnes / yr land

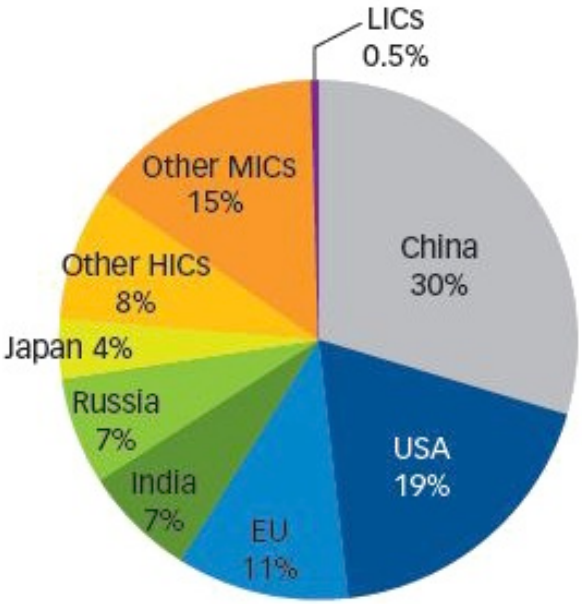
8.8 x10^9 metric tonnes / yr oceans

CO_2 emissions

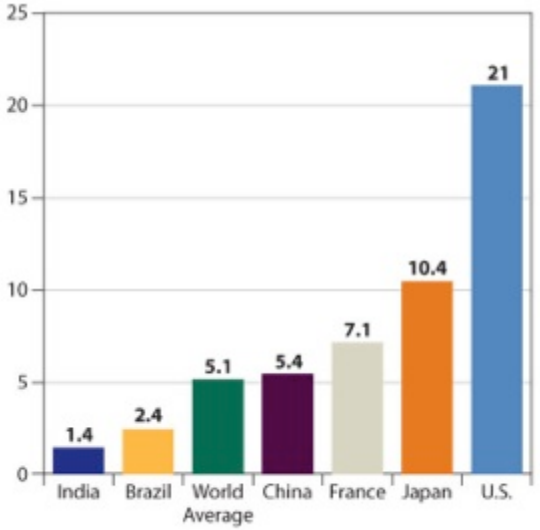
By sector

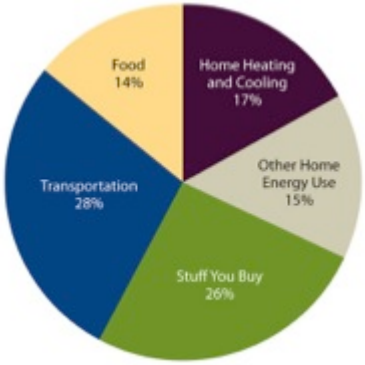


By country



Per person

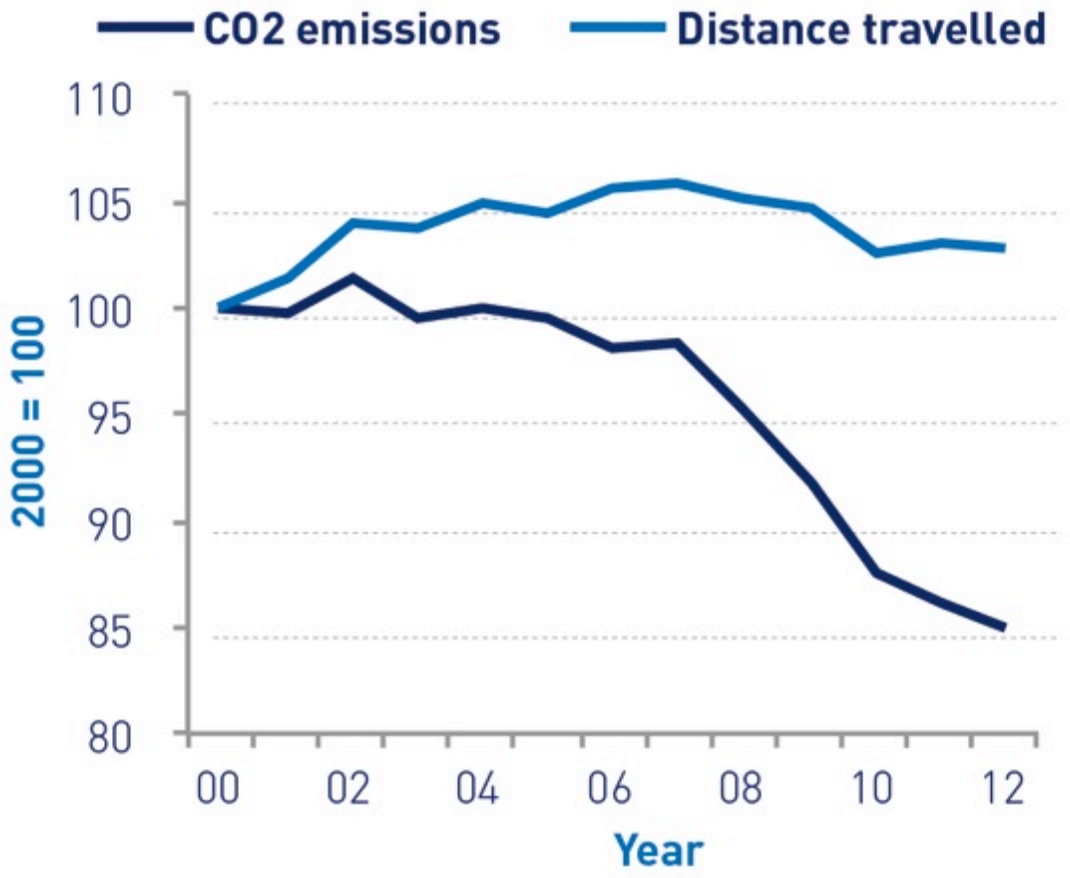




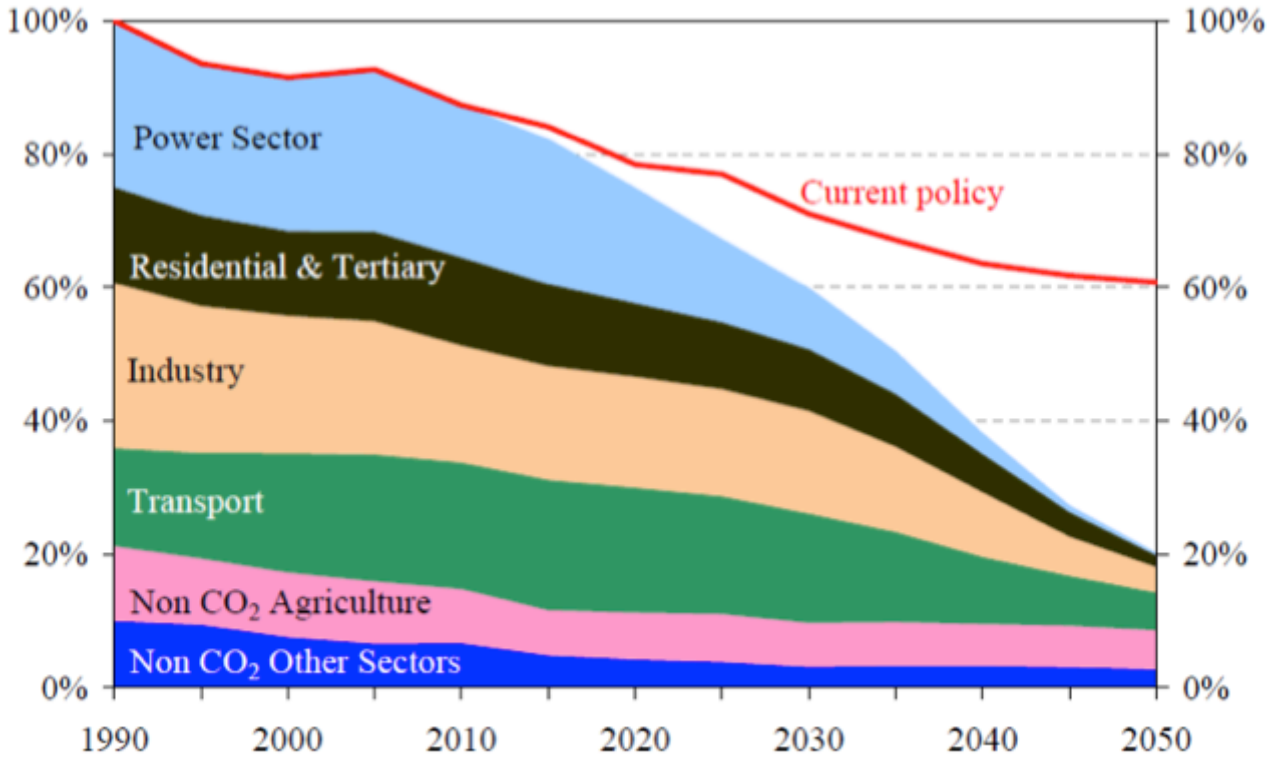
IEA, 2012

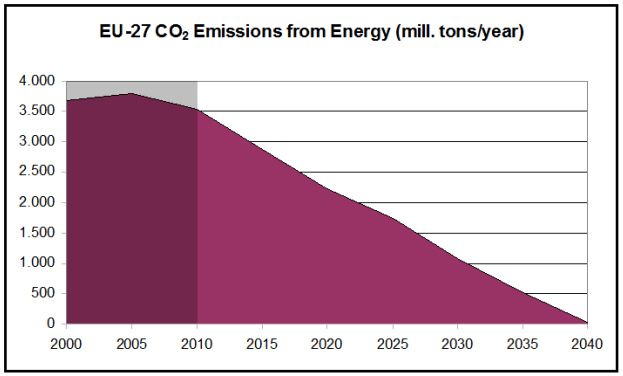
ucsusa.org

CO_2 emissions from all cars in use, and distance travelled (Source DfT)



EU planned 80% reduction of CO_2 emissions

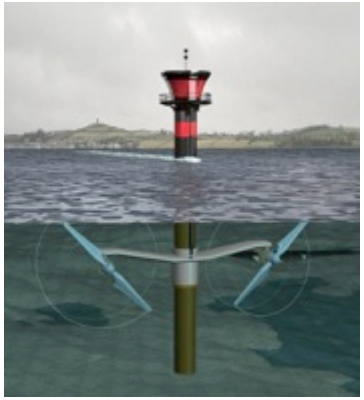


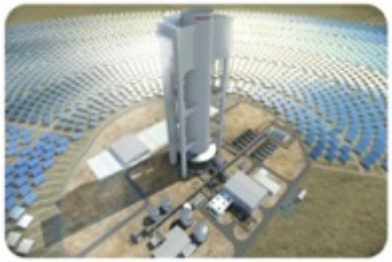


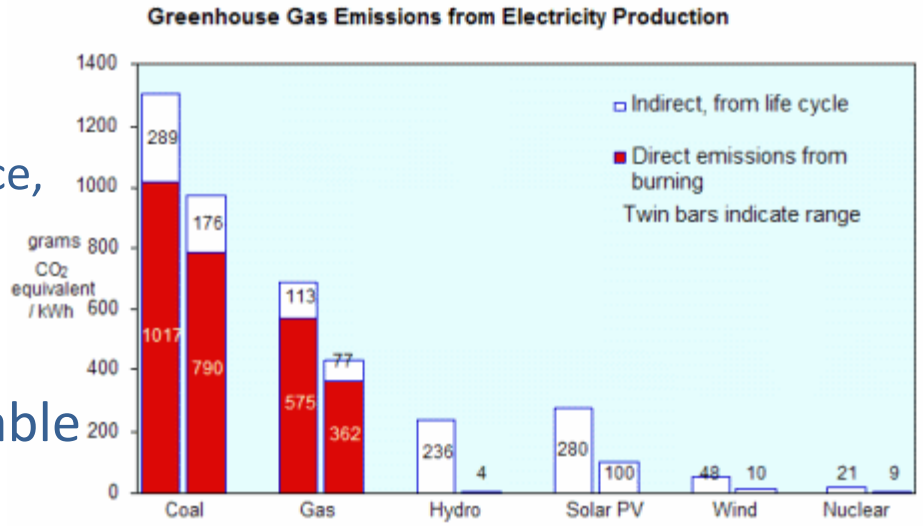
Towards 0% for the power sector !

Alors on s'arrête de produire le CO_2 ?

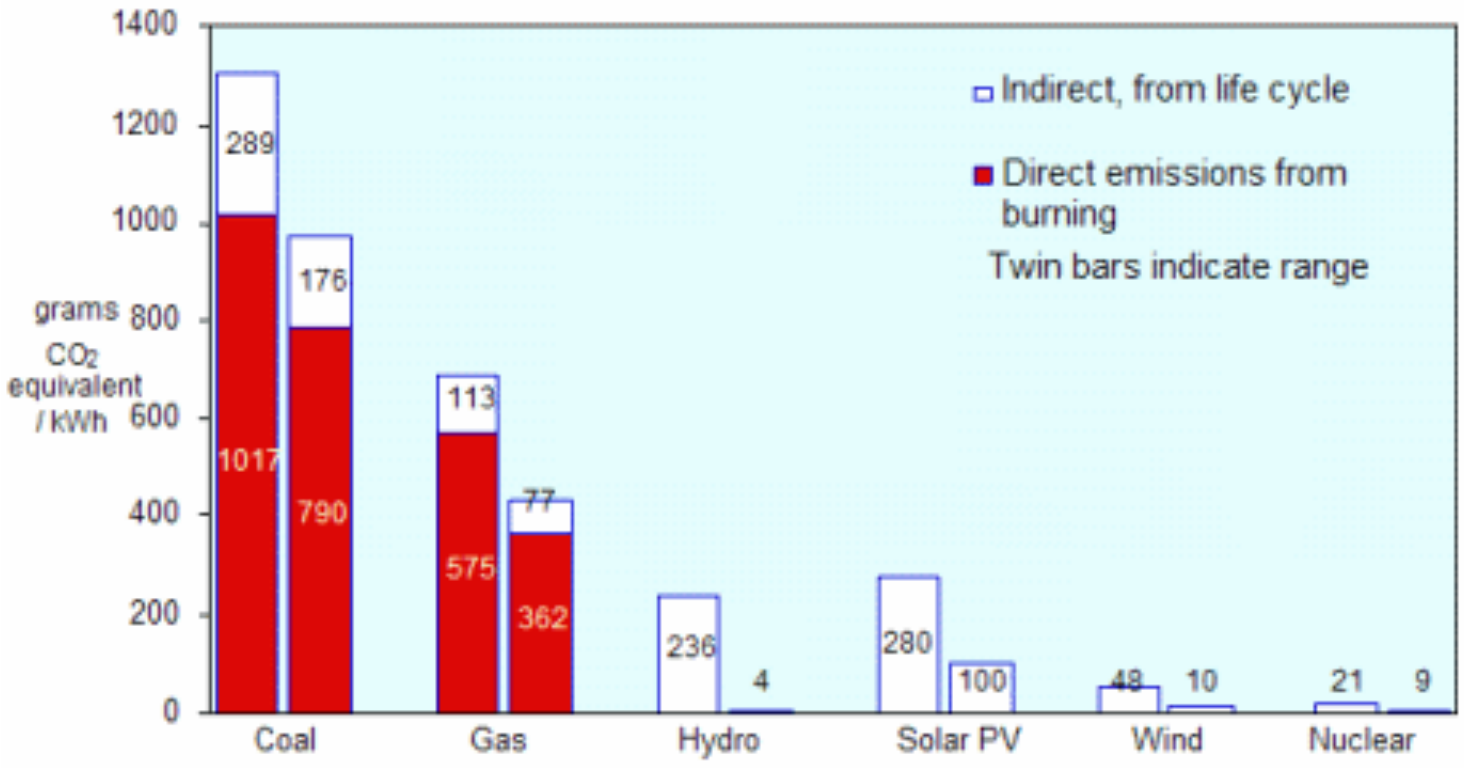
- ☑ La production d'énergie à base des carbone est encore d'actualité
  - ☑ 25% réserves de charbon aux US
  - ☑ Gaz/huiles de schiste
- ☑ Certains industries produisent du CO_2 (ciment, NH_3 ..)
- ☑ Energies renouvelables
  - ☑ pas ***constants*** (vent, marrés, soleil..)
    → stockage d'énergie ?
  - ☑ pas ***accessibles*** (marrés, houlomotrice)
  - ☑ parfois pas assez ***puissants*** (houlomotrice, hydroéléctrique, géothermale …)
  - ☑ ***émettent du CO_2*** (quand on considère l'ensemble du procédé)
  - ☑ US → ⅓C, ⅓Nucléaire, ⅓Renouvelable
- ☑ Le besoin d'énergie est/sera croissant







Les énergies renouvelables ne sont pas sans émission de gaz à effet de serre



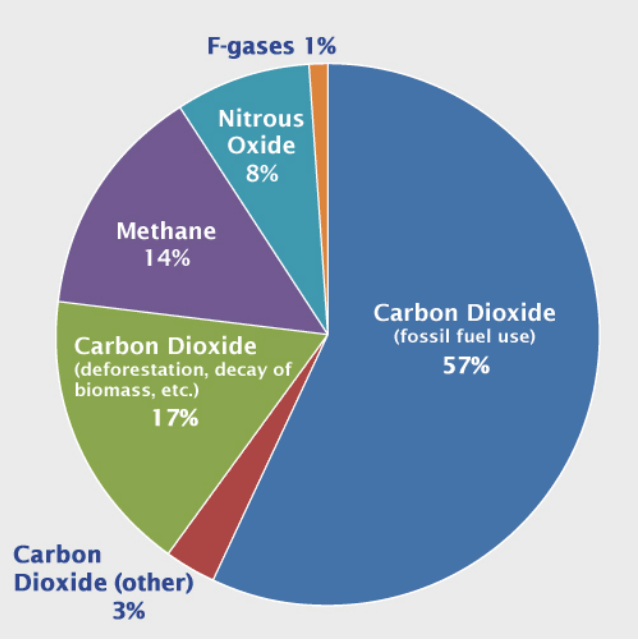
http://www.world-nuclear.org/education/comparativeco2.html

Le problème CO_2

- ☑ Dans l'avenir (proche, moyen, long...) il va y avoir du carbone → CO_2

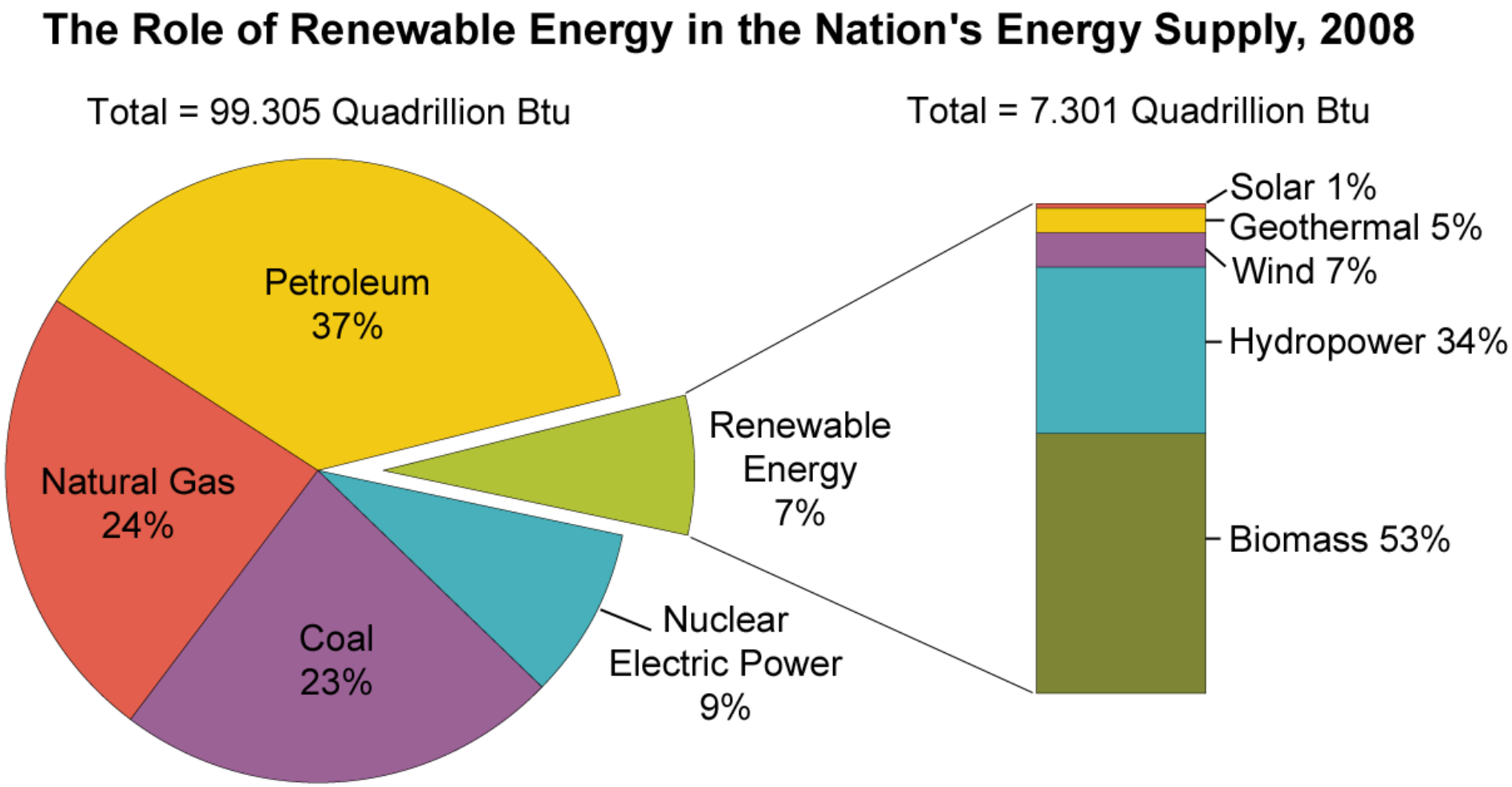
- ☑ Alors..
  - ☑ ou sort le CO_2
  - ☑ comment capter ce CO_2
  - ☑ qu'est qu'on fait avec
    - ☑ transport
    - ☑ stockage
    - ☑ réutilisation : transformation chimique

Divers gaz à effet de serre



http://epa.gov/climatechange/ghgemissions/global.html

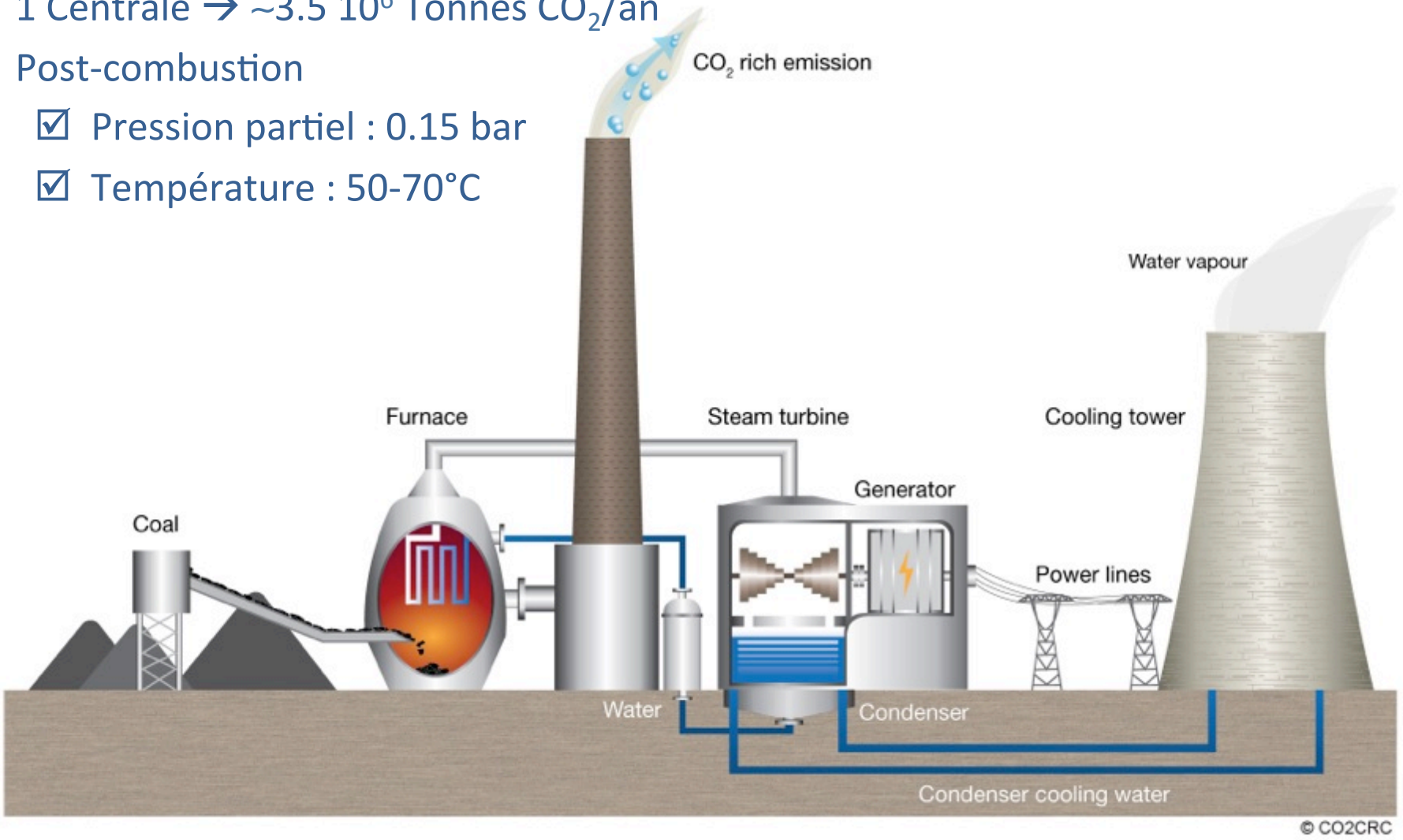
Et aux US … 65% de ces énergies produisant du CO_2



Note: Sum of components may not equal 100% due to independent rounding.
Source: Energy Information Administration, *Renewable Energy Consumption and Electricity Preliminary Statistics 2008*, Table 1: U.S. Energy Consumption by Energy Source, 2004-2008 (July 2009).

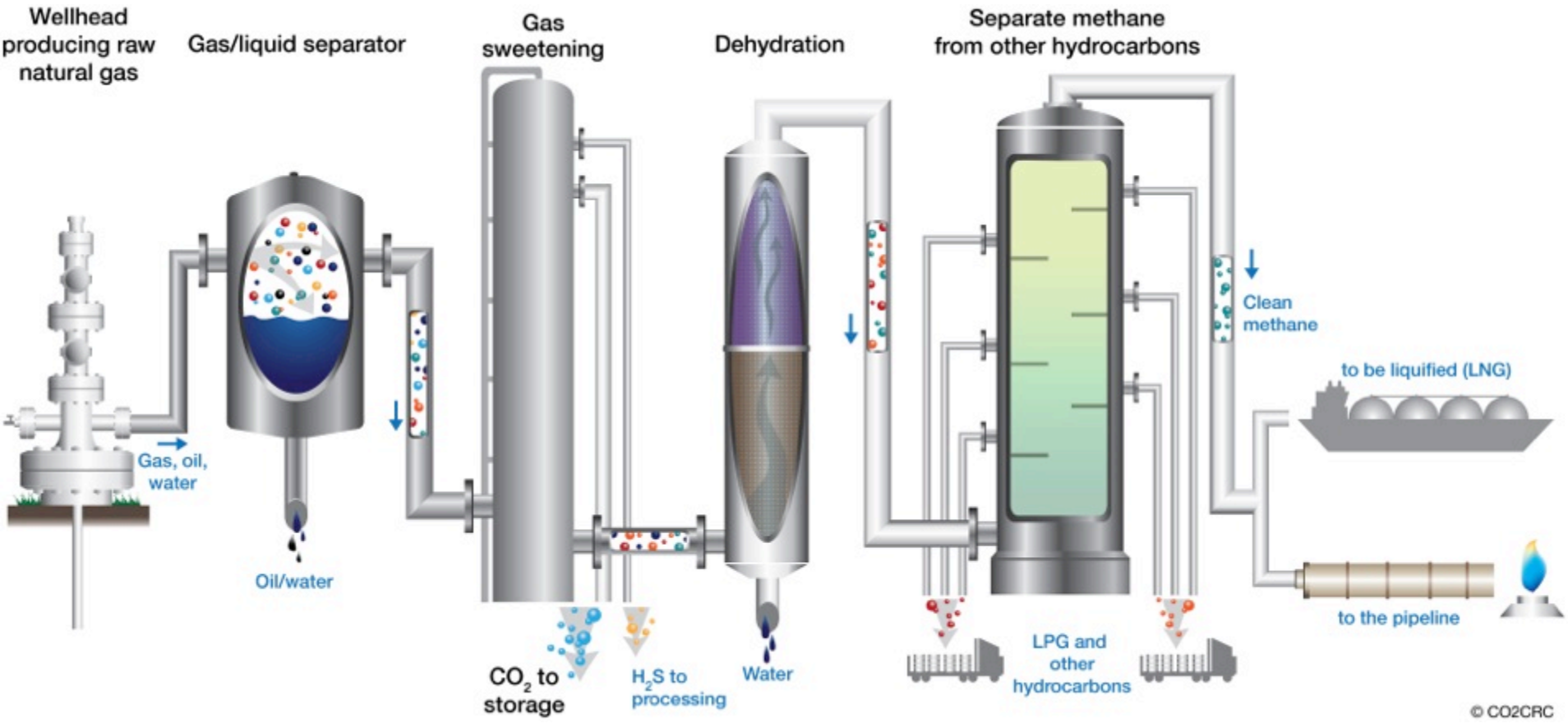
Opportunités pour le capture du CO_2 : Centrales thermiques

- ☑ 1 Centrale → ~3.5 10^6 Tonnes CO_2/an
- ☑ Post-combustion
  - ☑ Pression partiel : 0.15 bar
  - ☑ Température : 50-70°C



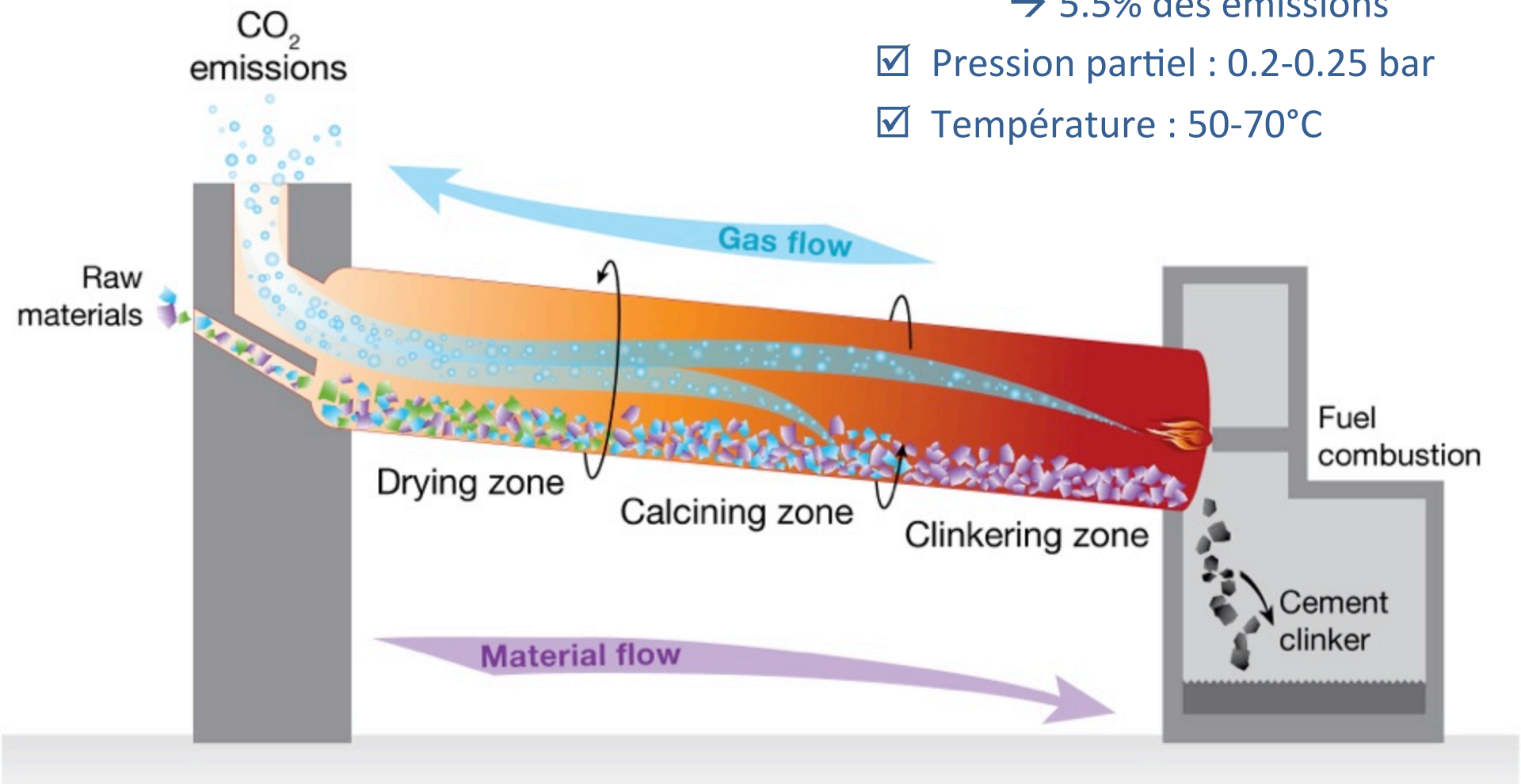
Opportunités pour le capture du CO_2 : Gaz naturel

- ☑ Electricité à partir du gaz naturel → moitié moins que le charbon
- ☑ Pression : 40 bar
- ☑ Température : 30-50°C



Opportunités pour le capture du CO_2 : Cimenteries

- ☑ 1 Tonne ciment → 1 Tonne CO_2
  → 5.5% des émissions
- ☑ Pression partiel : 0.2-0.25 bar
- ☑ Température : 50-70°C



Opportunités pour le capture du CO_2 : Aciéries

- ☑ Plus grand émetteur de CO_2
- ☑ 1 Tonne acier → 1.7 Tonne CO_2
- ☑ Pression partiel : 0.25 bar
- ☑ Température : 50-70°C